# REPORT OF THE 35th MEETING OF THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES

CGMS-35

Cocoa Beach, FL., USA
5-9 November 2007

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Discovery shuttle landing, STS-120, 7 November 2007
Cape Canaveral, Florida, USA

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at CGMS-35.

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## A. INTRODUCTION

### A.1 Welcome

Mary Kicza, Assistant Administrator of the US National Oceanic and Atmospheric Administration (NOAA) for Satellite and Informations Services, provided an opening statement by phone. On behalf of NOAA, she welcomed the participants of the 35th Coordination Group for Meteorological Satellites to Cocoa Beach. Ms Kicza stated that no one agency, no one nation, no one international organisation can go it alone, and that at NOAA, it was recognised that it is only through strong, reliable, sustained partnerships that society will reap the benefits of remote sensing. She continued by saying that she fully supports the work of CGMS, a unique forum providing a critical opportunity for satellite operators and users of meteorological data to discuss and resolve technical issues associated with meteorological satellite operations, products, and data delivery. Ms Kicza also noted the importance of working closely with other international bodies, such as the Group on Earth Observations, the Committee on Earth Observation Satellites, and the World Meteorological Organization's Space Programme. She emphasised that these international bodies provide complementary coordinating capabilities, and efforts to further develop synergies between them can only benefit the global user community.

CGMS-35 was officially opened by Mr Gary Davis, Director of Systems Development, NOAA/NESDIS, on 5 November 2007 at 12:00 in Cocoa Beach, Florida, USA. He stated that it would be a pleasure to chair CGMS-35 and continued by saying that he was honoured to be the local host and hoped everybody would enjoy the meeting at Cocoa Beach. He expressed his gratitude to those who had contributed to the preparation and organisation of the meeting, and also to the preparations and support made by the CGMS Secretariat. In his closing remarks, he wished the participants a fruitful meeting and a successful outcome.

On behalf of the CGMS Secretariat, Mr Mikael Rattenborg, Director of Operations of EUMETSAT, also welcomed the participants to the 35th session of the CGMS. He stated he was very pleased and honoured to be working alongside the hosts of NOAA, a CGMS founding member that also played host to its first meeting held in Washington in 1972. He furthermore recalled the 35th anniversary of CGMS and its success as a dedicated forum for the coordination of meteorological satellite systems, praising the fundamental contribution provided by NOAA over the years. Highlighting the key role of meteorological satellites within the Global Observing System, he further said that the task of enabling satellite operators, development agencies and WMO to ensure efficiency and sustainability, through technical and operational coordination, is upon CGMS. He concluded by wishing everybody a fruitful and constructive meeting.

This opening session was closed by Mr Gary Davis with a wish for a very successful 35th CGMS meeting.

Following the resumption of the Plenary session on Thursday 8 November, 2007, the Director-General of EUMETSAT, Dr Lars Prahm, expressed his pleasure in attending CGMS and again welcomed all the participants. Recalling the 35th anniversary of the Group, he stated that CGMS owes its success to its effective role as a dedicated forum for the operational coordination of meteorological satellite systems. The robust development of Earth observation over recent years and the related efforts for international cooperation underscore the opportunity of optimising coordination and improving synergies among international bodies in the sector. Dr Prahm expressed the wish that this ambitious aim will become closer thanks to the planned discussions at CGMS-35.

## A.2 Election of Chairperson

Mr Gary Davis, Director of Systems Development, NOAA/NESDIS, was unanimously elected as Chairperson of CGMS-35 with Mr Gordon Bridge and Dr Piero Valabrega as Rapporteurs. Chairpersons for the working groups had been elected at the previous CGMS meeting; Mr Marlin O Perkins for Working Group I on Telecommunications, with Mr Gordon Bridge acting as Rapporteur; Dr Mi-Lim Ou for Working Group II on Satellite Products, with Dr Mitch Goldberg and Dr Johannes Schmetz acting as Rapporteurs; Mr Gary Davis as Chairperson for Working Group III on Global Contingency Planning, with Dr Donald Hinsman as Rapporteur; and Mr Mikael Rattenborg elected as Chairperson of Working Group IV on Integrated Strategy for Data Dissemination from Meteorological Satellites, with Mr Gordon Bridge acting as Rapporteur.

## A.3 New CGMS Members

Whilst it noted that there were no new CGMS Members at CGMS-35, the CGMS Secretariat, highlighted the participation of KARI as an observer, and expressed the hope that it could soon become the 16th Member of CGMS.

The meeting also welcomed Mrs Barbara Ryan, the Chairperson of the Committee on Earth Observation Satellites (CEOS) as an Observer in the context of the proposed increased coordination amongst CGMS, CEOS and the WMO Space Programme.

## A.4 Adoption of Schedule

The schedule was adopted and the meeting recalled that the four working groups had met previously on 5 and 6 November 2007.

The Secretariat provided a draft order of business (see Annex 1), which was used as a basis for the subsequent discussions together with a list of working papers submitted to CGMS-35 (see Annex 2).

## A.5 Nomination of Drafting Committee

The Drafting Committee was nominated, consisting of the Chairperson of CGMS-35 and its Rapporteurs, together with the Chairpersons for the working groups and their Rapporteurs, and the CGMS Secretariat.

The drafting of various sections of the final meeting report was carried out by the Secretariat assisted by CGMS participants, based upon summaries of submitted working papers and the reports of the working groups and plenary sessions.

## A.6 Review of Actions from Previous Meetings

The Secretariat reviewed the outstanding actions from previous meetings, taking into account inputs provided in Working Papers CMA-WP-01, ESA-WP-07, EUM-WP-01/02, JMA-WP-01, KMA-WP-01, NOAA-WP-01/34/34/37 and WMO-WP-01, as well as by other means of correspondence, including e-mail.

| CGMS-33 actions | | | | | | |
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| **Actionee** | **Action** | **Description** | **Closing Document** | **Deadline** | **Status** | **Comment** |
| CGMS Members | 33.07 | Action 33.07 CGMS Members are requested to support the arrangements for their high profile training event as described in the document WMO-WP-17. | EUM-WP-12, JMA-WP-01, WMO SP built a webpage to carry out on-line registration. | 02-Nov-06 | CLOSED at CGMS-34 | NOAA refers to this action in CGMS-35 NOAA-WP-10 and WMO in WMO-WP-14.<br>Furthermore it has been decided to move away from the HP training events due to the time zone constraints and to hold regional training events instead. |
| CGMS Members | 33.10 | Action 33.10 CGMS CGMS Members are requested to provide comments and inputs on the proposal for a new CGMS Internet site to the Secretariat by the end of 2005. Based on this input, the CGMS Secretariat to discuss with WMO a way forward. | JMA by e-mail, NOAA, WMO. See also WMO-WP-16 (CGMS-35) for the way forward. | 31-Dec-05 | CLOSED at CGMS-34 | The way forward was discussed in 2007 by CGMS Secretariat and WMO. WMO-WP-16 |
| WMO | 33.18 | Action 33.18 The fire papers prompted CGMS to recommend that the WMO Space Programme Office create a web site posting all the links to real time fire detection data. | ESA, EUM, NOAA by e-mail. WMO: web page created in May 2007, the real time fire detection data is now available at http://www.wmo.int/pages/prog/sat/Onlineproducts.html#Fire | 05-Nov-07 | CLOSED | WMO: Please note also Recommendation 33.06:<br>CGMS Members are encouraged to provide the location of their web sites on real time fire detection to the WMO. |
| EUM;NOAA;WMO | 33.24 | Action 33.24 EUMETSAT, NOAA together with WMO to develop a EUMETCast to NOAA ADM transition plan for users in South America and report details to CGMS. | EUM-WP-11 (CGMS-33). WMO-WP-20 (CGMS-33) and WMO-WP-24 (CGMS-35). Pending input from NOAA. NOAA-WP-33?? | 05-Nov-07 | OPEN | NOAA has positioned its GOES-10 satellite to provide geostationary satellite coverage over South America. GOES-10 data is currently being disseminated via direct broadcast and used operationally. NOAA does not currently have plans to develop ADM capability, but is in the process of developing GEONETCast service. See NOAA-WP-33.<br>Discussed in WGIV. |

| Permanent actions/actions/recommendations resulting from CGMS-34 | | | | | |
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| **Actionee** | **Action** | **Description** | **Closing document** | **Deadline** | **Status** |
| CGMS Members | Permanent 01 | Permanent 01. All CGMS Members to inform the Secretariat of any change in the status or plans of their satellites to allow the updating of the CGMS Tables e-mail, of Satellites (tables 1-7). The Secretariat to review the tables of current and planned polar and geostationary satellites, and to distribute this updated information, via the WWW Operational Newsletter, via Electronic Bulletin Board, or other means as appropriate. CGMS satellite operators to update table 7 for polar-orbiting satellite equator crossing times on an annual basis. CGMS Members to update the table on polar-orbiting satellite equator crossing times as well as the table on coverage from geostationary satellites.<br>(Permanent actions 02 and 09 of CGMS-35 were closed and incorporated in permanent action 01). | CNES e-mail input (no change). CMA-WP-02/03/04/05 (annexes); CNSA-WP01/02; EUM-WP-02; ESA-WP-01; JMA-WP-02/03; KMA-WP-02; NOAA-WP-02/03/05/06/37. See also http://cgms.wmo.int | 07-Nov-07 | |
| CGMS satellite operators | Permanent 02 | Permanent 02. All CGMS satellite operators to review the Transition Tables for LRIT/LRPT (appendix A of CGMS-31 WMO-WP-03) and provide any updates as appropriate at every CGMS plenary meeting. | EUM-WP-02; JMA-WP-02;KMA-WP-02; NOAA-WP-35.<br><br>WMO: Transition to HRIT/LRIT and HRPT/LRPT soon completed except for NOAA-POES series, and new dissemination approaches are being implemented (including DVB-S, Internet). It is suggested to close this action and to ask WG IV to propose a new and broader action requesting the provision of the list of dissemination means available for each satellite mission. | 07-Nov-07 | CLOSED |
| CGMS Members | Permanent 03 | Permanent 03. CGMS Members to report on spacecraft anomalies from solar events at CGMS meetings. | ESA-WP-07; EUM-WP-05; NOAA-WP-04; | 07-Nov-07 | |
| CGMS Members | Permanent 04 | Permanent 04.CGMS Members to provide information for the WMO database of satellite receiving equipment, as appropriate. | EUM: Operations biannual report via CGMS plenary listserver.<br>JMA: Provided to WMO by e-mail 26 Sep 2007.<br>NOAA-WP-26<br>WMO has temporarily suspended the database on-line access pending review and update of the content (Oct 2007). | 07-Nov-07 | |
| CGMS Members | Permanent 05 | Permanent 05. CGMS Members to review the list of available list servers used by CGMS groups and update as appropriate. | continuous/ongoing. ESA-WP-07, sent by e-mail; JMA by e-mail; NOAA by e-mail; WMO-WP-15 | 07-Nov-07 | |
| CGMS satellite operators | Permanent 06 | Permanent 06. CGMS satellite operators to consider the IOC satellite requirements, especially the data dissemination methods, bearing in mind the ongoing formations of GOOS Regional Alliances (GRAs). | ESA-WP-04. NOAA-WP-29 (CGMS-34) | 07-Nov-07 | |

| Permanent actions/actions/recommendations resulting from CGMS-34 | | | | | |
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| **Actionee** | **Action** | **Description** | **Closing document** | **Deadline** | **Status** |
| CGMS Members | Permanent 07 | Permanent 07. CGMS Members to consider the WIS (WMO Information System) concept (notion of DCPC [Data Collecting Product Centre], catalogue/metadata standards, protocols) when changing/implementing processing and dissemination systems.<br>*After confirmation from WMO, this action has been closed as it is now more appropriately taken into account in Action 35.32.* | EUM: Portal project started with the hope to have something ready by 2008 and to take the WIS concept into consideration. Status of portal to be reported at CGMS-36.<br>NOAA continues to investigate the WIS concept. | 07-Nov-07 | CLOSED |
| CGMS Members | Permanent 08 | Permanent 08. CGMS Members to consider WMO Core Metadata profiles within the context of the ISO Standard for Geographic Metadata (ISO 19115). | EUM-WP-18<br>NOAA's response to consider the WMO Core Metadata profiles remains the same as stated in their response at CGMS-XXXII. However, NOAA continues to investigate the WMO Core Metadata profiles within the context of the ISO Standard for Geographic Metadata (ISO 19115). CGMS will be informed of any changes in the NOAA position. | 07-Nov-07 | |
| CGMS satellite operators | Permanent 09 | Permanent 09. All CGMS satellite operators to update the WMO generated tables indicating transition of broadcast services of satellites in polar and geostationary orbit, and inform the Secretariat accordingly. | EUM-WP-02; JMA-WP-02; KMA-WP-02; NOAA-WP-35. It is proposed to close this action (see WMO input to permanent action 02). | 07-Nov-07 | CLOSED |
| CMA;WMO;CNSA | 34.01 | Action 34.01 CNSA/CMA and WMO to organise the 4th IGeoLab GEO-Microwave Focus Group meeting (FG-4) in China, with a goal to review scientific and technological elements in support of a possible Chinese undertaking in respect of FY-4M. Deadline: Before 30 | IGEOLab GEO MW FG4 was held at CMA in Beijing on 12-13 April 2007 and the report was circulated by e-mail to Plenary. WMO-WP-04. | 29-Jun-07 | CLOSED |
| WMO | 34.02 | Action 34.02 WMO to convene a Task Group to determine the interest of space agencies for an IGeoLab mission based on Molniya orbits. Deadline: CGMS-35 | Task Group convened in Moscow, 24 Apr 2007 and Geneva 9-10 Oct 2007. WMO-WP-03. | 07-Nov-07 | CLOSED |
| ESA | 34.03 | Action 34.03 ESA to check whether it is envisaged that ECMWF will further distribute ADM AEOLUS level 2 data to other NWP centres. Deadline: CGMS-35 | ESA-WP-03. ECMWF allowed to distribute levels 1b, 2b and 2c to met user community for any use. Registration according to procedures. | 07-Nov-07 | CLOSED |
| WMO | 34.04 | Action 34.04 WMO to organise a second Workshop on optimisation of GEO and LEO satellite plans to monitor progress in implementing the recommendations from the first Workshop and extend considerations to detailed instrument capability, taking into account | Workshop held 21-22 June 2007. Report to be presented at CGMS-35. ESA attended. WMO-WP-05/06. | 15-Sep-07 | CLOSED |
| EUM | 34.05 | Action 34.05 EUMETSAT to convene and lead a Task Force to assess possibilities for sharing ground segment facilities for radio-occultation missions and report at CGMS-35. EUMETSAT point of contact Dr Kenneth Holmlund (kenneth.holmlund (at) eumetsat.int). Deadline: CGMS-35 | EUM-WP-09 | 07-Nov-07 | CLOSED |
| WMO | 34.06 | Action 34.06 WMO shall set up a RARS implementation group with participation of CGMS members involved in RARS, in accordance with the draft Terms of Reference proposed in Appendix of CGMS-34 WMO-WP-28. Deadline: June 2007 | RARS Workshop held 3-4 July 2007. Report available at http://www.wmo.int/pages/prog/sat/Reports.html#RARSIG. WMO-WP-25. | 30-Jun-07 | CLOSED |

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| **Actionee** | **Action** | **Description** | **Closing document** | **Deadline** | **Status** |
| WMO | 34.07 | Action 34.07 WMO, with the support of ET-SAT, to refine the response to GCOS requirements on the basis of WMO-WP-37. Deadline: CGMS-35 | Meeting held 3-7 Sept 2007. NASA to develop customised interface with Global Change Master Directory on-line portal to facilitate access to GCOS-related satellite data. ESA involved in ET SAT.<br><br>WMO-WP-01; ET-SAT-3 has reviewed the response to GCOS requirements on 3-7 September with GCOS Secretariat. Following action was agreed: Action ET-SAT-3.11 M. King to provide an interface, to be developed by NASA/GSFC, to the Global Change Master Directory portal (www.gcmd.nasa.gov) in order to facilitate browsing and retrieval of instrument data that have been identified as relevant for FCDRs of GCOS Essential Climate Variables. (end November 2007) | 07-Nov-07 | CLOSED |
| WMO | 34.08 | Action 34.08 WMO to coordinate with CEOS to ensure that CGMS and CEOS provide consistent responses to GCOS requirements and complement each other's efforts. Deadline: CGMS-35 | ESA is involved in both CEOS and CGMS.<br>EUM-WP-14.<br>WMO: WMO Space Programme and CEOS Chair have kept each other informed of their activities and cooperated on this issue, namely through participation of CEOS Constellations in the Second Re-design and Optim | 07-Nov-07 | CLOSED |
| CGMS Members | 34.09 | Action 34.09 CGMS to continue its support of the VL, its structure and goals, and requests a full report on VL implementation (from the VL Management Group Meeting in 2007) be presented to CGMS-35. Deadline: CGMS-35 | EUM-WP-12; JMA submitted the activity report for VL to VLMG-3 on 4 June 2007; NOAA-WP-10; | 07-Nov-07 | CLOSED |
| EUM | 34.10 | Action 34.10 The Secretariat to contact the IPWG Chairpersons to invite inputs for WRC 2007, and whenever appropriate, to the Chair of WGI - Telecommunications, concerning the requirements for frequency bands for advanced sensors operating at frequencies | Discussed in WGI.<br>An IPWG on Microwave frequency protection report has been provided including parameters of required frequency bands for passive MW observations. This information will be forwarded to SFCG to be included into the relevant SFCG recommendation. | 07-Nov-07 | CLOSED |
| WMO | 34.11 | Action 34.11 WMO to confirm nomination of a frequency management expert representing CGMS at SFCG on an annual basis (currently Mr Robert Wolf). Deadline: CGMS-35 | Meeting held 3-7 Sept 2007. NASA to develop customised interface with Global Change Master Directory on-line portal to facilitate access to GCOS-related satellite data. ESA involved in ET SAT.<br><br>WMO-WP-01; ET-SAT-3 has reviewed the response to GCOS requi | 07-Nov-06 | CLOSED |

| Permanent actions/actions/recommendations resulting from CGMS-34 | | | | | |
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| **Actionee** | **Action** | **Description** | **Closing document** | **Deadline** | **Status** |
| CGMS Members | 34.12 | Action 34.12 CGMS members to review Space Frequency Coordination Group (SFCG) Resolution Res A12-1R2 and inform whether this resolution shall be used by CGMS agencies. Deadline: 31 August 2007 | ESA and NOAA are SFCG members and use RES A12-1R2 for frequency coordination.<br>EUM-WP-15<br>Statement and resolution provided by e-mail to CGMS plenary. | (31/08/2007)<br>New date:<br>31 Jul 08 | OPEN |
| EUM;WMO | 34.13 | Action 34.13 CGMS Secretariat, with the support of WMO, to respond to SFCG Liaison statement as soon as possible. Deadline: 15 December 2006 | Statement and resolution provided by e-mail to CGMS plenary. EUM-WP-15. WMO-WP-18 | 15-Dec-06 | CLOSED |
| CMA;KMA | 34.14 | Action 34.14 CMA and KMA to consider nominating a representative to the expert group related to meteorological satellite service matters of SFCG. Deadline: 31 December 2006 | Dr Bong-Ju Lee, Senior Engineer, Environmental and Meteorological Satellite Division, KMA, bjlee (at) kma.go.kr<br>Mr Zhiqing ZHANG, CMA, zqzhang (at) nsmc.cma.gov.cn | 31-Dec-06 | CLOSED |
| EUM | 34.15 | Action 34.15 EUMETSAT to inform CGMS Members when it has determined which three IDCS channels will be allocated for Tsunami monitoring purposes. Deadline: 31 December 2006 | Additional international channels number 17, 19 and 21. Information provided via the plenary list server. | 31-Dec-06 | CLOSED |
| WMO | 34.16 | Action 34.16 WMO to inform CGMS Members via the Secretariat when the ASDAR programme is terminated so that the Secretariat can reallocate ASDAR IDCS channel to other purposes. Deadline: 31 December 2006 | On 20 March 2007, WMO informed CGMS Secretariat that the last ASDAR unit had been deactivated on 20 February 2007 and that the ASDAR IDCS channels could be reallocated to other applications. | 31-Dec-06 | CLOSED |
| EUM | 34.17 | Action 34.17 The Secretariat, in coordination with NOAA, to initiate the discussions of the ad hoc IDCS Working Group by proposing an agenda, schedule and priority of discussion topics, follow up of discussions and report results to CGMS on a regular basi | To be discussed in WGI. EUM-WP-17. | 07-Nov-07 | CLOSED |
| CMA | 34.18 | Action 34.18 CMA is requested to put the software for image enhancement and analysis on a server for download by CGMS members. Deadline: 31 December 2006 | Provided by e-mail on 7 Feb 2007:<br>ftp server ftp://nsmc-ftp.cma.gov.cn<br>username: bangsh<br>password: ban123 | 31-Dec-06 | CLOSED |
| CGMS Members | 34.19 | Action 34.19 CGMS members to explore the potential of the Open Archival Information System Reference Model (OAIS-RM) as a framework for long-term satellite information preservation for enhancing interoperability of current, future, and historical data set | EUM-WP-18, NOAA-WP-39 | 07-Nov-07 | CLOSED |
| NOAA | 34.20 | Action 34.20 NESDIS is invited to provide a paper to CGMS-35 on progress in novel studies on the height allocation of AMVs to layers. Deadline: CGMS-35 | NOAA-WP-22 | 07-Nov-07 | CLOSED |
| CGMS Members | 34.21 | Action 34.21 CGMS members operating imaging instruments on polar orbiters should consider producing AMV wind products over the poles and report to CGMS-35 on the investigations. Deadline: CGMS-35 | EUM-WP-22, NOAA-WP-24, | 07-Nov-07 | CLOSED |
| CGMS Members | 34.22 | Action 34.22 All CGMS members producing AMV products to report on the use of the standard CGMS AMV statistics with a paper to CGMS 35. The paper should also present the co-location criteria currently in use. Deadline: CGMS-35 (feedback from 2 co-chairs) | EUM-WP-23; JMA-WP-06; NOAA-WP-25; | 07-Nov-07 | CLOSED |

| Permanent actions/actions/recommendations resulting from CGMS-34 | | | | | |
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| **Actionee** | **Action** | **Description** | **Closing document** | **Deadline** | **Status** |
| KMA | 34.23 | Action 34.23 KMA is invited to present a tentative product generation and dissemination plan for COMS at CGMS 35. Deadline: CGMS-35 | KMA-WP-08 | 07-Nov-07 | CLOSED |
| WMO | 34.24 | Action 34.24 The CGMS THORPEX Rapporteur will contact CGMS Member focal points with regards to their becoming involved in THORPEX Regional Planning activities. Deadline: CGMS-35 | ESA was contacted. WMO-WP-09. | 07-Nov-07 | CLOSED |
| NOAA | 34.25 | Action 34.25 NOAA is invited to report on reprocessing of AVHRR data for a new aerosol climatology over the oceans to CGMS 35. Deadline: CGMS-35 | NOAA-WP-27 | 07-Nov-07 | CLOSED |
| EUM | 34.26 | Action 34.26 EUMETSAT to present paper on the results of the cloud workshop held in 2005 and subsequent investigations. Deadline: CGMS-35 | EUM-WP-25 | 07-Nov-07 | CLOSED |
| WMO | 34.27 | Action 34.27: WMO to set up a Task Force on Codes following the TORs spelled out in WMO-WP-36 and report progress at CGMS 35. Deadline: CGMS-35 | It is now envisaged to convene this Task Force by the end of January or February 2008 time frame. | 07-Nov-07 | OPEN |
| CGMS satellite operators | 34.28 | Action 34.28: Each Satellite Operator is invited to nominate an expert to contribute to the WMO led Task Force on codes. Deadline: 31 December 2006 | EUM: Dr Simon Elliott, simon.elliott (at) eumetsat.int<br>JMA: Mr Masahito Osugi, mosugi (at) met.kishou.go.jp<br>NOAA: Mr Thomas Smith, Thomas.Smith (at) noaa.gov | 31-Dec-06 | OPEN |
| CGMS satellite operators | 34.29 | Action 34.29: CGMS operators to report to CGMS-35 on their future plans for using direct broadcast beyond 2015. Deadline: CGMS-35 | EUM-WP-06/08; JMA-WP-07; NOAA-WP-31; | 07-Nov-07 | CLOSED |
| CGMS Members | Recommendation 34.01 | Recommendation 34.01 CGMS, noting that the technical work on the GIFTS payload on ground is providing excellent results, and that it appears feasible to host the payload on Elektro-L2 in 2010, invites the main concerned parties to unblock the situation enabling EDU upgrading to flight model, thus also unblocking several CGMS members willing to contribute to the project once the core space segment issue is solved. Deadline: CGMS-35 | CNES is involved in the GSICS Implementation Plan and provides adequate resources on a best effort basis.<br>EUM participates.<br>NOAA: In January of 2006, NOAA informed the Federal Space Agency of Russia that while it is interested in having GIFTS in geostationary orbit, GIFTS is a NASA designed instrument that still requires considerable investment to make it flight qualified. In February of 2006, NASA informed the Federal Space Agency that due to funding constraints, it does not intend to complete a flight-qualified instrument. | 07-Nov-07 | CLOSED |
| CGMS Members | Recommendation 34.02 | Recommendation 34.02 CGMS, noting that marked progress has taken place in setting the scientific background and developing several technical concepts for a GEO-Microwave, invites space agencies that are considering or may consider microwave missions in geostationary orbit to accelerate their decisional process and identify a 'lead space agency' as soon as possible; and invites all Members, including user-oriented ones, to prepare contributions to the IGeoLab GEO-Microwave initiative following the identification of the 'lead space agency'. Essential contributions have already been indicated in previous CGMS sessions, as follows: provision of experimental data by airborne campaigns (CGMS-32.16), and securing funds for scientific activities (CGMS-33.01). Deadline: CGMS-35 | ESA has attended workshops.<br>NOAA: NOAA is supportive of the IGeoLab studies and feels the research agencies need to lead. Direct contributions by NOAA would be in data evaluation, assimilation of geo-microwave data into models, calibration/validation studies, and ground station processing system development. | 07-Nov-07 | CLOSED |

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| **Actionee** | **Action** | **Description** | **Closing document** | **Deadline** | **Status** |
| CGMS Members | Recommendation 34.03 | Recommendation 34.03 CGMS to pursue the geographical expansion of the global RARS network towards South-America, southern Africa and the Pacific, as well as the expansion of the RARS concept to additional time-critical parameters for NWP beyond ATOVS. Deadline: CGMS-35 | JMA-WP-08; WMO-WP-25.<br>NOAA does not plan to implement RARS, however, data would be available through the environmental satellite processing centre (ESPC) ftp service. | 07-Nov-07 | CLOSED |
| CGMS Members | Recommendation 34.04 | Recommendation 34.04 All CGMS members should make software tools useful for image enhancement and analysis available to other CGMS members and inform them accordingly. Deadline: CGMS-35 | ESA-WP-06. EUM ongoing/continuous. NOAA-WP-08 | 07-Nov-07 | CLOSED |
| CGMS Members | Recommendation 34.05 | Recommendation 34.05 In order to assure a rapid implementation of the GSICS, CGMS Members need to assure that adequate resources (manpower, infrastructure) are made available to adhere to the agreed implementation plan. Deadline: CGMS-35 | CNES involved, on a best effort for resource provision.<br>ESA is co-chair of CEOS Cal/Val and coordinates with GSICS.<br>EUM-WP-19<br>JMA-WP-05<br>NOAA-WP-09 | 07-Nov-07 | CLOSED |
| CGMS satellite operators | Recommendation 34.06 | Recommendation 34.06 Operational archive operators to install necessary reprocessing capabilities to allow for regeneration of datasets with improved quality. This includes that archive operators provide sufficient information of data quality and calibration accuracies to the user community. Deadline: CGMS-35 | JMA-WP-05; NOAA-WP-15<br>Not yet done by EUMETSAT. | 07-Nov-07 | CLOSED |
| CGMS satellite operators | Recommendation 34.07 | Recommendation 34.07 Archive operators are invited to develop mechanisms and provide means to allow running of third parties algorithms. Deadline: CGMS-35 | ESA-WP-06, NOAA-WP-15<br>Nnt yet done by EUMETSAT. | 07-Nov-07 | CLOSED |
| CGMS satellite operators | Recommendation 34.08 | Recommendation 34.08 It is recommended to make further efforts toward a near-global RARS and also include the data of advanced sounders and other data critical to NWP. Deadline: CGMS-35 | JMA-WP-08; WMO-WP-25<br>NOAA: The development of the NOAA RARS is being reconsidered. Data from the current NOAA series of advanced sounders and the advanced sounders of the NPP/NPOESS will be available through the NESDIS Environmental Satellite Processing Center's (ESPC's) File Transfer Protocol (FTP) service. | 07-Nov-07 | CLOSED |
| CGMS Members | Recommendation 34.09 | Recommendation 34.09 ITWG should foster coordinated international collaboration for future product development related to increasing the amount of data assimilated in NWP by the use of cloudy radiances (e.g. need improved cloudy radiative transfer modelling), cloud-cleared infrared radiances, and surface channels (need improved surface emissivity modelling. The ITWG Rapporteur should inform the ITWG co-chairs of this new recommendation. Status reports from each CGMS agency on these topics at the next CGMS meeting are encouraged. Deadline: CGMS-35 | EUM input provided via ITWG Rapporteur. NOAA-WP-16<br><br>Discussed in CGMS-35, Working Group II | 07-Nov-07 | CLOSED |

| Permanent actions/actions/recommendations resulting from CGMS-34 | | | | | |
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| **Actionee** | **Action** | **Description** | **Closing document** | **Deadline** | **Status** |
| CGMS Members | Recommendation 34.10 | Recommendation 34.10 ITWG should foster coordinated international collaboration for future product development related to development of climate data records from TOVS and other long-term satellite series. The ITWG Rapporteur should inform the ITWG co-chairs of this new recommendation. Status reports from each CGMS agency on the generation of CDRs at the next CGMS meeting are encouraged. Deadline: CGMS-35 | CNES supports scientific developments of climate data records from TOVS. (E.g. cirrus properties deduced from TOVS measurements (Stubenrauch C.J. <mailto:Claudia.Stubenrauch (at) lmd.polytechnique.fr> , Chédin A., Rädel G., Scott N.A., Serrar S.: Cloud propert NOAA-WP-38<br>Discussed in CGMS-35 Working Group II | 07-Nov-07 | CLOSED |
| ESA | Recommendation 34.11 | Recommendation 34.11 CGMS recommends that the status of the European contribution to the Global Precipitation Measurement (GPM) is clarified by ESA. Deadline: CGMS-35 | ESA-WP-08 | 07-Nov-07 | CLOSED |
| CGMS satellite operators | Recommendation 34.12 | Recommendation 34.12 Satellite operators should provide detailed information in near-real-time as well as quarterly assessment reports of instrument performance, particularly information should include noise assessment, spectral response characteristics (central wave number, shape and stability). Deadline: CGMS-35 | JMA started to provide detailed information on MTSAT-1R navigation and calibration through the Meteorological Satellite Center (MSC) website at http://mscweb.kishou.go.jp/monitoring/mtsat_monit.htm on 2 November 2006.<br>NOAA-WP-18 | 07-Nov-07 | CLOSED |
| CGMS satellite operators | Recommendation 34.13 | Recommendation 34.13 Satellite operators should maintain both conical scanning microwave imagers and cross-track scanning sounders on the same satellite platform. Deadline: CGMS-35 | EUM: Will be considered in the context of Post-EPS.<br>NOAA: NPOESS will fly the Cross-track Infrared Sounder (CrIS), Advanced Technology Microwave Sounder (ATMS), and, beginning with NPOESS C2, the Microwave Imager/Sounder (MIS). | 07-Nov-07 | CLOSED |
| CGMS satellite operators | Recommendation 34.14 | Recommendation 34.14 There should be a comparison of standard methods for the height assignment of AMVs with the new measurements from instruments on the A-Train (e.g. with the cloud lidar). Deadline: CGMS-35 | EUM-WP-21, KMA-WP-09; NOAA-WP-19, | 07-Nov-07 | CLOSED |
| CGMS satellite operators | Recommendation 34.15 | Recommendation 34.15 There should be a comparison of the operational algorithms of all satellite wind producers for the height assignment of AMVs from clouds using a common data set from SEVIRI on MSG, and the same ancillary data . Deadline: CGMS-35 | EUM-WP-23; JMA-WP-06; KMA-WP-09; NOAA-WP-20 | 07-Nov-07 | CLOSED |
| CGMS satellite operators | Recommendation 34.16 | Recommendation 34.16 An experiment should be performed to apply operational AMV retrieval algorithms to simulated images from high resolution NWP fields. Deadline: CGMS-35 | NOAA-WP-21 | 07-Nov-07 | CLOSED |
| CGMS satellite operators | Recommendation 34.17 | Recommendation 34.17 Considering the positive impact on re-analyses of re-processed AMVs it is recommended to complete the global reprocessing by including all geostationary satellites. Deadline: CGMS-35 | Done by EUM. NOAA-WP-23 | 07-Nov-07 | CLOSED |

| Permanent actions/actions/recommendations resulting from CGMS-34 | | | | | |
|---|---|---|---|---|---|
| **Actionee** | **Action** | **Description** | **Closing document** | **Deadline** | **Status** |
| NOAA;EUM;WMO | Recommendation 34.18 | Recommendation 34.18 Co-Chairs of the ITWG, IWWG and IPWG to consider common topics for future joint sessions during potential parallel conduct of future workshops. Deadline: CGMS-35 | To take place in 2010 at the earliest.<br>NOAA: During the final session of ITSC-15 the idea of a joint ITWG, IWWG and IPWG meeting/session was discussed. No official action or recommendation was recorded in the ITSC-15 report. However the majority of the ITWG participants are not in favor of a joint event. In the forthcoming ITSC-16, to be held in May 2008, ITWG will again review this topic and report the outcome to CGMS.<br>Discussed in CGMS-35 Working Group II. | 07-Nov-07 | CLOSED |
| NASA;ESA;CNES; ISRO | Recommendation 34.19 | Recommendation 34.19 NASA, ESA, CNES and ISRO to consider partnership towards the long term continuity of altimeter missions and inform CGMS-35. Deadline: CGMS-35 | ESA-WP-04 | 07-Nov-07 | CLOSED |
| CGMS Members | Recommendation 34.20 | Recommendation 34.20: CGMS to take into consideration plans for Earth radiation budget instruments on future GEO missions when evaluating the adequacy in low Earth orbit planning. Deadline: CGMS-35 | | 07-Nov-07 | CLOSED |
| NASA;ESA;JAXA; CNES;ISRO;CNSA | Recommendation 34.21 | Recommendation 34.21 NASA, ESA, JAXA, CNES, ISRO and CNSA to indicate the potential contributions their missions could make towards optimization of the polar-orbit prior to CGMS-35. Deadline: CGMS-35 | ESA attended the optimisation workshop.<br>CNSA-WP-03. | 07-Nov-07 | CLOSED |
| WMO | Recommendation 34.22 | Recommendation 34.22 The WMO Space Programme to host a Workshop to allow CGMS satellite operators (both operational and R&D) to consider how their combined plans for low Earth and geostationary missions could respond to WMO requirements. Deadline: 31 July 2007 | The 2nd Workshop was held on 21-22 June 2007. WMO-WP-06. | 31-Jul-07 | CLOSED |
| CGMS satellite operators | Recommendation 34.23 | Recommendation 34.23 CGMS operators should support the objectives of the IGDDS implementation plan. Deadline: CGMS-35 | JMA has been disseminating HRIT imagery data from MTSAT-1R via the Internet as its contribution to ADM/IGDDS. In addition, JMA is planning to provide MTSAT-1R imagery data in the compact JPEG format via the Internet by the end of 2007.<br>EUM: Contributes with EUMETCast; RMDCN and GTS data feed. | 07-Nov-07 | CLOSED |

## B. REPORT ON THE STATUS OF CURRENT SATELLITE SYSTEMS

### B.1 Polar-orbiting Meteorological Satellite Systems

In CMA-WP-02, CMA reported on its polar-orbiting FY-1 satellite series. It recalled that the FY-1 polar-orbiting meteorological satellite programme started in 1988, and that FY-1A was launched on 7 September 1988. It continued by informing CGMS that the programme has produced four satellites, namely the FY-1A/B/C/D where the latter is currently in operation and will be the last satellite of this programme. It added that the FY-1 satellite series is a 3-axis stabilised spacecraft programme, carrying the Multi-channel Visible and Infrared Scanning Radiometer (MVISR) for Earth environment monitoring at sub-point resolution 1.1 km; and the Space Environment Monitor (SEM) for in-situ observation of charged particles in solar winds. Furthermore, a direct Readout Service is available through the HRPT transmission.

EUMESAT reported on the status of the EUMETSAT Polar System (EPS) in EUM-WP-03. EPS is the European contribution to the Initial Joint Polar System (IJPS) established with NOAA, and the first European contribution to the follow-up Joint Polar System (JPS) expected to be formed with the US “converged” NPOESS system.

The paper reported that after a successful launch and commissioning period, and a well performing ground segment, a major failure of the HRPT mission occurred on 4 July 2007. The paper further described that the nominal A-HRPT autonomously ceased transmitting and that EUMETSAT completely deactivated the unit. It continued by stating that a series of on-board/ground tests had been performed, and that although no definitive conclusions were available, investigations had thus far concluded that the failure on the nominal A-HRPT side A is of a permanent, non-correctable nature, which was most likely a problem with an output transistor in the Solid State Power Amplifier (SSPA) electronics. Further investigations were ongoing and pending additional results there were no intentions to commence activation of the redundant HRPT side B. In addition, issues and anomalies on Metop-A were being addressed for Metop-B and -C.

The paper concluded by saying that the successful launch and commissioning of the EUMETSAT Polar System/Metop-A satellite represented key milestones for operational meteorology and international cooperation. In the future, the cooperation would continue for the remainder of the IJPS, i.e. NOAA N’, Metop-B and -C and in the definition of the future Joint Polar System, capitalising on the success.

NOAA-WP-02 updated CGMS on the status of the POES programme. The POES spacecraft constellation includes two primary, one secondary, two standby and one non-operational spacecraft. These spacecraft are in circular orbits inclined at approximately 98 degrees (retrograde). As of 21 May 2007, NOAA declared EUMETSAT's METOP-A as their mid-morning operational

spacecraft. The primary operational spacecraft, NOAA-18 is in sun-synchronous afternoon orbit, whereas three secondary spacecraft, NOAA-17, NOAA-16 and NOAA-15 provide additional payload operational data. NOAA-12 is a standby spacecraft supporting additional user data requirements and NOAA-14 was decommissioned on 23 May 2007.

The next POES launch, NOAA-N' is slated for launch in February 2009, and will be renamed NOAA-19 once it achieves orbit.

**Action 35.01: NOAA to provide more detailed information on the DMSP satellite system. Deadline: CGMS-36**

## Table 1: Current Polar-Orbiting Satellites Coordinated within CGMS

(as of 9 November 2007)

| **Orbit type**<br><br>(equatorial crossing times) | **Satellites in orbit**<br>(+operation mode)<br>P=Pre-operational<br>Op=operational<br>B=back-up<br>L=limited availability<br>R= R&D | **Operator** | **Equatorial Crossing Time**<br>A=Ascend (northward)<br>D=Descend (southward)<br>+Altitude | **Launch date** | **Status** |
|---|---|---|---|---|---|
| **Sun-synchronous local "early morning" orbit (05:00 –07:00) (17:00 – 19:00)** | FY-1D (Op) | CMA | 18:50 (D)<br>866 km | 15 May 2002 | Functional. CHRPT. MVISR, SEM. Expected end of service ≥2007. Last s/c of FY-1 series. |
| | NOAA-12 (L) | NOAA | 05:24 (D)<br>804 km | 05/1991 | Standby s/c. Functional (except sounding). |
| | NOAA-15 (B) | NOAA | 05:16 (D)<br>807 km | 05/1998 | Functional (intermittent problems with AVHRR, AMSU-B & HIRS) |
| | DMSP-F13 (B) | NOAA | 18:33 (A)<br>850 km | 03/1995 | Defence satellite. Data available to civilian users through NOAA. |
| | DMSP-F14 (B) | NOAA | 17:24 (A)<br>852 km | 04/1997 | Defence satellite. SSMT1 (microwave temperature sounder) non-functional. SSMT2 non-functional. Only 1 functional onboard recorder. Data available to civilian users through NOAA. |
| | DMSP-F17 (Op) | NOAA | 17:31 (A)<br>850 km | 4 Nov 2006 | Defence satellite. SSMIS. Data available to civilian users through NOAA. |
| **Sun-synchronous local "morning" orbit (07:00 – 12:00) (19:00 – 24:00)** | Metop-A (Op) | EUMETSAT | 21:30 (A)<br>837 km | 19 Oct 2006 | Commissioning Operational. HRPT and LRPT not functional. EUMETCast ADM |
| | NOAA-17 (B) | NOAA | 10:08 (D)<br>810 km | 6/2002 | Functional. AMSU-A1 failed. |
| | DMSP-F15 (B) | NOAA | 19:37 (A)<br>850 km | 12/1999 | Defence satellite. SSMT2 (microwave water vapour sounder) non-functional. Data available to civilian users through NOAA. |
| | DMSP-F16 (Op) | NOAA | 20:04 (A)<br>850 km | 10/2003 | Defence satellite. SSMIS. Data available to civilian users through NOAA. |
| **Sun-synchronous local "afternoon" orbit (12:00 – 17:00) (00:00 – 05:00)** | NOAA-16 (B) | NOAA | 16:04 (A)<br>849 km | 09/2000 | Functional, no APT. Intermittent problems with AVHRR. |
| | NOAA-18 (Op) | NOAA | 13:37 (A)<br>854 km | 5/2005 | Functional. Noise on HIRS long wave channels |
| | DMSP-F12 (L) | NOAA | 15:35 (A)<br>850 km | 8/1994 | Defence Satellite. SSMI (microwave imager) and SSMT1 non-functional. Non-operational (no onboard recorders). |

## B.2 Geostationary Meteorological Satellite Systems

In CMA-WP-03 CMA reported on the status of the FY-2 geostationary satellites, whose programme has produced a total of four satellites, of which FY-2A at 86.5°E and FY-2B at 123.5°E had both been successfully de-orbited. It continued by stating that FY-2C at 105°E is the primary satellite for operational use and that FY-2D, launched on 15 November 2006, is stationed at 86.5°E. It stated that the capability of FY-2C/D is identical, carrying both a VISSR and a SEM and that in June 2007, FY-2D joined FY-2C in flood season observations. The ground station receives images alternatively from FY-2C and FY-2D's interlaced scanning every 15 minutes in flood season from June-September, every 30 minutes out of the flood season.

In EUM-WP-04 EUMETSAT reported on the operation of its Meteosat System including the EUMETSAT ATOVS Retransmission Service (EARS) and International Data Collection System (IDCS) service. The EUMETCast ADM would be reported on in a separate Working Paper (EUM-WP-11). It stated that the Meteosat system currently comprises four satellites: Meteosat-6, -7, -8 and -9, where Meteosat-9 is the primary spacecraft at 0°, with Meteosat-8 as backup also providing a rapid scanning service, and with Meteosat-6 and -7 contributing to the Indian Ocean Data Coverage Service. Meteosat-5 was de-orbited in April 2007 after more than 16 years of service.

The working paper also provided detailed information on the various spacecraft and ground segments, on the long-term planning and its assumptions, on IDCS, on service transitions, and on dedicated project undertakings, such as the Indian Ocean service, the EARS project, and EUMETCast South America.

It concluded with an outline of a new initiative, the Earth Observation Portal Project, whose main objective is to implement a unified and central service structure, in order to provide EUMETSAT users with a single point of entry for online access to all EUMETSAT data and dissemination services.

JMA reported in JMA-WP-02 on the status of its multi-functional transport satellites, MTSAT-1R and MTSAT-2, including the International Data Collection System (IDCS) of MTSAT-1R.

It stated that no significant spacecraft anomalies occurred on the MTSAT spacecraft during the reporting period, and that maintenance was performed on MTSAT-1R for around 27 hours at the beginning of June 2007. During this period, MTSAT-2 successfully conducted back-up observation for MTSAT-1R. It further informed that the IDCS of MTSAT-1R has been functioning properly since the satellite began operation, and that as of the end of September 2007, 13 IDCPs were registered on 5 out of 33 MTSAT-IDCS channels.

It concluded that MTSAT-2 has been in standby in a geostationary orbit since 4 September 2006, and that JMA is planning to conduct rapid scanning using MTSAT-2 mid 2008 as part of the THORPEX regional campaign.

CGMS noted that as from 12 March 2008, MTSAT HRiD and WEFAX dissemination would be discontinued.

In NOAA-WP-03, NOAA reported on the status of its geo-synchronous meteorological satellites, where it nominally operates two meteorological satellites in geostationary orbit over the equator. Each satellite views almost a third of the Earth's surface: One monitors North and South America and most of the Atlantic Ocean, the other North America and the Pacific Ocean basin. GOES-12 (or GOES-East) is positioned at 75°W longitude and the equator, while GOES-11 (or GOES-West) is positioned at 135°W longitude and the equator. GOES-10 is located at 60°W to support coverage of South America.

The GOES-13 satellite was successfully launched on 24 May 2006 and is currently in in-orbit storage mode as the primary backup for the operational GOES satellites.

GOES-9 was decommissioned on 24 June 2007 and GOES-8 was decommissioned on 5 May 2004. GOES-3 and GOES-7, spin-stabilised satellites from the previous GOES series, continue a track record of more than 55 years of combined service via continued support of non-NOAA users in a data relay mode (non-imaging).

**Table 2: Current Geostationary Satellites Coordinated within CGMS**
(as of 9 November 2007, sorted by organisation)

| **Sector** | **Satellites currently in orbit (+type)** P: Pre-operational Op: Operational B: Back-up L: Limited availability | **Operator** | **Location** | **Launch date** | **Status** |
|---|---|---|---|---|---|
| **West–Pacific (108°E-180°E)** | MTSAT-1R (Op) | JMA | 140°E | 26 Feb 2005 | Fully Functional |
| | MTSAT-2 (B) | JMA | 145°E | 18 Feb 2006 | Multifunctional Transport Satellite (in-orbit back-up to MTSAT-1R until 2010 thereafter operational) |
| **East-Pacific (180°W- 108°W)** | GOES-11 (Op) | NOAA | 135°W | 3 May 2000 | Operational GOES-West spacecraft since 28 Jun 2006 |
| **West-Atlantic (108°W-36°W)** | GOES-10 (B) | NOAA | 60° W | 04/1997 | Supports South America. Inverted, solar array anomaly, DCP interrogator on back-up. |
| | GOES-12 (Op) | NOAA | 75°W | 07/2001 | Solar X-Ray Imager anomaly May 05 under investigation |
| | GOES-13 (B) | NOAA | 105°W | 16 May 2006 | In storage mode. |

| Sector | Satellites currently in orbit (+type)<br>P: Pre-operational<br>Op: Operational<br>B: Back-up<br>L: Limited availability | Operator | Location | Launch date | Status |
|---|---|---|---|---|---|
| **East-Atlantic (36°W-36°E)** | Meteosat-8 (B) | EUMETSAT | 3.4°W | 28 Aug 2002 | No LRIT. Back-up to Meteosat-9. Rapid scanning service. EUMETCast ADM. |
| | Meteosat-9 (Op) | EUMETSAT | 0°W | 21 Dec 2005 | Primary s/c. Fully operational. EUMETCast ADM. |
| **Indian Ocean (36°E-108°E)** | FY-2C (Op) | CMA | 105°E | 19 Oct 2004 | S-VISSR (improved), DCS, SEM. Expected end of service ≥2009 |
| | FY-2D (B) | CMA | 86.5°E | 15 Nov 2006 | S-VISSR (improved), DCS, SEM, LRIT. Back-up to FY-2C. |
| | Meteosat-6 (B) | EUMETSAT | 67.5°E | 11/1993 | Functional. Back-up to Meteosat-7. DCP mission support. EUMETCast ADM. |
| | GOMS-N1 (L) | Roshydromet | 76°E | 11/1994 | Since 09/1998 in stand-by |
| | Meteosat-7 (Op) | EUMETSAT | 57.5°E | 02/1997 | Functional. IODC coverage committed till end 2010. EUMETCast ADM. |
| | INSAT 3-C (L) | IMD | 74°E | 24 Jan 2002 | No meteorological payload. Used for dissemination of processed meteorological data in broadcast mode in S-Band only over India and neighbouring countries. No WEFAX broadcast capability in L-band. |
| | Kalpana-1 (Op) (formerly METSAT) | IMD | 74°E | 20 Sep 2002 | Dedicated meteorological satellite.<br>- Monitoring cyclones & monsoon<br>- CMV Winds<br>- OLR<br>- Rainfall Estimation |

| Sector | Satellites currently in orbit (+type)<br>P: Pre-operational<br>Op: Operational<br>B: Back-up<br>L: Limited availability | Operator | Location | Launch date | Status |
|---|---|---|---|---|---|
| **Indian Ocean (36°E-108°E) (continued)** | INSAT-3A (Op) | IMD | 93.5°E | 10 Apr 2003 | - Monitoring cyclones & monsoon<br>- CMV Winds<br>- OLR<br>- Rainfall Estimation<br>- Mesoscale features<br>- Flood/intense precipitation advisory<br>- Snow detection<br><br>Operational since 24 Apr 2003. A 3-channel VHRR imager and CCD payload available for use similar to INSAT-2-E. |

## B.3 Research and Development Satellite Systems

CNSA presented in CNSA-WP-01 the status of the Chinese Earth Observation missions, which includes the FY satellite series, the CBERS satellite series, and HY-1B. The Working Paper also presented the status of the CNSA satellites in orbit, where HY-1B and CBERS02B were launched and have been operated in 2007.

Furthermore, it highlighted that CNSA actively promotes international cooperation and satellite data exchange, and that CNSA is committed to providing CBERS02 satellite data free of charge in China, Brazil, China's neighbouring countries and Africa. It continued by stating that data dissemination tests for CBERS02 have been implemented in Europe, Australia and other countries. CNSA will provide various kinds of data services with multiple methods, such as data exchange and paid or free distribution.

The Working Paper concluded by expressing CNSA's intention to conduct close cooperation with CGMS Members, and inviting experts to evaluate CNSA satellite data and applications.

In CNSA-WP-03, CGMS was introduced to the HY-1B satellite, successor of the HY-1A satellite, which is used to detect ocean colour and sea surface temperature. It was successfully launched on 11 April 2007 and the main sensors on board include the 10-band Chinese Ocean Colour and Temperature Scanner (COCTS) as well as a 4-band Coastal Zone Imager (CZI).

It continued by stating that during in-orbit testing, calibration and validation work had been performed and the characteristics of the platform and its sensors were available, and that the products for ocean colour and SST were prepared. It

pointed out that the data quality from the sensors and satellite specifications are better than those of HY-1A. It finally informed CGMS that the data from the satellite can be used in marine resource management, marine environment monitoring and protection, marine disaster monitoring and forecasting, oceanographic research and international cooperation.

In ESA-WP-01, CGMS was informed of the status of the current European Space Agency (ESA) Earth Observation missions. The Working Paper stated that two of these missions, MSG and Metop, are undertaken in cooperation with EUMETSAT. Furthermore, the success of the Envisat mission, launched in 2002, was well established, with a constant increase of user demand for data and services, resulting in over 1300 scientific projects currently served with Envisat data. Moreover, the data accessibility was constantly upgraded, through Internet and Telecom satellites multicast, and the 2007 Envisat symposium attracted about 1000 participants from all over the world. Data policy and means of access were presented to WGII.

It continued by stating that as from today, the Envisat mission has exceeded the original foreseen 5-year lifetime and it is expected to continue nominal operations until 2010. ERS-2, the second ESA Earth observation mission, launched in 1995, continues to satisfy a steadily increasing data demand despite the failure of gyroscopes and low rate recorders, for which workaround solutions have been successfully implemented. Finally, PROBA, an experimental ESA satellite, continues to provide remarkable hyperspectral data since 2001.

In JAXA-WP-01, JAXA presented the updated status of its Advanced Land Observing Satellite, ALOS. After the Initial Calibration and Validation Phase, ALOS routine operations began in late October 2006. The routine operations of all the sensors were currently going well.

Furthermore, the paper indicated that the ALOS data was available through ALOS data nodes dedicated to each region and that in this context, the ALOS Level 0 data were distributed to the nodes on a regular basis and users could obtain the ALOS products through the user's node. A regional distributor was designated for each node for commercial distribution of the ALOS products within the relevant zone.

It concluded by reporting on the ALOS's contribution to Sentinel Asia, a type of new collaboration between space agencies and disaster management agencies applying Remote Sensing and Web-GIS technologies to assist disaster management in the Asia-Pacific region. The Sentinel Asia initiative was reported to GEO as an early achievement of GEOSS.

It was also mentioned that JMA's MTSAT Imagery was also available on the website (http://dmss.tksc.jaxa.jp/sentinel/).

**Action 35.02: CGMS invited NASA to provide information on its current R&D Earth Observation satellites. Deadline: CGMS-36**

## Table 3: Current R & D satellites discussed within CGMS

(as of 9 November 2007, sorted by organisation)

| **Satellites in orbit** (+operation mode) | **Operator** | **Crossing Time** A=Northw D=Southw +Altitude | **Launch date** | **Application/ instruments** | **Status, Application and other information** |
|---|---|---|---|---|---|
| PARASOL | CNES | 705 km sun-synchr. | 18/12/2004 | POLDER | Characterisation of clouds and aerosols micro-physical and radiative properties. Data can be accessed for level 1 at <http://parasol-polder.cnes.fr/> and for level 2 and more at <http://www-icare.univ-lille1.fr/> |
| SPOT-5 | CNES | 832 km sun-synchr. | 3/05/2002 | DORIS, HRG, HRS, VEGETATION | Cartography, land surface, agriculture and forestry, civil planning and mapping, digital terrain models, environmental monitoring |
| CBERS-02 | CNSA/ AEB | 10:30 (D) 778 km | 10/2003 | Multi-spectral Camera, Infrared Scanner Camera, Wide Field Imager Camera | Land resource observation |
| HY-1B | CNSA | 10:30 +/-30 min (D) 798 km | 04/2007 | Ocean colour and temperature scanner and 4 bands CCD imager. (CZI) | |
| ERS-1 | ESA | 10:30 (D) 785 km | 07/1991 | Altimeter, SAR, SAR-wave, ATSR, Scatterometer | Replaced by ERS-2 in Mar 2000 after an overlapping period |
| ERS-2 | ESA | 10:30 (D) 785 km | 04/1995 | Altimeter, SAR, SAR-wave, ATSR, Scatterometer, GOME | Due to OB recorder problems in Jun 2003, the LBR mission is only ensured over ESA agreed acquisition stations. |
| ENVISAT | ESA | 10:000 (D) 800 km | 03/2002 | 10 instruments for Environment: ASAR, AATSR, MERIS, GOMOS, MIPAS, SCHIAMACHY, RA-2, MWR, DORIS | ▪ MIPAS is operated at 80% of its duty cycle.<br>▪ GOMOS performs satisfactorily with reduced azimuth range, since Aug 2005.<br>▪ RA-2 anomalies between Feb 2006 and Feb 2007 have been compensated with on-ground tools.<br><br>Operations funding extended 3 years (till 2010) |

| **Satellites in orbit** (+operation mode) | **Operator** | **Crossing Time** A=Northw D=Southw +Altitude | **Launch date** | **Application/ instruments** | **Status, Application and other information** |
|---|---|---|---|---|---|
| PROBA | ESA | 10: 30 (D) 613 km | 10/2001 | CHRIS | Drifting orbit. Technology experiment. AO Science mission since 2003. |
| ALOS | JAXA | 10:30 700km sun-synchronous | 24 Jan 2006 | PRISM, AVNIR-2, PALSAR | Advanced Land Observing Satellite (mapping, precise land coverage observation, disaster monitoring, resource surveying) |
| TRMM | JAXA/ NASA | 402 km non-sun-synchr. | 11/1997 | Precipitation Radar equipment provided by JAXA and TRMM Microwave Imager (TMI), satellite bus and other instruments provided by NASA | Measures tropical rainfall/precipitation and radiation energy |
| ACRIMSAT | NASA | 716 km sun-synchr. | 20/12/1999 | ACRIM III | Active Cavity Radiometer Irradiance Monitor Satellite Measures total solar irradiance, studies incoming solar radiation and adds measurements of ocean and atmosphere currents and temperatures as well as surface temperatures. |
| Aura | NASA/BNSC | 705 km sun-synchr. | 15/07/2004 | Comprehensive measurements of atmospheric chemistry and trace gasses | |
| Terra | NASA | 705 km sun-synchr. | 18/12/1999 | CERES, MISR, MODIS, MOPITT, ASTER | Measurement of the Earth's climate system, atmosphere, land, oceans and interactions with solar radiation |
| Jason-1 | NASA/ CNES | 1336 km non-sun-synchr. | 07/12/2001 | Laser retroreflector array Poseidon-2 solid state radar altimeter DORIS receiver Jason Microwave Radiometer BlackJack GPS Receiver tracking system | Ocean surface topography Follow-on mission to TOPEX/P. Monitor global ocean circulation for global climate prediction. |

| **Satellites in orbit** (+operation mode) | **Operator** | **Crossing Time** A=Northw D=Southw +Altitude | **Launch date** | **Application/ instruments** | **Status, Application and other information** |
|---|---|---|---|---|---|
| Aqua | NASA | 705 km sun-synchr. | 04/05/2002 | AMSR-E, AIRS, AMSU-A, CERES, HSB, MODIS | Collects data on Earth's water cycle, precise atmospheric and oceanic measurements, and interaction with solar radiation AMSR-E provided by JAXA. HSB provided by INPE (no longer functional) |
| Landsat 7 | NASA | 705 km sun-synchr. | 15/04/1999 | Enhanced Thematic Mapper Plus Instrument (ETM+) | Well-calibrated, multispectral, moderate resolution, substantially cloud-free, sunlit digital images of the Earth's continental and coastal areas |
| NMP EO-1 (New Millennium Program Earth Observing-1) | NASA | 10:01 (D) 705 km sun-synchr. | 21/11/2000 | Advanced Land Imager<br>Hyperion<br>LAC (atmospheric corrector) | Demonstrates and validates advanced technology instruments (multi and hyperspectral), spacecraft systems, and in flight mission concepts |
| ICESat (Ice, Cloud, and Land Elevation Satellite) | NASA | 600 km circular non-sun-synchr. | Jan. 2003 | Geo-science Laser Altimeter System<br>GPS BlackJack receiver | Measures ice sheet topography, ice sheet elevation changes, cloud and aerosol heights and land topography and vegetation characteristics. |
| QuickSCAT (Quick Scatterometer) | NASA | 803 km sun-synchr. | 19/06/1999 | SeaWinds | Sea surface wind speed and direction data for global climate research operational weather forecasting and storm warning |
| SORCE (Solar Radiation and Climate Experiment) | NASA | (40˚ incl) 640 km non-sun-synchr. | 25/01/2003 | - XPS (Extreme Ultraviolet (XUV) Photometer System)<br>- TIM (Total Irradiance Monitor)<br>- SIM (Spectral Irradiance Monitor A&B)<br>- SOLSTICE (Solar Stellar Irradiance Comparison Experiment A&B) | Will provide total irradiance measurements and full spectral irradiance measurements. Continuation of ACRIMSAT total solar irradiance measurements. |
| TOMS EP (Total Ozone Mapping Spectrometer - Earth Probe) | NASA | 740 km sun-synchr. | 02/07/1996 | Total Ozone Mapping Spectrometer | Measurements of total column ozone and its variation on a daily basis |

| **Satellites in orbit** (+operation mode) | **Operator** | **Crossing Time** A=Northw D=Southw +Altitude | **Launch date** | **Application/ instruments** | **Status, Application and other information** |
|---|---|---|---|---|---|
| GRACE (Gravity Recovery and Climate Experiment) | NASA/ DRL | (89° incl) 485 km non-sun-synchr. | 17/03/2002 | - Star Camera Assembly<br>- GPS BlackJack Receiver<br>- Instruments Processing Unit<br>- Laser Retro-Reflector Assembly<br>- K-Band Ranging Instruments<br>- SuperSTAR Accelerometers | Accurate global and high-resolution determination of static and time-variable components of Earth's gravity field<br>Measurement of:<br>- Gravitational field<br>- GPS atmospheric and ionospheric limb sounding |
| SRTM (Shuttle Radar Topography Mission) | NASA | 233 km non-sun-synchr. | 11/02/2000 (11 day duration) | X-SAR<br>SIR-C<br>GPS BlackJack Receiver | Topographic mapping of the Earth. Data currently used by various Government Agencies |
| CALIPSO | NASA/ CNES | 705 km sun-synchronous | 28 Apr 2006 | | Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations for climate predictions |
| CloudSAT | NASA/ CSA | 705 km sun-synchronous | 28 Apr 2006 | | Global cloud properties (applications: air quality, aviation safety, disaster management, energy and water management) |
| Monitor-E | ROSCOSMOS | (550 km) (10:30) | 08/2005 | Land Observing Satellite | Experimental exploitation |
| RESURS-DK1 | ROSCOSMOS | Elliptical orbit, $H_p$=360km, $H_a$=604km, incl.=70.4° | 15 Jun 2006 | - Panchromatic scanner<br>- Multi-spectral scanner<br>- PAMELA (Italy) for primary cosmic radiation investigation<br>- ARINA for earthquake prediction investigation | Testing in orbit and experimental exploitation |

## B.4 Anomalies from solar and other events

CMA-WP-11 informed CGMS that the National Centre for Space Weather (NCSW) had been established and since July 2004 provided a space weather service by regularly issuing weekly, monthly, and annual bulletins to inform the public on hazardous space weather events. It stated that NCSW's operation is currently supported by both ground- and space-based facilities, where for the ground part, there are GPS networks and a digital ionosonde, a solar photosphere and chromospheres telescope et other scientific equipments. As for the space-based facilities, these include the energetic particles and solar X-ray flux monitors onboard the FY-1 and FY-2 satellite

series respectively. It continued by stating that new instruments will be deployed in the near future, such as a Solar X-ray Imager (SXI), Solar Ultraviolet Flux Monitor, and Magnetometer. It concluded that a more sophisticated ground-based observational network focusing on ionosphere and mid- and upper-atmosphere was taking shape.

EUM-WP-05 reported on the anomalies attributed to solar events that had been detected on the EUMETSAT in-orbit satellites: Metosat-6, 7, 8 and 9 and Metop-A.

It described the Meteosat-8 loss of solar array current, battery charge ending, unexpected safe mode switching and orbit change, and continued by outlining other effects affecting instruments on Meteosat-9, such as the SEVIRI imager, Intermediate Frequency Processor of the Mission Communication Payload. It further indicated effects on the Metop-A spacecraft and its instruments, such as GOME Ghost EQ SOL, GOME Scan Unit uncommanded switch-on, MHS fault mode entry, IASI laser SEU anomaly, IASI 1-bit error, SSR anomaly, and a further range of effects.

It also reported on actions taken and conclusions made, as well as on measures to minimise any similar impacts in future.

NOAA-WP-04 provided an update of the solar activities from high proton events of solar flares and Coronal Mass Ejections (CMEs). These occurrences were associated with energetic proton events of Solar Cycle 23 as it approaches its minimum, which is expected to occur during the latter half of 2008. Information was provided on major activities observed from September 2006 through July 2007. A single episode of major space weather activity occurred during the summary period. It is typical for energetic electron fluxes to increase during the declining phase of the solar cycle as recurrent coronal holes produce regular intervals of high-speed solar winds that interact with the geomagnetic field. Electron flux levels reached high levels at geosynchronous orbit on about 55% of the days during the period. Very high flux levels occurred on 14 December 2006.

WMO-WP-02 addressed the relevance of Space Weather observations for WMO activities and the potential role of WMO in that area. It underlined the critical importance of Space Weather events for CGMS satellites, the contribution of CGMS satellites to Space Weather observations, and the possible impact of Space Weather phenomena on climate variables and on a number of human activities.

It further stated that Space Weather was not within the current mandate of WMO, but several WMO Members had suggested that WMO could support global cooperation in this area. Given the very limited resources that could be devoted to such a new activity within WMO, it would be focussed on some precise topics such as observation requirements, instrument information and data exchange. It was noted that the International Space Environment Service (ISES), working in connection with ICSU, had approached WMO and was

seeking the support of WMO for coordinating space weather activities in the United Nations framework.

It concluded by inviting the CGMS satellite operators to express their views on whether they would see a benefit in WMO involvement in Space Weather, its potential scope, as well as on the specific role of CGMS in this respect.

CMA supported the view of a WMO involvement in particular for harmonisation of requirements and data exchange. EUMETSAT indicated that it was considering including space weather observations among post-EPS objectives. JMA reported on emerging cooperation with the National Institute of Information and Communication Technology (NICT) which is responsible for space weather activities in Japan. WMO concluded that this positive feedback from CGMS would be taken into account in the report that WMO will present to CM-8 in January 2008.

## C. REPORT ON FUTURE SATELLITE SYSTEMS

### C.1 Future Polar-orbiting Meteorological Satellite Systems

CMA informed CGMS in CMA-WP-04 about the development of FY-3, the new series of polar-orbiting meteorological satellites with a total of seven starting with FY-3A and ending with FY-3G, covering the period from 2008 to 2021. It indicated that the FY-3 series will operate either the morning or afternoon orbit, and that the main instruments would include the Medium Resolution Spectral Imager (MERSI), the Microwave Radiation Imager (MWRI), in addition to Visible and Infrared Scanning Radiometer (VISR). Furthermore, it stated that the sounding instruments will include the Infrared Atmospheric Sounder (IRAS), the Microwave Temperature Sounder (MWTS), and Microwave Humidity Sounder (MWHS) and that on board there would be a Total Ozone Unit and Solar Backscatter Ultraviolet Sounder (TOU/SBUS), as well as an Earth Radiation Budget instrument.

EUMETSAT provided updates in EUM-WP-06 on its plans for post-EPS, which would be the continuation of the EPS operational programme with an anticipated start of operations in 2018/2019. The EUMETSAT Post-EPS Programme was ongoing, and the current Phase 0 activities focus on a User Consultation process and the definition and consolidation of mission requirements, in line with established preliminary mission requirements and with the support of ESA, whose Pre-Phase A competitive studies are planned to start in early autumn 2007.

Furthermore, the paper provided a list of observation missions identified in the Mission Requirement Document and its related study approach. It concluded by giving an overview of the timing of phases 0 (ongoing) to E (2009-2018 plus 15 years of operations).

NOAA-WP-05 discussed NOAA's future polar-orbiting meteorological satellite systems, current operational system, and the planned launch schedule for

NOAA-N'. Information was provided on the international polar-orbiting satellite programme coordination between EUMETSAT and NOAA. An agreement is in place between NOAA and EUMETSAT on the Initial Joint Polar-orbiting Operational Satellite System (IJPS). This programme will include two series of independent but fully coordinated NOAA and EUMETSAT satellites, exchange of instruments and global data, cooperation in algorithm development, and plans for real-time direct broadcast. The goal of this cooperation is to provide continuity of measurements from polar orbits, cost sharing, and improved forecast and monitoring capabilities through the introduction of new technologies.

NOAA discussed the development and implementation plans for the National Polar-orbiting Operational Environmental Satellite System (NPOESS). Beginning later this decade, NPOESS spacecraft will be launched into two orbital planes to provide significantly improved operational capabilities and benefits to satisfy the critical civil and national security requirements for space-based, remotely sensed environmental data. It informed CGMS of the advanced technology visible, infrared, and microwave imagers and sounders that are being developed for NPOESS. The NPOESS sensors will deliver higher spatial and temporal resolution atmospheric, oceanic, terrestrial, and solar-geophysical data enabling more accurate short-term weather forecasts, as well as serving the data continuity requirements for improved global climate change assessment and prediction. NOAA stated that the NPOESS programme is on the path to creating a high performance, polar-orbiting satellite system that will be more responsive to user requirements, deliver more capability at less cost, and provide sustained, space-based measurements as a cornerstone of an Integrated Global Observing System. Finally it stated that these activities represent a significant step toward achieving the planned national and international operational satellite programmes that will ensure continuous support to a variety of users well into the 21$^{st}$ century.

## Table 4: Future Polar-Orbiting Satellites Coordinated within CGMS

(as of 9 November 2007)

| Orbit type (equatorial crossing times) | Future additional Satellites | Operator | Crossing Time A=Ascend. (northward) D=Descend. (southward) +Altitude | Planned launch date | Other information |
|---|---|---|---|---|---|
| **Sun-synchronous local "early morning" orbit (05:00 – 07:00) (17:00 – 19:00)** | NPOESS-2 | NOAA | 05:30 (D) 833 km | 01/2016 | LRD (AHRPT), HRD |
| | NPOESS-4 | NOAA | 05:30 (D) 833 km | 2022 | LRD (AHRPT), HRD |
| | DMSP-S19 | NOAA | 05:30 (D) 833 km | 2010 | (SSMI/S) |
| | DMSP-S20 | NOAA | 05:30 (D) 833 km | 10/2012 | (SSMI/S) |
| **Sun-synchronous local "morning" orbit (07:00 – 12:00) (19:00 – 24:00)** | FY-3A | CMA | 10:00 (D) 836 km | 2008 | AHRPT/MPT VIRR, MERSI, MWRI, IRAS, MWTS, MWHS, TOU/SBUS, SEM |
| | FY-3C | CMA | 836 km | 2013 | - " - |
| | FY-3D | CMA | 836 km | 2015 | - " - |
| | FY-3E | CMA | 836 km | 2017 | - " - |
| | FY-3F | CMA | 836 km | 2019 | - " - |
| | FY-3G | CMA | 836 km | 2021 | - " - |
| | Metop-1 | EUMETSAT | 21:30 (A) 837 km | 04/2011 | HRPT, LRPT. EUMETCast ADM. |
| | Metop-3 | EUMETSAT | 21:30 (A) 837 km | 10/2015 | HRPT, LRPT. EUMETCast ADM. |
| | DMSP-S18 | NOAA | 08:00 (D) 833 km | 2008 | (SSMI/S) |
| | METEOR-M N1 | ROS-HYDROMET | 10:20 (A) 830 km | 2008 | AHRPT |
| | METEOR-M N2 | ROS-HYDROMET | 10:20 (A) 830 km | 2009 | AHRPT |
| **Sun-synchronous local "afternoon" orbit (12:00 – 17:00) (00:00 – 05:00)** | FY-3B | CMA | 14:00 (A) 836 km | 2010 | AHRPT/MPT VIRR, MERSI, MWRI, IRAS, MWTS, MWHS, TOU/SBUS, SEM |
| | NOAA-N' | NOAA | 14:00 | 2009 | (NOAA-19 once in orbit) |
| | NPP-NPOESS Preparatory Project | NOAA/NASA | 13:30 (A) 833 km | 09/2009 | (VIIRS, CrIS, ATMS, OMPS) HRD |
| | NPOESS-1 | NOAA | 13:30 (A) 833 km | 01/2013 | LRD (AHRPT), HRD |
| | NPOESS-3 | NOAA | 13:30 (A) 833 km | 2020 | LRD(AHRPT), HRD |

| Orbit type<br><br>(equatorial crossing times) | Future additional Satellites | Operator | Crossing Time<br>A=Ascend. (northward)<br>D=Descend. (southward)<br>+Altitude | Planned launch date | Other information |
|---|---|---|---|---|---|
| **Non-sun-synchronous orbit** | OSTM (Ocean Surface Topography Mission) | CNES/ EUMETSAT/ NASA/ NOAA | (66° inclin.) 1336 km | 06/2008 | Follow-on of Jason-1 sea surface topography measurement |

## C.2 Future Geostationary Meteorological Satellite Systems

In CMA-WP-03, CMA reported on the status and continuation of the FY-2 geostationary satellite programme. The FY-2 programme will continue with the FY-2E/F spacecraft, with FY-2E planned for launch in 2008 and with a designed life time of three years. The overall programme duration is foreseen till 2015.

EUMETSAT reported on the status of preparation of MSG-3 and MSG-4 in EUM-WP-07. The paper informed CGMS that MSG-3 remained in storage in the clean room at the prime contractor's premises with anomaly investigations ongoing, whereas MSG-4 was undergoing integration and test activities. In preparation for long term storage it had been decided to make refurbishments and if necessary, maintain all the Ground Support Equipment (GSE) at satellite and SEVIRI level, and to store other Ground Support Equipment until the development work on the Meteosat Third Generation (MTG) had started. The completion of GERB-4 Assembly Integration and Testing is foreseen by the end of 2007/beginning of 2008.

The paper concluded by indicating that MSG-3 is planned for launch in January 2011, and MSG-4 in 2012-2013, implying that MTG would have to be launched in 2015.

In EUM-WP-08 EUMETSAT updated CGMS on its plans for Meteosat Third Generation (MTG). The MTG Programme is under definition and its Phase A concept and feasibility trades are well underway in coordination between EUMETSAT and ESA. Furthermore EUMETSAT is running Mission and System Level engineering activities and ESA has started competitive Space Segment studies in February 2007, aiming at their completion in early summer 2008. The paper concluded with information on the MTG Preparatory Programme including Phase B activities, planned to start at EUMETSAT in January 2008.

JMA provided a report on the preparatory activities for the follow-on satellite to MTSAT-2 in JMA-WP-03. The paper reported on tentative plans for follow-on

satellites to MTSAT-2, where JMA is planning to launch one by 2015, when MTSAT-2 is scheduled to complete its operation.

This satellite is tentatively planned to carry an imager comparable to the Advanced Baseline Imager (ABI) or the Flexible Combined Imager (FCI). In order to deal with the huge amounts of data to be obtained with the follow-on satellite, JMA is exploring the feasibility of alternative dissemination measures such as new frequency bands and the Internet.

The paper concluded that JMA will finalise the specifications of the satellite based on the results of meteorological mission examination as well as on user requirements.

KMA provided an update on the COMS programme in KMA-WP-02, which is the first multi-purpose geostationary satellite programme called Communication, Ocean and Meteorological Satellite (COMS), initiated in cooperation with three other government ministries. The multi-missions of COMS are intended not only as meteorological and oceanic observation for the public welfare, but also as in-orbit test of a developed communications payload to be used for the next geosynchronous satellite.

The COMS meteorological imager has undergone several tests in the course of 2007 and began assembly and integration testing in September. The launch of COMS-1 is currently foreseen for 2009.

KMA-WP-03 further reported on the COMS ground system at the Meteorological Satellite Center (MSC) in Korea. It informed CGMS that the COMS operation and meteorological products application service system (COMPASS) of MSC will consist in a number of functional systems, such as Data Acquisition and Transmission System, Image Pre-processing System, LRIT/HRIT Generation System, COMS Meteorological Data Processing System, and Interactive Satellite Data Analysis System. Furthermore, it reported on the ground segment configuration, and future development plans.

In NOAA-WP-06, NOAA reported on the GOES-R programme. GOES-R reached several important milestones in 2007 such as the System Program Definition and Risk Reduction (PDRR) contracts, awarded in late 2005 to Boeing, Northup Grumman and Lockheed Martin, ended in April 2007. All instruments are in the implementation phase with the exception of the Geostationary Lightning Mapper (GLM). Finally, NOAA stated that the new GOES-R instruments will advance operational environmental remote sensing technology by several decades, and that it would provide four-times the environmental information over a greater geographical location in less time, at higher resolutions, and with higher spectral content.

The GOES-O satellite has completed post storage testing for the Imager, Sounder and X-ray Imager is complete and the planned launch date is April 2008. GOES-P is currently in ground storage and is planned to be launched in

May 2009. The new GOES-N series ground system was handed over from NASA to NOAA on 23 October 2007.

NOAA-WP-07 reported on the GOES-R Advanced Baseline Imager (ABI) and the Continuation of GOES-N Class Sounder Products. It stated that the ABI will offer more spectral bands, higher spatial resolution, and faster imaging than the current GOES Imager. Measurements from the ABI will be used for a wide range of qualitative and quantitative weather, environmental oceanographic, and climate applications.

It continued by indicating that the first, and likely the second, of the new series of GOES will not carry an infrared sounder dedicated to acquiring high vertical resolution atmospheric temperature and humidity profiles that are key to mesoscale and regional severe weather forecasting. On the other hand, the ABI will provide some continuity for the GOES-N class current sounder products in order to bridge the gap until the advent of the GOES advanced infrared sounder.

The paper stated that both theoretical analysis and retrieval simulations show that data from the ABI can be combined with temperature and moisture information from forecast models to produce derived products that will be adequate substitutes for the legacy products from the current GOES Sounders. Furthermore, products generated from SEVIRI (Spinning Enhanced Visible and InfraRed Imager) measurements also demonstrate the utility of those legacy products for nowcasting applications. It concluded by stating that due to very coarse vertical resolution and limited accuracy in the legacy sounding products, placing a hyperspectral resolution infrared (IR) sounder with high temporal resolution in the GOES-R series is an essential step toward realising substantial improvements in mesoscale and severe weather forecasting required by the user communities.

WMO-WP-03 described the background to the IGeoLab concept with reference to discussions at CGMS-34 and CM-7. At CGMS-34 two test cases had been identified (GIFTS and GOMAS). CM-7 decided to address these two cases in a more general way as “IR Hyperspectral” and “Microwave” and identified a further candidate test case, namely the exploitation of a Highly Elliptical Orbit (HEO) for observing the polar regions.

The potential candidate missions/test cases were described and their latest status was described. No substantial progress had been recorded in setting up a demonstration mission for a hyperspectral sounder, although the interest of such a mission was reaffirmed in the light of current geostationary plans for the 2014-2015 timeframe. The latest status of the GEO-Microwave test case was covered in a separate paper (WMO-WP-04). The third test case, HEO, had received high attention since CM-7 through the establishment of a Task Group to take the concept forward. WMO briefly described the outcomes of the first meeting of the Task Group and those of the second meeting (where the group was renamed the “IGeoLab for HEO Focus Group”), which took place shortly before CGMS-35.

In conclusion the document invited CGMS members to actively focus on the next steps necessary in the process of bringing the concept of IGeoLab to a reality by considering firm implementation proposals.

NASA clarified that NASA activities on GIFTS had been terminated but confirmed the interest of hyperspectral sounding from geostationary orbit and looked forward to the implementation of HES in the GOES-R series.

WMO-WP-04 addressed in more depth the progress made on the IGeoLab initiative for GEO-Microwave. It recalled that the Chinese Delegation at CGMS-34 had stated its interest to lead this initiative in the framework of the next generation of geostationary satellites, FY-4, that includes consideration of a microwave component (FY-4"M").

In response to Action 34.01 WMO and CMA/CNSA organised the 4th meeting of the GEO-Microwave Focus Group (FG-4) in Beijing, 12-13 April 2007. Both scientific and technical aspects were considered. An abstract of the report was going to be sent out soon to CGMS members and was attached as Annex 1 to the working paper.

FG-4 recognised that, before starting to write a proposal for the possible GEO-Microwave implementation, it was necessary to select a baseline configuration. Two alternative options were competing, based on either a filled-aperture or a synthetic-aperture antenna. FG-4 tasked WMO to set up a small Task Team to collect comparative information on the two concepts. This turned out to be unfeasible because the NASA and ESA candidate members of the Task Team declared that their respective agencies had already made internal assessments in favour of synthetic-aperture systems, therefore a new assessment by a Task Team was unnecessary. The idea of the Task Team was therefore downgraded to a review of 14 proposals presented at the various FG meetings, many on the synthetic-aperture concept, some on the filled-aperture concept and a few in comparison between the two concepts. The report on this review was attached as Annex 2 to the Working Paper. The conclusions recommended that the two configurations were both pursued, one for implementation in the 2015 timeframe for priority on precipitation, based on the filled-aperture concept, and the other for technological development in a less constrained time and financial framework to make progress with the synthetic-aperture concept until ready to provide indisputably better performance at comparable cost, or comparable performance at lower cost. The analysis suggested that if the synthetic-aperture concept was forced to fit the 2015 timeframe, the objective could only be temperature and (perhaps) humidity profiling whereas precipitation observation would be significant but not satisfactory.

The report was expected to provide a useful background for the decision process allowing CNSA and CMA to confirm their plan to implement GEO-Microwave with an international partnership. If CGMS-35 confirmed this way

forward, the Focus Group would develop in the course of 2008 the outline of an implementation proposal to be presented to CGMS-36.

ESA had already informed WMO that ESA could not adhere to the conclusions of the paper. ESA was of the opinion that the comparison had not been carried out by an independent body. ESA's own conclusion was that only the synthetic aperture concept had the potential to fully meet the user requirements presented at FG-4.

NASA recalled that the US Decadal Survey had recommended a geostationary microwave mission and that the currently considered concept was the PATH mission using an array synthetic aperture antenna, but that all pieces of advice would be considered before making a decision to start a programme.

CMA, on the other hand, supported the approach proposed by the paper, confirmed its wish to develop a GEO-Microwave demonstration mission with international partnership and its readiness to take the lead of the IGEOLab GEO MW Focus Group to further refine the proposal in 2008, and thanked WMO for facilitating such discussions.

CMA made the following statement:

"China expresses its appreciation to WMO for co-organising the FG-4 meeting in China, which was of great help for fostering the concept and clarifying the framework of the IGeoLab Geo-microwave candidate project. Particular thanks are addressed to Dr Bizzarri for his report that summarised the outcome of the meeting and the status of outstanding issues.

CMA underlines the clear requirements for Microwave sounding from GEO platforms because of the high temporal resolution that is required both by the international community and by China, specifically at the flooding season between May and September in China and South-East Asia. The year 2008 is an important milestone for China for the formal start of FY-4 activities. CMA recalls that it has proposed two years ago that the FY-4 programme should comprise two series, i.e. an optical series and a Microwave series, and this is the baseline for China's participation in the Focus Group. However, the FY-4 microwave series would be a totally new concept for the community and there is not much experience or preliminary studies made in China in this area. China does not rule out any opportunities at present. At the beginning of 2008, according to plan, CMA will refer to CNSA and solicit initiating the GEO-MW feasibility studies, with the aim to complete it by the end of year 2008.

China is convinced of the current and future importance of IGeoLab, that it is indeed an excellent proposal for the benefit of the international community. However, China also anticipates and appreciates the great challenge for China as a developing country, both technologically, as Dr Bizzarri pointed out, and from a budgetary viewpoint. China basically agrees to the recommendations and the few key points proposed by Dr Bizzarri. China is

willing to take a more active role in the Focus Group, and calls and counts upon, the continued support from the WMO, the Focus Group and the whole CGMS community. As for cooperation, China's standpoint is that IGeoLab is an international endeavour, and it is hoped that WMO and the whole CGMS community will do their best to facilitate and promote international cooperation at any possible level. Our societal needs and an ever-changing environment do need more advanced GEO satellites. This is our common vision for the future. We invite CGMS Members to provide comments and suggestions."

As a consequence of the presentation on the status of the GEO-Microwave initiative, and the statement from CMA, the following was agreed:

**Action 35.03: CMA/CNSA and WMO will cooperate in finalising the work of the GEO-Microwave Focus Group that, according to its Terms of Reference and taking into account the work already done, should:**

- **define a mission scenario attempting to converge with results of feasibility studies in China as they become progressively available;**
- **identify mission components suitable for international partnerships and preliminary assess the realism of collecting the interest of prospective partners;**
- **draft a proposal to the group of prospective partners, including work plan and schedule; and present it to CGMS-36, that implies that CMA/CNSA commit to act as Leading Agency.**

**Deadline: CGMS-36, preceded by a presentation at a last meeting of the Focus Group possibly to be held tentatively with the next IPWG meeting in Beijing in autumn 2008.**

**Table 5: Future Geostationary Satellites Coordinated within CGMS**
(as of 9 November 2007)

| Sector | Future additional satellites | Operator | Planned launch | (Planned location) Other remarks |
|---|---|---|---|---|
| **East-Pacific (180˚W-108˚W) and West-Atlantic (108˚W-36˚W)** | MSG-3 | EUMETSAT | 2011 | 0°. LRIT, EUMETCast ADM. |
| | MSG-4 | EUMETSAT | 2013 | 0°. LRIT, EUMETCast ADM. |
| | GOES-O | NOAA | 04/2008 | 135° W or 75° W |
| | GOES-P | NOAA | 04/2009 | 135° W or 75° W |

| Sector | Future additional satellites | Operator | Planned launch | (Planned location) Other remarks |
|---|---|---|---|---|
| | GOES-R | NOAA | 2014 | **135° W or 75° W ABI, GLM, SUV, EXIS, SEISS (Advanced Baseline Imager, Geostationary Lightning Mapper, Solar UV Imager, Extreme UV and X-ray Irradiance Sensors, Space Environment In-Situ Suite)** |
| **Indian Ocean (36˚E-108˚E)** | FY-2F | CMA | 2011 | 5 channel VISSR, LRIT 86.5°E |
| | Electro-L N1 | Roshydromet | 2008 | 76°E |
| | Electro-L N2 | Roshydromet | 2010 | 76°E or 14.5°W (TBC) |
| | Electro-L N3 | Roshydromet | 2015 | |
| **Indian Ocean (36˚E-108˚E) continued** | INSAT-3D | IMD | 2008 | Location TBD. Dedicated Meteorological mission with improved 6-channel Imager and a 19 channel Sounder. |
| **West-Pacific (108˚E-180˚E)** | FY-2E | CMA | 2008 | 5 channel VISSR, LRIT 123°E |
| | FY-2G | CMA | 2013 | 5 channel VISSR, LRIT 123°E |
| | MTSAT follow-on | JMA | 2013-2015 | 140°E |
| | COMS-1 | KMA | 2009 | 5 channel. HRIT/LRIT Meteorological imager (MI), Geostationary Ocean Colour Imager (GOCI) 116.2°E or 128.2°E |
| | COMS-2 | KMA | 2014 | 116.2°E or 128.2°E |

## C.3 Future Research and Development Satellite Systems

CNSA-WP-02 informed CGMS of the status of the Earth Observation missions under development, including the CBERS-03/04, HY-2 (ocean monitoring) and HJ-series (environmental and disaster monitoring), where HJ-1 is planned for launch in 2008.

The paper further described the status of each series, and concluded by indicating that the FY-4 satellite is being developed together with CMA and that discussions on orbit microwave development with WMO had taken place. Furthermore, it stated that in order to improve the quantitative observation application level, a DPC (Directional Polarisation Camera) prototype system had been developed, with aerosol monitoring as main objective. Further developments were ongoing, and new ways of atmospheric composition detection, laser active remote sensing and rainfall monitoring were being studied in order to support a start of a corresponding space programme.

**Action 35.04: CNSA to inform WMO of the data policy for the HY-2 satellite after completion of HY-2 phase B studies. Deadline: CGMS-36**

ESA-WP-02 informed CGMS of the status of the future European Space Agency Earth Observation missions where two of them, MTG and post EPS, are run in cooperation with EUMETSAT. It stated that the Living Planet Programme has three lines of implementation: Earth Explorer satellites, Earth Watch satellites, plus services and applications demonstration.

It indicated that after the decision on the implementation of Swarm and EarthCARE missions, a new Core Explorer is under selection with the first explorer launch foreseen for March 2008. The first Earth Explorer mission will be launched in March 2008.

It concluded by informing CGMS that since January 2002 the Earth Watch includes the Global Monitoring for Environment and Security (GMES) services element and that the ESA GMES space component programme Phase 1 is well advanced, with five families of Sentinels planned. Finally it stated that the Sentinel-1 development phase was started in April 2007, and that Sentinels 2 and 3 are expected to kick off by end 2007.

JAXA provided the updated status of JAXA's Greenhouse Gases Observing Satellite, GOSAT in JAXA-WP-02. The information on the ground system, data policy and data distribution plan were recently announced, preparing for the launch in 2008.

The latency of level 1 product is 3 to 6 hours from the time of observation for global data on the basis of the current operation scenario and that with a downlink per orbit, latency would be 0.5-3 hours. For higher level products, the latency is over a week because the higher level processing needs to await the delivery of subsidiary data, such as pressure, temperature and so on.

GOSAT data are open to the meteorological user community. Currently, real-time data distribution is not planned, however, JAXA pointed out that real-time service capability could be furnished depending on the further requests from users. WMO expressed the willingness to respond to the offer officially.

**Action 35.05: CGMS Members to indicate to JAXA their interest in having access to GOSAT data (kawai.takayuki (at) jaxa.jp and umezawa.kazuo (at) jaxa.jp). Deadline: CGMS-36**

In JAXA-WP-03, CGMS was provided with an update on the status of JAXA's Global Change Observation Mission, GCOM.

The GCOM-W project has made progress and started Preliminary Studies in 2007. The GCOM-W1 project was approved by the Space Activities Commission of Japan to proceed to the development phase. Also, the system preliminary design review of the AMSR2 instrument was held in July 2007. In

designing the instrument and the interface with a spacecraft, one focused point was to improve the reliability to extend the design life from 3 to 5 years. As a result, JAXA decided to add a redundant momentum wheel and interface board for two signal processor circuits.

Comparing with the former specification of the AMSR2, the additional 7.3 GHz channel was approved for possible mitigation of radio-frequency interference regarding the C-band receiver.

Finally, a possibility of GCOM and NPOESS cooperation in the GEOSS context was stated. Recently, the GCOM and NPOESS cooperation has been reported to GEO as an early achievement of the GEOSS, and discussion between JAXA and NOAA has started. The next meeting is planned to be held in Japan in the near future.

**Table 6: Future R&D satellites discussed within CGMS**
(as of 9 November 2007, sorted by organisation)

| Satellites | Operator | Crossing Time | Planned launch date | Application and other information |
|---|---|---|---|---|
| HJ-1A | CNSA | 650 km 10:30 A | 2008 | Land, resource and environment monitoring |
| HJ-1B | CNSA | 650 km 10:30 A | 2008 | Land, resource and environment monitoring |
| HJ-C | CNSA | 6:00 D | 2008 | Land, resource and environment monitoring |
| CBERS-03 | CNSA/AEB | 10:30 A | 2010 | Land, resource and environment monitoring |
| CBERS-04 | CNSA/AEB | 10:30 A | 2012 | Land, resource and environment monitoring |
| CRYOSAT-2 | ESA | 717 km Non-sun-synchronous | Mar 2009 | Polar ice monitoring |
| GOCE | ESA | 250 km (6:00 A) | Mar 2008 | Gravity mission |
| SMOS | ESA | 755 km (6:00 A) | 2008 | Salinity & Soil moisture |
| ADM-Aeolus | ESA | 405 km (18:00 A) | June 2009 | Wind profiles |
| SWARM (three satellites) | ESA | 2 sats at 450 km 1 sat at 530 km (drifting up to 9 hours from the lower pair) | Apr 2010 | Earth interior |
| EarthCare | ESA/JAXA | 450 km (10:30D) | Dec 2012 | Cloud, radiation, aerosols |
| GOSAT | JAXA & Japan's Ministry of Environment | 13:00 666km sun-synchronous | Aug 2008 | Greenhouse Gases Observing Satellite monitoring the distribution of the density of carbon dioxide |
| OCO | NASA | 705 km sun-synchronous polar | Sep 2008 | Orbiting Carbon Observatory (observations of atmospheric carbon dioxide) |

| Satellites | Operator | Crossing Time | Planned launch date | Application and other information |
|---|---|---|---|---|
| Aquarius | NASA/CONAE | 657 km sun-synchronous | Jul 2009 | Global sea surface salinity (SSS) |
| GPM | NASA/JAXA | 407 km Non sun-synchr. (core-satellite) | 2013 | Global Precipitation Measurement, follow-on and expanded mission of the current on-going TRMM |
| GCOM-W | JAXA | 699.6 km sun-synchronous | JFY2010 | Global water and energy circulation |
| GCOM-C | JAXA | 798 km Sun-synchronous | JFY2011 | Carbon cycle and radiation budget (Atmosphere, Ocean, Land and Cryosphere) |
| LDCM (Landsat Data Continuity Mission) | NASA/US Geological Survey | 828 km (at equator) sun-synchronous | Jan 2011 | Extension of Landsat record of multispectral 30m resolution |
| Glory | NASA | 824 km sun-synchronous | Dec 2008 | in framework of Climate Change Research Initiative (CCRI) global distribution of natural and anthropogenic aerosols |
| Deep Space Climate Observatory (DSCOVR) | NASA (offices of Earth and Space Science) | L1 | TBD | Measure how solar radiation affects climate by using Sun-Earth libration point L1 from which it will observe Earth |
| OSTM/Jason II | NASA, NOAA, CNES, EUMETSAT | 1336 km non-sun synchronous | Jun 2008 | Ocean surface topography, global ocean circulation for climate prediction, follow-on to Jason I |
| NPP (NPOESS Preparatory Project) | NASA & IPO NOAA | 824 km (10:20 D) sun-synchronous | 12/2009 | Application and other information: monitoring climate trends and global biological productivity |
| Kanopus-V | ROSCOSMOS | 510-540 km sun-synchronous | TBD | Monitoring of naturally occurring and man-made extreme events |

### C.4 Reconfiguration of future combinations of LEO and GEO missions

No Working Paper was presented under this item.

## D. OPERATIONAL CONTINUITY AND RELIABILITY

### D.1 Global Planning, Including Orbital Positions and Reconfiguration of the Space-based Component of the GOS

EUM-WP-09 reported on EUMETSAT contacts with the European Space Operations Centre (ESOC) concerning the possibilities to provide Ground Support Network data to the University Corporation for Atmospheric Research (UCAR) on a bilateral exchange basis.

It mentioned that data ownership issues and possibilities for re-distribution of data from EUMETSAT to UCAR have now been clarified, and that the next step of the project is the implementation of the necessary changes and an agreement about an implementation plan and approach. A trial data exchange is foreseen to commence in the 2007/2008 period.

WMO-WP-05 presented the latest issue of the "Status of the space-based component of the Global Observing System (GOS)".

At the last three CGMS Sessions, WMO had delivered a report on the status of the space-based component of GOS. The report consisted of a wide overview of satellite programmes and short sections on the analysis of compliance of the system with WMO requirements. WMO informed CGMS that this report was being converted into a WMO database and would continue to be updated on a nearly-continuous basis. Also, a section on the potential performance of typical instruments in terms of data quality would be added. This year's updated report would be distributed as soon as the conversion to the database is completed.

The present document (WMO-WP-05) contained an Annex "Gap Analysis" that was based on collected material and could be used to identify priorities for future plans. It was prepared by Dr Bizzarro Bizzarri as consultant for the WMO Space Programme.

With reference to a typology of 29 instruments/missions, the Gap Analysis records for each instrument/mission:

- The definition of "nominal" instrument characteristics;
- The addressed geophysical parameters;
- The assumed/suggested observing strategy;
- The current and planned programmes until year 2020;
- Comments on the situation as projected beyond 2020;
- Recommendations.

A synoptic table of geophysical parameters (127) versus instrument/mission types (29) was provided in Appendix 1 to the Annex. For each of the 157 instruments mentioned in the main text, a descriptive table was provided in Appendix 2 to the Annex. For most programmes, the analysis was based on the status as of September 2006, i.e. the information contained in the yearly report on the status of GOS presented at CGMS-34. However, follow-on developments that affected the scenario had been taken into account to the best of the author's knowledge. CGMS Members were invited to use this Gap Analysis as a reference for further discussions on the evolution of the GOS and global planning of future missions.

CGMS satellite operators unanimously acknowledged the value of such a gap analysis and of the underlying documentation that had been gathered. They encouraged WMO to maintain it as a living document, noting that it would be a useful reference for planning satellite missions, not only for meteorology but for many of the Societal Benefit Areas identified by GEO. The CEOS observer

supported the view that this would be a greatly useful reference document for multiple partners.

**Recommendation 35.01: CGMS Members were invited to use the Gap Analysis as a reference for further discussions on the evolution of the GOS and global planning of future missions.**

**Action 35.06: CGMS Members to provide feedback to WMO (bibizzar (at) tin.it). Deadline: On a continuous basis, and for review at CGMS-36.**

WMO-WP-06 introduced the draft Vision for the Global Observing System (GOS) to 2025, in response to CGMS Actions 34.04, 34.07 and 34.08. Following CGMS-34 discussions on the optimisation of the space-based GOS and on the response to GCOS requirements, the WMO Commission for Basic Systems (CBS) discussed these issues and agreed to initiate a re-design of the space-based GOS, which triggered an important sequence of actions.

The Workshop on the Re-design and Optimization of the Space-based Global Observing System (OPT-2) was convened in June 2007 and reviewed the critical issues identified at the first optimisation workshop held in 2006, in the light of the detailed gap analysis. Its final Report (contained in Annex 1 of WMO-WP-06) addresses the strategy to ensure continuity of essential climate observation variables.

The outcome of the OPT-2 workshop was the basis for developing a draft vision for the GOS to 2025, by the relevant OPAG-IOS Expert Teams. The draft vision calls upon optimising the existing operational GEO and LEO components, consolidating the altimetry measurement strategy, enhancing atmospheric sounding with an operational Radio Occultation constellation, refining sea surface wind observation, and bringing several new missions to an operational status: Global precipitation, Earth Radiation Budget, atmospheric composition, specific imagery for ocean colour and vegetation and possibly missions in Molniya orbits.

Implementing such a new vision would require enhanced cooperation and coordination among operational and R&D agencies in order to optimise the effort, and to ensure timely availability and consistent quality of data worldwide. This new vision, which contributes to the integration of the WMO global observing systems, would further reinforce the importance of the space-based GOS as a major component of the GEOSS.

CGMS satellite operators were invited to comment on this development, to support its refinement until CBS 2008 and to plan to contribute to its implementation in the coming decade.

CGMS emphasised the important outcome of the OPT-2 workshop and WMO was invited to make the report available on the CGMS website. CGMS stressed that developing such a new vision was important to help each individual agency to develop its own planning as a contribution to the whole

system. CMA and EUMETSAT underlined the need to consider surface and space-based components of the GOS in parallel when developing the new vision, and welcomed the fact that the new vision was clearly addressing several SBAs.

WMO-WP-07 reported on the progress made with respect to the practical implementation of the Implementation Plan for the Evolution of the Surface and Space-based Subsystems of the Global Observing System (IP-EGOS).

The Annex included the latest update of the space-related part of the IP-EGOS, as reviewed by the Expert Team on Evolution of the GOS in July 2007, and the Expert Team on Satellite Systems in September 2007.

CGMS Satellite Operators noted that particular progress had been made on recommendations S1 and S5, through the GSICS and RARS projects, respectively, and that most of the other recommendations had been addressed in the optimisation workshop or during the present CGMS session.

### D.2 Inter-regional contingency measures

There were no Working Papers presented under this item.

### D.3 Long-term global contingency planning

There were no Working Papers presented under this item.

## E. SATELLITE REQUIREMENTS OF WMO AND IOC PROGRAMMES

### E.1 World Weather Watch

In WMO-WP-30, the WMO reported that its CBS OPAG-IOS Expert Team on the Evolution of the GOS (ET-EGOS), Geneva, July 2007, and the joint meeting of the Expert Team on Satellite Systems (ET-SAT) and the Expert Team on Satellite Utilization and Products (ET-SUP), Geneva, 3-7 September 2007, had reviewed the status of the WMO/CEOS database of user requirements for observations. ET-EGOS then reviewed the status of Statements of Guidance in 12 application areas.

CGMS Members were invited to take note that ET-EGOS agreed to review all WMO observational data requirements for each application area and had designated focal points in charge of reviewing and updating the SOG. Furthermore, ET-SAT had designated experts to assist the ET-EGOS focal points in their review for satellite aspects. A course of actions was also agreed by ET-SAT to update the description of space-based observing capabilities that is contained in the database.

## E.2 Other WMO Programmes

In NOAA-WP-09, NOAA presented information on the new WMO Global Space-based Satellite InterCalibration System (GSICS), the first internationally coordinated effort by operational satellite agencies with contributions from research agencies to routinely generate, document and report on the comparability of satellite observations to reference observations. GSICS will improve global satellite data sets for climate applications by ensuring observations are well calibrated through operational analysis of instrument performance, satellite intercalibration, and validation over reference sites.

WMO-WP-08 described the background to the concept of Regional/Specialized Satellite Centres (R/SSC) with reference to the associated discussions at CM-6 and CM-7.

The paper further described progress since CM-7, highlighting the actions taken by the participating agencies to refine the concept and develop an agreed Implementation Plan. CGMS will note that it is the intention to finalise that Implementation Plan at the meeting of the Participating Agencies at their meeting immediately following CGMS-35.

The views of ET-SUP, expressed at their September 2007 meeting, are detailed and the attention of CGMS was drawn to the suggestion made regarding CGMS governance of the activity and relationship with GSICS, and to the proposal for CGMS to establish a new international science working group on the theme of climate and calibration.

Version 0.4 of the R/SSC-CM Implementation Plan was included for information as an Annex to the Working Paper.

**Action 35.07: CGMS to form a small focus group to consider the recommendation "establish a new international science working group on the theme of climate and calibration", and to report their findings back to CGMS-36. The focus group to be composed of Dr Schmetz, EUMETSAT, Dr Goldberg NOAA/NESDIS, and Dr Purdom, Chairperson WMO OPAG-IOS. Deadline: May 2008 and to report at CGMS-36**

WMO-WP-09 informed CGMS Members of activities and plans for THORPEX, with particular focus on major science activities related to remote sensing, activities of the THORPEX Observing Systems Working Group and the Data Assimilation and Observing Strategies Working Groups, It also underlined that THORPEX had become an official programme within the WMO AREP's Open Programme Area Group World Weather Research Programme (OPAG WWRP) and as a result its International Core Steering Committee had been restructured.

CGMS Members were invited:

- To note the report and comment as appropriate;

- To actively participate in THORPEX field programmes and become engaged in the planning and execution of those programmes;

- To participate in and support the 4th WMO Workshop on "The impact of various observing systems on numerical weather prediction", scheduled for March 2008;

- To confirm their agencies representatives for satellite issues to THORPEX (see table 1 of Annex 2 in the Working Paper) in order to ensure their active participation in THORPEX activities.

**Action 35.08: WMO (supported by CGMS Members) to update their THORPEX Focal Points and Contacts given in Table 1, Annex 2 of WMO-WP-09 to CGMS THORPEX Rapporteur. Deadline: 1 December 2007**

WMO-WP-10, presented by WMO on behalf of the GCOS Secretariat, summarised recent developments in the Global Climate Observing System (GCOS) programme, particularly in the Atmospheric Observations Panel for Climate (AOPC), that are relevant to CGMS. CGMS was informed that the GCOS Steering Committee and its Science Panels very much welcomed the joint response provided by CGMS and WMO to the GCOS Implementation Plan and the continuing support by space agencies and the WMO Space Programme in addressing GCOS satellite requirements in all relevant fora. The AOPC had underlined the relevance of GSICS and of a potential collaboration between GSICS and the GCOS Reference Upper Air Network (GRUAN). It welcomed the actions taken by space agencies for reprocessing some climate datasets. GCOS had established a joint AOPC/TOPC working group on Land Surface albedo and highlighted the need for coherent processing of surface and aerosol products.

WMO-WP-11 informed CGMS Members on WMO's Tropical Cyclone Programme activities and related satellite needs.

It described recent and planned activities related to the use of satellite data in tropical cyclone applications. It drew attention to the vital importance of satellite data to the detection, monitoring and structure characterisation of tropical cyclones and for predicting their evolution.

The paper highlighted the need to take actions to develop or confirm plans assuring the continued availability of specific satellite data types such as ocean surface microwave imagery, scatterometry and altimetry data as well as a total precipitable water derived product. It stated that the tropical cyclone community was also looking forward to the swift implementation of the planned Global Precipitation Mission (GPM).

CGMS were pleased to note the efforts of EUMETSAT to maintain the Indian Ocean Data Coverage service from Meteosat-7.

WMO-WP-12 provided information on current international developments regarding disaster risk reduction, as well as the International Charter on Space and Major Disasters, and on related specific satellite-based observation requirements for disaster risk reduction (i.e. risk identification, early warning systems, impact assessment, emergency preparedness, early recovery, risk transfer and sectoral planning). It was noted that the future satellite observation requirements may involve very high resolution land surface imagery.

WMO-WP-13 provided the current status of implementation of the International Polar Year 2007-2008 (IPY) that started in March 2007 and will be continued up to March 2009. CGMS could note that the IPY Space Task Group (STG), which was formed in December 2006 by Space Agencies at the request of the Executive Heads of WMO and ICSU, had made substantial progress in the development of Agency portfolios to provide IPY projects with satellite data and products according to their requirements.
CGMS were invited to note that STG was well on the way to developing the concept of an effective space component of the observing system for the polar regions during IPY.

CGMS was invited to review the recommendations of the first STG session that took place in Geneva in January 2007, in particular those that relate to CGMS activities and undertake appropriate actions. The STG had recommended to coordinate ground receiving station activities for polar orbiters through CGMS, to ensure that we have guaranteed full polar AVHRR coverage at 1 km resolution during IPY; to extend to the polar region as far as possible the high latitude coverage of geophysical products derived from geostationary satellites; to advance the use of Molniya orbits to provide pseudo geostationary polar coverage; to design a user interface pointing to GOS satellite data for IPY scientists, linking the IPY portal home page to relevant browsing and ordering interfaces.

With respect to high latitude coverage of geostationary products, CGMS satellite operators took the action to check the status. EUMETSAT highlighted that MSG now allowed deriving products up to the coast of Eastern Greenland. JMA indicated that it has been producing Sea Ice Motion vectors over the sea of Okhotsk derived initially from GMS and now from MTSAT-1R imagery.

CGMS Members were invited to reconfirm their commitment to the objectives of the IPY.

WMO-WP-26 presented information on the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) which is maintaining a Strategic Work Plan for Building a Sustained Global Ocean Observing System in Support of GEOSS. Although this baseline system is

designed to meet climate requirements, the system is supporting global weather prediction, global and coastal ocean prediction, marine hazard warning, marine environmental monitoring, naval applications, and many other non-climate uses.

59% of the global in situ network was completed in August 2007 (drifter and Argo components are completed). Outreach is being continued to remind Members/Member States that a global system cannot be achieved with existing resources and that commitments must be increased to ensure a sustained global system.

JCOMM is investigating the need to develop global in situ wave observing capability for assimilation, model validation, satellite validation, wave climate, research (roles of waves in coupled ocean-atmosphere systems).

The initial ocean observing system for climate depends on space based global measurements of 1) sea surface temperature (SST), 2) sea surface height, 3) surface vector winds, 4) ocean colour, and 5) sea ice. These satellite contributions are detailed in other international plans, but continued close coordination with the in situ systems is essential for comprehensive ocean observation. Satellite observations (wind, SST, ocean colour) with higher temporal and spatial resolutions are required for Met-ocean Products and Services (MOPS) because their major activities are carried out in the coastal seas. Potential of very high-spatial resolution sensors for JCOMM programme areas is pointed out.

JCOMM is working on a strategy of action to make satellite observations more accessible through expansion of a data assembly and data delivery model pioneered as the GHRSST Pilot Project. Broadening the number of data sources for each variable important to JCOMM (e.g. SST, ocean surface topography, ocean vector winds) through international cooperation and data sharing reduces the impact of loss or outage of any single data stream.

In the context of the WMO Integrated Global Observing System, and following recommendations of the 15$^{th}$ WMO Congress, JCOMM is proposing to establish four pilot projects. One of them is a pilot project for the data collection of ocean observations using new satellite data telecommunication systems (e.g. Iridium).

WMO-WP-27 informed CGMS Members that acknowledging the high relevance of satellite data for climate related applications, the WMO Commission for Climatology (CCl) had decided to establish an Expert Team on Climate Monitoring including the use of Satellite and Marine Data and Products.

Through this initiative, the CCl wished to foster an interaction with satellite experts and provide satellite operators with a feedback mechanism to improve climate monitoring and applications using satellite data and products.

It was clarified by WMO that GCOS was the primary source of climate monitoring requirements and that the additional activities initiated by CCI would build upon the important work done in close cooperation among WMO, CGMS and GCOS.

### E.3 IOC Programmes

There were no Working Papers presented under this item, however, reference was made to WMO-WP-26 on the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM).

## F. INTERACTION WITH GEO

### F.1 Applications of Meteorological Satellite Data for Environment Monitoring

EUM-WP-10 presented the status of the Network of EUMETSAT Satellite Application Facilities (SAF). The first 7 approved SAFs started a 5-year Continuous Development and Operations Phase in March 2007, whilst the SAF on support to Operational Hydrology and Water Management is completing the second year of its development phase.

In the period 2007-2012, the SAF network will continue the development and operations phase and will carry on operations based upon Meteosat and third party products, Metop-based product validation, and the development and operations of new products, including post-MSG and post-EPS.

**Action 35.09: EUMETSAT to prepare a paper on its SAF activities for the Bulletin of the Meteorological Society. Deadline: CGMS-36**

### F.2 Geonetcast/EUMETCast

EUM-WP-11 presented the current status of the EUMETCast system architecture, data services supported, and registration statistics, with an outlook for the near term evolution of the EUMETCast Europe, Africa and Americas Services. Additionally, the status and intended development of GEONETCast were described, highlighting the role of EUMETCast in this system.

Since its start in 2002, EUMETCast (EUMETSAT's broadcast system for environmental data) has gone through a rapid growth phase, with a continuous increase of dissemination bandwidth and addition of data services. In the evolving GEONETCast system, EUMETCast constitutes the first operational building block. The system consists of three elements: data providers, dissemination infrastructure and the users. Europe is covered using a Ku-band system via Hotbird-6, Africa is covered using a C-band system via Atlantic Bird 3, and for a 2006-2008 trial period (with a potential scope for prolongation) the Americas using C-band transponders onboard NSS-806. The paper further

described the dissemination of the various environmental data streams and products. A product navigator can be found at http://www.eumetsat.int/products.

CGMS was informed that by the end of July 2007, some 2300 users of EUMETCast reception stations had registered, of which approximately 1800 had a subscription for the Meteosat Second Generation 15 minutes SEVIRI service.

The paper further stated that GEONETCast is a low cost, global, environmental information delivery system by which satellite and in situ data, products, and services from the GEO System of Systems (GEOSS) are transmitted to users through communications satellites, by means of a multicast, access-controlled, broadband capability. Following developments since CGMS-34, it is confirmed that the communication satellites for each sector of the globe are provided by one or more partners in GEONETCast and the current coverage is based on contribution from the EUMETSAT, NOAA and CMA. The regional components include one or more data collection, management, and dissemination centres that receive, process, prioritise, and schedule the incoming data streams or products.

The exchange of data between the various centers and the redistribution of this data is a main focus of GEONETCast, transforming dissemination centres with regional coverage into a system with global coverage.

There followed a presentation by WMO of its WIGOS concept and the restructuring of the WMO.

### F.3 CGMS and GEO/GEOSS interactions

There were no Working Papers presented under this item.

## G. OTHER ITEMS OF INTEREST

### G.1 Training

EUM-WP-12 reported on the status and future plans of EUMETSAT's training activities in support of the WMO/CGMS Virtual Laboratory (VL) for Satellite Meteorology. It indicated that as a global satellite operator, EUMETSAT, has supported the Virtual Laboratory from its beginning and utilises the cooperation network to provide outreach training, especially for WMO RA I. Furthermore, EUMETSAT has recently started to align its training activities for its Member and Cooperating States in WMO RA VI with the aims and objectives of the EUMETCAL project.

Training support activities were, additionally, provided in WMO RA II, at the Centre of Excellence in Muscat, Oman and, to a very limited extent, to South America, in close collaboration with EUMETSAT Member States Spain and Portugal.

Finally, in its support to the VL, the EUMETSAT training approach follows the recommendations of the WMO Space Programme Implementation Plan.

The Chairperson added that GEONETCast offered a great potential for the regular exchange of educational resources through the use of administrative channels or even a designated "training Channel".

KMA-WP-11 reported on the 1st International Training Course on Analysis of COMS Data in Korea, organised by KMA in September 2007 for foreign users from 13 countries in the Asia-Pacific area in order to introduce the COMS programme and to form an initial user community for COMS data.

The document presented the scope of the course, which was to provide information on COMS status and development plans, COMS instruments, data processing and operations. It is planned to hold similar training courses on an annual basis in order to monitor the growth of the COMS user community.

WMO-WP-14 presented a report of training activities within the VL since CGMS-34, along with future plans and direction. It also provided an updated report on the outcome of the highly successful High Profile Training Event (HPTE) of 2006. Also, the third meeting of the VL Management Group (VLMG) in June 2007 was described with recommendations from this Group's meeting presented to CGMS for endorsement of its recommendations.

CGMS:

(1) Endorsed the proposal that the Virtual Laboratory (VL) and its management group (VLMG) shall continue for the foreseeable future;

(2) Strongly supported the addition of a new VL Centre of Excellence in China located at the China Meteorological Agency Training Centre (CMATC), being the Beijing component of the Nanjing RTC, whilst noting that this was, in effect, merely a change of location of an existing CoE;

(3) Endorsed the appointment of Dr Volker Gaertner (EUMETSAT) to take over as the new Satellite Sponsors' co-chair of the VL Management Group from the outgoing co-chair, Dr James Purdom (USA), together with Luiz Machado (INPE, Brazil);

(4) Noted the revised goals and objectives, terms of reference and expectations of partners agreed by VLMG-3 ;

(5) Noted that satellite operators sponsoring Centres of Excellence should be asked to re-affirm their commitment to the VL by confirming their intentions to meet the revised expectations, terms of reference and principles statements (and that the WMO Space Programme circulate the revised Terms of Reference, Objectives and Partner Expectation

documents to the various VL partners seeking their agreement to continue under the new arrangements);

(6) Agreed that the WMO should take contact with IMD with a view to clarifying its plans as co-sponsor of the VL Centre of Excellence in Oman;

**Action 35.10: WMO to contact IMD with a view to clarifying its plans as co-sponsor of the VL Centre of Excellence in Oman. Deadline: 31 December 2007**

(7) Noted that satellite operators sponsoring Centres of Excellence are urged to work closely with them in the formation of Regional Focus Groups.

(8) Noted and strongly endorsed the proposal that satellite operators who are VL sponsors should install an ADDE server;

(9) Agreed that the WMO Space Programme Office explores all options to develop a full time support officer position covering satellite meteorology training and utilisation;

(10) Noted the synergy between the topics already addressed in VL training events and eight of the nine GEO Societal Benefit Areas, further noting the proposal that this should be reflected in future development of a widely used training syllabus;

(11) Noted that the VLMG will investigate options for creating a comprehensive learning environment for online satellite courses using software such as Moodle.

Recalling the success and significance of the VL as a training resource, WMO added that it had every confidence in the further exploitation of the VL as a training tool, especially under the guidance of the new WMO Director of Education and Training (Dr Jeff Wilson), a “founding father” of the VL concept, and the new co-Chairs of the VLMG.

In NOAA-WP-10, CGMS was informed about NOAA’s support for the CGMS Virtual Laboratory Focus Group (Session II). NOAA provided the HPTE Lecture and Weather Briefing summary table for the October and November 2006 event. The Focus Group of the Americas participated in several events including a Weather Briefing between the Americas and Portugal, where they hosted a workshop. The NOAA registrations for the HPTE lectures began in late September and NOAA used its Weather Briefings from 25-26 September 2006 to review the HPTE lecture process.

Thanks to a team effort by Costa Rica, Brazil, the Cooperative Program for Meteorological Education and Training (COMET), CIRA and EUMETSAT, the four core lectures were translated into Spanish by October 2006. Brazil (new

WMO CoE) translated all lectures into Portuguese and these were delivered to five Portuguese speaking countries in November 2006.

## G.2 Information

EUM-WP-13 gave a brief summary of conferences and events which had taken place since CGMS-34 and listed those planned for the next two years. EUMETSAT's recent, current and future publications were also listed. CGMS Members were invited to take note.

In WMO-WP-15, WMO informed CGMS on the status of the current content of the various CGMS e-mail list servers hosted by WMO. The lists were presented both to inform CGMS members and also to provide the opportunity for review and update of their content. CGMS members were reminded, however, that changes may be notified to the CGMS Secretariat at any time.

The paper concluded with the problem of the enormous increase of "spam" on these list servers and proposed corrective measures. The document informed CGMS that both the ITWG and IWWG had recently decided to move their e-mail lists to be hosted on alternative servers as a consequence of the "spam" problem, a fact that serves to illustrate the critical need to take appropriate measures to address the problem at source. CGMS encouraged WMO to implement appropriate measures.

WMO-WP-16 proposed a way forward for the establishment of a dedicated CGMS web site to enhance the external visibility of CGMS, to establish information channels for CGMS Members and to improve the display and update facility for the CGMS Consolidated Report. The proposal included an outline description of the expected content provided by WMO as a starting point for discussions. CGMS was informed that initial steps had been taken to enhance the website, taking advantage of the overall re-design of the WMO website as well as the set-up by the CGMS Secretariat of a dedicated ftp-server for sharing working papers and documents. The development of the web pages was proposed to be based on a collaborative effort between WMO and the CGMS Secretariat.

It was noted that the pages were intended to serve the needs of the whole CGMS membership. All Members were therefore encouraged to guide the development process via feedback, comments and suggestions on prototype pages that would be periodically presented for review during the intersessional period.

CGMS thanked WMO for this initiative and for the development already made. It was stressed that keeping the information up-to-date was essential and required a continuing effort. EUMETSAT confirmed its readiness to contribute to the website in its capacity as the CGMS Secretariat and recommended the creation of a formal editorial committee. EUMETSAT further proposed to coordinate with WMO and to seek to combine efforts to ensure sustainability of this website initiative.

**Action 35.11: All CGMS Members to nominate points of contact to support the CGMS website editorial committee. Deadline: 31 December 2007**

**Action 35.12: WMO and CGMS Secretariat to establish a CGMS web editorial committee by March 2008 in order to guide the completion and further enhancement of the CGMS website and the ftp server and ensure their sustainability. Deadline: March 2008 and to report to CGMS-36**

## G.4 Any other business

EUM-WP-14 identified some areas of common interest between CGMS, CEOS and the WMO Space Programme, and summarised the current coordination arrangements. Based on this analysis, some practical measures for improved coordination and communication were proposed.

The paper informed that this topic would also be discussed at the forthcoming CEOS Plenary, during which the CGMS Secretariat would communicate the views of CGMS on the proposals submitted for discussion.

Areas to be considered for coordination and collaboration included:

- Evolution of the Space-based component of the Global Observing System;
- Calibration of sensors;
- Response to GCOS requirements;
- Regional Specialised Satellite Centres for Climate Monitoring (RSSC-CM) Initiative, and in addition
- Further potential areas of common interest may include the CEOS/WMO database of space-based capabilities, and efforts towards more common and coordinated documentation.

CGMS was invited to take note of the current status and to comment on the proposals for increased communication and coordination; and to propose other practical measures, as appropriate, to foster communication and coordination. Of particular potential, is increased collaboration on the constellations effort.

CGMS unanimously supported the proposal by the Secretariat for increased coordination between CGMS, CEOS and the WMO SP, and invited the Secretariat to take the lead on this matter.

EUM-WP-29 briefly presented a recommendation from the 2nd GOFC/GOLD Workshop on (Geostationary Fire Monitoring and Applications) held at EUMETSAT, Darmstadt, from 4-6 December 2006:

"With the plans of operational agencies to produce real-time fire detection and characterization products, developers and implementation teams need access to detailed information on data pre-processing chains, calibration of the 3.9 and 11 micron bands at higher temperatures, and noise levels at these higher

temperatures. More specifically there is a need for minimum and ideally no smoothing or filtering of information within the 3.9 micron band, and for detailed characterization of its behaviour beyond 300K and up to the saturation point. It is imperative that agencies provide detailed information on how observations in this channel are pre-processed and converted to level 1 radiance imagery from which fire products will be derived".

CGMS was invited to discuss the recommendation in the light of recent activities within CGMS reflecting the importance of the monitoring of active fires from space.

At CGMS-34 in 2006, it was agreed to create a single CGMS consolidated report for the first 30 years (thereafter to be updated on a 4 to 5 yearly basis). EUM-WP-30 described the status of the initiative and the proposed way forward, including the compilation of a 35-year report (rather than 30 years) and a tentative schedule for the implementation.

CGMS unanimously endorsed the proposal by the Secretariat for a 35-year consolidated report as described in the Working Paper.

EUM-WP-31 proposed an update of the CGMS Charter and its annexes. With the launch of Metop-A, the first of three satellites of the EUMETSAT Polar System (EPS) on 19 October 2006, and the successful completion of its commissioning on 15 May 2007, Europe joined the USA, the Russian Federation and China in launching an operational polar-orbiting mission.

Since the CGMS Charter recalls in its Preamble the preceding situation, it would be recommended to update it to reflect the current reality.

This Working Paper proposed on behalf of the CGMS Secretariat the required amendments and was circulated among the CMGS Members for consideration one month ahead of the CGMS-35, in accordance with the relevant provision of the CGMS Charter.

CGMS-35 approved the new version of its Charter, as provided in EUM-WP-31.

## H. FINAL SESSION

### H.1 Reports from the Working Groups

Reports from the four working groups were presented by Mr Marlin O Perkins (WG I on Telecommunications), Dr Mi-Lim Ou (WG II on Satellite Products), Mr Gary Davis (WG III on Global Contingency Planning) and Mr Mikael Rattenborg (WG IV on Global Data Dissemination by Satellite).

The CGMS-35 Chairperson took note of the reports and thanked the participants, Chairpersons and Rapporteurs for their active and fruitful discussions. They endorsed the proposed actions and recommendations formulated by each working group and congratulated the four working groups

for their comprehensive reports and for their achievements since the preceding meeting of CGMS.

## H.2 Nomination of CGMS Representatives at WMO and other meetings

CGMS agreed that EUMETSAT would represent CGMS at the 60th Executive Council of WMO (EC-LX) on 18-27 June 2008, in Geneva, Switzerland.

## H.3 Nomination of Chairpersons of Working Groups for CGMS-36

With regard to the meetings of the Working Groups that would take place at CGMS-36 it was agreed that:

- Working Group I on Telecommunications will be chaired by Mr Marlin O. Perkins, with Mr Gordon Bridge as Rapporteur;

- Working Group II on Satellite Products including Satellite-Derived Winds will be chaired by Mr Toshiyuki Kurino with Dr Johannes Schmetz and Dr Mitch Goldberg as rapporteurs;

- Working Group III on CGMS Global Contingency Planning will be chaired by Mr Gary Davis, with Mr Jerome Lafeuille as Rapporteur;

- Working Group IV on Global Data Dissemination by Satellites will be chaired by Mr Mikael Rattenborg, with Mr Gordon Bridge as Rapporteur.

## H.4 Any Other Business

There was no additional business.

## H.6 Summary List of Actions from CGMS-35

| Actions open from CGMS-33 (at CGMS-35) | | | | | |
|---|---|---|---|---|---|
| **Actionee** | **Action** | **Description** | **Action feedback/closing document** | **Deadline** | **Status** |
| EUM; NOAA; WMO | 33.24 | Action 33.24 EUMETSAT, NOAA together with WMO to develop a EUMETCast to NOAA ADM transition plan for users in South America and report details to CGMS. | EUM-WP-11 (CGMS-33). WMO-WP-20 (CGMS-33) and WMO-WP-24 (CGMS-35).<br><br>NOAA-WP-33 (CGMS-35), however, NOAA has positioned its GOES-10 satellite to provide geostationary satellite coverage over South America. GOES-10 data is currently being disseminated via direct broadcast and used operationally. NOAA does not currently have plans to develop ADM capability, but is in the process of developing GEONETCast service. See NOAA-WP-33. Discussed in WGIV. | (5 Nov 2007) New date: CGMS-36 | OPEN for NOAA |

| Actions open from CGMS 34 (at CGMS-35) | | | | | |
|---|---|---|---|---|---|
| **Actionee** | **Action** | **Description** | **Action feedback/closing document** | **Deadline** | **Status** |
| CGMS Members | 34.12 | Action 34.12 CGMS members to review Space Frequency Coordination Group (SFCG) Resolution Res A12-1R2 and inform whether this resolution shall be used by CGMS agencies. Deadline: 31 August 2007 | ESA and NOAA are SFCG members and use RES A12-1R2 for frequency coordination.<br>EUM-WP-15<br>Statement and resolution provided by e-mail to CGMS plenary. | (31 Aug 2007) New date: 31 Jul 08 | OPEN |

| CGMS 35 actions | | | | | |
|---|---|---|---|---|---|
| **Actionee** | **Action** | **Description** | **Action feedback/closing document** | **Deadline** | **Status** |
| CGMS Members | Permanent 01 | All CGMS Members to inform the Secretariat of any change in the status or plans of their satellites to allow the updating of the CGMS Tables e-mail, of Satellites (tables 1-6 of the plenary report). The Secretariat to review the tables of current and planned polar and geostationary satellites, and to distribute this updated information, via the WWW Operational Newsletter, via Electronic Bulletin Board, or other means as appropriate. CGMS satellite operators to update table 7 for polar-orbiting satellite equator crossing times on an annual basis. CGMS Members to update the table on polar-orbiting satellite equator crossing times as well as the table on coverage from geostationary satellites.<br>*(CGMS-35 permanent actions 02 and 09 were closed and are partly incorporated in permanent action 01).* | | CGMS-36 | OPEN |
| CGMS satellite operators | Permanent 02 | CGMS Members to report on spacecraft anomalies from solar events at CGMS meetings.<br>*NB The Secretariat has included the word "spacecraft" in this permanent action since CGMS-35* | | CGMS-36 | OPEN |
| CGMS Members | Permanent 03 | CGMS Members to provide information for the WMO database of satellite receiving equipment, as appropriate. | | CGMS-36 | OPEN |
| CGMS Members | Permanent 04 | CGMS Members to review the list of available list servers used by CGMS groups and update as appropriate. | | CGMS-36 | OPEN |
| CGMS Members | Permanent 05 | CGMS satellite operators to consider the IOC satellite requirements, especially the data dissemination methods, bearing in mind the ongoing formations of GOOS Regional Alliances (GRAs). | | CGMS-36 | OPEN |
| CGMS Members | Permanent 06 | CGMS Members to consider WMO Core Metadata profiles within the context of the ISO Standard for Geographic Metadata (ISO 19115). | | CGMS-36 | OPEN |
| NOAA | 35.01 | Action 35.01: NOAA to provide more detailed information on the DMSP satellite system. Deadline: CGMS-36 | | CGMS-36 | OPEN |
| NASA | 35.02 | Action 35.02: CGMS invited NASA to provide information on its current R&D Earth Observation satellites. Deadline: CGMS-36 | | CGMS-36 | OPEN |

| CGMS 35 actions | | | | | |
|---|---|---|---|---|---|
| **Actionee** | **Action** | **Description** | **Action feedback/closing document** | **Deadline** | **Status** |
| CMA, CNSA, WMO | 35.03 | Action 35.03: CMA/CNSA and WMO will cooperate in finalising the work of the GEO-Microwave Focus Group that, according to its Terms of Reference and taking into account the work already done, should:<br><br>- define a mission scenario attempting to converge with results of feasibility studies in China as they become progressively available;<br>- identify mission components suitable for international partnerships and preliminary assess the realism of collecting the interest of prospective partners;<br>- draft a proposal to the group of prospective partners, including work plan and schedule; and present it to CGMS-36, that implies that CMA/CNSA commit to act as Leading Agency.<br><br>Deadline: CGMS-36, preceded by a presentation at a last meeting of the Focus Group possibly to be held tentatively with the next IPWG meeting in Beijing in autumn 2008. | | IPWG 2008 and CGMS-36 | OPEN |
| CNSA | 35.04 | Action 35.04: CNSA to inform WMO of the data policy for the HY-2 satellite after completion of HY-2 phase B studies. Deadline: CGMS-36 | | CGMS-36 | OPEN |
| CGMS Members | 35.05 | Action 35.05: CGMS Members to indicate to JAXA their interest in having access to GOSAT data (kawai.takayuki@jaxa.jp and umezawa.kazuo@jaxa.jp). Deadline: CGMS-36 | | CGMS-36 | OPEN |
| CGMS Members | 35.06 | Action 35.06: CGMS Members to provide feedback [on the gap analysis] to WMO (bibizzar@tin.it). Deadline: On a continuous basis, and for review at CGMS-36. | | continuous and CGMS-36 | OPEN |
| EUM, NOAA, WMO | 35.07 | Action 35.07: CGMS to form a small focus group to consider the recommendation “establish a new international science working group on the theme of climate and calibration”, and to report their finding back to CGMS-36. The focus group to be composed of Dr Schmetz, EUMETSAT, Dr Goldberg NOAA/NESDIS, and Dr Purdom, Chairperson WMO OPAG-IOS. Deadline: May 2008 and to report at CGMS-36 | | 30 May 2008; CGMS-36 | OPEN |
| WMO | 35.08 | Action 35.08: WMO (supported by CGMS Members) to update their THORPEX Focal Points and Contacts given in Table 1, Annex 2 of WMO-WP-09 to CGMS THORPEX Rapporteur. Deadline: 1 December 2007 | | 01-Dec-07 | OPEN |
| EUM | 35.09 | Action 35.09: EUMETSAT to prepare a paper on its SAF activities for the Bulletin of the Meteorological Society. Deadline: CGMS-36 | | CGMS-36 | OPEN |
| WMO | 35.10 | Action 35.10: WMO to contact IMD with a view to clarifying its plans as co-sponsor of the VL Centre of Excellence in Oman. Deadline: 31 December 2007 | | 31-Dec-07 | OPEN |
| CGMS Members | 35.11 | Action 35.11: All CGMS Members to nominate points of contact to support the CGMS website editorial committee. Deadline: 31 December 2007 | | 31-Dec-07 | OPEN |

| CGMS 35 actions | | | | | |
|---|---|---|---|---|---|
| **Actionee** | **Action** | **Description** | **Action feedback/closing document** | **Deadline** | **Status** |
| WMO, EUM | 35.12 | Action 35.12: WMO and CGMS Secretariat to establish a CGMS web editorial committee by March 2008 in order to guide the completion and further enhancement of the CGMS website and the ftp server and ensure their sustainability. Deadline: March 2008 and to report to CGMS-36 | | 31 Mar 2008; CGMS-36 | OPEN |
| EUM | 35.13 | Action 35.13: CGMS Secretariat, with assistance of WMO, to prepare a draft letter to FCC expressing its concerns over the potential RF power increase for unlicensed fixed services devices around 60 GHz. Deadline: 30 November 2007 | Letter submitted online with the FCC on 9 November 2007 (only online submissions accepted by the FCC). | 30-Nov-07 | CLOSED |
| WMO | 35.14 | Action 35.14: WMO to confirm its requirement for the continued use of the CGMS coordinated IDCS to support its ASAP programme, and to assist with the promotion of the IDCS for potential future ASAP operators. Deadlines: CGMS-36 | | CGMS-36 | OPEN |
| NOAA | 35.15 | Action 35.15: NOAA to organise with other IDCS coordinator agencies (CMA, JMA, EUMETSAT) a meeting to discuss the future use and technical aspects of the IDCS. The participation of other CGMS Members would be welcomed. Deadline: 30 April 2008 | | 30-Apr-08 | OPEN |
| WMO | 35.16 | Action 35.16: WMO to distribute the RGB Workshop report and present representative examples of RGB schemes on the WMO web site. Deadline: 31 January 2008 | | 31-Jan-08 | OPEN |
| CMA, EUM, JMA, NOAA, WMO | 35.17 | Action 35.17: VL partners to implement RGB schemes for training use within the WMO Virtual Laboratory. Deadline: CGMS-36 | | CGMS-36 | OPEN |
| WMO | 35.18 | Action 35.18: GSICS GCC to propose web-based interface to other satellite agencies for near-real-time instrument monitoring. Deadline: CGMS-36 | | CGMS-36 | OPEN |
| NOAA | 35.19 | Action 35.19: NOAA/NESDIS to send to all CGMS members the URL of web sites on climate products described in NOAA-WP-29. Deadline: 31 December 2007 | | 31-Dec-07 | OPEN |
| NOAA | 35.20 | Action 35.20: NOAA/NESDIS to include information on global and regional anomalies in their products as well. Deadline: CGMS-36 | | CGMS-36 | OPEN |
| JAXA, NASA | 35.21 | Action 35.21: NASA and JAXA to report on status and plans for GPM at CGMS-36. Deadline: CGMS-36 | | CGMS-36 | OPEN |
| CGMS Members | 35.22 | Action 35.22: CGMS Members to report on precipitation estimation and validation activities at CGMS-36. Deadine: CGMS-36 | | CGMS-36 | OPEN |
| Satellite operators (+ WMO) | 35.23 | Action 35.23: The Task Force on codes to consider possible use of additional data formats for satellite product dissemination and archive delivery, and report to CGMS. Deadline: CGMS-36 | | CGMS-36 | OPEN |
| Satellite operators (current and future + WMO) | 35.24 | Action 35.24: CGMS current and future satellite operators to review their possible flexibilities to adjust the nominal locations of their baseline geostationary satellites and to provide the information at the next CGMS session. Deadline: CGMS-36 | | CGMS-36 | OPEN |

| CGMS 35 actions | | | | | |
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| **Actionee** | **Action** | **Description** | **Action feedback/closing document** | **Deadline** | **Status** |
| CMA, ROSH, EUM, NOAA | 35.25 | Action 35.25: Each CGMS polar orbiting satellite operator to consider providing to all other polar orbiting satellite operators, and to the direct readout community, their processing software necessary to produce Level 1B data from the direct broadcast data stream, and to provide the technical specifications for their direct broadcast data stream necessary to produce Level 1B data. Deadline: 31 March 2008 | | 31-Mar-08 | OPEN |
| EUM | 35.26 | Action 35.26: EUMETSAT to provide CGMS with the results of the Post-EPS, Phase 0 studies, in particular, results pertaining to data dissemination. Deadline: CGMS-36 | | CGMS-36 | OPEN |
| EUM | 35.27 | Action 35.27: EUMETSAT to provide CGMS with the results of the MTG trade-off studies, in particular, results pertaining to the MTG data dissemination system. Deadline: CGMS-36 | | CGMS-36 | OPEN |
| Satellite operators | 35.28 | Action 35.28: Satellite operators to provide WMO with detailed information, on all the methods available, or planned, for operational data access from each of their satellites contributing to the GOS, via relevant URL of the satellite operator's web page. This detailed information shall include the designation of the dissemination or retrieval services, their summary contents, formats used, and technical characteristics such as:<br><br>• For real-time dissemination via the satellite itself (Direct Broadcast): frequency, bandwidth, data rate (uncompressed);<br>• For Real-time dissemination through multi-mission satellite dissemination system (Advanced Dissemination Methods): satellite name, location, frequency band, area covered, data rate (uncompressed);<br>• For Real-time dissemination via Internet FTP: address;<br>• For On-line data retrieval : address;<br>• URL for precise information on data access modalities<br>Deadline: May 2008, and to report at CGMS-36 | | 31 May 2008; CGMS-36 | OPEN |
| WMO, EUM | 35.29 | Action 35.29: WMO/CGMS Secretariat to collect the data access information from satellite operators and make it available through the CGMS and/or WMO websites. Deadline: CGMS-36 | | CGMS-36 | OPEN |
| CGMS Members | 35.30 | Action 35.30: CGMS members to report on their use of compression techniques (from the operational and user perspectives) for current and future satellite systems. Deadline: CGMS-36 | | CGMS-36 | OPEN |
| NOAA, EUM | 35.31 | Action 35.31: NOAA and EUMETSAT to study possibilities for the use of NPOESS ground infrastructure to improve the timeliness of Metop data, within the framework of JPS discussions and report findings to CGMS. Deadline: CGMS-36 | | CGMS-36 | OPEN |

| CGMS 35 actions | | | | | |
|---|---|---|---|---|---|
| **Actionee** | **Action** | **Description** | **Action feedback/closing document** | **Deadline** | **Status** |
| CGMS Members | 35.32 | Action 35.32: CGMS members involved with the IGDDS to consider applying as DCPCs within the context of the IGDDS and WIS, in consultation with WMO. Deadline: May 2008 | | 31-May-08 | OPEN |
| CGMS Members | Recommendation 35.01 | Recommendation 35.01: CGMS Members were invited to use the Gap Analysis as a reference for further discussions on the evolution of the GOS and global planning of future missions. | | CGMS-36 | OPEN |
| Satellite operators (+ WMO) | Recommendation 35.02 | Recommendation 35.02: Satellite operators are requested to provide near real-time monitoring of instrument performance on easily accessible websites and to archive the information. | | CGMS-36 | OPEN |
| | Recommendation 35.03 | Recommendation 35.03: Continue aircraft campaigns with SI traceable instruments to provide absolute calibration opportunities for critical satellite instruments, such as IASI, AIRS and CrIS. | | CGMS-36 | OPEN |
| Satellite operators (+ WMO) | Recommendation 35.04 | Recommendation 35.04: Satellite operators to explain significant discrepancies in satellite inter-calibration as part of their contribution to GSICS. Pertinent reports should be delivered to the GCC. | | CGMS-36 | OPEN |
| | Recommendation 35.05 | Recommendation 35.05: In view of the positive impact of radio-occultation measurements on NWP forecasts CGMS expresses strong support to future plans for the continuation of radio-occultation measurements from constellations with adequate coverage. | | CGMS-36 | OPEN |
| CGMS Members | Recommendation 35.06 | Recommendation 35.06: CGMS encourages continuation of the generation of long-term satellite-based climatologies. | | CGMS-36 | OPEN |
| CGMS Members | Recommendation 35.07 | Recommendation 35.07: CGMS members to respond to recommendation 34.15 should finalise the first phase of the project (i.e. the processing of the AMVs with their own operational AMV algorithm without any modification) before IWW9 and discuss the results. | | 31-Jan-08 | OPEN |
| EUM | Recommendation 35.08 | Recommendation 35.08: IWW9 should discuss the results from the height assignment studies based on advanced instruments on the A-train. The co-Chairs of IWWG are invited to provide a summary report to CGMS-36. | | 30 Apr 08 CGMS-36 | OPEN |
| EUM | Recommendation 35.09 | Recommendation 35.09: IWW9 should discuss the results of the studies using the images simulated from NWP model output to track AMVs. Co-Chairs of IWWG are invited to provide a summary report to CGMS-36 on results of the ongoing studies on deriving AMVs from images simulated from NWP model. The report should address both the imagers as well as the hyperspectral sounders. | | 30 Apr 08 CGMS-36 | OPEN |
| ESA | Recommendation 35.10 | Recommendation 35.10: Direct retrievals of wind fields from Doppler Wind Lidars need to be continued beyond the ESA ADM mission. | | CGMS-36 | OPEN |

| CGMS 35 actions | | | | | |
|---|---|---|---|---|---|
| **Actionee** | **Action** | **Description** | **Action feedback/closing document** | **Deadline** | **Status** |
| EUM | Recommendation 35.11 | Recommendation 35.11: IWW9 should discuss the height allocation to atmospheric layers and pursue tests within NWP assimilation and forecast systems. | | 30-Apr-08 | OPEN |
| EUM | Recommendation 35.12 | Recommendation 35.12: CGMS 35 recommends to put the CGMS wind statistics on the new IWWG web site and to discuss at IWW9 whether a strict adherence to CGMS collocation criteria should be followed and whether the criteria need to be re-defined. | | 30-Apr-08 | OPEN |
| CGMS Members | Recommendation 35.13 | Recommendation 35.13: CGMS members are encouraged to present papers demonstrating the possibilities of advanced sounding for analysing convective instability of the atmosphere, particularly utilising information from the hyperspectral sounders AIRS and IASI. | | CGMS-36 | OPEN |
| Satellite operators (+ WMO) | Recommendation 35.14 | Recommendation 35.14: Future satellite sensors are expected to be used for fire monitoring; relevant channels and sensors should be adequately characterised for this application. The matter should be part of the pertinent work under GSICS. | | CGMS-36 | OPEN |
| Satellite operators | Recommendation 35.15 | Recommendation 35.15: CGMS satellite operators to consider making a data interface available such as ADDE servers so that McIDAS-V and HYDRA can be applied to their data. | | CGMS-36 | OPEN |
| CGMS Members | Recommendation 35.16 | Recommendation 35.16: CGMS Members to continue to support activities of the three International Working Groups (ITWG, IWWG and IPWG) particularly upcoming science meetings in 2008. | | 2008 GMS-36 | OPEN |

## H.7 Approval of Draft Final Report

CGMS reviewed the Draft Final Report of the meeting. The Secretariat agreed to include amendments received at the meeting in a revised draft version, which would be distributed electronically to CGMS Members for final comments. It was agreed that CGMS Members would submit any further modifications to the Secretariat by 30 November 2007, to enable the electronic distribution of a finalised version by the Secretariat three weeks thereafter. It was further agreed that the final version of the report would be provided to participants both as a hard copy document and via CD-ROM, which would also contain all CGMS-35 Working Papers and presentations.

## H.8 Date and Place of Next Meetings

EUMETSAT informed CGMS that CGMS-36 would be held from 3-7 November 2008 in Europe. The exact location to be confirmed at a later stage.

The Chairperson thanked all participants for their cooperation and fruitful participation in CGMS-35, adding that there had been many interesting discussions and important developments during the working group and plenary sessions. He also thanked the Rapporteurs and Secretariat for preparing the final report in a timely manner. All parties warmly thanked NOAA for the excellent hosting and organisation of the meeting in Cocoa Beach and for the support and cooperation with the CGMS Secretariat.

The meeting adjourned at 12:30 on 9 November 2007.

# PARALLEL WORKING GROUP SESSIONS

## WORKING GROUP I: TELECOMMUNICATIONS

## I/0 Introduction

As agreed at CGMS-34, Mr Marlin O. Perkins (NOAA) and Mr Gordon Bridge (EUMETSAT) were elected as Chairperson and Rapporteur, respectively, of Working Group I (WG I) on Telecommunications. WG I comprised representatives of the satellite operators from CMA, JMA, NOAA, KMA and EUMETSAT together with WMO (see Annex ??? for full list of participants).

**Coordination of frequency allocations: SFCG, ITU and WRC activities**

The meeting recalled that at the World Radio Conference 2007 (WRC-07) which took place in Geneva from 22 October to 16 November 2007 a number of issues of interest and concern to EUMETSAT in relation to the Meteorological Satellite Service (MetSat) and Earth Exploration-Satellite Service (EESS) as defined in the RR of the ITU would be discussed.

EUMETSAT-WP-15, JMA-WP-04, WMO-WP-18, and NOAA-WP-12 each highlighted topics of most relevance to CGMS members and provided an outlook on the desired outcomes of WRC-07.

Those WRC-07 agenda items of relevance were:

- Agenda Item 1.2 - Extension of the 18 GHz Meteorological Satellite (MetSat) Service allocation and protection of the 10.6 – 10.68 GHz and 36 – 37 GHz Earth Exploration-Satellite Service (EESS) (passive) bands,

- Agenda Item 1.17 - Protection of the 1400 – 1427 MHz EESS (passive) band,

- Agenda Item 1.20 - Protection of the EESS (passive) bands at 1400 – 1427 MHz, 23.6 – 24.0 GHz, 31.3 – 31.5 GHz, 50.2 – 50.4 GHz and 52.6 – 54.25 GHz from unwanted emissions,

- Agenda Item 1.3 - Consider upgrading the radiolocation service to primary allocation status in the bands 9000-9200 MHz and 9300-9500 MHz and extending by up to 200 MHz

- Agenda Item 1.4 - To consider frequency-related matters for the future development of IMT 2000 and systems beyond IMT 2000 taking into account the results of ITU R studies in accordance with Resolution 228 (Rev.WRC 03),

- Agenda Item 7.2 – Potential agenda items for WRC-11.

**Concerning WRC-07 Agenda Item 1.2 - Extension of the 18 GHz Meteorological Satellite (MetSat) Service allocation and protection of the 10.6 – 10.68 GHz and 36 – 37 GHz Earth Exploration-Satellite Service (passive) bands, in particular, the extension of the 18 GHz MetSat Service allocation by 100 MHz**, JMA informed the meeting that it had requested the Japanese radio-communication administration (a function of the Ministry of Internal Affairs and Communications (MIC)) to support the extension of the frequency bandwidth. The MIC represented Japan's preliminary views at a meeting of the APT Conference Preparatory Group for WRC-07 (APG07) in Pusan, Korea in July 2007 as follows:

"Japan supports sharing studies of possibility to extend the geostationary meteorological satellites allocation within the bands 18-18.4 GHz. Sharing criteria for the extension should be appropriately defined, based on the result of the ITU-R studies in the possibility of sharing this band with other allocated services."

At the APG07, the meeting summarized the preliminary APT common proposal on this agenda point as follows:

"In order to secure the necessary frequency spectrum for next-generation geostationary meteorological satellite (MetSat) systems, APT supports extension of the existing 18 GHz MetSat allocation by 100 MHz. However, existing services (FS, FSS including feeder-links for the BSS Plan (Regions 1 and 3) and MS) must be protected from harmful interference due to the possible extension of MetSat allocation. Additionally, extending the ±8° coordination arc currently applicable to FSS networks in this band, to MetSat in the band 18.1-18.4 GHz is appropriate. This could be accomplished through appropriate modifications of Table 5-1 in RR Appendix 5."

**Concerning the regulatory provisions to protect the Earth Exploration-Satellite Service (passive) in the bands 10.6 - 10.68 GHz and 36 - 37 GHz**

The band 10.6 – 10.68 GHz together with the band 10.68 – 10.7 GHz (covered by RR Footnote 5.340 – "all emissions are prohibited") is of primary interest to measure rain, snow, sea state and ocean wind for ocean and land surfaces. The band 36 – 37 GHz is vital for the study of global water circulation since in this band it is possible to monitor rain, snow, ocean ice and water vapour for ocean and land surfaces.

Both bands are identified as candidate channels for the observation missions in the framework of Post-EPS. The band 10.6 – 10.68 GHz is a candidate channel for the Microwave Sounder (MWS) as well as for the Microwave Imager (MWI). The band 36 – 37 GHz is a candidate channel to be observed in the MWI.

**Concerning WRC-07 Agenda Item 1.17 - Protection of the 1.4 GHz Earth Exploration-Satellite Service (passive) band**

WRC-03 concluded a secondary allocation to the fixed-satellite service (FSS) for feeder links for non geostationary satellite networks in the mobile-satellite service with service links below 1 GHz through RR footnote 5.339A in the bands 1390-1392 MHz (Earth-to-space) and 1430-1432 MHz (space-to-Earth). However, due to the fact that there was a lack of studies and test measurements with regard to the protection of other services in the bands or in the passive band 1400-1427 MHz it was decided that these additional allocations shall not be used until the completion of all studies and the results of these studies reported to WRC 07.

The band 1400 – 1427 MHz is a vital resource for measuring soil moisture (over land), ocean salinity, and other aspects of the Earth and its atmosphere. This band is one of the few bands for which RR footnote 5.340 prohibits all emissions, emphasising its particular importance for the science community. The band 1400 – 1427 MHz is a candidate channel for the Microwave Imager (MWI) in the framework of Post-EPS for the measurement of ocean salinity and soil moisture.

**Concerning WRC-07 Agenda Item 1.20 - Protection of several Earth Exploration-Satellite Service (passive) bands from unwanted emissions**

This agenda item deals with the issue of inclusion of regulatory provisions in the RR to protect the EESS (passive) in a total of five bands from unwanted emissions from numerous active services in neighbouring frequency bands. All the bands as listed below to be considered under this agenda item are covered by RR footnote 5.340 - “all emissions are prohibited”:

- 1400 – 1427 MHz
- 23.6 – 24.0 GHz
- 31.3 – 31.5 GHz
- 50.2 – 50.4 GHz
- 52.6 – 54.25 GHz

CEPT supports the adoption of adequate limitations and therefore proposes to include mandatory unwanted emission limits in the RR to provide full protection to the EESS (passive) in the five bands listed above.

**Concerning Agenda Item 1.3**

In accordance with Resolution 747, to consider upgrading the radiolocation service to primary allocation status in the bands 9000-9200 MHz and 9300-9500 MHz and extending by up to 200 MHz the primary allocations to the Earth exploration-satellite (active) and space research service (active) in the band 9500-9800 MHz without placing undue constraint on the services to which the bands are allocated.

**Concerning Agenda item 1.4**

"To consider frequency-related matters for the future development of IMT-2000 and systems beyond IMT-2000 taking into account the results of ITU-R studies in accordance with Resolution 228 (Rev.WRC-03)."

In this agenda point, discussion will be focused on the frequency-band sharing criteria between International Mobile Telecommunication 2000 (IMT-2000) and systems beyond IMT-2000 (refer to below as IMT-2000 & Beyond) and other radio communication services that already have frequency allocations in the relevant bands.

**JMA** also informed WG I that it has been using the 468 MHz band to provide earthquake and tsunami warning information to users in Japan via the Japanese geostationary meteorological satellites, and will continue the service using the same band. JMA therefore explained to the MIC that it is necessary to correct the description in the draft report in order to reflect Japan's current status and future plans for utilization of the 460-470 MHz band by Japanese geostationary meteorological satellites, and that sharing studies are necessary. The MIC requested WP8F to correct the description to reflect the actual status in Japan.

At the APG07, the meeting summarized the preliminary APT common proposal on this agenda point as follows:

"*With regard to the terrestrial components of the future development of IMT-2000 and systems beyond IMT-2000*, *APT supports that the bands 450-470 MHz, 2300-2400 MHz should be identified and Method 1A under Agenda Item 1.4 could be applied."*

**Concerning WRC-07 Agenda Item 7.2 – Potential Agenda Items for WRC-11**

**Consideration of frequency allocations between 275 and 3000 GHz**

On the tentative agenda for WRC-11 that was agreed already at WRC-03 an item 2.2 was included to consider frequency allocations between 275 GHz and 3 000 GHz taking into account the result of ITU-R studies in accordance with Resolution 950 (WRC 03).

CEPT proposes to modify the Agenda Item 2.2 for WRC-11 limiting the consideration on the revision of the adequacy of the protection provided to passive services by RR 5.565 in the light of planned applications for passive services between 275 GHz and 3 000 GHz.

**Concerning the extension of the MetSat service allocation at 7750 – 7850 MHz by up to 100 MHz**

The spectrum available and nominally foreseen for the downlink of raw instrument data of polar-orbiting MetSat systems, namely 7750 – 7850 MHz, already today is very limited and forced most operators of the soon to be launched systems to use other frequency bands that like the band 8025 – 8400 MHz are already facing congestion. Increasing spectrum requirements of next generation polar-orbiting systems like the EUMETSAT Polar System (EPS) follow-on system (Post-EPS) will worsen this situation.

CEPT proposes an agenda item for WRC-11 considering the existing allocation to the meteorological satellite service in the band 7750 – 7850 MHz with a view to extending this allocation by up to 100 MHz limited to non-geostationary meteorological satellites in the space-to-Earth direction to provide up to a maximum of 200 MHz of contiguous spectrum

**Concerning the adequacy and possible improvement of the regulatory status and recognition of the scientific services in the Radio Regulations**

Reliable access to Earth Observation global data obtained using the radio spectrum is not only essential to maintaining and improving the accuracy of weather forecasts that contribute to the safety of life and preservation of property throughout the world, but also the monitoring and prediction of climate change, support in sustainable development as well as in disaster prediction, monitoring and mitigation, recognising that more than 90% of natural disasters are climate or weather related.

In order to cater for this CEPT proposes an agenda item for WRC-11 to consider ways of improving in the Radio Regulations the regulatory recognition and status of Earth Observation carried out in the Earth Exploration Satellite Service (active and passive), the Meteorological Satellite Service, the Meteorological Aids Service and Radiolocation Service and in particular the increasingly essential role of corresponding applications, in climate change, sustainable development and disaster prediction, monitoring and mitigation related activities.

**Outlook for MetSat issues at WRC-07**

With regard to the extension of the MetSat allocation at 18 GHz from 200 MHz to 300 MHz of contiguous spectrum there is generally wide support from the regional groups from around the world, however there still remains the task at the WRC-07 itself to find an agreement on the direction (upwards or downwards) in which the MetSat allocation should be extended.

Although there is no compatibility problem in either direction, in particular the Arab countries are against an extension downwards to protect their interests in feeder links for broadcasting satellites. Contrary to the position of the Arab

countries, especially the US and Canada favour an extension downwards and are against an extension upwards as proposed by CEPT in order to protect their interests with regard to the fixed-satellite service use.

**Outlook for EESS (passive) issues at WRC-07**

Regarding the protection of the EESS (passive) in the various frequency bands under agenda items 1.2 and 1.20 the proposals to the WRC-07 will be covering a wide range of options from providing full protection through the inclusion of adequate limits in the RR to "no change" to the current regulatory status. It will be subject to heavy discussions at WRC-07 itself to find a mutually acceptable solution for each individual band in particular for the bands 1400 – 1427 MHz and 10.6 – 10.68 GHz.

**Outlook for possible Agenda Items for WRC-11**

A WRC agenda comprises about 20 – 25 items. CEPT already proposes 20 new agenda items. Other regional organisation will also propose a number of new agenda items for WRC-11 in the same order of magnitude. Together with the issues (unfinished business or consequential follow-on issues) resulting from the discussions on the WRC-07 items, the chance of getting a new item on the agenda for WRC-11 is unpredictable and largely depends on the support an issue receives from the regional organisations.

## I/2 Technical Information from the Space Frequency Co-ordination Group and ITU-R

In NOAA–WP-12, CGMS was informed that the 26th meeting of SFCG was held in Bonn, Germany from 19-27 September 2006 and SFCG-26 met in Maspalomas, Spain during 19-27 September 2007. This ad hoc international group meets annually to discuss radio frequency matters of interest to the various civil space agencies. SFCG is the pre-eminent radio-frequency collegiate of space agencies and related national and international organizations through which global space systems spectrum resources are judiciously husbanded for the benefit of humanity. The input documents are usually attributed to one of several working groups. The two working groups of most importance to metsats are the "ITU Matters and preparation for WRC-07" and the "EES and Metsat". (Note: EES = Earth exploration satellite).

NOAA inputs to SFCG-26 summarized the June 2006 passive microwave workshop held in Silver Spring, Maryland; presented alternatives for resolving 6-7 GHz band EES compatibility issues; proposed changes to the SFCG resolution covering metsat operations in the 7750-7850 MHz band; discussed ways to protect downlinks in 25.5-27 GHz used for manned missions; and provided an updated list of present and future radio frequency requirements of NOAA satellite networks

The NOAA inputs to SFCG-27 are summarized the May 2007 passive microwave workshop held in Silver Spring, Maryland; presented alternatives

for resolving 6-7 GHz band EES compatibility issues; discussed ways to protect downlinks in 25.5-27 GHz used for manned missions as well as for the future 15 or so NPOESS SafetyNet Earth stations; and provided an updated list of present and future radio frequency requirements of NOAA satellite networks.

WMO-WP-17 reported on the CGMS agreement to the SFCG proposal to improve coordination between CGMS and SFCG by nominating a responsible person to represent SFCG at CGMS and vice versa on a yearly basis. WMO had designated Mr Robert Wolf to represent WMO. CGMS selected Mr Wolf as their representative at the SFCG-27 meeting in September 2007 in Maspalomas, Spain.

CGMS forwarded a liaison statement thanking the SFCG for considering the input of the "CGMS/WMO Forum on Data Transmissions from Meteorological Satellites" This liaison statement was presented by the CGMS/SFCG coordinator and discussed at the SFCG-27 Meeting in Maspalomas, Spain in September 2007.

In this liaison statement:

- CGMS noted that SFCG already provides a forum for multilateral discussions and coordination of spectrum matters of mutual interest concerning space radio communication services which can be utilized by the MetSat operators.
- CGMS noted the proposed activities and has initialized several actions to implement suitable measures.

In order to avoid potential interference cases between CGMS members in the future, it was proposed to use the coordination procedure as described in SFCG Res A12-1R2 (http://sfcgonline.org/resources/res/RES_A12-1R2.pdf). An action was issued that CGMS members shall agree to use this SFCG Resolution and to report back by the end of August 2007.No replies from CGMS members were received by this date. It will therefore be necessary to discuss this subject during CGMS-35.

The possibility to create an "**SFCG Inter-Sessional Working Group (IWG)"** to resolve urgent issues, working (usually by correspondence) between SFCG and CGMS meetings when considered necessary in order to make use of the time between the yearly meetings of both groups, was noted and a special request to establish such an IWG would be forwarded by CGMS when required. SFCG-27 expressed its thanks to CGMS for the liaison statement. It noted the nominations of experts and looks forward to receiving confirmation that CGMS members will make use of SFCG Res A12-1R2.

WMO added that the application of the SFCG Resolution A12-1R2 would be very useful for highlighting potential frequency sharing problems well in advance, and before there were possible financial impacts caused by the need to take corrective measures.

Therefore, concerning old **Action 34.12** "CGMS members to review Space Frequency Coordination Group (SFCG) Resolution Res A12-1R2 and inform whether this resolution shall be used by CGMS agencies" **it was agreed that in order to avoid frequency coordination problems between CGMS Members, this action would be kept open for the time being. Deadline: 31 July 2008**.

NOAA added that it would file formal notification of its intention to participate in the Group in the near future.

WMO-WP-18 reported on the annual meeting of the Space Frequency Coordination Group (SFCG-27) took place in Maspalomas, Spain from 17 - 27 September 2007. The main meeting results related to the Meteorological Satellite Service (MetSat) and the Earth Exploration Satellite Service (EESS) are listed in the following paragraphs:

- Preparation for the World Radio Conference 2007 (WRC 2007)

SFCG has updated Resolution 23-1R4 "SFCG Objectives for World Radio Conferences". This document gives guidelines and technical background information to be used at WRC 2007 but also includes positions for future WRCs.

- Extension of the METSAT Allocation a 7750-7850 MHz

To accommodate increased frequency spectrum requirements for future polar orbiting MetSat systems, an extension by up to 100 MHz of the primary allocation to NGSO MetSat at 7750 - 7850 MHz is needed. This will be discussed at WRC-2007 in WRC-11 of the agenda.

- Recognition of the Increasingly Essential Role of Earth Observations Carried Out by METSAT, METAIDS and EESS

WRC-2007 has received a proposal "to consider, in accordance with **Resolution [EUR/XX5] (WRC-07)**, the adequacy and possible improvement of the regulatory status and recognition of the increasingly essential role of Earth observation carried out in the Earth Exploration Satellite Service (active and passive), the Meteorological Satellite Service, the Meteorological Aids Service and Radiolocation Service".

- Outputs of Passive Microwave Sensing Workshops

SFCG discussed how best the outcome of the three workshops held by NOAA could be appropriately reflected in SFCG Resolution 21-2R2. It was concluded that the information as presented cannot simply be merged into the table of SFCG Resolution 21-2R2 as this resolution focuses on the protection requirements of passive sensing in different bands while the three workshops focused more on the measurement functions.

- Use of the Bands 6.9 - 7.3 GHz for Sea Surface Temperature Measurements

JAXA provided information on GCOM-W1 which will be launched in 2011 with an AMSR-2 sensor building upon the AMSR-E operated on AQUA. In order to cater for the interference problems at 6.9 GHz, GCOM-W1 will in addition use 7.3 GHz. Experiments over Japan showed smaller interference from the fixed service at 7.3 GHz as at 6.9 GHz. Measurements were only performed over land. The situation over the sea, in order to assess e.g. the influence from FSS downlink reflections from the sea surface, was not included in the experiment. JAXA is seeking information on the use of the 7.3 GHz band on a worldwide basis in order to get an idea of the interference situation on a global basis at 7.3 GHz as compared to 6.9 GHz.

- Impact of Wrong or Missing Data Due to Corrupted Measurements of Passive Sensors

CNES highlighted the impact of wrong or missing data on meteorological forecast and climate modelling due to corrupted measurements of passive radiometers. SFCG concurred with the issue raised in the document that generally the impact of RFI or wrong measurements derived from non-natural or man-made transmissions within satellite passive bands, and the consequential impact on the meteorological forecast and climate modelling in the framework of NWP is not precisely known. The only sensible way identified that could improve the knowledge of the impact of wrong or missing data might be the establishment of an expert group, with a few experts from the field of meteorological forecasting and climate modelling together with a few frequency management experts who could establish a work plan on how to identify and determine the impact of corrupted data.

- Out-of-Bounds (OOB) Emissions of Active Sensors

NASA presented a document providing a comparison of the various types of computation of the out-of-band (OOB) emission limits derived from spaceborne radar, especially concerning the 40 dB bandwidth. An action item was agreed within SFCG to collect data concerning the out-of-band emission limits. The collection of those elements would allow a possible revision of Annex 8 (OOB limits for primary radar systems) of ITU-R Recommendation SM.1541.

- **RF Power Increase for** Unlicensed **Fixed Service Devices Around 60 GHz**

During SFCG a specific issue was raised concerning potential RF power increase for unlicensed fixed service devices around 60 GHz, as noted in a FCC NPRM (Notice of Proposed Rule Making). The proposed change would affect AMSU (Advanced Microwave Sounding Unit) channels around 60 GHz, as well as future possible spectrometer-based observations such as high

altitude sounding channels that are critical for upper tropospheric, stratospheric and mesospheric temperature profiling.

Due to potential in-band interference to EESS (passive) bands used for weather forecasting, SFCG members would like to conduct compatibility analysis between existing and future observation systems and unlicensed devices as planned according to technical standards contained in Part 15 basis in the 57-64 GHz frequency range.

CGMS members expressed concern that it appeared that in the true sense of co-sharing (i.e. coordination and agreement of achieving a way forward for all partners concerned) of this frequency band, FCC is currently not respecting the co-primary customers. Furthermore, in order to determine if there is a real problem for CGMS members, then sharing studies will have to be performed .within the framework of the ITU and its working parties.

A copy of a recent letter expressing the concerns of the SFCG to the FCC was noted by WG I and it was agreed that CGMS should draft a similar letter, expressing the concerns of the Members over the potential interference that could result from the unregulated proliferation of such services.

**Action 35.13: CGMS Secretariat, with assistance of WMO, to prepare a draft letter to FCC expressing its concerns over the potential RF power increase for unlicensed fixed services devices around 60 GHz. Deadline: 30 November 2007. (This letter was submitted online with the FCC on 9 November 2007).**

NOAA-WP-40 presented a summary of frequency declarations for the Argos-4 system. The Argos Data Collection and location System (DCS) is jointly run by the US (NOAA), France (CNES), and Europe at large with EUMETSAT, providing global data recovery services. The current generation of Argos DCS instrument is the Argos-3 instrument. NOAA expects a full constellation of three Argos-3 instruments by 2009. In response to user requirements, the Argos Operation Committee has worked closely with participating organizations to plan for a new Advance Data Collection System (A-DCS) for the NPOESS satellites. This report to the CGMS outlines the key enhancements to the instrument including an increased frequency bandwidth, increased instrument sensitivity, and a higher data rate for the uplink and the downlink to the platform. The CGMS is invited to consider the design of the Argos-4 instrument, and frequency declaration, as well as proposed recommendations for future coordination.

NOAA-WP-41 presented a summary of L-Band frequency for SAREL time downlink for the Argos-4 system. Under the February 2007 Memorandum of Understanding between Centre National d'Etudes Spatiales (CNES) of France and Indian Space Research Organization (ISRO) of India a new polar orbiting satellite is planned for launch in 2009. This contribution gives the rational to use the meteorological band 1698-1710 MHz for the real time telemetry downlink of the Argos system. Then it gives the proposed frequency set for L band emitters

and insights of potential interference with other systems using the same frequency band. The satellite is proposed to carry an Argos-3 instrument and a Ka band altimeter/radiometer. The satellite is planned to be launched into a 6am-6pm sun synchronous orbit and provide a gap filling mission between the morning and afternoon missions covered by NOAA-18 and Metop-A which both carry an Argos DCS payloads. SARAL is proposed to have an L-Band downlink for real time broadcast of data to make use of its network of 23 HRPT stations (for Argos-3, 58 HRPT stations for Argos-2 satellites) distributed globally. This network provides approximately 60% of data collected by the DCS system in 30 minutes or less. The CGMS is invited to review the paper and make recommendations for future coordination.

## I/2 Telecommunication techniques

EUM-WP-16 presented a status report on the prototyping of high data rate data collection platforms (DCPs). EUMETSAT summarised the preparatory activities for developing pre-industrialized prototypes (transmitter and receiver) of a High Rate DCP System for the Meteosat Second Generation satellites. Based on an evolution of a previous prototype, the design of the pre-industrialized prototypes has focused on enhancing the behaviour of the receivers whilst under the influence of the spinning of the MSG satellites, and whilst still using Bandwidth Efficient Modulation schemes and S/W Radio concepts, therefore minimising the dependence on H/W platforms. Once Factory and Laboratory tests are completed successfully, the prototypes will be deployed at selected locations within the MSG DCP antenna coverage and exhaustively tested in a pseudo-operational way. This Pre-Operational Pilot Phase has been designed to cover different operational scenarios, such as the eclipse season of the MSG satellite, and will provide complementary information that will allow consolidation of the system specifications of the new EUMETSAT High Rate DCP System by mid 2008.

Noting that this approach by EUMETSAT was needed to address the impact of characteristics of one satellite system, namely, the rotating MSG satellites, and would lead to uncoordinated use of DCP channels within the global framework of CGMS, WMO queried whether there was, in fact, scope for CGMS to develop the concept of globally coordinated, multi-standard receivers for the DCP missions of its Members. EUMETSAT added that whilst such a development would not be possible for MSG, it could realistically be studied for its third generation Meteosat satellites.

WMO further proposed that studies of a future, coordinated DCP system should be initiated now in order to allow sufficient time for development. WMO added that such a system should support the CGMS concept of “help your neighbour” within the framework of global contingency planning.

CMA-WP-05 summarised the program is being planned for FY-4, the next generation of Chinese geostationary meteorological satellites that will take over the FY-2 series after 2015. A preliminarily FY-4 frequency network is being considered, bearing in mind the need to transmit an increased data

volume, and with added FY-4 functions such as Search and Rescue, DCP; which needs new frequencies in addition to those of the current FY-2 network. In consideration of the increased data volume to be transmitted and a new function assumed for FY-4, an additional 300MHz between 18.0-18.4GHz (pending the hopefully positive result of WRC-07 Res.) is required for raw data transmission; 406.025MHz (uplink) /1544.5 MHz (downlink) are needed for Search and Rescue, and 8175-8215MHz data uplink for a data broadcast system. Other factors to be considered for the future FY-4 frequency network include the requirement for a new orbital location for satellites for backup/storage purposes, beside the primary locations at 86.5°E, 105°E, 123.5°E.

## I/3 Co-ordination of International Data Collection & Distribution

### I/3.1 Status and Problems of the IDCS

NOAA-WP-14 provided a status report on the performance of the International Data Collection System (IDCS). NOAA's DCS Automated Processing System II (DAPS II) project, intended to replace the 18 year old DAPS-I has been cancelled. A new system called the DCS Alternative Data Distribution System (DADDS) is being built from functionality already provided in new digital demodulators to provide emergency backup for the faltering DAPS system, and to form a basis for a new replacement system. NOAA has just completed new Certification Standards to allow transmitters to use smaller channels, and plans to begin development of new transmitters within 18 months to 2 years. This will allow us to double the number of channels on our system over the long term (estimated 10 years to completion) from approximately 200 channels to 400 channels. The transition to high data rate continues, with approximately 19,000 of the 28,000 platforms assigned reporting at 300 or 1200 baud. Work continues on the Channel Interference and Monitoring System (CIMS). This system, which will enable better monitoring and evaluation of the international channels, is due for acceptance testing and final acceptance by September 30, 2007. NOAA is also investigating the use of two way communications to better command and control platforms. A phase I analysis was completed, and a Phase II effort which will deliver a prototype receiver and wave form definition has just been awarded. As previously noted, a conflict in the addressing scheme makes it difficult for NOAA to include new addresses generated by EUMETSAT. There is no current plan to address this issue, but it will remain open for action in the future.

EUM-WP-17 informed CGMS that at the beginning in October 2007, there were only 62 International DCP (IDCP) registered worldwide for normal use of the IDCS, using only 7 of the 33 channels available. In addition, the following DCP programmes made use of further International channels for regional purposes:

- 60 DCP allocated on channels I23 and 24, operated by the Aeronet programme.

- 20 DCP allocated on channels I25 and I26, operated by ROSHYDROMET.

- 173 DCP allocated on channels I27-I33, operated by WMO agro-meteorological and hydro-meteorological networks.

- 41 DCP allocated on channels I08, I09, I11, I17, I19 and I21 supporting IOTWS.

Globally, the total number of IDCP allocated on individual IDCS channels is:

| channel | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | | | | | | 1 | | 10 | 19 | | 10 | 11 | 4 | 5 | 2 | 29 | 9 |
| | | | | | | R | | I | I | | I | R | R | R | R | R | I |

| channel | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | | 2 | 10 | | | 30 | 30 | 20 | | 44 | 32 | 10 | 28 | 31 | 14 | 14 |
| | | I | R | I | CMA | Aeronet | | Russia | | WMO | | | | | | |

(R – regular IDCS; I – IOTWS; CMA – reserved for China
Table WGI-1: IDCP allocation on individual IDCS channels

WG I recalled that channels I23-I24 are used for Aeronet, I27-I33 for WMO networks and I25-I26 for (Planeta/ROSHYDROMET) are being used within the Meteosat IDCS field of view, on a temporary basis, with the special agreement of CGMS.

Following the termination of direct broadcast service from Meteosat-7, WG I also recalled that there is no longer any DCPRS service and all DCP messages are relayed via EUMETCast and the GTS. Meteosat-9 (MSG-2) is fully operational in supporting both the IDCS and the Meteosat DCS.

Several tidal gauges operated by the PTWC (Pacific Tsunami Warning Centre) were reallocated to I08, I09, I11, I17, I19 and I21 with the agreement of CGMS, transmitting every 15 minutes via Meteosat-6. There are currently 41 DCPs assigned to the IOTWS via Meteosat-6. In addition 2 regional channels on MSG-2 (Meteosat-9) are supporting 17 IOTWS DCPs.

Currently there are 33 DCP channels allocated for IDCS use. Many are now used for regional purposes by EUMETSAT, NOAA and in the future possibly JMA.

WG I noted that there are far fewer truly mobile DCPs using more than one satellite on the international channels and agreed that there should be a discussion about the long term plans for the use of channels and the service itself.

At CGMS-34, EUMETSAT suggested, and it was agreed, that there should be another forum for discussing these questions at a technical level, with a

participation including, as a minimum, NOAA, JMA and EUMETSAT, as IDCS system level coordinators and WMO. A potential meeting (plus use of teleconferences as appropriate) in spring 2008 was suggested by EUMETSAT. Other CGMS Member participation would be most welcome. (See also section I/4).

JMA-WP-02 informed CGMS that the MTSAT-1R's International Data Collection System (IDCS) had been functioning properly since the satellite started routine operations. Although harmful interference was frequently observed on IDCS channel 33 from August 2006 through July 2007, there was no negative impact on IDCS operation since no International Data Collection Platform (IDCP) is registered on the channel.

JMA added that the IDCPs of the Aircraft to Satellite Data Relay programme (ASDAR) were deregistered from MTSAT-IDCS on 27 March 2007 in accordance with the termination of that program (related to the completion of Action 34.16). Additionally, the NOAA GOES Shipboard Environmental (data) Acquisition System (SEAS) project has also been confirmed as completed, and the IDCPs used for that project had been deregistered from MTSAT-IDCS on 27 April 2007. As of the end of September 2007, 13 IDCPs were registered on 5 out of 33 MTSAT-IDCS channels. Further information regarding the MTSAT-IDCS is available under "Monthly Operations Reports" on the Meteorological Satellite Center (MSC) website at:

http://mscweb.kishou.go.jp/operation/opr_report.htm.

### I/3.2 Ships, Including ASAP

WMO-WP-28 provided a status report on ASAP operations over the last year. While the main concentration of the ASAP operations continued to be over the Northern Atlantic, an important contribution was also made by Japanese research ships operating primarily in the North Western Pacific areas and seas adjacent to Japan (although the research ship Mirai also occasionally operates in the Atlantic and Indian Oceans). The number of soundings reported from the Japanese had also increased significantly since 2005 (from 582 in 2005 to 938 launches in 2006). The percentage of Japanese reports getting onto the GTS continues to be generally high when compared to that of E-ASAP ships. Whilst a total of 4238 sounding messages from E-ASAP ships were inserted on the GTS in 2005, the loss rate (due to loss of sondes at launch, operator error or transmission problems) continued at unacceptably high levels. As a consequence, the initial objectives of the E-ASAP programme have had to be readjusted to more realistic levels.

The usual practice for the transmission of upper air soundings from ships under E-ASAP management was reported to be transmission via Inmarsat-C. Trials to implement Globalstar as a cheaper system had not proved satisfactory because the communication procedures differ between the East and West Atlantic. Further, the coverage of Globalstar is not 100% in the relevant area. Basically, Globalstar was still an option in combination with Inmarsat-C as a backup

system, but further tests had been postponed. The cost of upper air TEMP code data transmission via Inmarsat was a limiting factor for the ASAP Programme, and transmission of ASAP data in BUFR might have data telecommunications cost implications. The cost of upper air TEMP code data transmission via Inmarsat was extremely high compared to a standard SHIP code transmission from VOS. To alleviate this cost burden, an agreement was reached within the EUCOS that the Met Office should be reimbursed for cost incurred by E-ASAP operators. This system had operated well to date, but would need to be reconsidered in the light of the recent Goonhilly problems. In addition, the E-ASAP has been testing the use of Globalstar as an alternative to Inmarsat communications, as a means of reducing transmission costs.

Noting the increasing use of other communications satellites such as INMARSAT for the ASAP operators and the relatively low number of ASAPs using the IDCS globally, not to mention difficulties in promoting the use of the IDCS for ASAP activities and the recruitment of ASAP operating ships, **WG I** agreed

**Action 35.14: WMO to confirm its requirement for the continued use of the CGMS coordinated IDCS to support its ASAP programme, and to assist with the promotion of the IDCS for potential future ASAP operators. Deadlines: CGMS-36**

### I/3.3 ASDAR

**WG I** recalled that this WMO programme had been terminated in March 2007 and it was agreed that this Agenda Item was no longer necessary.

### I/3.4 Dissemination of DCP messages (GTS or other means)

No working papers were presented under this topic.

## I/4 Future use of the IDCS

In EUM-WP-17 the following issues were raised concerning the future use of the IDCS:

Currently there are 33 DCP channels allocated for IDCS use. Many are now used for regional purposes by EUMETSAT and NOAA and, in the future, possibly also JMA. Furthermore, there are far fewer truly mobile DCPs using more than one satellite on the international channels.

EUMETSAT considered that a discussion is now required on the long term plans for the use of IDCS channels. In particular, there is a need to determine:

- How many active Programmes are using IDCS for truly international applications?

- Are there any plans for future use of the IDCS for international applications

- Note the impact of DCPs (especially NOAA) gradually moving to High Bit Rate DCPs and with narrower spacing (1.5kHz),

- Should the IDCS specification be re-evaluated, bearing in mind plans for NPOESS and MTG?

- What are the future spacecraft contingency plans for the use of DCPs and, in particular, use of the IDCS?

- Several IDCS Channels are not being used according to specification, e.g. many allocated DCP belonging to major networks are no longer transmitting, although they are still allocated. There is now an agreed "channel policing" policy, is this effective enough?

At CGMS-34, EUMETSAT suggested, and it was agreed that there should be another forum for discussing these questions at a technical level. Participation to include, as a minimum, NOAA, JMA and EUMETSAT, as IDCS system level coordinators and WMO. A potential meeting (plus use of teleconference as appropriate) in spring 2008 was identified by EUMETSAT. Other CGMS participation would be most welcome to participate. To facilitate the setting up of this Forum, the following course of action was agreed:

**Action 35.15: NOAA to organise with other IDCS coordinator agencies (CMA, JMA, EUMETSAT) a meeting to discuss the future use and technical aspects of the IDCS. The participation of other CGMS Members would be welcomed. Deadline: 30 April 2008**

### I/5 Search and Rescue (S&R)

There were no Working Papers discussed under this agenda item.

### I/6 Conclusion and preparation of WG report

The WG report was prepared and the draft text for a letter to FCC provided at the end of the report.

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**Proposed draft text by WG I for a letter to FCC**

**Ref.: Potential impact of the Commission's Rules Regarding Operation in the 57-64 GHz Band (ET Docket No. 07-113 RM-11104)**

Dear Sir,

During the 35th meeting of the Coordination Group for Meteorological Satellites (CGMS) in Cocoa Beach Florida in November 2007 the meeting was informed

by the liaison officer of the Space Frequency Coordination Group (SFCG) on the issue of the revision of the FCC´s Rules regarding operation in the 57 – 64 GHz Band (ET Docket No. 07-113 RM-11104). After first study of this change CGMS members were concerned on potential interference to their satellite systems which could be caused by the planned operations under this new regulation and could have a strong negative impact on environmental monitoring in this time of heightened awareness of global climate change.

**Background of CGMS**

The Coordination Group for Meteorological Satellites (CGMS) aims at achieving global coordination of services provided by its members. The members are the major operators of geostationary and polar-orbiting meteorological satellite systems.

Members of CGMS are:

China Meteorological Administration, EUMETSAT, India Meteorological Department, IOC/UNESCO, Japan Meteorological Agency, Korea Meteorological Organisation, NOAA/NESDIS, ROSHYDROMET, WMO, ESA, NASA, JAXA, Rosaviacosmos.

Delegates are often supported by other agencies, for example, ESA (with EUMETSAT), NASDA (with Japan), NASA (with NOAA) and ISRO (with IMD).
There are two major components in the current meteorological satellite network coordinated by CGMS. One element consists of the various geostationary meteorological satellites operated by Europe, China, India, Japan, the United States of America and the Russian Federation. These satellites operate on the equatorial belt and provide a continuous view of the weather from approximately 70 degrees North to 70 degrees South. The launch of the first GOES satellite in 1974 by the USA was followed in 1977 with the launches of GMS by Japan and METEOSAT by the European Space Agency (responsibility for this satellite now rests with the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). The network was augmented in 1983 with the launch of the INSAT-1A, in 1994 with the launch of the Russian Federation's GOMS-N1 and in 1997 with the launch of FY-2A by China.

The second major element comprises the polar-orbiting satellites operated by the Russian Federation, China and the United States of America.

Since 1972, the Coordination Group for Meteorological Satellites (CGMS) has provided a forum, in which the satellite operators have studied, jointly with the World Meteorological Organisation (WMO), technical operational aspects of the global network, so as to ensure maximum efficiency and usefulness through proper coordination in the design of the satellites and in the procedures for data acquisition and dissemination. The specific design of each of the satellites is based on national and regional requirements for data and services and therefore some differences in design and mission are inevitable.

The World Meteorological Organization, a specialised agency of the United Nations, has a membership of 185 states and territories (as of June 2000). The main purpose of the WMO Satellite Activities Programme is:

To coordinate environmental satellite matters and activities throughout all the WMO Programmes and to give guidance to WMO and other multi-sponsored programmes on the potential of remote-sensing techniques in meteorology, hydrology, related disciplines and their applications. Satellites have become a fundamental tool for the WMO to carry out its basic goals. The WMO needs to play a role in the coordination of the global network of meteorological satellites because of the data and services provided to the large number of countries who are neither satellite operators nor members of a consortium operating such satellites. This is also very pertinent for the large parts of the globe outside national jurisdiction, especially the large open ocean areas. WMO and UNEP were the two sponsoring agencies in the establishment of the IPCC that was recently awarded the Nobel Price for its efforts to identify Climate change mostly attributed to anthropogenic activities.

The global network of meteorological satellites, whose technical and operational coordination is the objective of CGMS, constitutes a major portion of the space-based component in the Global Observing System (GOS) of the World Weather Watch (WWW).

**Reason for concern**

The frequency band 57 – 64 GHz includes the sub band 57 – 59.3 GHz where, among other services the EESS (passive) and SRS (passive) have aco-primary allocation. This frequency sub band is operationally used since many years for high altitude microwave sounding instruments operated by CGMS member agencies. This includes the Advanced Microwave Sounding Unit (AMSU) which is presently operated by EUMETSAT and NOAA. The channels in the sub band are critical for upper tropospheric, stratospheric, and mesospheric temperature profiling. These measurements are essential elements for computer models calculating weather forecasts. It needs to be noted that interference to such sensors would result in wrong measurements which would have an impact on the correctness of the global model and would deteriorate the quality of forecasts in large regions of the world. The models rely on global correctness of all measurements taken during satellite passes. The adverse impact would also greatly inhibit climate monitoring.

Since approximately 70 per cent of the Earth's surface is water and even the land areas have many regions which are sparsely inhabited, the polar-orbiting satellite system provides the data needed to fill-in the gaps of surface and atmospheric temperature profiles over the areas not adequately covered by conventional observing systems particularly in the Southern Hemisphere and in high latitudes both in the Arctic and Antarctic. Circling the Earth in a near-polar orbit, these spacecraft are able to acquire data from all parts of the globe in the course of a series of successive revolutions. With a relatively low

altitude their sensors can acquire higher-resolution data, both spatially and spectrally, than can the high-altitude geostationary satellites. For these reasons the polar-orbiting satellites are principally used to obtain specific sets of observations of three main types: a) daily global cloud cover; b) reasonably accurate quantitative measurements of surface temperature and c) most important, the vertical variation of temperature and water vapour in the atmosphere.

The proposed change would affect AMSU (Advanced Microwave Sounding Unit) channels around 60 GHz, as well as future possible spectrometer-based observations. These are high altitude sounding channels that are critical for upper tropospheric, stratospheric, and mesospheric temperature profiling.
Due to a potential in-band interference to EESS (passive) bands used for weather forecasting, Space Frequency Coordination Group (SFCG) members would like to conduct compatibility analysis between existing and future observation systems and unlicensed devices as planned according to technical standards contained in Part 15 basis in the 57-64 GHz frequency range.

At WRC-97 a general reallocation took place in the frequency range 50 – 71 GHz to identify where and how the various services could share this band in an optimal way. Key elements in the sharing analysis were the assumptions made about the technical characteristics of the terrestrial services planned to operate in this frequency range and their expected density of deployment. On that basis some bands were allocated co-primary to terrestrial and satellite passive services. At the time, given the atmospheric attenuation in this frequency range, it was assumed that relatively low-powered short range devices were going to be the main terrestrial users in this band. This seems to be not the case any longer with the proposed FCC rule making.

CGMS member agencies therefore share the concerns of the Space Frequency Coordination Group which were forwarded to you by a letter from the Executive Secretary of SFCG following their annual meeting in September 2007. The major concern of CGMS is that no detailed sharing analysis was performed to prove that no harmful interference of the new systems to sensors operated on meteorological satellites would occur. CGMS members therefore strongly support the request of the SFCG for provision of technical parameters of the new services to allow proper sharing studies. In particular it would be necessary to calculate the value of the received power at the EESS satellite antenna derived from the aggregation of the transmitted devices within a pixel (satellite footprint) of an EESS satellite and to compare this received result with thresholds contained in appropriate ITU-R Recommendations. In order to make this calculation, it would be necessary to know:

- Average density of transmitters per $km^2$ within urban and rural areas,

- RF characteristics of the transmitters around 60 GHz: RF power, description of the antenna pattern (antenna gain),

- The maximum height above sea-level at which these devices will be deployed.

CGMS member organisation would be very grateful if you could help allowing the necessary sharing studies by submitting this information to the SFCG and would appreciate to be copied on this via the CGMS secretariat at EUMETSAT.

Respectfully submitted
CGMS Secretariat

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# WORKING GROUP II: SATELLITE PRODUCTS

## II/0 Introduction

Working Group II on Satellite Products was chaired by Dr Mi-Lim Ou, KMA. Dr. Mitch Goldberg and Dr. Johannes Schmetz, EUMETSAT, assisted as rapporteurs. Several working papers were presented and discussed, three of those papers had been moved from WG III and one paper from the plenary to WG II; those papers are summarised under the topic “Additional papers” at the end of this report. Several of the papers were in response to actions and recommendations from CGMS-34. The responses to actions and recommendations emerging from previous meetings of the three CGMS Working groups ITSC, IPWG and IWWG provided again a key contribution to the discussions of WG II at CGMS 35. It was noted that all past actions were successfully addressed and closed.

## II/1 Image Processing Techniques

CMA-WP-07 described an image animation using images from two FY-2 satellites. With the successful launch of FY-2D two geostationary satellites became available, FY-2C at 105E and FY-2D at 86.5E. Overlapping observations range from 35 degrees East to 156.5 degrees East longitude, spanning as much as 121.5 degrees. The ground station alternatively receives images from the two satellites every 15 minutes during flood season and every 30 minutes outside the flood season. Images from the two satellites are merged into an enhanced animation to provide better information on the atmospheric flow. CMA-WP-07 also briefed CGMS 35 on factors impacting the quality of the merged image animation as well as the improvements that have been made to provide stable image animations. The common area covered by the two satellites, separated by only 18 degrees, is used to show daily animations on TV which is welcomed by forecasters and also by the public. WG II was impressed by the quality of the image navigation.

ESA-WP-06 reported on the development of a number of software tools to handle data from ESA remote sensing satellites. The tools are available on-line, which was noted by WG II.

WMO-WP-19 presented the outcome of the RGB Composite Satellite Imagery Workshop, held in Boulder, USA in June 2007. The focus of the workshop was to consider recommendations for standards and guidance in the use of this multi-spectral image display technique. The approach would then be presented and discussed in User Conferences and training events, especially in the context of the WMO VL with the general intention to promote wider acceptance of this common approach for image analysis by the user community. The workshop recognized that guiding principles for the generation of RGB products are extremely valuable but that a full (prescriptive) harmonisation of product definition schemes was probably impractical. To this end the workshop recommended generic schemes for different types of application areas. The paper presented proposals for the selection of

channels and attribution of colours for various RGB product groups for the atmosphere/cloud microphysics, air mass and surface, respectively. In the discussion it was iterated that the implementation of the proposed schemes would help to create a common basis for RGB applications which in turn would foster communication and co-operation.

**Action 35.16: WMO to distribute the RGB Workshop report and present representative examples of RGB schemes on the WMO web site. Deadline: 31 January 2008**

**Action 35.17: VL partners to implement RGB schemes for training use within the WMO Virtual Laboratory. Deadline: CGMS-36**

### II/2 Satellite Data Calibration and Validation

CMA-WP-08 informed CGMS about the calibration work of FY-2C/D with either model simulations or an inter-calibration method using TERRAS/AQUA MODIS data. The inter-calibration using MODIS is planned to become operational. The work has so far been conducted in a test mode. In the discussion it was pointed out that the content of the paper presents the main contributions of CMA contribution to GSICS. WG II acknowledged the work of CMA in support of GSICS.

EUM-WP-18 responded to the CGMS Action 34.19 inviting CGMS members to explore the potential of the Open Archival Information System Reference Model (OAIS-RM) as a framework for long-term satellite information preservation for enhancing interoperability of current, future, and historical data sets, as well as for the GEOSS interoperability, and to report at CGMS 35 accordingly. The document indicated how well the OAIS-RM maps to the EUMETSAT Centralised Archiving System. WG II took note.

NOAA-WP-13 reported on the Comprehensive Large Array-data Stewardship System (CLASS) adoption of the Open Archival Information System (OAIS) Reference Model (OAIS-RM) to provide a framework and general guidelines in conducting its interactions with its data producers. The benefit CLASS perceives in using OAIS is that it provides a common set of functions, processes, and documents that are required to accomplish data transfers and a common terminology to establish the scope of the effort and the respective responsibilities of the data producers and the archive. To implement this for a pilot project between NOAA's CLASS and NASA, a workgroup was formed for the development of a data submission process using recommendations in the OAIS-RM. This case study will present the benefits and challenges that were encountered when enhancing CLASS to support the storage and distribution of NASA's Earth Observing System (EOS) data.

NOAA-WP-15 reported on NOAA's national data centres efforts to improve information on raw satellite data quality and calibration for their archives of environmental satellite data. NOAA's National Geophysical Data Centre (NGDC) has established a project to harvest metadata from existing real-time products.

NOAA's National Oceanic Data Center (NODC) is leading efforts to develop and archive a high resolution global sea surface temperature data set. NOAA's National Climatic Data Center (NCDC) has established a project to provide fundamental climate data records (FCDRs) from NOAA's historic environmental satellite data. These activities can be found at the web site: http://www.ncdc.noaa.gov/oa/satellite.html

Recent accomplishments include:

1) Rescue of historic data from the NOAA VTPR

2) Rescue of International Satellite Cloud Climatology Project data sets

3) Rescue of historic data from the DMSP SSMI instrument and reformatting of the data and metadata

4) Rescue of the historic GOES data dating back to 1978

5) Regular updating of FCDRs from the TOVS and ATOVS data sets

6) Updated users guides and documentation for the NOAA Polar orbiting satellites and improved documentation of the GOES rescue data sets

NOAA-WP-39 described how the Open Archive Information System Reference Model (OAIS RM) provides a widely accepted basis for enhancing the prospects for long-term preservation of historical data sets and for enhancing interoperability for future data sets including those created as part of the GEOSS program. There are three areas where the OAIS RM provides a solid basis for proceeding: 1) The Reference Model provides a clear description of the roles and responsibilities of an archive data producer and the user community (identified in the RM as the "Designated Community), 2) The Reference Model provides an abstract model for the couplings that must exist between data content and the descriptive information that long-term preservation requires, and 3) The Reference Model gives a reasonably complete description of the functions an archive must enact in order to ensure information understandability over the long periods involved in archival preservation. These functions include preservation planning – which then encompasses the planning needed to deal with IT obsolescence and evolution.

JMA-WP-05 also responded to actions from the previous CGMS (namely Recommendations 34.05 and 34.06) and described the contributions of JMA to GSICS. JMA has been participating in GSICS since the beginning and plans to operate a GSICS infrared inter-calibration system by June 2008 on the same computing platform as the current MTSAT-1R/NOAA inter-calibration system. In March 2007, JMA installed a new storage system with 160 TB of disk space that is capable of holding all historical data from the JMA meteorological satellites. Using this system and data, JMA plans to reprocess GMS-5 and MTSAT-1R images and to reprocess AMVs and climate products from these images for

reanalysis. Working Group II noted the excellent work of JMA in support of GSICS and highlighted especially the intercomparison between MTSAT with AIRS. JMA confirmed that the results of the re-processed AMVs and climate products will be made available to the user community.

NOAA-WP-18 reported on the importance of instrument performance monitoring which is critical for ensuring the level 1b product quality for both numerical weather prediction and climate change detection. There is a need to develop a comprehensive instrument performance monitoring system to address this issue. Prototypes of such systems for both polar orbiting and geostationary satellites have been demonstrated in the WMO/GSICS (Global Space-based Intercalibration System) program. Several examples are provided in this paper. CGMS member agencies are encouraged to develop standardized instrument performance monitoring systems and share the results with the members through GSICS. This will greatly contribute to the improved accuracy in numerical weather prediction and climate change detection.

Based on discussions of the previous papers, WG II placed the following actions and recommendations:

**Recommendation 35.02: Satellite operators are requested to provide near real-time monitoring of instrument performance on easily accessible websites and to archive the information. Deadline: CGMS-36**

**Action 35.18: GSICS GCC to propose a web-based interface to other satellite agencies for near-real-time instrument monitoring. Deadline: CGMS-36**

**Recommendation 35.03: Aircraft campaigns with SI traceable instruments should continue to provide absolute calibration opportunities for critical satellite instruments, such as IASI, AIRS and CrIS. Deadline: CGMS-36**

EUM-WP-19 highlighted the activities performed at EUMETSAT as a GSICS Processing and Research Centre (GPRC). WG II noted the work towards an efficient implementation and operation of the GSICS project. With regard to the operational intercomparison between HIRS and Meteosat it was noted that the large bias between Meteosat-7 and HIRS channel 16 needs explanations. The group was informed about the planned implementation of an external FTP server for the GSICS intercalibration activities. GSICS partners will be invited to make use of the data sets on that server. In order to ease the use of the data EUM will follow international standards for data provision.

WMO-WP-20 provided a brief summary status of the GSICS project. Progress was recorded during the year 2007, following the first Operations Plan. The third meeting of the GSICS Executive Panel, held on 4 November 2007, refined the Operations Plan for 2008, which foresees namely the start of routine GEO-LEO infrared imager inter-calibration using hyperspectral instruments as reference. CGMS satellite operators were invited to note the progress of GSICS, and to confirm their continuing support to this project.

NASA was welcomed as a new member. It was mentioned that the next meetings of the GRWG and GDWG will be held in February 2008 in the Washington DC area, while the GSICS Executive Panel plans to meet in April 2008. The Panel had also addressed the importance the Global Reference Upper-air Network (GRUAN). The discussion recorded that GSICS has been considered as an early achievement of GEO and that the cooperation with the CEOS-Cal/Val is being continued; in particular it has been suggested that the CEOS Cal/Val Group would be asked to write a manual on best practices for future pre-launch characterisation. Last but not least the discussion highlighted the cooperation with ISCCP which constitutes an endeavour comprising experience of high relevance to GSICS. The discussion concluded with a recommendation echoing earlier discussions at the GSICS Executive Panel held on 4 November 2007.

**Recommendation 35.04: Satellite operators to explain significant discrepancies in satellite inter-calibration as part of their contribution to GSICS. Pertinent reports should be delivered to the GCC. Deadline: CGMS-36**

### II/3 Vertical sounding and ITWG matters

CMA-WP-09 provided an overview of the CMA/NSMC activities concerning TOVS/ATOVS data reception, processing and archiving. Up to now NSMC has archived 10 years of HRPT TOVS/ATOVS data and retrievals. The long time series data are from three NSMC ground stations covering China and surrounding areas; as such they provide potentially important data for climate study in East Asia. A plan had been proposed to include reprocessing of the data in order to establish a climate data bank of TOVS/ATOVS derived products.

KMA-WP-06 described recent progress made on satellite data assimilation in numerical weather prediction at the Korea Meteorological Administration (KMA). It was shown that winds from MODIS over polar regions as well as the ocean surface winds from QuikSCAT have a positive impact on the forecasts of the KMA NWP model. The paper concluded with an outline of future plans which include the assimilation of sea surface winds from SSM/I data as well as RARS data. WG II commended KMA on its achievements which demonstrated yet again the importance of satellite data for NWP.

NOAA-WP-16 reported on activities at the Joint Center for Satellite Data Assimilation (JCSDA) directed towards the use of cloud and precipitation contaminated radiances. Development of fast and accurate radiative transfer models including atmospheric scattering is essential for assimilation of cloudy radiances from satellites in numerical weather prediction models. Currently, JCSDA community radiative transfer model (CRTM) includes fast computations of optical parameters of clouds and precipitation. Preliminary tests from assimilating SSMIS cloudy/precipitation contaminated radiances of sounding channels in mesoscale models are encouraging and show great

potentials for improving storm structure analysis. JCSDA is investing new resources for testing cloudy radiances with NCEP global forecast system.

NOAA-WP-17 summarised the progress from JCSDA in assimilating COSMIC GPS Radio Occultation measurements. GPS RO data are minimally affected by aerosols, clouds or precipitation, are independent of radiosonde calibration, are not expected to have instrument drift, and satellite-to-satellite instrument bias. The promising results found with COSMIC in weather forecasting seems to indicate that the GPS RO observations provide a unique and value piece of information to the assimilation system. Future work at the US JCSDA includes to improve the use of GPS RO observations (bending angle instead refractivity), account for horizontal gradients of refractivity in the forward operator in order to reduce the representative error of the forward models, and assimilate operationally GPS RO data from the CHAMP and other GPS RO missions (e.g. GRAS from Metop).

**Recommendation 35.05: In view of the positive impact of radio-occultation measurements on NWP forecasts, CGMS expresses strong support to future plans for the continuation of radio-occultation measurements from constellations with adequate coverage.**

NOAA-WP-29 reported on the current status of the generation of long-term satellite-based climatologies at NOAA. The paper presents status of climatologies of clouds, aerosols, precipitation, OLR, ozone, atmospheric temperature, vegetation, sea surface temperature, ocean surface winds, HIRS upper tropospheric water vapour, and tropical cyclones. WMO thanked NOAA, also on behalf of GCOS, and asked NOAA to continue this valuable activity.

**Recommendation 35.06: CGMS encourages continuation of the generation of long-term satellite-based climatologies. Deadline: CGMS-36**

**Action 35.19: NOAA/NESDIS to send to all CGMS members the URL of web sites on climate products described in NOAA-WP-29. Deadline: 31 December 2007**

**Action 35.20: NOAA/NESDIS to include information on global and regional anomalies in their products as well. Deadline: CGMS-36**

NOAA-WP-38 summarised that the ITWG has fostered the international collaboration of product development for TOVS and ATOVS for over 15 years. The Climate Working Groups at the International TOVS Study Conferences (ITSCs) has met and produced reports and recommendations on a regular basis since the early 1990s in response to action items from ITSC-XV, NOAA's National Climatic Data Center has populated the ITWG web site with initial content for the Climate Working Group. We recommend other Space Agencies review this page and provide content as appropriate.

NOAA is planning to develop an operational program that will produce CDRs on a routine basis. The Scientific Data Stewardship (SDS) Program seeks to

support the routine, operational production of Climate Data Records (CDRs) for data from the atmosphere, oceans, and land surface. This production requires collaboration between experts in the climate community and experts in data management, and must be informed by user feedback on the accessibility and usability of the produced CDRs. As part of the SDS Program, NOAA is establishing a web site to provide comprehensive information on the status of CDRs and links to products. This web site will also be linked to the ITWG Climate Working Group site.

### II/4 Precipitation and IPWG Matters

WMO-WP-21 informed CGMS Members on the status of activities related to International Precipitation Working Group (IPWG). CGMS Members noted with appreciation the array of important activities being addressed by the International Precipitation Working Group (IPWG) including: i) algorithm inventory; ii) validation studies; iii) evaluation of high resolution precipitation products; iv) precipitation assimilation into NWP; v) investigations into new sensor technology for IGeoLab microwave sensing and a future snow hydrology mission; vi) participation in the GPM passive microwave intercalibration working group; vii) science support of the first CEOS precipitation constellation meeting; and, vii) and interaction with the other CGMS science working groups. CGMS-35 noted the breadth of the IPWG activities and thanked outgoing co-Chairs Dr. Joe Turk, NRL, and Dr. Peter Bauer, ECMWF, for their leadership and guidance of the IPWG into those areas and welcomed incoming co-Chairs Ralph Ferraro, NESDIS, and Chris Kidd, U. Birmingham. CGMS Members looked forward to supporting the upcoming PEHRPP workshop scheduled to take place 3-5 December 2007 at the WMO in Geneva, the second IPWG/GPM/GRP workshop for modelling snowfall set for mid 2008, and the 4$^{th}$ IPWG Workshop planned for fall 2008 in Beijing, China. CGMS-35 noted with appreciation the efforts being put forth by NASA and JAXA with regard precipitation measurement from space and requested NASA and JAXA to reports on the status and plans for the GPM at CGMS-36. CGMS-35 further requested all members to update as necessary the inventory of their routinely produced precipitation estimates to the IPWG co-chairs and to report to CGMS-36 on their activities with respect to precipitation estimation and validation activity for time scales ranging from nowcasting and climate.

The Working concluded the discussion with the following actions:

**Action 35.21: NASA and JAXA to report on status and plans for GPM at CGMS-36. Deadline: CGMS-36**

**Action 35.22: CGMS Members to report on precipitation estimation and validation activities at CGMS-36. Deadine: CGMS-36**

ESA-WP-08 informed CGMS on the status of the European Global Precipitation Mission EGPM. The paper recalled that EGPM had not been selected from the list of ESA Earth Explorer Missions, where the Swarm and

EarthCARE missions had been selected. ESA continues to participate as observer at GPM meetings. The paper also informed CGMS about the ongoing activities related to precipitation within ESA.

EUM-WP-20 reported on algorithms to estimate precipitation in addition to the operational rain rate retrievals using Meteosat data, the so-called Multi-sensor precipitation estimate (MPE) method. EUMETSAT plans to provide, at least offline, installations of two further precipitation estimate schemes, the so-called CMORPH and the Hydroestimator. The aim is to closely monitor the performance of these various methods over the Meteosat field of view, especially over the African continent, to perform an evaluation with specialised partner organisations and to provide the information in a routine manner. In the discussion it was also mentioned that EUMETSAT has a Satellite Application Facility (SAF) addressing hydrological parameters including precipitation.

### II/5 Atmospheric Motion Vectors and IWWG Matters

EUM-WP-22 briefly reported on the development of polar Atmospheric Motion Vectors (AMVs) from the full resolution data of the Advanced High Resolution Radiometer (AVHRR/3) on Metop-A. This product is an agreed product in the frame of the so-called Day-2 development activities for EPS products. Besides drawing on the experience and expertise with geostationary AMV from Meteosat satellites EUMETSAT has started cooperation with NOAA/CIMSS, to take into account their expertise with MODIS and AVHRR winds. The paper briefly described the relevant aspects and the status. It is expected that a first prototype will be available in spring 2008. The availability of the AMV product is planned for end 2008.

EUM-WP-23 reported on the current status of the CGMS recommendation 34.15 at EUMETSAT. The recommendation reads: There should be a comparison of the operational algorithms of all satellite wind producers for the height assignment of AMVs from clouds using a common data set from SEVIRI on MSG, and the same ancillary data. As other satellite operators also responded to this recommendation Working Group II concluded the discussion with a further recommendation.

EUM-WP-28 announced the 9th Workshop of the International Winds Working Group (IWWG) to be held in the Washington D.C. area with NOAA/NESDIS as local host. The paper reported on the status of pertinent actions from the 8$^{th}$ International Winds Workshop (IWW), which took place from 24 - 28 April 2006 in Beijing, and the relevant actions and recommendations from CGMS 34. WG II noted the active work of the AMV community pursuing the pertinent recommendations and actions of CGMS-34. WG II commended the AMV community's recent work and progress on height assignment utilising A-Train data.

Discussions were concluded with the following recommendations:

**Recommendation 35.07: CGMS members responding to recommendation 34.15 should finalise the first phase of the project (i.e. the processing of the AMVs with their own operational AMV algorithm without any modification) before IWW9 and discuss the results there. Deadline: 31 January 2008**

**Recommendation 35.08: IWW9 should discuss the results from the height assignment studies based on advanced instruments on the A-train. The co-Chairs of IWWG are invited to provide a summary report to CGMS36. Deadline: April 2008**

**Recommendation 35.09: IWW9 should discuss the results of the studies using the images simulated from NWP model output to track AMVs. Co-Chairs of IWWG are invited to provide a summary report to CGMS36 on results of the ongoing studies on deriving AMVs from images simulated from NWP model. The report should address both imagers and hyperspectral sounders. Deadline: April 2008**

**Recommendation 35.10: Direct retrievals of wind fields from Doppler Wind Lidars need to be continued beyond the ESA ADM mission.**

JMA-WP-06 reported on the status of Atmospheric Motion Vector (AMV) products generated by JMA. JMA generates three types of AMV associated with three MTSAT-1R channels, IR, WV and VIS. JMA generates and delivers AMVs for full disk via GTS every six hours at 00, 06, 12 and 18 UTC. In addition, JMA also generates AMVs over the Northern Hemisphere for use in its NWP system. WG II was informed that JMA introduced a new height assignment scheme at 06 UTC on 30 May 2007 in order to mitigate a slow wind speed bias. In response to Recommendation 34.15, JMA generated AMVs from METEOSAT-8 images using its own algorithm and sent them to the CGMS study coordination team. For further AMV improvement JMA is currently examining another height assignment scheme, and also plans to generate AMVs from MTSAT-1R 3.8 μm images. WG II commended JMA on the innovative work that will lead to better height assignment of AMVs. EUMETSAT also echoed the appreciation of the ongoing cooperation with JMA in the field of AMV derivation.

KMA-WP-09 also responded to CGMS Recommendation 34.15. The paper reported on the difference of AMV height assignment using the same KMA AMV height assignment scheme however different atmospheric profiles, i.e. from ECMWF and KMA NWP models, respectively. It was noted that the differences are surprisingly large. In the discussion, WGII also recalled the need to improve height assignment and to utilise other techniques, e.g. stereo techniques for validation or better height assignment.

NOAA-WP-19 summarised activities to improve validation of AMV height assignments by using Calipso's active measurements of cloud height. Researchers at CIMSS are coordinating efforts with a team led by EUMETSAT to look at how Calipso cloud height measurements match up with

current AMV cloud height assignments. Algorithms matching Calipso's orbital paths with AMV locations, and deriving appropriate spatial averaging (i.e., a number of Calipso's footprints fall within a single AMV target scene) are being designed. The investigators will be looking for systematic biases in the passive height assignments. If found, these biases will be applied to the AMV data sets, and compared against RAOBs to understand how the altered heights affect the AMV performance/accuracy statistics.

NOAA-WP-22 reported on investigations of the assignment of altitude heights to satellite-derived atmospheric motion vectors (AMVs), commonly known as cloud-drift and water vapour (WV)-motion winds. The traditional practice of assigning AMV heights to discrete tropospheric levels is shown to be inadequate, and a superior methodology is achieved by representing the AMV motion in terms of tropospheric layers. Large volumes of multispectral (IR, VIS and WV) AMV datasets are compared to collocated rawinsonde wind profiles collected by the U.S. Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) program at three geographically-disparate sites: the U.S. Southern Great Plains, the North Slope of Alaska, and the Tropical Western Pacific. These comparisons reveal that RMS differences between matched AMVs and rawinsonde wind values are minimized if the rawinsonde values are averaged over specified layers. In other words, generally AMVs better represents a motion over a tropospheric layer, rather than a discrete level. The layer characteristics are specifically identified according to AMV height (high-cloud vs. low-cloud), type (spectral bands, clear vs. cloudy), geo-location, height assignment method, and amount of environmental vertical wind shear present. The findings have potential important implications for AMV data assimilation and NWP. WG II expressed great interest in the novel height assignment approach described in NOAA paper 22.

**Recommendation 35.11: IWW9 should discuss the height allocation to atmospheric layers and pursue tests within NWP assimilation and forecast systems. Deadline: April 2008**

EUM-WP-21 reported on the current status of its response to CGMS recommendation 34.14. EUMETSAT initiated an external study in December 2006 that aims to compare the standard methods for AMV height assignment with CALIOP measurements on board CALIPSO. This study is not finished yet, and should be completed in autumn 2007. The contractor is a French laboratory located in Paris: the Laboratoire de Meteorologie Dynamique (LMD). Two periods of coincident CALIOP and AMV data are available, allowing the analysis of the cloud top height assignment of about 26000 AMVs. Tools to read, search for coincidence, visualise and analyse the data have been developed during this first phase. Then a first analyse has been conducted on CLA, AMV and CALIOP cloud pressure distributions. There are on average 15 profiles (30 % of the points) per 23x23 pixels AMV target box.
CALIOP cloud top pressure distribution compared to CLA ones are in fair agreement. Larger discrepancies are observed between CALIOP and the AMV final pressure distributions. The operational AMV HA process tends to overestimate the cloud top pressure detected by the lidar. The AMV

alternative height assignment method, based on the use of coldest pixel percentages, set clouds at a higher level. It then tends to decrease the discrepancies with CALIOP pressure retrieval.

NOAA-WP-20 reported on progress towards the recommendation from the 8th International Winds Workshop to conduct a study among operational satellite AMV producers designed to inter-compare the algorithms in order to identify strengths and weaknesses. All processes (targeting, tracking, height assignment, quality control) will ultimately be examined. The performance metrics will be assessed in terms of AMV spatial coherence and accuracy vs. independent validation (i.e. RAOBS). The idea is to select a common image triplet time period from SEVIRI on MSG, and require that all producers apply the same ancillary data (i.e. model guess) as they run their algorithms on this case. AMVs extracted from VIS(0.8μm), IR(10.8μm), IR(13.4μm), WV(6.2μm) and WV(7.3μm) spectral bands will be collected along with such additional information as each AMV target location, size and brightness temp., height and height corrections (low cloud, semi-transparent cloud, etc), tracking method, and quality indicators. Upon the successful collection of all datasets, an inter-comparison will be performed. CIMSS will focus on the various height assignment methods employed. Such a study would require that the AMV producers are willing to reprocess the SEVIRI images in a 'research mode', in which a number of targets will be selected for consistent heights assignment and tracking.

NOAA-WP-21 summarized activities at the Cooperative Institute for Meteorological Satellite Studies (CIMSS) in conducting research on satellite-derived atmospheric motion vectors (AMVs) using the NOAA/NESDIS operational AMV algorithm on simulated output from Numerical Weather Prediction (NWP) models. Using the model wind fields themselves as "truth", the algorithm and also new satellite data types can be benchmarked for quality and sensitivity to input variations. Two types of simulated datasets are being examined: 1) Simulated Meteosat-8 images are derived from a high-resolution version of the European Center for Medium-Range Weather Forecasts (ECMWF) global model, and 2) The Weather Research and Forecasting (WRF) model is used to simulate images from a hyperspectral sounder similar to the Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS). The use of simulated data allows for a close loop testing of the performance of AMVs, and can also be used to show impacts of poor navigation and other instrument anomalies.

NOAA-WP-23 summarised current status on the reprocessing of AMVS. At the present time, the only set of reprocessed AMVs available at NOAA are polar cloud-drift AMVs derived from the Advanced Very High Resolution Radiometer (AVHRR) instrument aboard NOAA's operational polar orbiting satellites for the period 1981-2006. (Dworak, et al, 2006). The cloud tracking process and attendant quality control schemes used to generate these AVHRR AMV datasets are based on the established procedures (Velden et al, 2005) used for generating AMVs from NOAA's Geostationary Operational Environmental Satellites (GOES). It is expected that these reprocessed AVHRR cloud-drift

AMV datasets will serve as critical inputs to future reanalysis efforts under taken by operational NWP centers. NOAA/NESDIS recognizes the importance and impact that reprocessed AMVs can have on reanalysis efforts undertaken by NWP centers. To this end, NOAA/NESDIS is looking for opportunities (with some associated funding) to develop a capability to reprocess GOES AMVs using its state-of-the-art AMV algorithms. These opportunities may come from leveraging ongoing efforts within NOAA/NESDIS that particularly involve the retrieval of historical GOES data from NOAA's National Climatic Data Center (NCDC) and their placement onto large disk arrays. Currently, NOAA/NESDIS is also interfacing with the Environmental Modelling Center (EMC) of the National Centers for Environmental Prediction (NCEP) which is in the planning stages for its next large reanalysis effort which is scheduled to begin in CY 2008. NOAA/NESDIS will work to capitalize on possible funding opportunities this effort may bring as a means to reprocess GOES AMVs and provide them to the NCEP/EMC reanalysis effort and any future ECMWF reanalysis efforts. WG II noted with appreciation the re-processing of AVHRR winds.

NOAA-WP-24 reported on the status of efforts to estimate tropospheric winds at high latitudes from polar-orbiting satellite imagers, in particular the Moderate Resolution Imaging Spectroradiometer (MODIS) and the Advanced Very High Resolution Radiometer (AVHRR). Over the last few years, model impact studies conducted at major numerical weather prediction (NWP) centers in six countries have shown that the MODIS winds have a positive impact on global weather forecasts. It is therefore important to continue generating, improving, testing, and extending these products. In addition, new products should be explored, such as winds from hyperspectral sounders. For example, the Atmospheric InfraRed Sounder (AIRS) and the Infrared Atmospheric Sounding Interferometer (IASI) may offer an improvement in height assignment, albeit at a lower spatial resolution. Product latency is also an important issue, in that a large proportion of the MODIS and AVHRR winds are not generated soon enough for early model runs. Experiments with direct broadcast sites demonstrate that the delay in obtaining MODIS data can be reduced substantially. In the discussion it was mentioned that the US decadal survey recommends pursuance of ADM-follow-on.

NOAA-WP-25 reported on the under apparent utilization of the standard CGMS AMV statistical reports. These reports provide statistical comparisons that are needed for proper AMV error analysis by both satellite operators and their respective AMV users. Numerical Weather Prediction (NWP) users, for example, can use these statistics to help in the proper assignment of observational error to the AMVs. Satellite operators can intercompare, on a first-order basis, their AMV statistics for their own operational satellite(s) against AMV statistics generated by other operational satellite operators for their respective satellite(s). The existence of large differences in the magnitudes of the statistical metrics is expected to trigger inquiries and discussion between satellite operators regarding AMV algorithms and quality control procedures. The paper provides suggestions for increasing their utility by increasing the visibility of the reports and makes them more accessible. This can be achieved by:

1. Communicating to the AMV user community that these reports exist, that they are generated on a monthly basis by all satellite operators, and where they can be found.

2. Adding the reports to the IWWG web site which is hosted by the Cooperative Institute for Meteorological Satellite Studies (CIMSS).

EUM-WP-24 also reported that the CGMS statistics are derived routinely at EUMETSAT and are used as an independent tool for product validation.

In the discussion by WG II on how CGMS wind statistics for AMVs are utilised, it was also noted that the collocation criteria used by different satellite operators are not exactly the same.

**Recommendation 35.12: CGMS 35 recommends to put the CGMS wind statistics on the new IWWG web site and to discuss at IWW9 whether a strict adherence to CGMS collocation criteria should be followed and whether the criteria need to be re-defined. Deadline: 30 April 2008**

### II/6 Cloud and Dust-related Parameters

EUM-WP-25, provided by Dr. Anke Thoss from the Swedish Meteorological and Hydrological Institute (SMHI), gave a detailed summary of a satellite cloud parameter retrieval Workshop held near Norrköping, Sweden 17-19 May 2006. The Workshop was organized by SMHI and sponsored by EUMETSAT. Mainly European experts working with operational cloud parameter retrieval schemes were invited to participate in the workshop and to contribute results from their algorithms to a cloud parameter inter-comparison campaign. The algorithm intercomparison focussed on MSG cloud products for one day of data, 17 January 2006. Intercomparison work was carried out as a visiting scientist activity by Andy Walther within the SAF for Nowcasting and Very Short Range Forecasting. The working group welcomed the paper; and with regard to a comparison of AVHRR cloud products with geostationary products it was pointed out that the data should be made comparable by applying necessary corrections, e.g. for parallax.

KMA-WP-10 reported on an effective algorithm to retrieve cloud optical thickness and effective radius from geostationary satellite data. The algorithm will be used as a part of the COMS meteorological data processing system in KMA. This paper also summarizes the algorithm theoretical basis, pre-performed retrieval results, and their validation results.

NOAA-WP-27 summarised progress towards the development of a long-term aerosol climatology from AVHRR over the ocean. Currently, the only global long-term record of space-based estimation of aerosol amount is obtained from the NOAA/AVHRR instrument. The AVHRR Pathfinder Atmosphere (PATMOS) climate-scale dataset was generated at the NOAA/NESDIS/STAR by reprocessing the AVHRR radiance observations from the NOAA-7, -9, -11, and -

14 polar-orbiting satellites. This dataset provides a nearly continuous record of atmospheric products (including aerosol optical thickness over ocean) spanning over 20 years from September 1981 to December 2001. Recently, a second round of reprocessing of the PATMOS data has been completed by using AVHRR observations retrospectively re-calibrated with MODIS radiances. The new data set, named PATMOS-x, has been extended to 2005 by including the AVHRR observations from the NOAA-15, -16, and -17 satellites. In a recent study conducted by scientist at NOAA/NESDIS/STAR, the PATMOS-x data set has been used to explore global and regional trends in aerosol optical thickness. The global trend from this study agrees with the findings in a NASA study, and shows a small decrease of the aerosol amount during the past twenty years (-0.018 per decade). On regional scales, the linear aerosol trends have different signs. Areas affected by emissions from developed western countries show a decrease, while those affected by emissions from the fast developing Asian countries show an increase of the aerosol amount.

NOAA-WP-28 summarised the unprecedented opportunity for validation of cloud products generated from the current suite of passive satellite radiometers (imagers and sounders) using CALIPSO and CloudSat data. Both of these missions provide information on the vertical profile of cloud properties that has never been available in the quantity and with the spatial coverage provided by these sensors. This report summarizes current NOAA efforts to use this new data source to validate operational cloud products. One additional goal of this work is to use CALIPSO and CloudSat to generate error-bars on the 30 years time series of cloud products provided by ISCCP, PATMOS and other satellite cloud climatologies. Very good agreement between CALIPSO and AVHRR cloud top pressures were reported. In the discussion WG II pointed out commonalities of the work addressed in NOAA-WP-28 with the ongoing work in the AMV community on comparing the AMV heights with measurements from Calipso and Cloudsat.

### II/7 Other Parameters and Products

EUM-WP-26 gave a detailed description of the current work on a new product called Fire Radiative Power (FRP). FRP is related to the rate at which the fuel biomass is being consumed. This is a direct result of the combustion process, whereby carbon-based fuel is oxidised with the release of a certain ‘heat yield’. Measuring this FRP and integrating it over the lifetime of the fire therefore provides a measure of the total Fire Radiative Energy, which should be proportional to the total fuel mass combusted. This paper also reported on the prototyping of such a product at EUMETSAT and its implementation on the Land SAF operational system.

EUM-WP-27 described a number of nowcasting applications, which are based on MSG image data and derived meteorological products. The applications range from possibilities to validate the accuracy of numerical weather prediction models with respect to the large scale circulation, e.g. the exact position of cyclones, to pre-convective identification of potentially unstable air masses and to a detailed characterisation of the cloud formation and dissipation processes. It

was shown that the unique opportunity of the MSG spectral channels together with the quick repeat cycle of at least 15 minutes allows the derivation of advanced nowcasting products, as e.g. the instability information and the exact determination of the onset of severe convection. Especially in this area of convective storm nowcasting, a combined use of complementary observation techniques and products is considered to be very beneficial and ensures the optimal use of the satellite data in an operational context. CGMS was invited to take note and to recommend the enhanced cooperation of CGMS partners in the development of further nowcasting products and techniques, especially considering the advanced utilisation of current and future geostationary satellite systems (Meteosat, GOES, MTG, GOES-R etc.). The Working Group commended EUMETSAT upon the comprehensive and very informative paper. In the discussion the Working Group iterated that one should not convey the impression that abundant information on atmospheric instability could be inferred from an imager per se; it is important to realise that breakthrough information on air mass instability will come from hyperspectral sounding.

**Recommendation 35.13: CGMS members are encouraged to present papers demonstrating the possibilities of advanced sounding for analysing convective instability of the atmosphere, particularly utilising information from the hyperspectral sounders AIRS and IASI. Deadline: CGMS-36**

EUM-WP-29 briefly presented a recommendation from the 2nd GOFC/GOLD Workshop on (Geostationary Fire Monitoring and Applications) held at EUMETSAT, Darmstadt, from 4 – 6 December 2006. The paper was based on a letter to the Director-General of EUMETSAT, Dr. Lars Prahm, from Dr Elaine Prins in her function as "GOFC/GOLD Fire Implementation Team Geostationary Network Lead". The essence of her letter is a specific request that future satellite instruments used for fire monitoring should be adequately characterised in order to allow for fire detection and quantitative estimates of fire related products. The Working Group recalled that this important issue is part of the GSICS work toward better characterisation of future satellite sensors. The Working Group concluded the discussion with a generic recommendation to improve the usefulness of future polar and geostationary imagers for fire monitoring.

**Recommendation 35.14: Future satellite sensors are expected to be used for fire monitoring; relevant channels and sensors should be adequately characterised for this application. The matter should be part of the pertinent work under GSICS.**

KMA-WP-07 reported on the Operational Analysis of Tropical Cyclones by KMA. Specifically, the Advanced Objective Dvorak Technique (AODT) has been the basis for the development at KMA where, currently, MTSAT data are used. WG II took note of the paper.

KMA-WP-08 responded to CGMS-34 Action 34.23, addressed to KMA, and reported on the plan for meteorological products generation using disseminated data from the COMS Meteorological Imager. The COMS Meteorological Data

Processing System (CMDPS), which is evolving in KMA, is designed to extract 16 baseline products operationally, and cloud information, sea surface temperature, fog, and wind products are considered for distribution via the LRIT service. WG II was pleased to note the good progress in KMA and expressed an interest in acquiring further technical and scientific details.

KMA-WP-05 introduced the activities at KMA related to the reception, processing, and utilization of AOTVS data in KMA, and data exchange within the context of the Asia-Pacific RARS (Regional ATOVS Re-transmission Services) program.

EUMETSAT informed the Group that due to a system failure there was no HRPT data dissemination from Metop-A. It was also suggested to that working papers addressing data exchange should be included within the agenda of WG IV.

JMA commented that it had started using A-P RARS (Asian-Pacific RARS) data in its operational global data assimilation system in February 2007. With A-P RARS the amount of available data increased by 10 – 40%. The use of RARS data had a positive impact on JMA's analysis and forecast products. The Group considered that this was a good example illustrating the importance of RARS data for NWP.

## II/8 Coordination of Code Forms for Satellite Data

WMO-WP-29 presented new data formats for additional products. This document summarized the recommendations of the last meeting of the Commission for Basic Systems (CBS-Ext.(06)) related to satellite data representation and the last recommendations of the CBS/Expert Team on Data Representation and Codes related to additions for satellite data GRIB 2 and BUFR codes.
Annex 1 contained the allocated BUFR entries for GHRSST data, currently in pre-operational status. Annex 2 contains the proposed entries for encoding Jason-2 data, currently submitted for validation.
Bearing in mind that CGMS Actions 34.27 and 34.28 foresee the setting up of a dedicated Task Force on Codes to review such issues in detail, CGMS Members are invited to take note and provide guidance to the future Task Force as appropriate.

During the discussion it was identified that the introduction of additional formats for data delivery and dissemination, such as NetCDF could make data access for a wider user community easier and more attractive. WMO confirmed that the use of such formats was under consideration by the relevant Expert Teams as agreed by CBS.

**Action 35.23: The Task Force on codes to consider possible use of additional data formats for satellite product dissemination and archive delivery, and report to CGMS. Deadline: CGMS-36**

## II/9 Additional Papers

Papers in this section were referred from WG III and the Plenary.

ESA-WP-03 explained the data policy for access to ERS and Envisat data, in particular, for Near Real Time data.

ESA-WP-04 informed the WG about the ocean related parameters provided or planned by ESA missions: ERS, Envisat, Explorer and GMES Space program. Some of them are relevant to IOC requirements. It also outlined the relevance of the new upcoming missions GOCE, CRYOSAT, SMOS.

ESA-WP-05 analysed how compliant ESA missions are with the GCOS Climate Monitoring Principles (CMP). The paper addressed each CMP item by item. The ESA Sentinel missions are being designed for the GMES services, with special emphasis on the European Commission's fast track services defined recently. The operational requirements of the Sentinels such as robustness, timeliness, high revisit frequency, data quality and reliability makes the system more than adequate for climate monitoring. The Sentinels design and, more generally, ESA's usual practices for EO missions' development and operation are, to a large extent, compatible with the GCOS climate monitoring principles.

NOAA-WP-08 described the software tool HYDRA which was developed at CIMSS and is highly efficient for multispectral and hyperspectral satellite data analysis and display. This is particularly well suited for analysis of hyperspectral data from AIRS and IASI. WG II considered HYDRA an extremely valuable tool. WG II was also informed that the newly developed McIDAS-V will in future include HYDRA. WG II looked forward to future enhancements planned by CIMSS for HYDRA.

**Recommendation 35.15: CGMS satellite operators to consider making a data interface available such as ADDE servers so that McIDAS-V and HYDRA can be applied to their data. Deadline: CGMS-36**

Furthermore, CGMS Members noted with interest the use of HYDRA as a powerful tool for education and training purposes and encouraged other CGMS Members to use it.

## II/10 Conclusion and preparation of WG report

As a topic under AOB, WG II was asked to express a view on a joint future meeting of all three International Working Groups under CGMS (ITWG, IWWG and IPWG). WG II recommended that the Chairpersons of the International Working Groups establish a list of topics of common interest to all three groups and take it from there. It was seen as worthwhile to try, at a future stage, to hold the International Working Group meetings at the same place, with a few common plenary meetings, but having most of the business carried out separately.

Discussions at WGII were focussed and reflected the excellent cooperative spirit at CGMS. WG II recalled that in 2008 all three International Working Groups will meet, therefore, it looked forward to updates on progress from all of them. In order to facilitate the conduct of the three International Working Group meetings WG II requested the following action:

**Action 35.16: CGMS Members to continue to support activities of the three International Working Groups (ITWG, IWWG and IPWG), particularly, the upcoming science meetings in 2008.**

WG II concluded with thanks from the Chairperson to all participants for their open and fruitful discussions. WG II members returned their thanks to Dr. Mi-Lim Ou and commended her on her very good Chairmanship of the meeting.

# WORKING GROUP III: CONTINGENCY PLANNING

## III/0 Introduction

As agreed at CGMS-34, Mr Gary Davis from NOAA was elected Chairperson of Working Group III (WGIII) on contingency planning, with Dr Don Hinsman, from WMO, appointed as Rapporteur. WGIII comprised representatives of the satellite operators from CMA, JMA, KMA, NOAA, KMA, and EUMETSAT together with representatives from WMO (see Annex 4 for the list of participants).

Working Group III on Global Contingency Planning met during CGMS-35 and reviewed the results and recommendations in WMO WPs-22 and 23 and NOAA-WP-03. ESA's working papers were referred to Working Group II.

## III/1 Revised GOS baseline for geostationary satellites

In WMO-WP-22, Working Group III reviewed the background and implications from WMO's draft Vision of the GOS to 2025 that stipulated geostationary satellites should be nominally distributed with no more than 60 degrees difference between the longitudes of adjacent locations. It noted that this new WMO recommendation extended the current requirement as stated in the CGMS Global Contingency Plan to cover all latitudes below 50 degrees with a zenith angle not higher than 70 degrees. In terms of area covered, optimizing the geostationary baseline would imply that the nominal locations are regularly distributed, hence the 60 degree longitude interval between adjacent locations. While at present the current in-orbit and planned missions exceeded the nominal configuration for six satellites, the Working Group agreed to focus on the nominal configuration for six geostationary satellites. The Working Group considered that an appropriate time frame for a possible new nominal configuration would be 2015. It also agreed in order to evaluate scenarios for different nominal configurations that it would be appropriate to see if there were flexibilities by the individual CGMS Members to utilize different nominal positions. Flexibilities could take into consideration frequency planning. It thus agreed to the following Action Item:

**Action 35.24: CGMS current and future satellite operators to review their possible flexibilities to adjust the nominal locations of their baseline geostationary satellites and to provide the information at the next CGMS session. Deadline: CGMS-36**

## III/2 CGMS Global Contingency Plan for geostationary orbit

There were no Working Papers presented under this item.

## III/3 Revised GOS baseline for polar-orbiting satellites

When discussing NOAA WP-30, Working Group III was informed of the failure of METOP-A's direct broadcast system. It noted that NOAA-17, with its

operational direct broadcast system and similar orbit, would provide a back-up for the imagery mission for the present but not for EUMETSAT-unique instruments such as ASCAT and IASI. However, if NOAA-17 were unable to support its direct broadcast mission then FY-3A, once launched and operational, could provide a contingency back-up for imager and sounding data. In order to implement the back-up, it would be necessary to process the FY-3A data at local direct readouts stations through either use of the FY-3A Technical Specifications or access to the processing software utilized by CMA to produce Level 1B data.

**Action 35.25: Each CGMS polar orbiting satellite operator to consider providing to all other polar orbiting satellite operators, and to the direct readout community, their processing software necessary to produce Level 1B data from the direct broadcast data stream, and to provide the technical specifications for their direct broadcast data stream necessary to produce Level 1B data. Deadline: 31 March 2008**

In WMO WP-23, Working Group III reviewed the background and implications of the draft "Vision of the GOS to 2025" regarding LEO satellites. According to this draft vision, the LEO component of the space-based GOS would be reconfigured and expanded in order to address additional missions. This change of baseline, once endorsed, would need to be reflected in the CGMS Global Contingency Plan. The Working Group noted that a distinction was made between core imagery and sounding missions in sun-synchronous polar-orbit and other LEO missions including: radio occultation sounding; ocean altimetry; ocean surface wind vector; global precipitation; Earth radiation budget; and atmospheric composition. The Working Group noted the core imagery and sounding mission was a heritage of current operational missions in polar-orbit that was addressed in the present CGMS Global Contingency Plan. The Working Group supported the view that the new baseline for imagery and sounding from polar-orbit should be a three-orbital plane constellation with 13:30, 17:30 and 21:30 as nominal Equatorial Crossing Times (ECT) with redundancy.

### III/4 CGMS Contingency plan for operational oceanographic satellites

There were no Working Papers presented under this item.

### III/5 Conclusion and preparation of WG report

The Working Group noted that the action item for processing software in section III/3 would constitute a significant milestone for LEO continuity of service through participation by CMA in not only the operational polar-orbiting constellation but also in contingency planning for LEO presently provided by NOAA and EUMETSAT.

# WORKING GROUP IV:
# GLOBAL DATA DISSEMINATION BY SATELLITE

## IV/0 Introduction

As agreed at CGMS-34, Mr Mikael Rattenborg from EUMETSAT was elected Chairperson of Working Group IV (WG IV) on Global Data Dissemination by Satellite, with Mr Gordon Bridge, also from EUMETSAT, appointed as Rapporteur. WG IV comprised representatives of the satellite operators from China, Japan, USA, Korea and EUMETSAT together with WMO (see Annex 4 for the full list of participants).

## IV/1 Direct Dissemination from Meteorological Satellites

EUM-WP-06 informed WG IV that EUMETSAT is currently running Phase 0 studies leading to the definition of the Post-EUMETSAT Polar System (EPS) Programme, in line with established preliminary mission requirements resulting from a first phase of a User Consultation process. There is also support from ESA, whose Post-EPS Pre-Phase A competitive studies are planned to start in autumn 2007. In the meantime, some progress is being made in terms of preliminary discussions with NOAA on future cooperation with an aim of establishing a Joint Polar System (JPS) following the Initial Joint Polar System (IJPS), to which EUMETSAT contributes with EPS. These discussions have so far focused on the requirements management framework to be setup to support this cooperation, and the planning for the activities of a Working Group devoted to the preparation of the drafts of future agreements for the JPS.

A first selection step of the candidate Post-EPS observation missions has been performed jointly by ESA and EUMETSAT in the definition of the scope of the studies based on the following criteria:

1. Missions implemented in GMES, i.e. oceanography missions on Sentinel-3 and atmospheric chemistry missions on Sentinel-5, do not require a specific effort, apart from the study of the accommodation of Sentinel-5 payload (as agreed between EUMETSAT and ESA for the implementation approach of the space component of GMES).

2. Missions already addressed in the framework of Earth Explorer follow-on studies will be considered at programmatic and possibly system level only.

3. Missions will not be addressed when their potential for operational implementation cannot be proven prior to the Post-EPS Implementation Phase.

Referring to the candidate observation missions identified in the Post-EPS Mission Requirement Document, the above criteria led to the selection and study approach described in the following table.

| Observation Mission | Study Approach |
|---|---|
| High-Resolution Infrared Sounding (IRS) | Full scope including sensor and system aspects |
| Microwave Sounding (MWS) | Full scope including sensor and system aspects |
| Scatterometry (SCA) | Full scope including sensor and system aspects |
| VIS/IR Imaging (VII) | Full scope including sensor and system aspects |
| Microwave Imaging (MWI) – Precipitation | Full scope including sensor and system aspects |
| Microwave Imaging (MWI) – Ocean and Land | Based on SMOS for 1.4 GHz channel |
| Radio Occultation Sounding (RO) | Full scope including sensor and system aspects |
| Nadir viewing UV/VIS/NIR - SWIR Sounding (UVNS) | Accommodation only, payload from Sentinel 5 |
| Doppler Wind Lidar (DWL) | Based on ADM Follow-on study |
| Multi-viewing, Multi-channel, Multi-polarisation Imaging (3MI) | Full scope including sensor and system aspects |

**WGIV Table 1**

The following main planning elements are assumed for the preparation of the Post-EPS Programme:

Phase 0: 2004-2008, on-going
Phase A: 2009-2010, planned
Phase B: 2011-2012, planned
Phase C/D: 2013-2018
Need date: 2018, for the first in-orbit elements for priority missions.
Phase E: Operations and Utilisation: 15 years after commissioning of the first in-orbit elements.

EUMETSAT added that it was too early in the study phase to provide CGMS with information about data dissemination, however, some very preliminary information may become available later in 2008. In the meantime, information was also posted on the EUMETSAT web site as it becomes available.

**Action 35.26: EUMETSAT to provide CGMS with the results of the Post-EPS, Phase 0 studies, in particular, results pertaining to data dissemination. Deadline: CGMS-36**

EUM-WP-08 informed the Group that the EUMETSAT Meteosat Third Generation (MTG) Programme is under definition and its Phase A concept and coordinated ESA and EUMETSAT feasibility trade-off studies are well underway. EUMETSAT is running Mission and System Level engineering activities and ESA started competitive Space Segment studies in February

2007, aiming at their completion in early summer 2008. An MTG Preparatory Programme, including Phase B activities, is planned to start at EUMETSAT in January 2008.

The Space Segment architecture for study in Phase A will accommodate three instruments:

- The flexible Combined Imager (FCI), for continuation of MSG image related missions;
- The Infra-red Sounder (IRS), sensor based on a Fourier Transform Spectrometer;
- The Lightning Imager (LI), for detection of total lightning flashes.

The result of the early Phase A trade-off analyses led to a recommendation for a twin-satellite configuration to support the MTG mission. This recommendation applies to the Phase A study activities of EUMETSAT and of ESA, pre-empting only the type of platform (3-axis body stabilised) but not binding yet any decision by EUMETSAT Delegations of what will be the MTG payload complement to target in the following Phases B/C/D. This will be covered by dedicated discussions and decisions at the end of the Phase A, following the Preliminary Requirements Review. The recommendation stemming from the Secretariat to study in Phase A the feasibility of the twin-satellite configuration was endorsed by the EUMETSAT Council earlier in 2007, the main elements being:

***I.*** *That the main missions of MTG should be met through a **twin** satellites configuration, respectively embarking, as main missions, the Imaging and Sounding mission, in a series of three-axis stabilised satellites, based on a common platform design.*

***II.*** *That, in order to improve the value for money of the MTG programme, every effort should be made during the preparation phase to ensure that the design lifetime of the satellites is maximised, and that overall flexibility regarding the schedule of launches is preserved.*

***III.*** *To urge ESA to initiate all necessary preparatory activities to obtain approval of their part of the programme in 2008 in order to secure data continuity in the geostationary orbit.*

The Proposal for the MTG Preparatory Programme Proposal was submitted to, and approved by the EUMETSAT Council in June 2007, opening the voting of an associated Resolution, which will hopefully enter into force by the end of 2007. The following main planning elements are assumed for the preparation of the MTG Programme:

| | |
|---|---|
| Phase 0: | 2001-2005, completed |
| Phase A: | 2006-2008, on-going |
| Phase B: | 2008-2009, planned as part of the MTG Preparatory Programme |

Phase C/D: 2010-2014, planned
Need date: 2015, for the first in-orbit elements
Phase E: Operations and Utilisation: 15 years after commissioning of the first in-orbit elements.

The nominal location for the imaging and sounding missions will be 0 degrees.

Concerning data dissemination, MTG will not have a direct broadcast service, but instead will likely make use of commercial service providers in the framework of a further evolution of EUMETCast. The Working Group noted that whilst the MTG frequency plan had not yet been fully consolidated, required frequencies would be registered and protected for the full lifetime of the MTG satellites.

**Action 35.27: EUMETSAT to provide CGMS with the results of the MTG trade-off studies, in particular, results pertaining to the MTG data dissemination system. Deadline: CGMS-36**

JMA-WP-07 reported on the planned data dissemination scheme for the MTSAT follow-on satellites, as JMA's response to former CGMS Action Item 34.29. WGIV noted that all observation data from the follow-on satellites will be disseminated over the Internet instead of by direct broadcast from the satellites. In addition to this Internet dissemination, studies into the feasibility of using a communications satellite will be continued in order to find an effective combination of methods or technologies, taking account of 1) convenience to users (particularly those in relatively low-speed Internet environments), 2) cost-effectiveness for both meteorological satellite operators and users, and 3) the possible mutual complementarity of dissemination through communications satellites and the Internet.

KMA-WP-04 informed CGMS that the Meteorological Imager of the Korean Communication, Ocean, and Meteorological Satellite (COMS) is planned to be operated in two observational modes, as shown in the table below.

| Observation Mode | Observation Area | | Observation Interval |
|---|---|---|---|
| Normal Mode | Full Disk | Full earth disk (FD) | Every 3 hours |
| | Regional Area | Asia and Pacific in Northern Hemisphere (APNH) | Every 30 min. |
| | | Extended Northern Hemisphere (ENH) | Every 30 min. |

| | | | |
|---|---|---|---|
| | | Limited Southern Hemisphere (LSH) | Every 30 min. |
| Special Observation Mode | Local area | 1000km x 1000km | In case of severe weather |

**WGIV Table 2**

The full earth disk will be observed every 3 hours, and three different regional areas will be scanned every 30 minutes between the full-disk observations. In case of severe weather occurring in and/or approaching the Korean peninsula, a special observation mission will be implemented approximately every 10 minutes, for interested local areas.

The COMS Meteorological Data Processing System (CMDPS) is under development by the National Institute of Meteorological Research/KMA. The system will generate up to 16 baseline meteorological products, including atmospheric motion vectors, cloud distribution, Asian dust, fog, etc.

KMA added that COMS will support an HRIT broadcast system for the dissemination of all full resolution data. An LRIT broadcast will follow agreed CGMS standards. Products will be made available in WMO standard formats.

Noting this information with interest, the following general action was agreed:

**Action 35.28: Satellite operators to provide WMO with detailed information, on all the methods available, or planned, for operational data access from each of their satellites contributing to the GOS, via relevant URL of the satellite operator's web page. This detailed information shall include the designation of the dissemination or retrieval services, their summary contents, formats used, and technical characteristics such as:**

- **For real-time dissemination via the satellite itself (Direct Broadcast): frequency, bandwidth, data rate (uncompressed);**
- **For Real-time dissemination through multi-mission satellite dissemination system (Advanced Dissemination Methods): satellite name, location, frequency band, area covered, data rate (uncompressed);**
- **For Real-time dissemination via Internet FTP: address;**
- **For On-line data retrieval : address;**
- **URL for precise information on data access modalities**

**Deadline: May 2008, and to report at CGMS-36**

**Action 35.29: WMO/CGMS Secretariat to collect the data access information from satellite operators and make it available through the CGMS and/or WMO websites. Deadline: CGMS-36**

NOAA-WP-31 presented a summary of the direct readout plans for future NOAA environmental spacecraft. The transition of the NOAA direct readout services is taking place across several spacecraft constellations. This will encompass many years of development, coordination and implementation. Replacement of the analog Weather Facsimile (WEFAX) with the new digital LRIT in 2005 started a transition period that will culminate with the implementation of the GOES Re-Broadcast (GRB) service on the GOES-R spacecraft constellation. NOAA's current direct broadcast services will change dramatically in data rate, data content, frequency allocation and field terminal configurations. The geostationary and polar-orbiting environmental satellite constellations will employ new downlink frequency allocations, larger bandwidths to accommodate all the instrument data and faster data rates, hence environmental data users will have to employ new field terminal receivers unique to those particular broadcast services.

NOAA-WP-32 provided information on the status of the Low Rate Information Transmission (LRIT) on the GOES I-M spacecraft. The LRIT broadcast is operational on both GOES-east and GOES-west spacecrafts. NOAA recently moved the physical location of the LRIT system from the previous Federal Building 4 location to the new NOAA Satellite Operations Facility on the Suitland, MD campus. NOAA continues to work with users and vendors to assess the quality and reliability of the service. Current planning objectives focus on re-evaluating the system architecture, improving data dissemination in the future and providing low cost systems to acquire the NOAA broadcasts.

Other items being considered for future implementation include expanding the product suite through the possible addition of additional imagery products, adding other compression algorithms (e.g. JPEG2000, zip) and adding improved monitoring capabilities.

Future development of the LRIT system will be defined through increased utilization and community outreach activities and a re-evaluation of system operations.

NOAA added that there are currently between 500 and 1000 GOES LRIT users, with a large proportion in central and South America, and in the Pacific region.

**IV/2 Advanced Dissemination Methods**

CMA-WP-06 informed WGIV that FengyunCast has switched to C band and makes use of the 'Asiasat-4' satellite, positioned at 122.2E and with a data bandwidth of 8 MHz. In October 2007, CMA officially announced the opening of FengyunCast C-band data dissemination service and currently there are 130 domestic users of the data broadcast. In the near future 19 international users will be receiving data from FengyunCast.

WG IV recalled that FengyunCast is designed to disseminate meteorological satellite data to domestic users and the authorized users in Asia-Pacific

region in a near-real-time. The data sources include MODIS stations (4 of the China Meteorological Administration in Beijing, Guangzhou, Urumqi and Lhasa, and 2 belonging to the State Oceanic Administration in Sanya and Beijing), as well as from NOAA/AVHRR, FY-1D and FY-2C stations of CMA.

The FengyunCast system is composed of a broadcasting centre and user reception terminals. The uplink station transmits data to the DVB satellite. User reception terminal follow normal commercial standards. The user terminal consists of an antenna, receiver, DVB router, PC and software for data reception and application. The aperture of antenna can be 1.2 m, 1.8m, 2.4m, but is 1.8m in most cases.

The data for broadcasting is segmented and transmitted in real time through a multiplex network to the uplink station. The broadcasting centre collects data according to a time schedule and broadcasts it according to priority levels.

Data is received by more 100 domestic users in meteorology, oceanic, agriculture, forestry, water conservancy, transportation, aviation and space. 13 Chinese universities are equipped with reception terminals in support of their research and education activities. In 2006, Bangladesh, Indonesia, Iran, Mongolia, Pakistan, Peru and Thailand installed receiving terminals. In October 2007, CMA donated the user terminals to NHMS of Cambodia, D.P.R. Korea, Kyrgyzstan, Laos, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Tajikistan, Uzbekistan, and Vietnam. Daily data volume amounts to around 28GB each day, or 10TB per year.

CMA added that there will likely be a steady increase in the number of products that will be added to the broadcast in the months and years to come. Whilst consideration of a data policy was ongoing as a means of system control, CMA welcomed the possibility for seeking data exchange agreements with other CGMS members and data providers.

WG IV recalled the earlier presentation of JMA-WP-07 by JMA, and noted that MTSAT images were already being rebroadcast via FengyunCast.

NOAA-WP-33 provided information on GEONETCast Americas. This is a regional contribution to a developing, global, near-real-time, environmental data dissemination system in support of the GEOSS. It will be a contribution from NOAA, whose goal is to enable enhanced dissemination, application, and exploitation of environmental data and products for the various societal benefits areas defined by GEO. The societal benefit areas include agriculture, energy, health, climate, weather, disaster mitigation, biodiversity, water resources, and ecosystems. GEONETCast Americas will serve North, Central, and South America, using inexpensive satellite receiver stations based on DVB standards and will link with similar regional environmental data dissemination systems deployed around the world. Stations are expected to cost in the region of $2500 making use of off the shelf components.

NOAA added that consideration was being given to the use of an information channel for specific warnings, admin messages and the exchange of education and training resources. Other data providers are expected to contribute to the system in due course and restrictions on the format of supplied data were expected to be minimal. The current bandwidth is 2 MBs but this is expected to increase in the future.

WG IV was pleased to note that GEONETCast Americas will start broadcasting a limited amount of data, in an early operational mode, in late November 2007.

EUM-WP-11 presented the status of the EUMETCast system architecture, data services supported, and user registration figures, with an outlook to the near-term evolution of the EUMETCast Europe, Africa and Americas Services.
The **EUMETCast Europe** infrastructure (implemented in 2002) is based on Ku-Band, with an up-link station co-located with the Meteosat Second Generation Primary Ground Station in Usingen/Germany, using a transponder onboard the satellite HotBird-6. Resulting from several upgrades for support of additional services, the total bandwidth of the EUMETCast Europe Service will amount to 14 Mbps at the end of 2007.

**EUMETCast Africa**, implemented in the second half of 2003, is using a C-band transponder onboard the satellite Atlantic Bird 3, with an up-link station located in Fucino/Italy. The bandwidth available for this service – after an increase in October 2007 – is 3 Mbps, to be upgraded to 3.3 Mbps in January 2008.

**EUMETCast Americas**, the second turn-around service, was implemented beginning of 2006, with an uplink station near Paris, using a C-band transponder onboard the satellite NSS-806. This service is conceived as a trial, currently limited until end of 2008. The bandwidth allocated to this service remains unchanged at 2 Mbps.

The dissemination of environmental data and products via EUMETCast is structured in two categories regarding User access:

- **Data whose access is open to all registered EUMETCast Users, with the attributes**:
- Essential data in the terms of WMO Resolution 40
- Open data policy being applied by the data provider
- No licensing required, provided without charge, with no conditions on use
- For part of this data, however, access may be restricted to certain user groups, or access may be provided only on explicit request

- **Data whose access is not open to all registered EUMETCast Users, with the attributes:**
- Additional data in the terms of WMO Resolution 40,
- A (non open) data policy being applied by the data provider
- Licensing required, licensing fees/charges potentially required
- Data may be denied by the provider.

The respective access control is implemented through the encryption/ decryption scheme implemented in EUMETCast. Additionally, EUMETSAT informed the Group about the status and intended development of GEONETCast services supported by EUMETSAT and based upon the key role played by EUMETCast in this global system.

Finally, EUMETSAT also informed the Group about its Product Navigator.
The Product Navigator is a tool on EUMETSAT's Web Site, designed to put a vast range of essential environmental data at the fingertips of users around the globe, making it thus easy to search for and list environmental satellite data and products. Information can be found on data and products generated by EUMETSAT's Geostationary and Low Earth Orbit satellites and the associated Application Ground Segments, as well as data from other environmental satellite operators and processing centres. Whilst the Navigator is also containing information about products provided by EUMETSAT's U-MARF, about web based services and data distributed via direct dissemination, the focus is on data and products disseminated through EUMETCast and GEONETCast.

Each product is presented with a short description and a range of important information, e.g. product coverage, dissemination mechanism, typical file formats, examples of file naming conventions, etc. Additionally, links are provided to more information on the product itself.

Version 1.0 of the Product Navigator has been released beginning of August 2007 on EUMETSAT's Web Pages (see: http://www.eumetsat.int/products)

### IV/3 Global Data Exchange

In CMA-WP-10, CMA informed WGIV that on 1 September 2007, the exchange of satellite data through the GTS started between CMA and EUMETSAT according to bilateral arrangements between the two Organizations.

#### 1. CMA Data to EUMETSAT

At present, CMA provides EUMETSAT with 11 FY-2C products. The daily data volume is 6.3GB. In periods when the satellite is providing intensified observations, the data amount becomes 10.6GB daily. Because of the large size (220MB) of the nominal full-disc image file, at the request of EUMETSAT, the file is segmented at CMA before being transmitted to EUMETSAT.

#### 2. EUMETSAT Data received by CMA

Metop level-two products: e.g. ATOVS, ASCAT (SAF).
MSG satellite data: MSG MPEF products, Foreign Satellite Data (GOES and MTSAT)

## 3. Data Re-transmission

CMA plans to rebroadcast EUMETSAT data through the FengyunCast system to domestic users, with the agreement of EUMETSAT, and will apply technical measures to ensure the proper use of the data.

EUMETSAT added that since it would terminate direct broadcast from Meteosat-7 over the Indian Ocean at some point in the future, the availability of FengyunCast would ensure the continued availability of this data within the region. Use will be made of a level of encryption on Fengyuncast to ensure compliance with EUMETSAT Data Policy. This system was expected to start in around 6 months time.

WMO commented that such an operational data exchange and rebroadcast was an important building block to implement full vision of its IGDDS concept in the region.

### RARS

In JMA-WP-08, JMA informed WGIV about its activities for the Regional ATOVS Retransmission Service (RARS). JMA has been exchanging ATOVS data via the Global Telecommunication System (GTS) with Australia, China, the Republic of Korea and Singapore for the Asia-Pacific RARS (A-P RARS). JMA has also been providing ATOVS data received at two stations, Kiyose in Japan and the Syowa Station in Antarctica.

JMA started using RARS data in its operational NWP global data assimilation scheme in February 2007. The RARS data has a positive impact on JMA's NWP analyses and forecasts.

JMA added that it was going to start receiving and providing Metop/ATOVS data in addition to NOAA/ATOVS data. For user support, JMA will open a dedicated website to provide operational information about the ATOVS data received at Kiyose and the Syowa Station, to be available at the following URL: http://mscweb.kishou.go.jp/rars/index.htm

### Data Compression

NOAA-WP-11 discussed the compression of satellite sensor earth science data as a technology subject of importance to CGMS members. NOAA views compression of satellite sensor Earth science data as an important technology to enhance data distribution with the expected great increase in data rates in the future from new sensors' faster scanning, finer spectral, and finer spatial resolutions. Examples of such sensors would be multi-spectral imagers and FTS/Michelson Sounders.

NOAA is not the only government agency undertaking research on compression of satellite Earth science data. CNES of France and the

Canadian Space Agency (CSA) are government bodies outside of the U.S. also undertaking research in this area.

NOAA has been undertaking research on compression of satellite sensor Earth science data for nearly five (5) years. Their research has been directed to “Lossless” compression. Our research shows that the data structure of satellite Earth science sensor data is unique in terms of patterns, structure, and features. Further, NOAA’s research shows that the amount of “Lossless” compression achievable for Earth science sensor data, varies with sensor type; with data characteristics significantly varying among sensor types. We also find that contemporary widely used compression mathematics such as that used in the JPEG series and CCSDS compression standards perform poorly on satellite sensor Earth science data for “Lossless” compression. The common math of these standards are transforms such as Discrete Cosine Transforms (DCT) and wavelets as a data pre-processor followed by an entropy coder (e.g. Arithmetic, Huffman, Rice).The NOAA research attempts to achieve highest levels of “Lossless” compression” with satellite earth science data, Novel new approaches and mathematics are required are being developed in the NOAA research.

New classes of compression algorithms, such as those coming out of NOAA, are performing by almost a factor of two to one greater then the ability of conventional compression algorithms when applied to this problem. By this, NOAA mean where conventional algorithms might achieve a 1.5 to 1 or 2 to 1 “Lossless” reduction in data volume when applied to satellite Earth science data; new classes of algorithms, such as those emerging from NOAA research, are yielding reductions of 3 to1 for multi-spectral Imager data, near 4 to1 for dispersive hyper-spectral sounder data such as the AIRS instrument, and with preliminary results reductions of 4 to1 and 5 to 1 for FTS/Michelson interferometer data.

Recalling that this topic had not been addressed in Technical Working Groups for some years, it was agreed that CGMS members should report on the use of compression techniques, present and future plans, at future meetings of WG IV.

**Action 35.30: CGMS members to report on their use of compression techniques (from the operational and user perspectives) for current and future satellite systems. Deadline: CGMS-36**

### IV/4 Integrated Global Dissemination Service (IGDDS) Development

WMO-WP-24 described the progress made with the IGDDS initiative since CGMS-34.

The IGGDS Implementation Group (IGDDS-IG) has been established and the document reported on the discussions and outcomes of the group’s first meeting. The group also suggested some clarifications of its Terms of Reference and of the IGDDS Implementation Plan.

The document drew attention to the activities identified by the IGDDS-IG as requiring the highest priority. These include the establishment of data requirements for each region, the achievement of sustainable quasi-global coverage of services that respond to the identified requirements, the identification of suitable data exchange mechanisms for transferring data between regions and the provision of appropriate user information and support.
A further topic of importance is the need to ensure complete harmonization with the emerging standards being developed for the WMO WIS, of which IGDDS is defined to be a crucial element. This is a key to global interoperability which is a need for WIS and even reinforced in the context of the GEOSS.

The document, furthermore, reported the views of ET-SUP which emphasized the requirement for level 1 imagery data from geostationary satellites in the DVB-S dissemination component of IGDDS in all regions, and noted the particular status of RA-III in this respect.
The paper also briefly reports the discussions on this topic at the recent APSDEU-8 meeting.

WG IV noted that the IGDDS implementation is progressing in accordance with the plan, however particular attention is required on:

- The formulation of data dissemination requirements for each region;
- The achievement of a robust and sustainable DVB-S dissemination architecture, with quasi-global coverage;
- The provision of appropriate user support arrangements;
- The adoption of WIS file naming and metadata standards (See Annex 3)

Furthermore, WG IV:

- Noted the question from the OPAG-IOS Chair whether the provisions of a Joint Polar System would enable Metop to take advantage of the NPOESS safety net in order to improve timeliness of global data delivery to users;
- Considered the proposed changes to the Terms of Reference of the IGDDS Implementation Group and to the IGDDS Implementation Plan as shown in the Annexes to this paper;
- Noted the requirement for DVB-S dissemination of GEO imagery, as one of the primary requirements, and the expectation that Action 33.24 would lead to a plan satisfying this requirement in South America.

The following action was agreed:

**Action 35.31: NOAA and EUMETSAT to study possibilities for the use of NPOESS ground infrastructure to improve the timeliness of Metop data, within the framework of JPS discussions and report findings to CGMS. Deadline: CGMS-36**

WG IV also agreed that old action 33.24, namely, “EUMETSAT, NOAA together with WMO to develop a EUMETCast to NOAA ADM transition plan for users in South America and report details to CGMS. Deadline: CGMS-34” was still outstanding for the time being, pending the implementation of a South America broadcast service that should satisfy meteorological requirements on a sustainable basis.

WMO commented that the application of, e.g. CMA, EUMETSAT and NOAA, as DCPCs within the context of the IDGGS and WIS, should be prepared with the aim of a designation by the CBS meeting scheduled for November 2008. WMO added that the technical requirements for DCPCs would be circulated in the coming months.

**Action 35.32: CGMS members involved with the IGDDS to consider applying as DCPCs within the context of the IGDDS and WIS, in consultation with WMO. Deadline: May 2008**

WMO-WP-25 described the progress that has been made with the RARS initiative since CGMS-34, the establishment of a RARS Implementation Group and detailed the discussions and outcomes of the first meeting of that group. That meeting focussed on the need for active engagement with the user community, and on the outstanding challenges that remain to be addressed before the initiative can be thought of as achieving its goals.

The paper stressed the remarkable progress achieved by the RARS global network over the past year and drew attention to the ambitious actions, that the group have accepted, to take the initiative forward in the coming year.

The paper went on to describe the views of ET-SUP which, among other issues, raise the important subject of the possible extension of the RARS planning to embrace both new satellites and new instruments into the scheme.

Additionally WMO presented global plots of the RARS network at the end of 2007 and that projected for end 2008. The inclusion of FY-3 data was seen as a high priority issue for the implementation Group, followed by NPP and, in due course, NPOESS data.

CMA and EUMETSAT agreed to further investigate mechanisms for the inclusion of FY-3 data within the RARS network.

WGIV noted the remarkable progress and agreed to actively address open issues that will take this important initiative towards its originally defined goals and beyond.

**IV/5 Conclusion and preparation of WG report**

The working group concluded with the finalisation of the report taking into account the related actions.

# ANNEXES:

# DRAFT ORDER OF BUSINESS OF THE 35TH CGMS MEETING
# 2-7 November 2006

**---------- WORKING GROUP SESSIONS ----------**

## WORKING GROUP I: TELECOMMUNICATIONS

I/0 Introduction
I/1 Coordination of frequency allocations: SFCG, ITU and WRC activities
I/2 Telecommunication techniques
I/3 Coordination of International Data Collection & Distribution
I/3.1 Status and Problems of IDCS
I/3.2 Ships, including ASAP
I/3.3 ASDAR
I/3.4 Dissemination of DCP messages (GTS or other means)
I/4 Future use of IDCS
I/5 Search and Rescue (S&R)
I/6 Conclusion and preparation of WG report

## WORKING GROUP II: SATELLITE PRODUCTS INCLUDING SATELLITE DERIVED WINDS

II/0 Introduction
II/1 Image processing techniques
II/2 Satellite Data Calibration and Validation
II/3 Vertical sounding and ITWG matters
II/4 Precipitation and IPWG matters
II/5 Atmospheric Motion Vectors and IWWG matters
II/6 Cloud and dust related parameters
II/7 Other parameters and products
II/8 Coordination of code forms for satellite data
II/9 Conclusion and preparation of WG report

## WORKING GROUP III: CONTINGENCY PLANNING

III/0 Introduction
III/1 Revised GOS baseline for geostationary satellites
III/2 CGMS Global Contingency Plan for geostationary orbit
III/3 Revised GOS baseline for polar-orbiting satellites
III/4 CGMS Contingency plan for operational oceanographic satellites
III/5 Conclusion and preparation of WG report

## WORKING GROUP IV: INTEGRATED STRATEGY FOR DATA DISSEMINATION FROM METEOROLOGICAL SATELLITES

IV/0 Introduction
IV/1 Direct dissemination from meteorological satellites
IV/2 Advanced Dissemination Methods
IV/3 Global data exchange

IV/4 Integrated Global Dissemination Service (IGDDS) development
IV/5 Conclusion and preparation of WG report

**---------- PLENARY SESSION ----------**

## A. INTRODUCTION

A.1 Welcome
A.2 Election of Chairpersons
A.3 New CGMS Members
A.4 Adoption of Schedule
A.5 Nomination of Drafting Committee
A.6 Review of Action Items

## B. REPORT ON THE STATUS OF CURRENT SATELLITE SYSTEMS

B.1 Polar Orbiting Meteorological Satellite Systems
B.2 Geostationary Meteorological Satellite Systems
B.3 Research and Development Satellite Systems
B.4 Anomalies from solar and other events

## C. REPORT ON FUTURE SATELLITE SYSTEMS

C.1 Future Polar Orbiting Meteorological Satellite Systems
C.2 Future Geostationary Meteorological Satellite Systems
C.3 Future Research and Development Satellite Systems
C.4 Reconfiguration of future combinations of LEO and GEO missions

## D. OPERATIONAL CONTINUITY AND RELIABILITY

D.1 Global planning, including orbital positions and reconfiguration of the space-based component of the GOS
D.2 Inter-regional contingency measures
D.3 Long-term global contingency planning

## E. SATELLITE REQUIREMENTS OF WMO AND IOC PROGRAMMES

E.1 World Weather Watch
E.2 Other WMO Programmes
E.3 IOC Programmes

## F. INTERACTION WITH GEO

F.1 Applications of Meteorological Satellite Data for Environment Monitoring
F.2 Geonetcast/EUMETCast
F.3 CGMS and GEO/GEOSS interactions

## G. OTHER ITEMS OF INTEREST

G.1 Training
G.2 Information
G.3 Any other business

## H. FINAL SESSION

H.1 Reports from the Working Groups
H.2 Nomination of CGMS Representatives at WMO and other meetings
H.3 Nomination of Chairpersons of Working Groups for CGMS-36
H.4 Any Other Business
H.5 Summary List of Actions from CGMS-35
H.6 Approval of Draft Final Report
H.7 Date and place of next meeting

# WORKING PAPERS SUBMITTED TO CGMS-35

## CMA

| WP Number | Title | Agenda Item |
|---|---|---|
| CMA-WP-01 | CMA Review of Action Items | A.5 |
| CMA-WP-02 | Status FY-1D Polar-orbiting Satellite | B.1 |
| CMA-WP-03 | Status of FY-2 Geostationary Satellite Program | B.2/C.2 |
| CMA-WP-04 | FY-3 Polar-orbiting Meteorological Satellite Program | C.1 |
| CMA-WP-05 | Preliminary Consideration on FY-4 Frequency Network | I/1 |
| CMA-WP-06 | Status of FengyunCast | IV/2 |
| CMA-WP-07 | FY-2 Dual Satellite Constellation Image Animation | II/1 |
| CMA-WP-08 | Status of Inter-calibration at CMA | II/2 |
| CMA-WP-09 | ATOVS Product and Plan for Climate Study at NSMC | II/3 |
| CMA-WP-10 | Satellite Data Exchange with EUMETSAT through GTS | IV/3 |
| CMA-WP-11 | National Centre for Space Weather | B.4 |

## CNSA

| WP Number | Title | Agenda Item |
|---|---|---|
| CNSA-WP-01 | Status of the current CNSA Earth Observation Missions | B.3, C.3 |
| CNSA-WP-02 | Status of the future CNSA Earth Observation Missions | B.3, C.3 |
| CNSA-WP-03 | Introduction of Marine Satellite (HY01-B) of China and its Applications | B.3 |

## ESA

| WP Number | Title | Agenda Item |
|---|---|---|
| ESA-WP-01 | Status of current ESA Earth Observation missions | B.3 |
| ESA-WP-02 | Status of the future ESA Earth Observation missions | C.3 |
| ESA-WP-03 | Access to ERS and Envisat data | III.3 |
| ESA-WP-04 | Oceanographic information provided by ESA missions | III.4 |
| ESA-WP-05 | Assessment by ESA of GCOS Climate monitoring principles for GMES | III.5 |
| ESA-WP-06 | Data handling software available at ESA | II.1 |
| ESA-WP-07 | List of ESA actions | A.6 |
| ESA-WP-08 | Status of the EGPM at ESA | II.4 |

Annex 2

## EUMETSAT

| WP Number | Title | Agenda Item |
|---|---|---|
| EUM-WP-01 | Review of Action Items | A.6 |
| EUM-WP-02 | EUMETSAT input to satellite tables (does not need presenting, complementary to EUM-WP-01). | A.6 |
| EUM-WP-03 | Status of the EUMETSAT Polar System (EPS) | B.1 |
| EUM-WP-04 | Status of the Meteosat System (incl MSG-2) | B.2 & I/3.1 |
| EUM-WP-05 | Report on anomalies from solar events | B.4 |
| EUM-WP-06 | Plans for Post-EPS | C.1 & IV/1 |
| EUM-WP-07 | Status of preparations for MSG-3 and MSG-4 | C.2 |
| EUM-WP-08 | Plans for Meteosat Third Generation (MTG) | C.2 & IV/1 |
| EUM-WP-09 | Report on Ground segment facilities for radio-occultation missions | D.1 & II/7 |
| EUM-WP-10 | Status of the EUMETSAT Satellite Applications Facilities | F.1 |
| EUM-WP-11 | Report on EUMETCast including GEONETCast | F.2 & IV/1 |
| EUM-WP-12 | Report on EUMETSAT Training Activities | G.1 |
| EUM-WP-13 | EUMETSAT Conferences and Publications | G.2 |
| EUM-WP-14 | Proposal for increased coordination between CGMS, CEOS and the WMO Space Programme | G.3 |
| EUM-WP-15 | General frequency management topics | I/1 |
| EUM-WP-16 | Status report on the prototyping on high rate DCP | I/2 |
| EUM-WP-17 | Status of the IDCS | I/4 |
| EUM-WP-18 | OAIS-RM (Open Archival Information System Reference Model) and EUMETSAT UMARF | II/2 and II/7 |
| EUM-WP-19 | Status of GSICS imlementation at EUMETSAT | II/7 |
| EUM-WP-20 | Status of upgrade of precipitation estimation from MSG | II/4 |
| EUM-WP-21 | Validation of cloud and AMV heights with Calipso (first result from study) | II/5 |
| EUM-WP-22 | Status of polar AMVs from AVHRR on Metop | II/5 |
| EUM-WP-23 | Comparison of operational Atmospheric Motion Vector (AMV) algorithms using the same MSG and ancillary data | II/5 |
| EUM-WP-24 | Report on use of standard CGMS AMV statistics | II/5 |
| EUM-WP-25 | Report of the Cloud Parameter Retrieval Workshop | II/6 |
| EUM-WP-26 | Implementation of an algorithm to derive Fire Radiate Power in the Land SAF | II/7 |
| EUM-WP-27 | Update on Nowcasting Applications of MSG | II/7 |
| EUM-WP-28 | Preparation of the 9th International Winds Workshop | II/5 |
| EUM-WP-29 | The GOFC-GOLD Fire Team Recommendation to CGMS* | G.3 & II/7* |
| EUM-WP-30 | Consolidated report status and way forward | G.3 |
| EUM-WP-31 | Proposal for amendment of the CGMS Charter | G.3 |

## JAXA

| WP Number | Title | Agenda Item |
|---|---|---|
| JAXA-WP-01 | Update of ALOS Status | B.3 |
| JAXA-WP-02 | Update of GOSAT Status | C.3 |
| JAXA-WP-03 | Update of GCOM Status | C.3 |

## JMA

| WP Number | Title | Agenda Item |
|---|---|---|
| JMA-WP-01 | Review of Action Items | A.6 |
| JMA-WP-02 | Status of Multi-functional Transport Satellite(MTSAT) | B.2, I/3.1 |
| JMA-WP-03 | Tentative Plans for Follow-on Satellites to MTSAT-2 | C.2 |
| JMA-WP-04 | JMA's Activities for WRC-07 | I/1 |
| JMA-WP-05 | JMA's GSICS Activities | II/2 |
| JMA-WP-06 | JMA's Atmospheric Motion Vector Products | II/5 |
| JMA-WP-07 | Data Dissemination Methods of the Follow-on Satellites to MTSAT | IV/1,2&4 |
| JMA-WP-08 | JMA's Activities for RARS | IV/3 |

## KMA

| WP Number | Title | Agenda Item |
|---|---|---|
| KMA-WP-01 | Review of Action Items | A.6 |
| KMA-WP-02 | Update on COMS Program | C.2 |
| KMA-WP-03 | Status of COMS Ground System at Meteorological Satellite Center of KMA | C.2 |
| KMA-WP-04 | COMS Data Dissemination Plan | IV/1 |
| KMA-WP-05 | KMA Activities for Asia-Pacific RARS | II/3 |
| KMA-WP-06 | Report on the progress of the satellite data assimilation in KMA | II/3 |
| KMA-WP-07 | Operational analysis of the typhoon intensity | II/7 |
| KMA-WP-08 | A tentative product generation and dissemination plan for COMS | II/7 |
| KMA-WP-09 | Comparison of Atmospheric Motion Vector Heights assigned by ECMWF and KMA NWP Profiles | II/5 |
| KMA-WP-10 | Retrieval of Cloud Optical Thickness and Effective Radius from Geostationary Satellite Data | II/6 |
| KMA-WP-11 | The 1st International Training Course on the Analysis of COMS Data in Korea | G.1 |

## NOAA

| WP Number | Title | Agenda Item |
|---|---|---|
| NOAA-WP-01 | Review CGMS XXXIII Action Items | A.6 |
| NOAA-WP-02 | Polar Orbiting Operational Environmental Satellite (POES) | B.1 |
| NOAA-WP-03 | Geostationary Operational Environmental Satellite (GOES) | B.2 |
| NOAA-WP-04 | Anomalies from Solar Events | B.4 |
| NOAA-WP-05 | Future Polar Orbiting Meteorological Satellite System | C.1 |
| NOAA-WP-06 | Report on the status of future Geostationary Meteorological Satellite System | C.2 |
| NOAA-WP-07 | The GOES-R ABI (Advanced Baseline Imager) and the continuation of GOES-N class sounder products | C.2 |
| NOAA-WP-08 | Software Tools Useful for Image Enhancement and Analysis | G.2 |
| NOAA-WP-9 | GSICS Progress Report | E.2 |
| NOAA-WP-10 | NOAA Support for the CGMS Virtual Laboratory Focus Group (Session II) | G.2 |

## NOAA (continued)

| WP Number | Title | Agenda Item |
|---|---|---|
| NOAA-WP-11 | Data Compression | G.2 |
| NOAA-WP-12 | Technical Input to the Space Frequency Coordination Group and ITU-R | I/1 New |
| NOAA-WP-13 | NOAA consideration of the Open Archival Information System Reference Model (OAIS-RM) | II/2 |
| NOAA-WP-14 | Status of the IDCS | 1/3.1 |
| NOAA-WP-15 | NOAA Archive Reprocessing Capabilities to Allow for Regeneration of Datasets with Improved Quality and NOAA Mechanisms to Allow Running of Third Party Algorithms | II/2 |
| NOAA-WP-16 | JCSDA Progress Report on the Use of Cloud Contaminated Radiances in NWP | II/3 |
| NOAA-WP-17 | Impact of COSMIC GPS RO in NWP | II/3 |
| NOAA-WP-18 | Real time Assessments of Instrument Performance from GSICS and NOAA websites | II/4 |
| NOAA-WP-19 | Comparison of standard methods for the height assignment of AMVs with the new measurements from instruments on the A-Train | II/5 |
| NOAA-WP-20 | In Response to Recommendation 34.15: International Operational AMV Algorithms Comparison Study | II/5 |
| NOAA-WP-21 | In response to Recommendation 34.16: Applications of Operational Atmospheric Motion Vector (AMV) Retrieval Algorithms to Simulated Images from High-resolution NWP | II/5 |
| NOAA-WP-22 | Progress in novel studies on the height allocation of AMVs to layers. | II/5 |
| NOAA-WP-23 | Global reprocessing of AMVs, including all geostationary satellites | II/5 |
| NOAA-WP-24 | NOAA consideration of producing AMV wind products over the poles | II/5 |
| NOAA-WP-25 | Use of the standard CGMS AMV statistics and co-location criteria | II/5 |
| NOAA-WP-26 | Updates for the CEOS/WMO Database | II/6.1 |
| NOAA-WP-27 | Reprocessing of the AVHRR record to produce a aerosol climatology over ocean | II/6.3 |
| NOAA-WP-28 | The Use of Cloudsat and CALIPSO for the Validation of Operational Cloud Products | II/6.3 |
| NOAA-WP-29 | NOAA Report on Climate Product Research Development | II/3 New |
| NOAA-WP-30 | NOAA Table of Polar-orbiting Satellite Equator Crossing Times and Frequencies | III/3 |
| NOAA-WP-31 | NOAA plans for using direct broadcast beyond 2015 | IV/1 |
| NOAA-WP-32 | The Current Status of the GOES LRIT Service | IV/1 |
| NOAA-WP-33 | Update on the NOAA Alternative Dissemination Methods (ADM) System and GEONETCast | IV/2 |
| NOAA-WP-34 | NOAA Updates to the CGMS List Servers and Distribution List | |
| NOAA-WP-35 | Update of WMO tables indicating transition of broadcast services: Status of LRIT/LRPT Conversion | |

## NOAA (continued)

| WP Number | Title | Agenda Item |
|---|---|---|
| NOAA-WP-37 | NOAA Table of Satellites | |
| NOAA-WP-38 | Development of Research Climate Data Records | II/3 |
| NOAA-WP-39 | Use of the Open Archive Information System Reference Model for Long-Term Preservation of Historical Data Sets and for Enhancing Interoperability for Future Data Sets Including GEOSS | II/2 New |
| NOAA-WP-40 | Frequency Declaration for the Argos-4 System | I/I |
| NOAA-WP-41 | L-Band Frequency for SAARAL Realtime Downlink | I/I |

## WMO

| WP Number | Title | Agenda Item |
|---|---|---|
| WMO-WP-01 | Review of outstanding actions | A.6 |
| WMO-WP-02 | Potential WMO activities regarding Space Weather | B.4 |
| WMO-WP-03 | IGeoLab overall status | C.2 |
| WMO-WP-04 | Update on Geostationary Microwave IGeoLab activities | C.2 |
| WMO-WP-05 | Evolution of the Space-based GOS : Gap Analysis | D.1 |
| WMO-WP-06 | Draft Vision of the GOS to 2025 and outcome of OPT-2 workshop | D.1 |
| WMO-WP-07 | Progress on the Implementation Plan for Evolution of the GOS | D.1 |
| WMO-WP-08 | Regional/Specialized Satellite Centres for Climate Monitoring | E.2 |
| WMO-WP-09 | Report on THORPEX | E.2 |
| WMO-WP-10 | Global Climate Observing system (GCOS) | E.2 |
| WMO-WP-11 | Tropical Cyclone Programme requirements | E.2 |
| WMO-WP-12 | Disaster Risk Reduction programme | E.2 |
| WMO-WP-13 | International Polar Year 2007-2008 | E.2 |
| WMO-WP-14 | Virtual Laboratory for training in Satellite Meteorology | G.1 |
| WMO-WP-15 | CGMS list servers | G.2 |
| WMO-WP-16 | CGMS web pages | G.2 |
| WMO-WP-17 | Coordination of frequency interference issues with SFCG | I/1 |
| WMO-WP-18 | Report from the 27$^{th}$ meeting of SFCG | I/1 |
| WMO-WP-19 | Outcome of the workshop on RGB composite satellite imagery | II/1 |
| WMO-WP-20 | Status of GSICS | II/2 |
| WMO-WP-21 | Report on IPWG | II/3 |
| WMO-WP-22 | Revision of the GOS baseline for Geo satellites | III/1 |
| WMO-WP-23 | Revision of the GOS baseline for LEO satellites | III/3 |
| WMO-WP-24 | Update on IGDDS | IV/4 |
| WMO-WP-25 | Update on the Global RARS network | IV/4 |
| WMO-WP-26 | Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) | E2 |
| WMO-WP-27 | Satellite data requirements for climate applications | E2 |
| WMO-WP-28 | ASAP | I/3.2 |
| WMO-WP-29 | Status Status of new request for satellite data representation in WMO GRIB 2 or BUFR codes | II/8 |
| WMO-WP-30 | Update on the WMO Rolling Review of Requirements | E1 |

# LIST OF PARTICIPANTS AT CGMS-35

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# APPENDIX: GENERAL CGMS INFORMATION

1. Charter for CGMS
2. CGMS Membership
3. Addresses for Procuring Archive Data
4. Contact List for Operational Engineering Matters
5. Address List for Distribution of CGMS Documents
6. E-mail List Servers
7. Glossary

# CHARTER FOR THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES (CGMS)[1]

## PREAMBLE

**RECALLING** that the Coordination on Geostationary Meteorological Satellites (CGMS) has met annually as an informal body since September 1972 when representatives of the United States (National Oceanic and Atmospheric Administration), the European Space Research Organisation (now the European Space Agency), and Japan (Japan Meteorological Agency) met to consider common interests relating to the design, operation and use of these agencies planned meteorological satellites,

**RECALLING** that the Union of Soviet Socialist Republics (State Committee for Hydrometeorology), India (India Meteorological Department) and the People's Republic of China (State Meteorological Administration) initiated development of geostationary satellites and joined CGMS in 1973, 1978, and 1986 respectively,

**RECOGNIZING** that the World Meteorological Organisation (WMO) as a representative of the meteorological satellite data user community has participated in CGMS since 1974,

**NOTING** that the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) has, with effect from January 1987, taken over responsibility from ESA for the METEOSAT satellite system and the current Secretariat of CGMS,

**CONSIDERING** that CGMS has served as an effective forum through which independent agency plans have been informally harmonised to meet common mission objectives and produce certain compatible data products from geostationary meteorological satellites for users around the world,

**RECALLING** that the USA, the USSR, China and Europe have launched polar-orbiting meteorological satellites, and that the polar and geostationary meteorological satellite systems together form a basic element of the space based portion of the WMO Global Observing System,

**BEING AWARE** of the concern expressed by the WMO Executive Council Panel of Experts over the lack of guaranteed continuity in the polar-orbit and its recommendation that there should be greater cooperation between operational meteorological satellite operators world-wide, so that a more effective utilisation of these operational systems, through the coordination and standardisation of many services provided, can be assured,

[1] This Charter was amended at CGMS-31 to take into account new membership of the R&D agencies ESA, NASA, JAXA and Rosaviakosmos. It was further amended at CGMS-34 to take into account the new membership of CNES (since CGMS-32), KMA (since CGMS-33), and CNSA.

**RECOGNIZING** the importance of operational meteorological satellites for monitoring and detection of climate change,

**RECOGNIZING** the expansion of the space-based component of the WMO's World Weather Watch Global Observing System to include Research & Development missions and the commitment of the National Aeronautics and Space Administration (NASA), European Space Agency (ESA), Russian Aviation and Space Agency (Rosaviakosmos) and the National Space Development Agency of Japan (NASDA) to make observations from its missions available to the world community at the 2nd session of the WMO Consultative Meetings on High Level Policy on Satellite matters in February 2002,

**NOTING** the expansion of CGMS at CGMS-31 to include NASA, ESA, Rosaviakosmos and the Japan Aerospace Exploration Agency (JAXA) as full members to improve coordination between operational meteorological and R&D satellite operators,

**NOTING** the further expansion of CGMS at CGMS-32 to include CNES, at CGMS-33 to include KMA, and at CGMS-34 to include CNSA, following to their commitment to make observations from their missions available to the world community in full adherence with the space-based component of the WMO's World Weather Watch Global Observing System,

**AND RECOGNIZING** the need to update the purpose and objectives of CGMS,

**AGREE**

I. To change the name of CGMS to the Coordination Group for Meteorological Satellites

II. To adopt a Charter, establishing Terms of Reference for CGMS, as follows:

OBJECTIVES

a) CGMS provides a forum for the exchange of technical information on geostationary and polar-orbiting meteorological satellite systems and research & development missions, such as reporting on current meteorological satellite status and future plans, telecommunications matters, operations, intercalibration of sensors, processing algorithms, products and their validation, data transmission formats and future data transmission standards.

b) CGMS harmonises to the extent possible meteorological satellite mission parameters such as orbits, sensors, and data formats and downlink frequencies.

c) CGMS encourages complementarity, compatibility and possible mutual back-up in the event of system failure through cooperative mission planning, compatible meteorological data products and services and the coordination of space and data related activities, thus complementing the work of other international satellite coordinating mechanisms.

MEMBERSHIP

d) CGMS Membership is open to all operators of meteorological satellites, to prospective operators having a clear commitment to develop and operate such satellites, and to the WMO, because of its unique role as representative of the world meteorological data user community. Further CGMS Membership is open to space agencies operating R&D satellite systems that have the potential to contribute to WMO and supported programmes.

e) The status of observer will be open to representatives of international organisations or groups who have declared an intent, supported by detailed system definition studies, to establish a meteorological satellite observing system. Once formal approval of the system is declared, membership of CGMS can be requested by the observer.

Within two years of becoming an observer, observers will report on progress being made towards the feasibility of securing national approval of a system. At that time CGMS Members may review the continued participation by each Observer.

f) The current Membership of CGMS is listed in an annex to this charter.

g) The addition of new Members and Observers will be by consensus of existing CGMS Members.

ORGANISATION

h) CGMS will meet in plenary session annually. Ad hoc Working Groups to consider specific issues in detail might be convened at the request of any Member provided that written notification is received and approved by the Membership at least 1 month in advance and all Members agree. Such Working Groups will report to the next meeting of CGMS.

i) One Member, on a voluntary basis, will serve as the Secretariat of CGMS.

j) Provisional meeting venues, dates and draft agenda for plenary meetings will be distributed by the Secretariat 6 months in advance of the meeting, for approval by the Members. An agreed Agenda will be circulated to each Member 3 months in advance of the meeting.

k) Plenary Meetings of CGMS will be chaired by each of the Members in turn, the Chairperson being proposed by the host country or organisation.

l) The Host of any CGMS meeting, assisted by the Secretariat, will be responsible for logistical support required by the meeting. Minutes will be prepared by the Secretariat, which will also serve as the repository of CGMS records. The Secretariat will also track action items adopted at meetings and provide CGMS Members with a status report on these and any other outstanding actions, four months prior to a meeting and again at the meeting itself.

PROCEDURE

m) The approval of recommendations, findings, plans, reports, minutes of meetings, the establishment of Working Groups will require the consensus of Members. Observers may participate fully in CGMS discussions and have their views included in reports, minutes etc., however, the approval of an observer will not be required to establish consensus.

n) Recommendations, findings, plans and reports will be non-binding on Members or Observers.

o) Once consensus has been reached amongst Members on recommendations, findings, plans and reports, minutes of meetings or other such information from CGMS, or its Working Groups, this information may be made publicly available.

p) Areas of cooperation identified by CGMS will be the subject of agreement between the relevant Members.

COORDINATION

q) The work of CGMS will be coordinated, as appropriate, with the World Meteorological Organisation and its relevant bodies, and with other international satellite coordination mechanisms, in particular the Committee on Earth Observation Satellites (CEOS) and the Earth Observation International Coordination Working Group (EO-ICWG) and the Space Frequency Coordination Group (SFCG).

Organisations wishing to receive information or advice from the CGMS should contact the Secretariat; which will pass the request on to all Members and coordinate an appropriate response, including documentation or representation by the relevant CGMS Members.

AMENDMENT

r) These Terms of Reference may be amended or modified by consensus of the Members. Proposals for amendments should be in the hands of the Members at least one month prior to a plenary meeting of CGMS.

EFFECTIVE DATE AND DURATION

s) These Terms of Reference will become effective upon adoption by consensus of all CGMS Members and will remain in effect unless or until terminated by the consensus of CGMS Members.

## MEMBERSHIP OF CGMS

The current Membership of CGMS is:

| | |
|---|---|
| CMA | joined 1989 |
| CNES | joined in 2004 |
| CNSA | joined in 2006 |
| ESA | re-joined in 2003 |
| EUMETSAT | joined 1987 (currently CGMS Secretariat) |
| IMD | joined 1979 |
| IOC/UNESCO | joined in 2001 |
| JAXA | joined in 2003 |
| JMA | founder member, 1972 |
| KMA | joined in 2005 |
| NASA | joined in 2003 |
| NOAA | founder member, 1972 |
| ROSCOSMOS | joined in 2003 |
| ROSHYDROMET | joined 1973 |
| WMO | joined 1973 |

In some cases delegates are supported by other Agencies, for example SRC Planeta (with Roshydromet), and ISRO (with IMD).

Appendix 3

## ADDRESSES FOR PROCURING ARCHIVE DATA

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Appendix 7

## GLOSSARY

| | |
|---|---|
| AAPP | AVHRR and ATOVS Processing Package |
| AATSR | Advanced Along Track Scanning Radiometer |
| ABI | Advanced Baseline Imager (GOES-R) |
| ABS | Advanced Baseline Sounder (GOES-R) |
| ACARS | Automated Communications Addressing and Reporting System |
| ACC | ASAP Coordinating Committee |
| ACRIMSAT | Active Cavity Radiometer Irradiance Monitor Satellite (NASA) |
| ADC | Atlantic Data Coverage |
| ADEOS-II | Advanced Earth Observing Satellite-II (JAXA) |
| ADM | Atmospheric Dynamics Mission (ESA) |
| ADM | Alternative Dissemination Methods |
| ADM | Advance Dissemination Means (WMO) |
| AERONET | Remote-sensing aerosol monitoring network programme |
| AIRS | Advanced IR Sounder |
| AHRPT | Advanced High Rate Picture Transmission |
| ALOS | Advanced Land Observing Satellite (JAXA) |
| AMDAR | Aircraft Meteorological Data Relay |
| AMR | Altimetry Microwave Radiomete |
| AMS | American Meteorological Society |
| AMSR | Advanced Microwave Scanning Radiometer |
| AMSR-E | Advanced Microwave Scanning Radiometer (modified version on ADEOS-II) |
| AMSU | Advanced Microwave Sounding Unit |
| AMV | Atmospheric Motion Vectors |
| AOCE | Attitude and Orbit Control Electronics |
| AOPC | Atmospheric Observation Panel for Climate (GCOS) |
| APSATS | Asian-Pacific Satellite Training |
| APT | Asia-Pacific Telecommunity (WRC) |
| APT | Automatic Picture Transmission |
| Aqua | Earth's water cycle observing mission (NASA) |
| Aquarius | global sea surface salinity measuring mission (NASA) |
| ARGOS | Data Collection and Location System |
| ARINA | scientific payload on Resurs-DK1 for earth quake prediction |
| ASAP | Automated Shipboard Aerological Programme |
| ASCAT | C-band dual swath scatterometer (Metop) |
| ASCII | American Standard Code for Information Interchange |
| ASDAR | Aircraft to Satellite Data Relay |
| ASICs | Application Specific Integrated Circuits |
| ATMS | Advanced Technology Microwave Sounder |
| ATOVS | Advanced TOVS |
| ATSR | Along Track Scan Radiometer (ERS, ESA) |
| Aura | Mission measuring atmospheric chemistry and trace gases (NASA) |
| AVHRR | Advanced Very High Resolution Radiometer |
| AVNIR | Advanced Visible and Near Infrared Radiometer type 2 (ALOS, JAXA) |

| | |
|---|---|
| Baumanets | R&D space technology satellite primarily for students (Roscosmos) |
| BBC | Black Body Calibration (Meteosat) |
| BCCP | Business Continuity and Contingency Plan (USA) |
| GMD | Basic Meteorological Data |
| BMTC | Australia Bureau of Meteorology Training Centre |
| BTD | Brightness Temperature Differences |
| BUFR | Binary Universal Form for data Representation |
| BSS | Broadcasting Satellite Service |
| | |
| CAL | Computer Aided Learning |
| CALIPSO | Cloud-Aerosol Lidar and Infrared Pathfinder Satellite (NASA/CNES) |
| CART | Cloud and Radiation Test-bed |
| CAS | Commission for Atmospheric Sciences (WMO) |
| CboM | Commonwealth Bureau of Meteorology Australia |
| CBS | Commission for Basic Systems |
| CCD | Charged Couple Device (INSAT-2E) |
| CCIR | Consultative Committee on International Radio |
| CCRI | Climate Change Research Initiative |
| CCSDS | Consultative Committee on Space Data Systems |
| CD | Compact Disc |
| CDMA | Code Division Multiple Access |
| CDS | Climate Data Set (EUMETSAT) |
| CEOS | Committee on Earth Observation Satellites |
| CEPT | Conference Européenne des Postes et Télécommunications/European Conference of Postal and Telecommunications Administrations |
| Cg | WMO Congress |
| CGMS | Coordination Group for Meteorological Satellites |
| CHAMP | German EO Satellite |
| CHRIS | Compact High Resolution Imaging Spectrometer (PROBA, ESA) |
| CHRPT | Chinese HRPT (FY-1C and D) |
| CI | Convective Initiation (NOAA) |
| CIIS | Common Instrument Interface Studies |
| CIMS | GOES Channel Interference Monitoring System |
| CIMSS | Cooperative Institute of Meteorological Satellite Studies, Univ. Wisconsin |
| CIS | Commonwealth of Independent States |
| CITEL | Inter-American Telecommunication Commission |
| CLARE | Cloud Lidar And Radar Experiment |
| CLASS | Comprehensive Large-Array Stewardship System (NOAA) |
| CloudSat | Global cloud property measuring satellite (NASA/CSA) |
| CLS | Collecte Localisation Satellites (Toulouse) |
| CM | WMO Consultative Meetings on High-Level Policy on Satellite Matters |
| CMA | China Meteorological Administration |
| CMD | Cyclone Warning Dissemination Service |
| CME | Coronal Mass Ejections |
| CMIS | Conical Scanning Microwave Imager/Sounder |

| | |
|---|---|
| CM-SAF | Satellite Application Facility on Climate Monitoring (EUMETSAT) |
| CMP | Climate Monitoring Principles (GCOS) |
| CMS | Centre de Météorologie Spatiale (Lannion) |
| CMV | Cloud Motion Vector |
| CMW | Cloud Motion Wind |
| CNR | Consiglio Nazionale delle Ricerche (Italy) |
| CNSA | China National Space Administration |
| COCTS | 10-band Chinese Ocean Colour and Temperature Scanner |
| COEs | Centres of Excellence (WMO) |
| COMS | Communication, Ocean and Meteorological Satellite (KMA) |
| CONAE | Comisión Nacional de Actividades Espaciales (Argentina) |
| COOP | Coastal Oceans Observations Panel (GOOS) |
| COP | Conference of the Parties (GCOS) |
| COSPAR | Committee on Space Research |
| COSPAS/ SARSAT | International satellite system for search and rescue (SAR) |
| CPM | Conference Preparatory Meeting (WRC) |
| CR | CGMS Consolidated Report |
| CrIS | Cross track Infrared Sounder |
| CRYOSAT | Polar Ice Monitoring Programme (ESA) |
| CZI | 4-band Coastal Zone Imager (HY-1B). |
| | |
| DAPS | DCS Automated Processing System (USA) |
| DCP | Data Collection Platform |
| DCPC | Data Collection and Processing Centres |
| DCRS | Collaboration on Global Frequency Allocation harmonization |
| DCS | Data Collection System |
| DCWDS | Digital Cyclone Warning Dissemination System (India) |
| DIF | Directory Interchange Format |
| DMSP | Defense Meteorological Satellite Program (NOAA) |
| DOD | Department of Defense (USA) |
| DOMSAT | Domestic telecommunications relay Satellite (NOAA) |
| DPC | Directional Polarisation Camera (CNSA) |
| DPI | Derived Product Images (USA) |
| DPM | WMO Natural Disaster Prevention and Mitigation Programme |
| DPT | Delayed Picture Transmission |
| DR | Direct Readout services (ADM) |
| DRS | DCP Retransmission System (Meteosat) |
| DRT | Data Relay Transponder (INSAT) |
| DSB | Direct Soundings Broadcast |
| DSCOVR | Deep Space Climate Observatory (NASA) |
| DUS | Data Utilisation Station (USA) (Japan) |
| DVB | Direct Video Broadcast |
| DWS | Disaster Warning System (India) |
| | |
| EARS | EUMETSAT ATOVS Retransmission Service |
| EarthCARE | Cloud & aerosol mission (ESA) |
| EBB | Electronic Bulletin Board |
| EC | Executive Council (WMO) |

| | |
|---|---|
| ECP | European Common Proposal (CEPT) |
| ECT | Equator crossing time |
| ECV | Essential Climate Variables |
| ECMWF | European Centre for Medium-Range Weather Forecasts |
| EDR | Environmental Data Records (NPOESS) |
| EDU | Engineering Development Unit |
| EEIS | EUMETSAT External Information System |
| EESS | Earth Exploration Satellite Service (Frequency Management) |
| EIRP | Effective isotropically-radiated power |
| ELEKTRO | Geostationary meteorological satellite |
| EMWIN | Emergency Manager Weather Information Network (NOAA) |
| ENVISAT | ESA polar satellite for environment monitoring |
| EO | Earth Observation |
| EOS | Earth Observation System |
| EPA | US Environmental Protection Agency |
| EPS | EUMETSAT Polar System |
| ERBE | Earth Radiation Budget Experiment |
| ERBS | Earth Radiation Budget Satellite (NASA) |
| ERS | ESA Remote Sensing Satellite |
| ESA | European Space Agency |
| ESCAP | Economic and Social Commission for Asia and the Pacific, UN |
| ESJWG | Earth Sciences Joint Working Group |
| ESOC | European Space Operations Centre (ESA) |
| ET-ODRRGOS | Expert Team on Observational Data Requirements and Redesign of the GOS |
| ET-EGOS | Expert Team on Evolution of the Global Observing System (WMO) |
| ET-SAT | OPAG IOS Expert Team on Satellite Systems (WMO) |
| ET-SUP | OPAG IOS Expert Team on Satellite Utilisation and Products (WMO) |
| EU | European Union |
| EUCOS | EUMETNET Composite Observing System |
| EUMETCast | EUMETSAT Satellite Data Dissemination System |
| EUMETNET | The Network of European Meteorological Services |
| EUMETSAT | European Organisation for the Exploitation of Meteorological Satellites |
| FAA | Federal Aviation Authority (USA) |
| FAO | Food and Agriculture Organisation (UN) |
| FENGYUNCast | FENGYUN Satellite Data Dissemination System |
| FOV | Field of View (NOAA) |
| FTP | File Transfer Protocol |
| FWIS | Future WMO Information Systems (CBS Inter-Programme Task Team) |
| FXTS | Facsimile Transmission System (USA) |
| FY-1 | Polar-orbiting Meteorological Satellite (PRC) |
| FY-2 | Future Geostationary Meteorological Satellite (PRC) |
| FY-3 | Second generation of Polar-orbiting Meteorological Satellite (PRC) |

| | |
|---|---|
| GAW | Global Atmosphere Watch (WMO Atmospheric Research Environment Programme) |
| GCOM | Global Change Observation Mission (NASDA) |
| GCOS | Global Climate Observing System |
| GDPT | Chinese Delayed Picture Transmission Format (Global Data) (FY-1C) |
| GDS | Ground Data System |
| GEO | inter-governmental Group on Earth Observations |
| GEOSS | Global Earth Observation System of Systems |
| GERB | Geostationary Earth Radiation Budget (MSG, EUMETSAT) |
| GESN | Global Education and Science Network |
| GEWEX | GEWEX Radiation Panel (NOAA) |
| GIFTS | Geosynchronous Imaging Fourier Transform Spectrometer (GOES-R) |
| GIMTACS | GOES I-M Telemetry and Command System |
| GLI | Generation Global Imager (GCOM) |
| GLM | Geostationary Lightning Mapper (GOES, NOAA) |
| GLOBUS | multichannel scanning radiometer (Meteor-3M N2) |
| Glory | CCRI global distribution of natural and anthropogenic aerosols mission (NASA) |
| GMES | Global Monitoring for Environment and Security (EU) |
| GMR | GOES-Meteosat Relay |
| GMS | Geostationary Meteorological Satellite (Japan) |
| GNSS | Global Navigation Satellite System |
| GOCE | Gravity Field and Steady State Ocean Circulation Explorer (ESA) |
| GOES | Geostationary Operational Environmental Satellite (USA) |
| GOME | Global Ozone Monitoring Experiment (Metop, ERS) |
| GOMS | Geostationary Operational Meteorological Satellite (Russ. Fed.) |
| GOMAS | Geostationary Observatory for Microwave Atmospheric Sounding (WMO) |
| GOOS | Global Ocean Observing System |
| GOS | Global Observing System |
| GOSAT | Greenhouse Gases Observing Satellite (JAXA/Jap. Min. of Environment) |
| GSLMP | Global Sea Level Monitoring Programme |
| GPCP | Global Precipitation Climatology Project |
| GPM | Global Precipitation Measurement (JAXA/NASA) |
| GPS | Global Positioning System |
| GRA | GOOS Regional Alliances |
| GRACE | Gravity Recovery and Climate Experiment (NASA/DLR) |
| GRAS | GNSS Receiver for Atmospheric Sounding |
| GRIB | Numerical weather prediction data in gridpoint form, expressed in binary |
| GSICS | Global Satellite Intercalibration System |
| GTS | Global Telecommunication System |
| GVAR | GOES Variable (data format) (USA) |
| | |
| HAPS | High Altitude Platform System |
| HDF | Hierarchical Data Format |

| | |
|---|---|
| HDFS | High Density Fixed Service |
| HDFSS | High Density Fixed Satellite Systems |
| HDR | High Data Rate |
| HEO | Highly Elliptical Orbit |
| HES | Hyperspectral Environmental Suite (GOES, NOAA) |
| HiRID | High Resolution Imager Data |
| HIRS | High Resolution Infrared Sounder |
| HR | High Resolution |
| HRD | High Rate Data (NPOESS, USA) |
| HRDCP | High Rate DCP |
| HRPT | High Rate Picture Transmission |
| HSRS | High Spectral Resolution Sounder (MSG) |
| HWR | Hydrology and Water Resource Programme (WMO) |
| HYDROS | Hydrosphere State Mission (NASA) |
| | |
| ICESat | Ice Cloud and Land Elevation Satellite (NASA) |
| ICI | Inversion Coupled Imager (India) |
| ICSC | CAS International Core Steering Committee (ICSC) (THORPEX) |
| ICWG | International Coordination Working Group (EO) |
| IDCP | International DCP |
| IDCS | International Data Collection System |
| IDDI | Infra-red Difference Dust Index |
| IDN | International Directory Network (CEOS) |
| IDPS | Interface Data Processing Segment (NPOESS) |
| IFRB | International Frequency Registration Board |
| IGACO | Integrated Global Atmospheric Chemistry Observations (IGOS) |
| IGDDS | Integrated Global Data Dissemination Service |
| IGEOLab | International Geostationary Laboratory concept |
| IGL | International Geostationary Laboratory |
| IJPS | Initial Joint Polar-orbiting Operational Satellite System |
| IKFS-2 | advanced IR atmospheric sounder |
| IMT-2000 | International Mobile Telecommunication 2000 (before FPLMTS) |
| INSAT | Indian geostationary satellite |
| IOC | Intergovernmental Oceanographic Commission (UNESCO) |
| IODC | Indian Ocean Data Collection |
| IOP | Initial Operations Phase (SAF, EUMETSAT) |
| IOTWS | Indian Ocean Tsunami Warning Service |
| IPO | Integrated Program Office (NOAA) |
| IPOMS | International Polar-orbiting Meteorological Satellite Group |
| IPWG | International Precipitation Working Group |
| IPY | International Polar Year (TIGGE/THORPEX) |
| IQGSE | Image Quality Ground Support Equipment (EUMETSAT) |
| IR | Infrared |
| IRAS | Infrared Atmospheric Sounder (FY-3, CMA) |
| IRTS | Infrared Temperature Sounder (EPS) |
| IRW | Infrared Window |
| ISS | Information Systems and Services |
| ISCCP | International Satellite Cloud Climatology Project |
| ISADP | Integrated System for the ATOVS Data Processing |

| | |
|---|---|
| ISWMR | SAF Integrated Satellite Wind Monitoring Report (EUMETSAT) |
| ISY | International Space Year |
| ITSC | International TOVS Study Conference |
| ITT | Invitation to Tender |
| ITU | International Telecommunication Union |
| ITWG | International TOVS Working Group |
| IVOS | Infrared and Visible Optical System Calibration (CEOS WGCV) |
| IWW | International Winds Workshop |
| IWWG | International Winds Workshop Group |
| JASON | Ocean surface Topography follow-on mission to TOPEX/POSEIDON (CNES/NASA) |
| JAXA | Japan Aeronautic Exploration Agency (name change of NASDA) |
| JCOMM | Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology |
| JCSDA | Joint Centre for Satellite Data Assimilation |
| JMA | Japan Meteorological Agency |
| JRA-25 | “Japanese Re-Analysis 25 years" JMA research project of long-range re-analysis of global atmosphere |
| JSC | Joint Scientific Committee (WCRP) |
| KARI | Korea Aerospace Research Institute |
| KLIMAT | scanning Infrared radiometer on Meteor-3M N1 (Russia) |
| KMA | Korea Meteorological Administration |
| KNMI | the Royal Dutch Meteorological Institute |
| KOMPAS | Microsatellite, earthquake investigations (Roscosmos) |
| LAN | Local Area Networks (Telecommunication) |
| Landsat | NASA Earth observing Satellite |
| LBR | Low Bit Rate |
| LCL | Latch Current Limiter |
| LDCM | Landsat Data Continuity Mission (NASA/US Geological Survey) |
| LDPT | Chinese Delayed Picture Transmission Format (Local Data Coverage) FY-1C |
| LEOP | Launch and Early Operations Phase |
| LR | Low Resolution |
| LRD | Low Rate Data (NPOESS, USA) |
| LRIT | Low Rate Information Transmission |
| LRPT | Low Rate Picture Transmission |
| LSPIM | Land Surface Processes and Interactions Mission (ESA) |
| LST | Local Solar Time |
| MAP | Mesoscale Alpine Experiment |
| MAP-SST | Merged Atlantic Product - Sea Surface Temperature (SAF, EUMETSAT) |
| MARF | Meteorological Archive and Retrieval Facility (EUMETSAT) |
| MBWG | MSG Biosphere Working Group |
| MCP | Meteorological Communications Package |
| MCUT | Multi-Constellation User Terminal (NOAA) |

| | |
|---|---|
| MDD | Meteorological Data Distribution (Meteosat) |
| MDUS | Medium-scale Data Utilization Station (for GMS S-VISSR) |
| MEGHA-TROPIQUE | CNES/ISRO mission |
| MERIS | Medium Resolution Imaging Spectrometer (ENVISAT) |
| MERSI | Medium Resolution Spectral Imager (FY-3, CMA) |
| MetAids | Meteorological Aids Service (frequency regulation) |
| Metop | Future European meteorological polar-orbiting satellite |
| METEOR | Polar-orbiting meteorological satellite (Roshydromet) |
| Meteosat | Geostationary meteorological satellite (EUMETSAT) |
| METSAT | Indian geostationary meteorological satellite |
| MetSat | meteorological satellite systems (frequency regulation) |
| MHS | Microwave Humidity Sounder (EPS) |
| MIEC | Meteorological Information Extraction Centre (ESOC) |
| MIMR | Multi-frequency Imaging Microwave radiometer |
| MIVZA | microwave scanning radiometer (Meteor 3M N1) |
| MOCC | Meteosat Operational Control Centre (ESOC) |
| MODIS | Moderate Resolution Imaging Spectroradiometer (NOAA) |
| MOP | Meteosat Operational Programme |
| MONITOR-E | Land Observing Satellite (Roscosmos) |
| MPEF | Meteorological Products Extraction Facility (EUMETSAT) |
| MSC | Meteorological Satellite Centre (Japan) |
| MSC-CAL | Computer Aided Learning system by JMA/MSC |
| MSG | Meteosat Second Generation |
| MSM | Meso-Scale Model |
| MSMR | Multichannel Scanning Microwave Radiometer (OCEANSAT-1) |
| MSS | Mobile Satellite Services (frequency regulation) |
| MSU | Microwave Sounding Unit |
| MTG | Meteosat Third Generation |
| MTP | Meteosat Transition Programme |
| MTS | Microwave Temperature Sounder (EPS) |
| MTSAT | Multi-functional Transport Satellite (Japan) |
| MTVZA | microwave scanning radiometer (Meteor 3M N1) |
| MVIS | Multi-channel VIS and IR Radiometer (FY-1C and D of PRC) |
| MWHS | Microwave Humidity Sounder |
| MWR | Microwave Radiometer (ERS, ESA) |
| MWRI | Microwave Radiation Imager (FY-3, CMA) |
| MWRS | Microwave Radiometers |
| MWTS | Microwave Temperature Sounder (FY-3, CMA) |
| | |
| NASA | National Aeronautics and Space Agency |
| NASDA | National Space Development Agency of Japan (changed to JAXA in 2003) |
| NEDT | Noise Equivalent Delta Temperature |
| NESDIS | National Environmental Satellite Data and Information Service |
| NGDC | National Geophysical Data Centre (USA) |
| NGSO | Non-geostationary systems |
| NIST | US National Institute of Standards and Technology |
| NMC | National Meteorological Centre |

| | |
|---|---|
| NMHS | National Meteorological & Hydrological Service |
| NMP EO-1 | New Millennium Program Earth Observing Mission (NASA) |
| NOAA | National Oceanic and Atmospheric Administration |
| NOS | National Ocean Service (USA) |
| NPOESS | National Polar-orbiting Operational Environmental Satellite System (USA) |
| NPP | NPOESS Preparatory Project |
| NSMC | National Satellite Meteorological Center of CMA (PRC) |
| NTIA | National Telecommunications and Information Agency (USA) |
| NWP | Numerical Weather Prediction |
| NWS | National Weather Service (USA) |
| | |
| OCAP | Operational Consortium of ASDAR Participants |
| OCEANSAT | Indian satellite for ocean applications |
| OCO | Orbiting Carbon Observatory (NASA) |
| OLR | Outgoing Longwave Radiation |
| OOPC | Oceans Observations Panel for Climate (GOOS) |
| OPAG-IOS | Open Programme Area Group in Integrated Observing Systems (successor of CBS WG on Satellites) |
| OSE | Operational System Experiments (ET-ODRRGOS) |
| OSSE | Observing System Simulation Experiments (ET-ODRRGOS) |
| OSTM | Ocean Surface Topography Mission (Jason-2) (CNES/NASA/ NOAA/EUMETSAT) |
| OWSE-AF | Operational WWW Systems Evaluation for Africa |
| | |
| PALSAR | Phased Array type L-band Synthetic Aperture Radar ((ALOS, JAXA) |
| PAMELA | AntiMatter Exploration and Light-nuclei Astrophysics |
| PATMOS | AVHRR Pathfinder Atmosphere (NOAA) |
| PC | Personal Computer |
| PMW | Passive Microwave |
| POEM | Polar-orbiting Earth Observation Mission (ESA) |
| POES | Polar-orbiting Operational Environmental Satellite (USA) |
| PR | Precipitation Radar (on TRMM, JAXA) |
| PRC | People's Republic of China |
| PRISM | Panchromatic Remote-sensing Instrument for Stereo Mapping (ALOS, JAXA) |
| PROBA | Project for On-Board Autonomy (ESA EO satellite) |
| PTT | Post Telegraph and Telecommunications authority |
| PTWC | Pacific Tsunami Warning Centre |
| | |
| QI | Quality Indices (EUMETSAT) |
| QuikSCAT | Quik Scatterometer (NASA) |
| | |
| RA | Regional Association of WMO |
| RARS | Regional ATOVS Re-transmission System (WMO) |
| RAMSDIS | Menu-driven system for analysing digital satellite imagery (McIDAS, USA) |
| RAOBS | Radiosonde Observations |

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|---|---|
| RASA | Russian Aviation and Space Agency |
| RDCP | Regional DCP (Japan) |
| RDR | Raw Data Records (NPOESS) |
| Resurs-DK | Russian land observing satellite (Roscosmos) |
| RFI | Radio Frequency Interference |
| RLAN | new wireless LANs |
| RMS | Root Mean Square |
| RMTC | Regional Meteorological Training Centre (WMO) |
| Roscosmos | [Russian] Federal Space Agency |
| Roshydromet | Russian Federal Service for Hydrometeorology and Environmental Monitoring |
| RSB | Reflective Solar Bands (MODIS NOAA) |
| RSMC | Regional Specialised Meteorological Centre |
| RSO | Rapid Scan Operations (NOAA) |
| RSS | Rapid Scan Service (EUMETSAT) |
| RT | Radiative Transfer |
| | |
| S&R | Search and Rescue mission |
| SAF | Satellite Application Facility (EUMETSAT) |
| SAFISY | Space Agency Forum on the ISY |
| SAGE III | Stratospheric Aerosol and Gas Experiment (NASA) |
| SAM | Satellite Anomaly Manager |
| SAR | Synthetic Aperture Radar (ERS ESA) |
| SARA | Short Range Automotive Radar (frequency management) |
| SARSAT | Search And Rescue, Satellite supported facility |
| SAST | Shanghai Academy of Space Technologies. |
| SATAID | Satellite Animation and Interactive Diagnosis (Japan) |
| SATOB | WMO code for Satellite Observation |
| SBA | Societal Benefit Area |
| SBSTA | UNFCCC Subsidiary Body for Scientific and Technology Advice |
| SBUS | Solar Backscatter Ultraviolet Sounder (FY-3, CMA) |
| SBUV | Solar Backscattered Ultra Violet (ozone) |
| SD | Solar Diffuser (MODIS) |
| SDR | Sensor Data Records (NPOESS) |
| SEAS | Shipboard Environmental (data) Acquisition System |
| SEC | Space Environment Center (NOAA) |
| SEISS | Space Environmental In-Situ Suite (GOES, NOAA) |
| SEM | Space Environment Monitor (GOES) |
| SEVIRI | Spinning Enhanced Visible and Infrared Imager (MSG) |
| S-FAX | S-band facsimile broadcast of FY-2 (PRC) |
| SFCG | Space Frequency Coordination Group |
| SGLI | Second Generation Global Imager (CGOM-B1) |
| SG-RFC | Steering Group on Radio Frequency Coordination |
| SICH-1M | Russian oceanographic satellite (Roscosmos) |
| SIS | Solar Imaging Suite (GOES, NOAA) |
| SMA | State Meteorological Administration (PRC) |
| SMD | Stored Mission Data (NPOESS) |
| SMOS | Soil Moisture and Ocean Salinity (ESA) |
| SORCE | Solar Radiation and Climate Experiment (NASA) |

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|---|---|
| SOT | Ship Observation Team (JCOMM) |
| SP | Space Programme (WMO) |
| SRR | Automotive Short-Range Radars (frequency management) |
| SRF | Spectral Response Function |
| SRS | Space Research Service (frequency regulation) |
| SRSO | Super-Rapid-Scan Operations |
| SRTM | Shuttle Radar Topography Mission (NASA) |
| SSM/I | Special Sensor Microwave/Imager (NOAA) |
| SSMI/S | Special Sensor Microwave Imager/Sounder (NOAA) |
| SSMR | Scanning Multispectral Microwave Radiometer |
| SSMT1 | microwave temperature sounder (NOAA) |
| SSMT2 | microwave water vapour sounder (NOAA) |
| SSP | Sub-Satellite Point |
| SST | Sea Surface Temperature |
| SSU | Stratospheric Sounding Unit |
| STC | Semi-Transparent Correction (NOAA) |
| S-VISSR | Stretched VISSR |
| SWARM | Earth Observation mission (ESA) |
| SXI | Solar X-Ray Imager (GOES-12) |
| | |
| TERRA | Earth climate measuring satellite (NASA) |
| TD | Technical Document (WMO) |
| THORPEX | International global atmospheric r & d programme (WMO CAS) |
| TIGGE | THORPEX Interactive Grand Global Ensemble |
| TIROS | Television Infrared Observation Satellite |
| TMI | TRMM Microwave Imager |
| TOMS | Total Ozone Mapping Spectrometer (NASA) |
| TOR | Terms of Reference |
| TOU | Total Ozone Unit (FY-3, CMA) |
| TOVS | TIROS Operational Vertical Sounder |
| TPW | Total Precipitable Water (NOAA) |
| TRMM | Tropical Rainfall Measuring Mission (NASA, JAXA) |
| TTC | Telemetry Tracking Control |
| | |
| UARS | Upper Atmosphere Research Satellite (NASA) |
| U-MARF | United Meteorological Archive Retrieval Facility (EUMETSAT) |
| UHF | Ultra High Frequency |
| UK | United Kingdom |
| UMTS | Universal Mobile Telecom System |
| UN | United Nations |
| UNFCCC | United Nations Framework Convention on Climate Change |
| UNISPACE | United Nations Space Conference |
| UN-OOSA | UN Office of Outer Space Affairs |
| USA | United States of America |
| UPS | Unified Propulsion Subsystem |
| UTC | Universal Time Coordinated |
| UWB | Ultra Wide Band |
| | |
| VAS | VISSR Atmospheric Sounder |

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|---|---|
| VGT | Vegetation |
| VHF | Very High Frequency |
| VHRR | Very High Resolution Radiometer |
| VIIRS | Visible Infrared Imaging Radiometer Suite |
| VIRSR | Visible and Infrared Scanning Radiometer (EPS) |
| VIS | Visible channel |
| VISITView | VL tool |
| VISSR | Visible and Infrared Spin Scan Radiometer |
| VL | Virtual Laboratory (training concept) |
| VL-FG | VL Focus Group Meeting |
| VLSI | Very Large Scale Integrated circuit |
| VPN-PP | WIS Virtual Private Network Pilot Project |
| VTX | VHF transmitter (NOAA) |
| | |
| WALEX | WAter vapour Lidar EXperiment |
| WARC | World Administrative Radio Conference |
| WCRP | World Climate Research Programme |
| WCS | WMO Core Standards |
| WEFAX | Weather facsimile |
| WG | Working Group |
| WGNE | Working Group on Numerical Experimentation |
| WHyCOS | World Hydrological Cycle Observing System (HWR, WMO) |
| WIS | WMO Information System |
| WMO | World Meteorological Organization |
| WP | Working Paper |
| WRC | World Radio Conference |
| WV | Water Vapour |
| WVMW | Water Vapour Motion Winds |
| WWW | World Weather Watch |
| | |
| X-ADC | Extended Atlantic Data Coverage |
| Y2K | Year 2000 compatibility |
| ZAP | Z-axis Precession Mode (GOES) |
| ZAMG | Zentralanstalt für Meteorologie und Geodynamik (Austrian NMHS) |