# REPORT OF THE 33rd MEETING OF THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES

CGMS-33

Tokyo, Japan
1-4 November 2005

Cover page photo:
Meganebashi Bridge, Imperial Palace, Tokyo, Japan

Back cover image:
Composite IR Channel of
GOES-10, GOES-12, Meteosat-7, Meteosat-5 and GOES-9
18 January 2005, 15:00 UTC

Please note that this report is published together
with a CD-ROM containing an electronic version
of the report together with all working papers presented
at CGMS-33.

Report edited on behalf of CGMS by:
CGMS Secretariat
EUMETSAT
Am Kavalleriesand 31
D-64295 Darmstadt
Germany
www.eumetsat.int

# TABLE OF CONTENTS



# TABLE OF TABLES AND FIGURES

# FINAL REPORT OF THE PLENARY SESSION

## A. INTRODUCTION

### A.1 Welcome

The 33rd CGMS meeting was officially opened by Mr Koichi Nagasaka, Director-General of JMA, on 1 November 2005 at 12 am in Tokyo, Japan. He welcomed all the CGMS participants stating it was a deep privilege and an honour to host, together with JAXA, the 33rd CGMS, corresponding to the 6th CGMS meeting held in Japan. Dr Nagasaka stated that CGMS had made a significant contribution to the development and maintenance of international coordination for providing global earth observation data to the users worldwide. Based on the conclusions and guidelines formulated at CGMS gatherings, each CGMS Member has been intensively striving to make available meteorological and environmental observation data from space to the international user communities, to meteorological services and for spacecraft development. He continued by emphasising the importance of continuous satellite meteorological observations and those from R&D satellites to promote the WMO World Weather Watch programme, as well as to the Global Earth Observation System of Systems (GEOSS). Furthermore, he stated that JMA is supporting these activities with its new MTSAT-1R satellite and its cooperation with NOAA involving the past use of GOES-9. He concluded by wishing CGMS a productive meeting and a comfortable and pleasant stay in autumnal Tokyo, Japan.

On behalf of the CGMS Secretariat, Dr Lars Prahm, Director-General of EUMETSAT, also welcomed the participants to the 33rd session of the CGMS. He announced that he was very pleased and honoured to have the opportunity to participate in a CGMS meeting for the first time and to join the hosts JMA and JAXA. He continued by stating that Japan is hosting CGMS for the sixth time which signifies its strong commitment to the group and its activities. Japan, together with NOAA, were founding members of CGMS back in 1972, and since then CGMS had come a long way and had made several contributions to meteorological satellite systems. Today, CGMS achievements appear to be even more crucial, as the growth of the earth observation systems, and the related efforts for international coordination and information exchange, have to meet the overall demands of the public and decision-makers for more accurate and timely data, improved products and better services. He confirmed EUMETSAT's commitment as CGMS Secretariat and its commitment towards GEO activities as well as its activities in pursuing a global GEOCast system. He also announced that he looked forward to welcoming KMA as a full Member during the Plenary session later in the week. He concluded by wishing everybody fruitful discussions and hoped they would strengthen the important activities of global satellite meteorology.

The opening session was closed by Mr Koichi Nagasaka, with a wish for a very successful 33rd CGMS meeting.

## A.2 Election of Chairmen

Mr Kazunobu Nakamura, JMA, and Dr Donald Hinsman, WMO, were unanimously elected as co-Chairmen of CGMS-33. Chairmen for the working groups had been elected at the previous CGMS meeting; Mr Robert Wolf for Working Group I on Telecommunications, with Mr Gordon Bridge acting as Rapporteur; Mr Hideyuki Hasegawa, JMA was elected chair for Working Group II on Satellite Products including Satellite-Derived Winds, with Dr Paul Menzel and Dr Johannes Schmetz acting as Rapporteurs; Mr Gary Davis as Chairman for Working Group III on Global Contingency Planning, with Dr Donald Hinsman as Rapporteur; and Mr Mikael Rattenborg elected as Chairman of Working Group IV on Integrated Strategy for Data Dissemination from Meteorological Satellites, with Mr Gordon Bridge acting as Rapporteur.

## A.3.1 Adoption of Schedule

The schedule (see annex 1) was adopted. The meeting recalled that the four working groups had met previously on 1 and 2 November 2005.

The Secretariat provided a list of working papers submitted to CGMS-33 (see annex 2), as well as a provisional draft order of business (see annex 1), which was used as a basis for the subsequent discussions.

## A.3.2 Nomination of new Members

Following an initial request to CGMS-32 in 2004, KMA was unanimously nominated as a full Member of CGMS. Dr Myoung-Hwan Ahn expressed his appreciation to CGMS and confirmed the desire of KMA to fulfil the objectives of CGMS and to be an active partner in the WMO Global Observing System, highlighting the future availability of COMS data to WMO Members.

## A.4 Nomination of Drafting Committee

The drafting of various sections of the Final Report was carried out by the Secretariat based upon summaries of submitted working papers and the reports of the working groups and plenary sessions.

## A.5 Review of Action Items from Previous Meetings

The Secretariat reviewed the outstanding actions from previous meetings, taking into account inputs provided in Working Papers ESA-WP-06, EUM-WP-01, JMA-WP-01, CMA-WP-01, NOAA-WP-01 and WMO-WP-02, as well as by other means of correspondence including e-mail etc.

## (i) Permanent actions

1. 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 of Satellites.

   *Related WPs: CMA-WP-03/05/07/09/10, ESA-WP-01/02, JMA-WP-02. NOAA provided the information by e-mail.*

   *It was agreed to merge permanent actions 1, 2, 8 and 11 – input to the various satellite tables - into a single permanent action, permanent action 1. (The remaining permanent actions are renumbered accordingly).*

2. 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.

   ***Closed.*** *(To be included in permanent action 1). Related WPs: JMA-WP-05, JMA-WP-06.*

3. EUMETSAT, Japan and USA to provide the agreed set of reporting statistics on IDCS performance and report to CGMS Secretariat and WMO on a regular basis.

   *Related WPs: EUM-WP-07, JMA-WP-09, NOAA-WP-09.*

4. CGMS Members to update the CEOS/WMO Consolidated Database as appropriate and at each CGMS meeting.

   *Input provided by Members as necessary.*

5. CGMS Members to report on anomalies from solar events at CGMS meetings.

   *Related WPs: NOAA-WP-04.*

6. 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.

   *Related WPs: JMA-WP-04. NOAA provided confirmation by e-mail.*

7. CGMS Members to update their relevant sections of the CGMS Consolidated Report as appropriate and to send their updates to the Secretariat at least 2 months prior to every CGMS plenary meeting.

   *Input provided by ESA, JMA and NOAA.*

8. CGMS satellite operators to update Table 7 for polar-orbiting satellite equator crossing times on an annual basis.

   ***Closed**. (To be included in permanent action 1). Related WPs: CMA-WP-10, ESA-WP-01/02. NOAA provided input by e-mail.*

9. CGMS Members to provide information for WMO database for satellite receiving equipment, as appropriate.

   *Related WPs: WMO-WP-01. NOAA provided input via e-mail.*

10. CGMS Members to review the list of available list servers used by CGMS groups and update as appropriate.

    *Based on the input provided by the CGMS Members, the CGMS Secretariat advises WMO to carry out the changes.*

11. CGMS Members to update the table on polar-orbiting satellite equator crossing times as well as the table on coverage from geostationary satellites.

    ***Closed.** (To be included in permanent action 1).*

12. 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).

    *Related WPs: ESA-WP-04.*

13. CGMS Members to consider the WIS concept (notion of DCPC, catalogue/metadata standards, protocols) when changing/implementing processing and dissemination systems.

    *Related WPs: JMA-WP-16, WMO-WP-19. See also WG IV discussions.*

14. CGMS Members to consider WMO Core Metadata profiles within the context of the ISO Standard for Geographic Metadata (ISO 19115).

    *Related WPs: NOAA-WP-22.*

**(ii) Actions from CGMS-31**

31.01 Following a request expressed at a EUMETSAT workshop with Arab countries in February 2003, EUMETSAT made a request that India make METSAT data available to Arab region countries. India indicated that this might be possible through the planned use of a Worldspace broadcast satellite. More details would be provided in due course.

***Closed**. Information has formally been provided to WMO and is available on its Internet site. WMO Secretary-General has written to all the WMO Members on this subject.*

31.05 USA to regularly inform CGMS and the World Meteorological Organization (WMO) on the technical specifications for the L-band and X-band direct readout broadcast services on NPOESS.

***Closed**. Table provided by NOAA.*

31.08 CGMS Members to consider continued geostationary coverage over the Indian Ocean beyond 2005 in order to provide WMO Members with the necessary satellite data in support of their national mandates.

***Closed.** EUMETSAT's Council has approved the continuation of the IODC service until the end of 2008.*

31.09 CGMS Members to consider processing of data from functioning satellite instruments for as long as possible.

***Closed.** EUMETSAT provided information on 21 July 2004 and ESA on 10 February 2005.*

31.29 (1) CGMS Members to note and support the upcoming IPWG science meeting. (2) CGMS Members to provide and update the inventory of routinely produced precipitation estimates, either operational or experimental/research, along with training information to the IPWG co-chairs via the IPWG web page. (3) CGMS Members to provide information to the IPWG Rapporteur on areas for future consideration by the IPWG.

***Closed.***

31.49 WMO to report on the output of the questionnaire on dissemination requirements to CGMS.

***Closed.***

**(iii) Actions from CGMS-32**

32.01 The CGMS Secretariat to request observer status in the THORPEX ICSC.

***Closed.***

32.02 The CGMS Secretariat to provide relevant material on the THORPEX Implementation Plan to CGMS Members with a request to reply to Dr. Jim Purdom before the end of July 2004.

***Closed.*** *Related WPs: WMO-WP-27.*

32.03 CGMS Members to provide points of contact responsible for updating the CGMS Consolidated Report.

***Closed*** *for all Members except IOC/UNESCO and NASA. The Secretariat will contact them to request this information.*

32.04 CGMS Members to send inputs to the CGMS Consolidated Report to the CGMS Secretariat.

***Closed****. (See permanent action 7).*

32.05 KMA to inform WMO whether the national payload of COMS could become part of the space-based GOS.

***Closed****.*

32.06 NOAA and CMA to develop operational procedures to avoid interference of their direct broadcasts into the main data dump transmissions of MetOp in the frequency band 7750-7850 MHz.

***Closed.*** *Related WPs: NOAA-WP-22. Also discussed in WG I.*

32.07 NOAA to report back on the analysis of study results concerning potential interference between polar-orbiting meteorological satellites.

***Closed****. See NOAA-WP-18. Discussed in WG I.*

32.08 The CGMS Secretariat to study the feasibility of using IDCS channels I25 and I26 simultaneously in the Russian and USA regions.

***Closed****.*

32.09 CGMS Members to review requirements for IDCS channel capacity in the near and long term future (up to 25 years) and to report to CGMS-33 accordingly.

***Closed.*** *Related WPs: EUM-WP-07, JMA-WP-05, NOAA-WP-10. Discussed in WG I.*

32.10 CGMS Members to examine the feasibility of opening up the use of IDCS channel capacity to a wider user community. Deadline CGMS-33

***Closed.*** *Related WPs: EUM-WP-07, JMA-WP-05, NOAA-WP-11. Discussed in WG I.*

32.11 (1) CGMS Members to identify key calibration publications. (2) Calibration papers from CGMS Members should be posted on a CGMS Web site by the CGMS Secretariat.

***Closed*** *for* ***CMA, ESA, EUMETSAT, JMA, NOAA,*** *and* ***CNES****. This information is being put on the CGMS Secretariat/EUMETSAT Internet site.*

32.12 CGMS Cal/Val focal points to plan to attend the Workshop of the Infrared Visible Optical Sensors (IVOS) subgroup of the CEOS Cal/Val Workshop (12 –14 October 2004) and to present experiences with inter-comparing and calibrating moderate resolution optical environmental satellites.

***Closed.***

32.13 CGMS Members to form local consortia to develop regional ATOVS Retransmission Services in conjunction with EARS. This activity is focused within the WMO Space Programme.

***Closed.*** *Related WPs: EUM-WP-11, JMA-WP-14, WMO-WP-19.*

32.14 CGMS Members are encouraged to present working papers on NWP utilisation of cloud affected radiances at CGMS-33.

***Closed.*** *Related WPs: EUM-WP-13, JMA-WP-15, NOAA-WP-12.*

32.15 CGMS Members to form a task team composed of the Rapporteurs for IPWG, ITWG and IWWG to report back for endorsement by CGMS-33 with requirements and expectations, for (1) host and hosting country and (2) other CGMS Members, with respect to future science/working group meetings (specifically IPWG, ITWG and IWWG).

***Closed by WG II discussions.*** *Related WPs: EUM-WP-13, NOAA-WP-13.*

32.16 CGMS recommends that R&D agencies support, as much as possible, the IPWG request for procuring experimental data sets (e.g. by airborne campaigns) to help cloud/precipitation modelling and instrument definition. A report on the support realised for this IPWG request should be given at CGMS-33.

***Closed*** *for ESA, EUMETSAT, NOAA. Related WPs: ESA-WP-03, EUM-WP-14, NOAA-WP-14.*

32.17 A working group of CGMS Members should be established to draft a master BUFR table for satellite data. CGMS should designate a Rapporteur between this group and the CBS ET on Data Representation and Codes. CGMS Member designated experts will be asked for input and to submit updates at upcoming CGMS meetings. The WMO Space Programme will compile the input and maintain the master BUFR table for satellite data.

***Closed by WG II discussions****. Related WPs: EUM-WP-15, NOAA-WP-15, WMO-WP-20.*

32.18 (1) CGMS Members with satellites that have the capability of detecting fires should develop near real time products for distribution to WMO Members. This activity should be coordinated by the WMO Space Programme in conjunction with the Expert Team on Satellite System Utilisation and Products (ET-SSUP). (2) CGMS Members to report on their capability and plans for fire products and their availability at CGMS-33**.**

***Closed****. Related WPs: CMA-WP-15, ESA-WP-05, EUM-WP-17, NOAA-WP-16, ROSH-WP-02.*

32.19 WMO to immediately inform CM participants that there will be a discussion on the IGEOLab concept at the next session of the WMO Consultative Meetings on High-level Policy on Satellite Matters tentatively scheduled for January 2005. The information should also note the intent to develop two “test” proposals. Interested CGMS Members to nominate a participant in an IGEOLab Task Team that will assist WMO in the preparation of two “test” proposals and a description of the IGEOLab concept.

***Closed****.*

32.20 CGMS Secretariat with WMO assistance to format WMO-WP-05 into a CGMS Global Contingency Plan based on the principles identified in WMO-WP-05**.**

***Closed****. Related WPs: WMO-WP-05.*

32.21 Each CGMS satellite operator to provide a point of contact for updating the WMO report resulting from CGMS-32 WMO-WP-26.

***Closed.***

32.22 CGMS satellite operators for operational meteorological satellites to provide WMO (Dr. Bizzarri: bibizzar@tin.it) with updated information for the WMO report resulting from CGMS-32 WMO-WP-26.

***Closed.***

32.23 WMO (Dr. Bizzarri: bibizzar@tin.it) to assemble available information for R&D missions and instruments for inclusion in the WMO report resulting from CGMS-32 WMO-WP-26 and submit to R&D agencies for validation and update.

***Closed.***

32.24 R&D agencies to validate, update and provide response related to action 32.23 to WMO (Dr. Bizzarri: bibizzar@tin.it).

***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 satellite series FY-1. FY-1D was launched in May 2002 and has exceeded life expectancy by one year. The satellite carries a multi-channel visible and infrared scan radiometer (MVISR) that has ten channels including four visible channels, three near IR channels, one short wave IR channel and two long wave IR channels. FY-1D transmits Chinese High Rate Picture Transmission (CHRPT) to users worldwide and also transmits GDPT and LDPT, which are received only by the National Satellite Meteorological Centre (NSMC) of CMA.

NOAA presented in NOAA-WP-02 the status of the POES spacecraft. The current constellation includes two primary, one secondary, two standby and one non-operational spacecraft. The spacecraft are in circular orbits inclined at approximately 98 degrees (retrograde). The primary operational spacecraft, NOAA-16 and NOAA-17, are in sun-synchronous afternoon and morning orbits, respectively. One secondary spacecraft, NOAA-15, provides additional payload operational data. NOAA-12 and NOAA-14 are standby spacecraft supporting additional user data requirements.

NOAA-18 was launched on 20 May 2005. It replaced NOAA-16 as a primary spacecraft when it became fully operational in August 2005. It operates in an

orbit with a 1:35 pm ascending node (afternoon orbit) and also carries the Microwave Humidity Sounder (MHS) and the Solar Backscatter Ultraviolet Spectral Radiometer (SBUV). Since launch, the High Resolution Infrared Radiation Sounder (HIRS) has experienced high noise in the long wave channels.

NOAA-17 was launched on 24 June 2002. It replaced NOAA-15 as a primary spacecraft when it became fully operational in October 2002. It operates in an orbit with a 10:20 am descending node (morning orbit) and carries a Solar Backscatter Ultraviolet Spectral Radiometer (SBUV). On 15 February 2003 DTR5 failed to operate and on 28 April 2003 the STX3 power degraded to 2 Watts. On 28 October 2003, the AMSU-A1 scan motor failed thus the instrument no longer provides any data. All other systems are operational.

NOAA-16 is the secondary afternoon satellite and operates in an orbit with a 2:11 pm ascending node. It uses a similar set of instruments as NOAA-17, in addition it operates a Solar Backscatter Ultraviolet Spectral Radiometer. In November 2000 the VHF transmitter (VTX) failed, making the broadcast of Automatic Picture Transmission impossible. Further, the data recorder DTR#5 failed in February 2000 and is no longer used. The SARR 243 MHz signal failed in November 2001 and since 17 September 2003 the AVHRR scan motor performance has changed, causing periodic current surges and loss of data. During periods of high scan motor current, the imagery is degraded.

Roshydromet informed CGMS, in ROSH-WP-02, about the status of Meteor-3M N1, launched in December 2001. The satellite is operating in a circular sun-synchronous orbit inclined at 99.6 degrees with a 09:15 am ascending node. The payload includes several instruments of which only the data of MSU-E and SAGE-III are currently available.

***Table 1: Current Polar-Orbiting Satellites Coordinated within CGMS***
*(as of 20 December 2005, sorted by organisation)*

| **Orbit type**<br><br>**(equatorial crossing times)** | **Satellites in orbit** (+operation mode)<br>P=Pre-operational<br>Op=operational<br>B=back-up<br>L=limited availability<br>R= R&D | **Operator** | **Crossing Time**<br>A=Northw<br>D=Southw<br>+Altitude | **Launch date** | **Status** |
|---|---|---|---|---|---|
| **Sun-synchr. "Morning" (6:00 – 12:00) (18:00 – 24:00)** | NOAA-17 (Op) | NOAA | 10:24 (D)<br>810 km | 6/2002 | Functional. AMSU-A1 Failed. |
| | NOAA-15 (B) | NOAA | 05:58 (D)<br>807 km | 05/1998 | Functional (intermittent problems with AVHRR, AMSU-B & HIRS) |
| | NOAA-12 (L) | NOAA | 04:55 (D)<br>804 km | 05/1991 | Functional (except sounding). |
| | DMSP-F16 (Op) | NOAA | 20:13 (A) | 10/2003 | Defence satellite. SSMIS data available to civilian users through NOAA. |

| Orbit type<br><br>(equatorial crossing times) | Satellites in orbit (+operation mode)<br>P=Pre-operational<br>Op=operational<br>B=back-up<br>L=limited availability<br>R= R&D | Operator | Crossing Time<br>A=Northw<br>D=Southw<br>+Altitude | Launch date | Status |
|---|---|---|---|---|---|
| | DMSP-F15 (B) | NOAA | 20:41 (A)<br>850 km | 12/1999 | Defence satellite. SSMT2 (microwave water vapour sounder) non-functional. Data available to civilian users through NOAA. |
| | DMSP-F14 (B) | NOAA | 18:36 (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. |
| | Meteor-3M-N1 (Op) | ROS-HYDROMET | 9:15 (A) | 12/2001 | Functional (with limited capabilities). |
| **Sun-synchr. "Afternoon" (12:00 – 16:00) (00:00 – 04:00)** | NOAA-18 (Op) | NOAA | 13:55 (A)<br>854 km | 5/2005 | Functional. Noise on HIRS long wave channels |
| | NOAA-16 (B) | NOAA | 14:11 (A)<br>850 km | 09/2000 | Functional, no APT. Intermittent problems with AVHRR. |
| | NOAA-14 (B) | NOAA | 19:30 (A)<br>845 km | 12/1994 | Functional. AVHRR and SBUV degraded. |
| **Sun-synchr. "Early morning" (4:00 – 6:00) (16:00 – 18:00)** | FY-1D (Op) | CMA | 08:20 (D)<br>866 km | 5/2002 | Functional. CHRPT |
| | DMSP-F13 (Op) | NOAA | 18:33 (A)<br>850 km | 03/1995 | Defence satellite. On orbit 125 months – estimate 7 months of mission life remaining. Data available to civilian users through NOAA. |

## B.2 Geostationary Meteorological Satellite Systems

In EUM-WP-02 EUMETSAT reported on the operation of its Meteosat System, which currently comprises four satellites: Meteosat-5, -6, -7 and -8.

The orbital inclination of Meteosat-5 at the end of July 2005 was 7.69° and increasing. The remaining hydrazine fuel on board is currently estimated to be 4.39 kg, of which a 3.9 kg reserve will be required to de-orbit the spacecraft at the end of its useful life. The current estimate for end of life is in the 2nd quarter of 2007. The additional lifetime, compared to previous estimates, originates from a more precise estimation of the expected actual thruster performance during the de-orbiting manoeuvres and a reviewed minimum target height for the final orbit.

In addition to operating as the stand-by satellite, Meteosat-6 continues to provide an operational Rapid Scan Service (RSS) since the formal start on 18 September 2001. The inclination of Meteosat-6 at the end of July 2005 was

4.92° and increasing. The remaining hydrazine fuel on board is estimated to be 6.17 kg of which 4 kg is reserved for de-orbiting.

Currently, the primary service at 0° longitude is provided by Meteosat-7 in parallel to primary operational services from Meteosat-8 (formerly called MSG-1) located at 3.4°W with image rectification at 0°. The parallel service of MTP is foreseen until June 2006. Meteosat-6 is the primary service back-up at 10°E whereas Meteosat-5 continues the Indian Ocean Data Coverage Service at 63°E.

The remaining hydrazine fuel on board Meteosat-7 is estimated to be 9.31 kg, of which a 4 kg reserve will be needed to re-orbit the spacecraft at the end of its useful life. It is estimated that the fuel available is enough to allow nominal orbit and attitude control well beyond 2008. It is planned to relocate Meteosat-7 to 63˚E, to take over the IODC service from Meteosat-5 during 2006.

Meteosat-8, launched on 28 August 2002, became operational on 29 January 2004. The spacecraft continues to operate very well and the configuration has remained stable since the failure of a Solid State Amplifier in October 2002. However, on 28 February 2005, at 16:12 UTC, there was solar damage to a detector of the GERB instrument. As a result, GERB operations were suspended from 28 February 2005 and only resumed at the end of the sun avoidance season, on 23 April 2005. Due to the location of their fields of view on the earth, the damaged detectors do not seem to seriously affect the scientific value of the GERB products. Finally, information on the performance of the Meteosat Ground Segment was also provided in the working paper.

India reported on the status of INSAT and the KALPANA-I (Metsat) satellites in IMD-WP-01. INSAT-3A belongs to the third generation of INSAT satellites and was successfully launched on 10 April 2003 and declared operational on 24 April 2003. Its meteorological payload is identical to that of INSAT-2E i.e. a three channel VHRR and a three channel Charged Couple Device (CCD). INSAT-3A also has a data Relay Transponder. The satellite is located at 93.5°E.

The dedicated meteorological satellite KALPANA-I was launched in September 2002. KALPANA-I is equipped with a three channel Very High Resolution Radiometer (VHRR) (VIS, IR and WV) and a Data Relay Transponder (DRT). The satellite has been operational since 24 September 2002 and is positioned at 74°E. The imaging mission is working satisfactorily and continues to be used operationally from the 74°E longitude position. Activities, such as image processing, derivation of meteorological products, data archive and dissemination of products to field stations for operational use, are completed on a routine basis.

India informed CGMS that dissemination of hourly imagery was now available via its website and it expected that half-hourly imagery would be available within one to two years. On a more global scale, distribution using the Worldspace Satellite System was envisaged by around 2007. India agreed to write to the

Secretary General of WMO providing more detailed information and planning on the distribution of INSAT imagery.

EUMETSAT added that, through an agreement with Météo-France and NOAA, it would be able to rebroadcast Indian satellite data through the EUMETCast system.

JMA reported on the status of MTSAT-1R and GMS-5 in JMA-WP-02. The MTSAT-1R, the successor to GMS-5, was launched on 26 February 2005 and declared operational on 28 June 2005, providing full operational distribution of imagery obtained by MTSAT-1R, including DCP and WEFAX services. MTSAT-1R observes 24 full disk images, 24 northern hemisphere images, and 8 south hemisphere images a day and is located at 140˚E. As a result GMS-5 was relocated to the back-up location of 120˚E. The relocation as well as the follow-on de-orbit and shutdown manoeuvres were performed by JAXA, and GMS-5 ended its transmission of signals on 21 July 2005.

JMA expressed its appreciation to NOAA for the support provided by GOES-9 as a back-up to the GMS data collection system. NOAA added that it had to terminate the services of GOES-9 on 12 November 2005, two months after the planned termination date. JMA appreciated this additional service provided by NOAA as it had provided a possibility for inter-calibration activities with MTSAT-1R.

JMA-WP-03 provided information on the MTSAT-1R ground segment and data processing facilities at the Meteorological Satellite Center (MSC). These systems consist of the MTSAT-1R ground system, the satellite data processing system, and the polar-orbiting meteorological satellite data receiving system.

In response to a query from JMA, EUMETSAT and NOAA agreed to provide points of contact for more detailed information on MetOp and NPOESS downlink characteristics.

In CMA-WP-04/05, CGMS was informed by China of the status of FY-2C which replaced FY-2B as primary operational spacecraft. It is the third Chinese geostationary meteorological satellite and was launched on 19 October 2004. The satellite is spin-stabilised and is stationed at 105°E. Its mission is to acquire visible, infrared and water vapour cloud images; transmitting S-VISSR images and low resolution images; data collection; space environment monitoring and it carries VISSR and SEM instruments and transmits 24 full-disc and 4 wind images per day.

In NOAA-WP-03, NOAA reported on the status of its geo-synchronous meteorological satellites. The current Geostationary Operational Environmental Satellites (GOES) are three-axis stabilised spacecraft in geosynchronous orbits. The current primary satellites, GOES-12 and GOES-10, are stationed over the East and West coasts of the United States, respectively.

These satellites are used to provide simultaneous images and soundings of the Western Hemisphere. GOES-11 is stored in orbit and is scheduled for replacement of GOES-10 mid 2006. In cooperation with Japan, GOES-9 is operational at 205˚W (155˚E) providing coverage of the Western Pacific. GOES-8 was deorbited 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 (non-imaging) data relay mode.

The primary instrument payload for the current series of GOES spacecraft is the imager and sounder. The GOES spacecraft also have Space Environmental Monitor (SEM) systems to measure magnetic fields, solar x-ray flux and high-energy electrons, protons and alpha particles. GOES-12 has the new Solar X-Ray Imager (SXI) instrument, which provides real-time images (one per minute) of the Sun in the X-Ray band. A data collection system on the GOES spacecraft receives and relays environmental data sensed by widely dispersed surface platforms such as river and rain gauges, seismometers, tide gauges, buoys, ships and automatic weather stations. Platforms transmit sensor data to the satellite at regular or self-timed intervals, upon interrogation by the satellite, or in an emergency alarm mode whenever a sensor receives information exceeding a present level.

***Table 2: Current Geostationary Satellites Coordinated within CGMS***
*(as of 12 January 2006, sorted by organisation)*

| **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** |
|---|---|---|---|---|---|
| **West–Pacific (108°E-180°E)** | FY-2B (Op, L) | CMA | 123.5°E | 06/2000 | Hemispheric scanning to provide backup observation for FY-2C. Transmission stops in eclipse periods. |
| | MTSAT-1R (Op) | JMA | 140°E | 02/2005 | Fully Functional |
| | GOES-9 (L) | NOAA | 200°W | 05/1995 | Operations of imaging and sounding functions have ceased. Any relocation TBC in 2006. |
| **East-Pacific (180°W- 108°W)** | GOES-10 (Op) | NOAA | 135°W | 04/1997 | Inverted, solar array anomaly, DCP interrogator on back-up |
| **West-Atlantic (108°W-36°W)** | GOES-12 (Op) | NOAA | 75°W | 7/2001 | Solar X-Ray Imager anomaly 9/05 under investigation |
| | GOES-11 (B) | NOAA | 105°W | 05/2000 | In-orbit back-up, 48 hours availability |
| **East-Atlantic (36°W-36°E)** | Meteosat-6 (B) | EUMETSAT | 10°E | 11/1993 | Rapid Scanning Service minor gain anomaly on IR imager |

| 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 |
|---|---|---|---|---|---|
| | Meteosat-7 (Op) | EUMETSAT | 0° | 02/1997 | Functional. (Till 14 Jun 2006) |
| | Meteosat-8 (Op) | EUMETSAT | 3.4°W | 28 Aug 2002 | EUMETCast, no LRIT |
| | MSG-2 (P, to become Meteosat-9 once operational) | EUMETSAT | 6.5°W | 21 Dec 2005 | In commissioning. To be moved to 0° for start of operations. EUMETCast. |
| **Indian Ocean (36°E-108°E)** | FY-2C (Op) | CMA | 105°E | 10/2004 | Functional |
| | FY-2A (B, L) | CMA | 86.5°E | 06/1997 | |
| | Meteosat-5 (Op) | EUMETSAT | 63°E | 03/1991 | IODC, functional but high inclination |
| | INSAT 2-B | IMD | 111.5°E | 07/1993 | Not in use for meteorological services. |
| | INSAT 2-C | IMD | 48.0°E | 12/1995 | Satellite for communications only. |
| | INSAT 2-E | IMD | 83°E | 04/1999 | Not in use. |
| | INSAT 3-C | 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 neighboring countries. No WEFAX broadcast capability in L-band. |
| | Kalpana-1 (Op) (METSAT) | IMD | 74°E | 12 Sep 2002 | Dedicated meteorological satellite. |
| **Indian Ocean (36°E-108°E) (continued)** | INSAT-3A (Op) | IMD | 93.5°E | 10 Apr 2003 | Operationalisation date: 24/04/03. A 3 channel VHRR imager and CCD payload available for use similar to INSAT-2-E. |
| | GOMS-N1 (B) | ROSHYDROMET | 76°E | 11/1994 | Since 9/98 in stand-by |

## B.3 Research and Development Satellite Systems

In ESA-WP-01, CGMS was informed of the status of the current European Space Agency (ESA) Earth Observation missions. Two of them, MSG and MetOp are being developed in cooperation with EUMETSAT.

The ERS-2 satellite, launched in 1995, is currently in limited Low Bit Rate (LBR) operations. A failure of the on-board recorders discontinued the global Low Rate observations on 22 June 2003. Since then the LR mission is continued within the visibility of ESA ground stations over Europe, North Atlantic, the Arctic, North America, Hobart, Beijing and Miami. The ERS HR

SAR products are available in ENVISAT format, whereas the Wave Mode and ATSR, will be made available in ENVISAT format by 2006. This will ensure a homogenous data access covering 14 years of continuous observations. Fuel consumption has been very low, and would under normal circumstances allow a continuation of the mission beyond 2008, including de-orbiting of the satellite. Further detailed information can be found at: http://earth.esa.int/ers/

Envisat, launched on 1 March 2002, has since then orbited in its assigned 35-day repeat cycle, 30 minutes ahead of the ERS-2 satellite. Satisfactory data acquisition and product generation performances have been achieved and a total of 78 different types of products are generated, amounting to about 250 GBytes of product data per day. Several of these products have been tailored to meet the needs of the meteorology community and are available from an FTP server in Near Real Time.

An important part of the Envisat data is transmitted to the ground via the ESA data relay satellite, Artemis, providing Europe with data acquisition capabilities for any location worldwide. Currently, 900 scientific projects are served with data from Envisat. Fuel allowing, the mission is expected to exceed the nominal lifetime of five years by three additional years. More detailed information on the Envisat mission, system, instruments, its products, user services can be found on the Envisat mission website at http://envisat.esa.int/.

The working paper also reported on the status of ESA's small satellite platform PROBA (Project for On-Board Autonomy) carrying, as its principal payload, the Compact High Resolution Imaging Spectrometer (CHRIS). Following a successful year of exploitation in 2004, a new Science Programme has been elaborated and implemented for 2005. The 2005 programme addresses major objectives identified by ESA including support to disaster monitoring as part of the International Charter on Space and Major Disasters among others, as well as the start of 20 new scientific projects.

EUMETSAT informed CGMS about an agreement it had with KNMI (the Royal Dutch Meteorological Institute) enabling the fast delivery of scatterometer data via EUMETCast.

ROSS-WP-01 informed CGMS about a new Russian Earth observation spacecraft "Monitor-E" which was launched on 26 August 2005. The satellite was developed by the Khrunichev Space Research and Production Center. The payload of "Monitor-E" includes two main instruments: a panchromatic survey instrument with 8-meter spatial resolution and a multi-spectral survey instrument with 20-meter resolution. This spacecraft is now under flight test.

***Table 3: Current R & D satellites discussed within CGMS***
*(as of 27 November 2005, 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 |
| 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 ensured over ESA agreed acquisition stations. Operations funding extended till 2008. |
| ENVISAT | ESA | 10:00 (D) 800 km | 03/2002 | ASAR, AATSR, MERIS, GOMOS, MIPAS, SCHIAMACHY, RA-2, MWR, DORIS | All instruments working nominally but MIPAS operated at discontinuous scenario since Jan 2005. Operations funding extended 3 years (till 2010) |
| PROBA | ESA | 10: 30 (D) 615 km | 10/2001 | CHRIS | Drifting orbit. Technology experiment. AO Science mission since 2003. |
| TRMM | JAXA/ NASA | 402 km non-sun-synchr. | 11/1997 | Precipitation Radar equipment Advanced Microwave scanning Radiometer (AMSR-E) provided by JAXA and satellite bus and other instruments provided by NASA | Measures tropical rainfall/precipitation and radiation energy |

| **Satellites in orbit** (+operation mode) | **Operator** | **Crossing Time** A=Northw D=Southw +Altitude | **Launch date** | **Application/ instruments** | **Status, Application and other information** |
|---|---|---|---|---|---|
| ACRIMSAT | NASA | 716 km sun-synchr. | 20/12/1999 | ACRIM III | Active Cavity Radiometer Irradiance Monitor Satellite<br>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<br>Poseidon-2 solid state radar altimeter<br>DORIS receiver<br>Jason Microwave Radiometer<br>BlackJack GPS Receiver tracking system | Ocean surface topography<br>Follow-on mission to TOPEX/P. Monitor global ocean circulation for global climate prediction. |
| 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) |
| ERBS (Earth Radiation Budget Satellite) | NASA | 585 km non-sun-synchr. | 05/10/1984 | ERBE<br>SAGE II | Studies how energy from the Sun is absorbed and re-emitted by the Earth |
| 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 |

| **Satellites in orbit** (+operation mode) | **Operator** | **Crossing Time** A=Northw D=Southw +Altitude | **Launch date** | **Application/ instruments** | **Status, Application and other information** |
|---|---|---|---|---|---|
| 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 mission concepts in flight |
| 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 and operational weather forecasting and storm warning |
| SAGE III (Stratospheric Aerosol and Gas Experiment ) | NASA/ FSA | 1020±20 km | 10/12/2001 | SAGE III | will provide accurate long-term measurements of the vertical structure of aerosols, ozone, water vapour, and other trace gases in the upper troposphere and stratosphere |
| 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 |
| UARS (Upper Atmosphere Research Satellite) | NASA | 585 km non-sun-synchr. | 15/09/1991 | - ISAMS (Improved Stratospheric and Mesospheric Sounder)<br>- MLS (Microwave Limb Sounder)<br>- HALOE (Halogen Occultation Experiment)<br>- HRDI (High Resolution Doppler Imager)<br>- WIND II (Wind Imaging Interferometer)<br>- ACRIM (Active Cavity Radiometer Irradiance Monitor)<br>- SOLSTICE (Solar-stellar Irradiance - Comparison Experiment)<br>- SUSIM (Solar Ultraviolet Spectral Irradiance Monitor)<br>- PEM (Particle Environment Monitor)<br>- CLAES (Cryogenic Limb Array Etalon Spectrometer) | Study of stratosphere, provision of mesosphere and thermosphere data |
| 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 |
| Monitor-E | ROSCOSMOS | (550 km) (10:30) | 08/2005 | Land Observing Satellite | |

## B.4 Anomalies from solar and other events

NOAA-WP-04 informed CGMS on solar activities occurring from July 2004 through September 2005. These occurrences were associated with the most highly energetic proton events of Solar Cycle 23. Several major solar flares

and geomagnetic storms occurred even as the solar cycle continued beyond the solar maximum observed around the year 2000. NOAA informed CGMS that it is typical for energetic electron activity to increase in the waning years of a solar cycle as recurrent coronal holes produce regular intervals of high speed solar wind that interact with the Earth's magnetic field.

Two periods of very high levels of electron flux occurred on 28-31 July 2004 and 18-19 May 2005. For the former period, region 649 and 652 produced a number of major flares (X- and M-class), ultimately having an impact on associated CMEs from which major and severe geomagnetic storms resulted days later.

Furthermore, the Working Paper reported on satellite failures or event upsets which can be caused by space weather effects, although the exact nature of the role of space weather is hard to define. Usually, cumulative bulk surface charging occurs in an environment of high electron fluence, which can lead to a major discharge event, possibly causing temporary or permanent satellite disruptions.

The Chairman noted that NOAA was the only satellite operator reporting such information on space weather and queried whether satellite operators were able to provide similar information on a regular basis. Whilst noting this was already a permanent action, China, EUMETSAT, India and Japan informed the meeting that although they had no active space environment monitoring capabilities on their satellites, they were able to provide information on e.g. single event anomalies possibly caused by space weather effects, adding that this information is normally provided in the routine quarterly reports. ESA recalled that it had provided information on space weather anomalies one or two years ago and would be happy to provide further information, as applicable, at future meetings of CGMS.

## C. REPORT ON FUTURE SATELLITE SYSTEMS

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

The status of the EUMETSAT Polar System (EPS) was presented in EUM-WP-03. The launch period of the first MetOp satellite has been set for 30 June 2006, from Baikonur. With an expected 45-month lifetime of NOAA-M, launched in June 2002, and a launch of the first MetOp satellite in 2006, there should be no (or little) gap in the morning orbit service. The EPS system will be operated for an initial period of 14 years. EUMETSAT has decided to use its EUMETCast system for the real-time dissemination of MetOp products to users.

The working paper added that the EPS Ground System Integration, Verification and Validation (IVV) strategy had been defined in order to optimise the schedule to allow the start of the system integration as early as possible with a first version of the Ground Segment, and to focus efforts on

launch critical functions up to the time of the first satellite launch. In addition, a detailed status on the readiness of the Space and Ground segments was provided, both of which are undergoing several acceptance reviews and test phases.

The first MetOp satellite to be launched will be MetOp-2 (to be renamed MetOp-A after launch) and MetOp-1 will go into storage until required for a follow-on launch.

In EUM-WP-10, EUMETSAT informed CGMS on its plans for post-EPS which would be the continuation of the EPS operational programme from around 2020. With EPS being part of the Initial Joint Polar System and including satellites from NOAA, both NOAA and EUMETSAT are interested to continue cooperation towards a future joint system, also in view of wider cooperation initiatives within the framework of the Global Earth Observation System of Systems (GEOSS). EUMETSAT stated that post-EPS preparation activities were being undertaken jointly with ESA, such as the collection and review of user requirements together with an identification of synergies within the framework of the Global Monitoring for Environment and Security (GMES) initiative.

In CMA-WP-06/07, China informed CGMS on its development of FY-3, a new series of polar-orbiting meteorological satellites. There will be 8 satellites in the series, starting with FY-3A and ending with FY-3H, and covering the period from 2007 to 2020. The paper described the mission and the instruments of FY-3. Compared with the FY-1 series, new instruments to be added include the Medium Resolution Spectral Imager (MERSI), the Microwave Radiation Imager (MWRI). Sounding instruments include the Infrared Atmospheric Sounder (IRAS), the Microwave Temperature Sounder (MWTS), and Microwave Humidity Sounder (MWHS). Also, there will be a Total Ozone Unit and Solar Backscatter Ultraviolet Sounder (TOU/SBUS). FY-3A is planned for launch in 2007 and China added that it was considering operating its satellite in either morning or afternoon orbits.

Roscosmos informed CGMS, in ROSS-WP-02, on its activities to create a new generation of hydro-meteorological polar-orbiting satellites, Meteor-M, within the framework of the Federal Space Program of Russia. The spacecraft has a wide range of onboard devices including not only meteorological instruments but also some additional observing devices for remote sensing of the Earth and for helio-geophysical parameters. It is assumed that Meteor-M will be manufactured in 2006, with an expected launch at the end of 2006, and with a service life of at least five years.

NOAA-WP-05 discussed NOAA's future polar-orbiting meteorological satellite systems. NOAA addressed the current operational system and the planned launch schedule for NOAA-N'. Information was provided on international polar-orbiting satellite programme coordination between EUMETSAT and NOAA. 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. 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 Working Paper also presented the development and implementation plans for NPOESS. Beginning later this decade, NPOESS spacecraft will be launched into three 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. The advanced technology visible, infrared, and microwave imagers and sounders that are being developed for NPOESS will deliver higher spatial and temporal resolution atmospheric, oceanic, terrestrial, and solar-geophysical data. This will lead to more accurate short-term weather forecasts, as well as serving the data continuity requirements for improved global climate change assessment and prediction. The NPOESS programme is well along 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. These activities represent a sound beginning for achieving the planned national and international operational satellite programmes that will ensure continuous support to a variety of users well into the 21st century. It was also noted that the earliest possible launch date for NPOESS is 2011.

NOAA clarified that for NOAA-N', December 2007 was the launch readiness date, however, the actual launch date could be later, provided that NOAA-18 continues to function satisfactorily. The NPP satellite would probably move from the 09.30 am to the 14.40 pm orbit with a launch date some 6-12 months later than the currently foreseen launch date in 2008. NOAA agreed to provide updated information at the next meeting of CGMS.

In addition, NOAA agreed to provide further information on the restructuring on the NPOESS programme by mid December 2005. CGMS noted that for the mid-morning orbit coverage would only be provided by MetOp until around 2015. In addition NOAA confirmed that the direct readout from NPP satellite would most likely only be available in X-band.

***Table 4: Future Polar-Orbiting Satellites Coordinated within CGMS***
*(as of 23 January 2006, sorted by organisation)*

| Orbit type (equatorial crossing times) | Future additional Satellites | Operator | Planned launch date | Other information |
|---|---|---|---|---|
| **Sun-synchr. "Morning" (6:00 – 12:00) (18:00 – 24:00)** | FY-3A | CMA | 2007 | (836 km) (10:00) AHRPT/MPT |
| | FY-3B | CMA | 2010 | (836 km) (14:00) AHRPT/MPT |
| | MetOp-1 | EUMETSAT | 12/2009 | (837 km) (09:30D) HRPT |
| | MetOp-2 | EUMETSAT | 06/2006 | (837 km) (09:30D) HRPT |
| | MetOp-3 | EUMETSAT | 06/2015 | (837 km) (09:30D) HRPT |
| | DMSP-S18 | NOAA | 10/2007 | (SSMI/S) |
| | NPOESS Preparatory Project (NPP) | NOAA/NASA | 04/2009 | (833 km) (10:30 D) (VIIRS, CrIS, ATMS, OMPS) HRD |
| | NPOESS | NOAA | 2011 (NET) Date will be determined by need | 21:30 (A) 833 km |
| | METEOR M-N1 | ROS-HYDROMET | 2006 | (10:20) AHRPT |
| | METEOR M-N2 | ROS-HYDROMET | 2008 | (10:20) AHRPT |
| **Sun-synchr. "Afternoon" (12:00 – 16:00) (00:00 – 04:00)** | NOAA-N' | NOAA | 2008 (TBC) | (14:00) |
| | NPOESS | NOAA | 2011 (NET) Date will be determined by need | 13:30 (A) 833 km |
| **Sun-synchr. "Early morning" (4:00 – 6:00) (16:00 – 18:00)** | DMSP-S17 | NOAA | 04/2006 | (SSMI/S) |
| | DMSP-S19 | NOAA | 10/2009 | (SSMI/S) |
| | DMSP-S20 | NOAA | 10/2011 | (SSMI/S) |
| | NPOESS | NOAA | 2011 (NET) Date will be determined by need | 17:30 (A) 833 km |
| **Non-sun-synchr.** | OSTM (Ocean Surface Topography Mission) | NASA/ NOAA/ EUMETSAT/ CNES | 06/2008 | follow-on of Jason-1 mission sea surface topography measurement 1336 km |

## C.2 Future Geostationary Meteorological Satellite Systems

EUMETSAT reported on the status of preparation of MSG-2, MSG-3 and MSG-4 in EUM-WP-04. Mainly due to Ariane-5 launcher problems, the launch of MSG-2 has been postponed several times. It was now scheduled for launch on 21 December 2005 and will be renamed Meteosat-9, once operational. It will then become the prime operational spacecraft at 0˚. Meteosat-8 will then be relocated to 3.4˚W.

The overall system readiness of the MSG-2 System, involving satellite, launch service, Ground Segment and Operations preparations, was assessed at a System Readiness Review which was successfully concluded in early November 2004. Concerning MSG-3, scheduled for launch in 2009, the satellite integration and system test phase has been completed and the satellite will be kept in an intermediate storage configuration until the end of the MSG-2 launch campaign, after which it will be placed in long-term storage.

Additionally, once MSG-2 is fully operational, Meteosat-7 will be relocated very close to 63°E, over the Indian Ocean. This will allow EUMETSAT to provide coverage of the Indian Ocean beyond 2005, until at least 2008, as approved by EUMETSAT's Council in June 2004. At the same Council meeting, the Resolution on the MSG Programme Extension entered into force. This includes an additional MSG-4 satellite, a GERB-4 Instrument and the extension of the MSG operational service until 2018. Related agreements have been signed with both ESA and Industry.

EUMETSAT added that whilst Meteosat-9 dissemination will be via EUMETCast there will also be a standard LRIT broadcast. This will also be the case for MSG-3 and MSG-4.

EUM-WP-09 informed CGMS of joint preparatory activities between EUMETSAT and ESA for the definition of a Meteosat Third Generation (MTG) geostationary mission which was expected to be available in the 2015 timeframe.

Pre-phase A studies were nearly complete and were driven by high level user needs and priorities established over the period 2000-2003 throughout the post-MSG user consultation process and are currently under evaluation by ESA and EUMETSAT. At system level these pre-phase A studies are still of an exploratory nature, aiming at providing relevant information for EUMETSAT Delegate Bodies to decide on relevant and affordable mission concepts to be further studied during feasibility (phase A) studies in the 2006-2007 timeframe. Activities have been kicked off by European industrial consortia through competitive tendering (contracted by ESA, supervised by EUMETSAT) where final results will be presented by the end of 2005. EUMETSAT has established an MTG Mission Team in order to provide independent short loop user and scientific feedback in the course of the studies. The development of the space segment and ground segment is envisaged for the 2014 timeframe.

An open workshop was held in April 2005 to narrow down the pre-selection of proposed mission concepts and decisions on the way forward will be proposed after completion and analysis of the results of pre-phases A studies. This will reduce the uncertainties on the scope of the mission concepts to be further considered and traded off during feasibility (phase A) studies. Further details can be found at http://www.eumetsat.int, under Preparation of Future

Programmes; Meteosat Third Generation (MTG); “Towards MTG – METEOSAT Third Generation”.

India informed CGMS on its plans for future INSAT satellites with meteorological applications in IND-WP-02. Under the INSAT-3 Programme, a new Geostationary Meteorological Satellite INSAT-3D is being developed. It will have an advanced imager with six channels and a nineteen channel sounder for the derivation of atmospheric temperature and moisture profiles. It will provide 1 km resolution imagery in the visible band and 4 km resolution imagery in the IR bands. The sampling rate of the imaging mission of INSAT-3D will be every half hour. INSAT-3D is scheduled for launch early 2007 and will provide much improved capabilities to the users of meteorological data from satellites.

JMA provided a report on its plans for the future Multifunctional Transport Satellites, the successor of GMS-5, in JMA-WP-05. MTSAT-2 will be launched by March 2006, and be located at either 135˚E or 145˚E and will act as a standby satellite until mid 2010 when it will take over as the primary spacecraft from MTSAT-1R at 140˚E. The expected life time is 5 years.

The latest information on the MTSAT satellite series is available at JMA’s website (http://www.jma.go.jp/jma/jma-eng/satellite/index.html).

In JMA-WP-06, JMA presented its long-term activities on how to materialise a robust satellite observing system. Due to the failure of GMS-5 and the resulting cooperation between NOAA and JMA to successfully backup GMS-5 with GOES-9, and recognising that space-based Earth remote sensing missions have inherent risk, including launch failure and in-orbit spacecraft failure, NOAA and JMA signed a long-term implementing arrangement on 23 February 2005. This arrangement guarantees continuous geostationary satellite coverage of the East Asia and the Western Pacific, in case either agency experiences a spacecraft failure (see also NOAA-WP-23). Furthermore, NOAA and JMA agreed to provide geostationary backup coverage in an emergency, and monitor typhoons and other severe weather that threaten both nations. If either a NOAA or JMA geostationary spacecraft stops operating and there is no available national back-up satellite, then the partner agency would temporarily move one of its satellites, if available, toward the appropriate region and provide coverage for up to one year - at no cost. This would allow the other agency time to recover from the failure and launch a replacement spacecraft. The long-term implementing arrangement will enter into force once JMA has two operable geostationary meteorological satellites, one operational satellite positioned at 140° East, and one that is not required for any other mission, and therefore available for backup.

The paper further stated that JMA has started concept studies on the follow-on satellite to MTSAT-2, aiming at completing its manufacture and launch by 2015 or earlier, in order to put in place a robust satellite observing system covering the Western Pacific as early as possible. The concept studies

include preparatory activities to arrange for a tentative mission specification for the follow-on satellite this year.

CMA reported in CMA-WP-08/09 on its continuation of the FY-2 programme with FY-2D/E/F/G satellites that have been approved for the period 2006–2015. The mission and function of FY-2D/E will be similar to those of FY-2C. Some improvement is foreseen with FY-2F/G, for instance, the provision of 48 images per day, all year round (28 discs and 20 Northern Hemisphere scan images), and increased lifetime and operational stability. The planned launch schedule for FY-2D/E/F/G will maintain operational continuity by providing a continuous stream of satellites in orbit.

Roscosmos informed CGMS, in ROSS-WP-03, on its continued development of the new geostationary meteorological satellite GOMS No. 2/Electro-L. The satellite is planned to be launched in 2007 and will be placed into a geostationary orbit at 76°E. A second GOMS satellite is foreseen for 2009. The spacecraft will be three-axis stabilised and carry an MSU-GS, a multi-zonal scanner with parameters close to those of the SEVIRI, as well as standard DCS equipment. GOMS No. 2/Electro-L will also relay data between weather centres, poll autonomous meteorological stations, receive and retransmit signals from Search and Rescue beacons of the COSPAS/SARSAT system. Furthermore, the satellite will carry seven helio-geophysical sensors.

In NOAA-WP-06 NOAA reported on the future GOES system. The GOES-N spacecraft is scheduled to be available for launch by November 2005; GOES-O, currently in ground storage at the spacecraft contractors, is scheduled for launch by April 2007. GOES-P is currently completing integration and is ready to start system testing. GOES-P will be placed in ground storage in late 2006 and is planned to be launched in October 2008.

Instrumentation will continue to be the present five channel imagers and eighteen channel filter wheel Sounders with the horizontal resolution of the imagers improved to 4 km in all IR channels, including the 13.3 micrometer channel. At least two SXI instruments will fly on the GOES-N series and the latter will have the WEFAX service upgraded to a digital LRIT system for distribution of data products. The GOES-N series will provide a dedicated Emergency Manager's Weather Information Network (EMWIN) for data products and warnings. An enhanced Data Collection System (DCS) will be provided allowing for the interrogation of more remote terminals.

In addition to these instrument and service upgrades, a number of GOES-N series spacecraft improvements are planned. Some of the most important changes include: increasing the GOES-R satellite design life from seven to ten years; the power subsystem has been upgraded to allow for continuous operations during eclipse; and the satellite attitude control system has been upgraded to utilise stellar inertial navigation allowing improved Image Navigation and Registration (INR) performance.

GOES-R procurement activities are well underway and each satellite in this series will carry a new Advanced Baseline Imager (ABI) which will have approximately 16 channels. The satellite will carry five instruments; the Hyperspectral Environmental Suite (HES), Solar Imaging Suite (SIS), and Space Environmental In-Situ Suite (SEISS) instruments; the Advanced Baseline Imager (ABI); and a Geostationary Lightning Mapper (GLM). The new GOES-R instruments will advance operational environmental remote sensing technology by several decades which will provide four-times the environmental information over a greater geographical location in less time, at higher resolution and with higher spectral content. The GOES-R programme will meet NOAA's mission objectives for continuous observations of atmospheric, oceanic, climatic, solar, and space infrared and imaging data of the northern hemisphere surface and atmosphere; supporting all of NOAA's mission goals in ecosystems, climate, weather and water, and commerce and transportation. Launch is currently scheduled for September 2012.

***Table 5: Future Geostationary Satellites Coordinated within CGMS***

*(as of 20 December 2005, sorted by organisation)*

| 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 | 2009 | 0° |
| | MSG-4 | EUMETSAT | 2010 | 0° |
| | GOES-N | NOAA | 02/2006 (NET) | 135°W or 75°W |
| | GOES-O | NOAA | 2007 (TBC) | 135°W or 75°W |
| | GOES-P | NOAA | 2008 | 135°W or 75°W |
| | GOES-R | NOAA | 2012 | 135°W or 75°W |
| **Indian Ocean (36˚E-108˚E)** | FY-2D | CMA | 2006 | 5 channel VISSR, LRIT |
| | FY-2E | CMA | 2009 | 5 channel VISSR, LRIT |
| | FY-2F | CMA | 2011 | 5 channel VISSR, LRIT |
| | FY-2G | CMA | 2013 | 5 channel VISSR, LRIT |
| | Electro-L N1 | ROS-HYDROMET | 2007 | 76°E |
| | Electro-L N2 | ROS-HYDROMET | 2009 | 76°E or 14.5°E (TBC) |
| | INSAT-3D | IMD | First quarter 2007 | Location TBD. Dedicated Meteorological mission with improved 6 channel Imager and a 19 channel Sounder. |
| **West-Pacific (108˚E-180˚E)** | MTSAT-2 | JMA | 15 Feb 2006 | Multifunctional Transport Satellite 135°E or 145°E (in-orbit back-up to MTSAT-1R until 2010) 140°E (operational from 2010) |

| Sector | Future additional satellites | Operator | Planned launch | (Planned location) Other remarks |
|---|---|---|---|---|
| | COMS | KMA | 2008 | 5 channel HRIT/LRIT 116.2°E or 128.2°E |

WMO-WP-22 reviewed the events following the CGMS-32 decision to promote international cooperation for implementing demonstration missions according to the International Geostationary Laboratory concept (IGEOLab). After a Preparatory Task Team meeting held in Geneva in December 2004, the IGEOLab concept was approved by the 5th Consultative Meeting on High-level Policy on Satellite Matters, held in Geneva in January 2005. Two Focus Groups were established for the GIFTS and GOMAS proposals respectively.

The Geostationary Imaging Fourier Transform Spectrometer (GIFTS) was rated as a valuable risk-reduction project for future geostationary infrared hyperspectral sounders and could be accommodated aboard the Russian Elektro-L spacecraft to be launched in 2009. It could also support satellite inter-calibration and complement operational atmospheric motion wind observations in support of GEOSS. The feasibility and cost of GIFTS flight is being investigated in further detail.

It was acknowledged that the Geostationary Observatory for Microwave Atmospheric Sounding (GOMAS) addressed an essential parameter (precipitation), with a promising technology (microwave in GEO orbit). Further developments are needed both on scientific and technical aspects and were expected to be pursued within the framework of the R&D programme of a Space Agency.

WMO-WP-22 Addendum 1 provided results of the 2nd meeting of the IGEOLab Focus Group on GEO-microwave which was aimed at consolidating as many aspects as possible of the science backing the GEO-microwave concept in order to better address future efforts. Progress in all areas was recorded, and a list of items for further study was agreed as follows:

1) to provide quantitative evidence on the impact of time sampling on products quality, function of regional climatology and addressed application;
2) to continue work on the basic relationships between mm-submm observation and precipitation at ground;
3) to focus on image processing activities aimed at enhancing resolution;
4) to focus on the characterisation of temperature and humidity profiles as a deliverable, specifically in cloudy areas as close as possible to precipitating cores;
5) to continue investigating how Cloud Resolving Models used in predictive mode may help precipitation retrieval and to continue to analyse which data from GEO-microwave provide more valuable information for NWP;
6) to implement an airborne campaign as soon as a Lead Agency for the IGEOLab GEO-microwave undertaking shows up.

It was noted that the continuation of the current studies and the need to better focus certain aspects is at serious risk due to the recent or upcoming termination of all studies awarded on the subject by ESA and EUMETSAT.

**Recommendation 33.01 It is recommended that CGMS encourages its Space Agency Members to provide continuity of funding for the scientific studies, pending the establishment of a consolidated study programme once a space agency has accepted the role of the lead space agency in the implementation of the IGEOLab GEO microwave project.**

The next meeting of the IGEOLab GEO-microwave Focus Group, FG-3, will be organised in April 2006 and will attempt to involve other interested parties in IGEOLab, beyond the restricted GOMAS-Team that was invited at FG-2.

Furthermore, WMO reported on the update on the IGEOLab GIFTS on Elektro-L No. 2 in WMO-WP-22, Addendum 2, and informed CGMS of the status for GIFTS activities after a Technical Meeting between the Space Dynamics Laboratory (SDL), Roscosmos, Planeta and the Lavochkin Association. The meeting concluded that, from a technical viewpoint, it is feasible to accommodate GIFTS on Elektro-L, provided that a number of activities are embarked very soon. In addition to working on the platform, work is also necessary on the payload since the currently available Engineering Demonstration Unit is not suitable for flight. SDL, Lavochkin and Roscosmos have signed a protocol for cooperating on assessing all details of the activity, and will provide a proposal in the next couple of months. Funding has been identified as the main critical item, especially on the USA side, for converting the EDU into a flight model. If this is solved in the next few months, a further Focus Group meeting will be called in spring 2006 aimed at enlarging international participation to the project.

## C.3 Future Research and Development Satellite Systems

ESA-WP-02 informed CGMS of the status of the future ESA Earth Observation missions. Two of them, MSG and MetOp are in cooperation with EUMETSAT. The Living Planet Programme has three lines of implementation: Earth Explorer satellites, Earth Watch satellites, plus services & applications demonstration.

After decisions on the implementation of SWARM and EarthCARE missions, a new Core Explorer is under selection.

CRYOSAT was launched on 8 October 2005, but failed to reach orbit due to a problem with the second stage of the launcher. ESA added that it hoped it would be able to procure a second CRYOSAT, however this could take up to 2-3 years to realise, since currently there was no formal approval.

The Earth Watch programme includes, since January 2002, the Global Monitoring for Environment and Security (GMES) services element. From the 10 portfolios selected, six will start services as from September 2005. The ESA proposal for the GMES space component programme is under preparation in view of the Ministerial conference foreseen in December 2005.

ESA informed CGMS about its proposal for a GMES space component which encompasses the development of new “Sentinel” missions and coordination with, and access to, other national and European missions. Five Sentinels are under definition, plus a "data gap filler" (GMES-1) for the period 2010/2011:

Sentinel-1: C-band SAR mission
Sentinel-2: a multispectral optical imaging mission
Sentinel-3: an ocean monitoring mission
Sentinel-4: a geostationary element for monitoring of atmospheric composition
Sentinel-5: a low-Earth orbit element devoted to the monitoring of atmospheric composition

ESA remarked that, to date, there was no clear data policy for provision of data to users from the Sentinel missions.

In JAXA-WP-01, CGMS was informed about the Advanced Land Observing Satellite (ALOS), scheduled for launch in Japanese fiscal year 2005. ALOS, will contribute to mapping, precise land coverage observation, disaster monitoring and resource surveying. The satellite is equipped with a Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM), which is comprised of three sets of optical systems to measure precise land elevation. Furthermore, it is equipped with an Advanced Visible and Near Infrared Radiometer type 2 (AVNIR-2) for the observation of land surfaces and the Phased Array type L-band Synthetic Aperture Radar (PALSAR), which enables day-and-night and all-weather observations.

In JAXA-WP-02, JAXA described the Greenhouse Gases Observing Satellite (GOSAT), provisionally scheduled to be launched in August 2008. GOSAT is a satellite to monitor the carbon dioxide (CO2) and the methane (CH4) globally from orbit and it aims to contribute to international efforts to prevent global warming, such as the Kyoto Protocol. It is a joint project of Japan Aerospace Exploration Agency (JAXA), the Ministry of Environment (MOE) and the National Institute for Environmental Studies (NIES). JAXA is responsible for satellite development, launch, and satellite operation. JAXA and MOE are in charge of the sensor development. MOE and NIES are responsible for satellite data utilisation.

In response to a query from the Chairman, JAXA confirmed that near real time GOSAT data would, for the time being, not be available to WMO Members since the satellite was classified as an R&D satellite and a data policy had not yet been defined. However, it agreed to provide further information at CGMS-34.

Roscosmos informed CGMS, in ROSS-WP-04, that it is planned to launch three new R&D satellites in the 2005-2006 timeframe: Kompas-2, Resurs-DK and Baumanets. Kompas-2 is a microsatellite for measuring and investigating high and low frequency electromagnetic radiation, electron concentration in the ionosphere and nuclear particles in near-Earth space. Its prime objective is to investigate earthquake prediction possibilities. Resurs-DK will receive panchromatic and multispectral images of the Earth at a high spatial resolution in a wide swath and its prime objective is to obtain precise panchromatic and multispectral images of the Earth for various economical and commercial applications, such as ecology, mapping, forestry monitoring, cadastre production, agriculture and disaster monitoring. Baumanets is a very small satellite with a prime objective of enabling students to acquire practical experience in space technology both in terms of provision of experiments and reception and processing of satellite data.

***Table 6: Future R&D satellites discussed within CGMS***
*(as of 27 November 2005, sorted by organisation)*

| Satellites | Operator | Crossing Time | Planned launch date | Application and other information |
|---|---|---|---|---|
| CRYOSAT-2 | ESA | 717 km | TBC | Polar ice monitoring Replacing CRYOSAT-1 lost due to launch failure in October 2005. |
| GOCE | ESA | 250 km (dawn-dusk) | 11/2006 | Gravity mission |
| SMOS | ESA | 755 km (6:00 A) | 09/2007 | Salinity & Soil moisture |
| ADM-Aeolus | ESA | 405 km (18:00 A) | 09/2008 | Wind profile |
| ALOS | JAXA | 10:30 700km sun-synchronous | 12/2005 | Advanced Land Observing Satellite (mapping, precise land coverage observation, disaster monitoring, resource surveying) |
| GOSAT | JAXA & Japan's Ministry of Environment | 13:00 666km sun-synchronous | 08/2008 | Greenhouse Gases Observing Satellite monitoring the distribution of the density of carbon dioxide |
| OCO | NASA | 705 km sun-synchronous polar | 09/2008 | Orbiting Carbon Observatory (observations of atmospheric carbon dioxide) |
| HYDROS | NASA | 670 km 6 AM/ 6 PM sun-synchronous | 9/2010 | Hydrosphere State Mission Earth's changing soil moisture and land surface freeze/thaw conditions |
| CALIPSO | NASA/ CNES | 705 km sun-synchronous | 11/2005 | Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations for climate predictions |
| Aquarius | NASA/CONAE | 657 km sun-synchronous | 03/2009 | global sea surface salinity (SSS) |

| Satellites | Operator | Crossing Time | Planned launch date | Application and other information |
|---|---|---|---|---|
| CloudSAT | NASA/ CSA | 705 km sun-synchronous | 11/2005 | global cloud properties (applications: air quality, aviation safety, disaster management, energy and water management) |
| GPM | NASA/JAXA | 407 km Non sun-synchr. (core-satellite) | 2010 | Global Precipitation Measurement, follow-on and expanded mission of the current on-going TRMM |
| LDCM (Landsat Data Continuity Mission) | NASA/US Geological Survey | 828 km (at equator) sun-synchronous | 07/2010 | Extension of Landsat record of multispectral 30m resolution |
| Glory | NASA | 824 km sun-synchronous | 12/2008 | 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 |
| Kompas-2 | ROSCOSMOS | 400-550 km 79° | 11/2005 | Monitoring of anomaly phenomena in the Earth ionosphere |
| Baumanets | ROSCOSMOS | 490-500 km (11:30) | 2006 | Land observing satellite |
| Resource-DK | ROSCOSMOS | (350 km) | 2006 | Land Observing Satellite |

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

See discussions of WG III.

## D. OPERATIONAL CONTINUITY AND RELIABILITY

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

WMO introduced WMO-WP-23 which collected essential information on satellites and instruments that form the space-based component of the GOS at the nominal date of September 2005, and including some updates and complementary information with respect to the first issue presented at CGMS-32, in WMO-WP-26. The document was compiled by Dr Bizzarro Bizzarri, WMO consultant, on the basis of:

- information provided by satellite operators members of CGMS at their annual meetings;
- extensive search on the Web for missing information, details and latest updates;
- books and personal notes, especially for the historical elements.

The structure of the document is such that it will provide, when updated on an annual basis, a short historical background on the various programmes, a slowly evolving framework on current and developing systems/instruments, and a more evolutionary framework for input of the latest information on systems/instruments that are still in their definition phase.

An effort has been made to provide template-like information in order to ensure homogeneity and completeness, and to facilitate comparisons of programmatic elements and performances. The purpose is to provide an available and simple tool to check to what extent Earth Observation satellites fulfil WMO requirements in terms of both coverage and quality.

The following systems have been considered:

- the constellation of operational meteorological geostationary satellites;
- the constellation of operational meteorological sun-synchronous satellites;
- a selection of R&D programmes conducted by space agencies associated with CGMS.

It should be noted that some information is still missing or needs confirmation, both in the chapters dealing with operational meteorological satellites and, even more, in the new chapter on R&D missions.

CGMS noted the status of current and planned satellites of the GOS at the nominal date of September 2005, i.e. close to CGMS-33, special attention being given to the sections reporting the analysis of compliance of GOS with WMO requirements in terms of observation coverage (Sections 2.9 and 3.8) and instrument performance (Sections 2.10 and 3.9). CGMS Members were invited to carefully check the information provided in the document and to contribute to resolve doubtful or missing areas soon after CGMS-33. It was agreed that the present document, incorporating the latest inputs received at the time of CGMS-33 would be published by WMO early in 2006, while further updates would be used for the next issue to be presented at CGMS-34. To this purpose, CGMS Members are recommended to designate a contact point to interact with Dr. Bizzarri at bibizzar@tin.it. The attention of CGMS Members was also raised to the quality and completeness of the information provided on satellites and instruments on their various websites.

**Recommendation 33.02 CGMS Members are encouraged to ensure that the description of their programmes on their websites contains an adequate level of technical information.**

**Action 33.01 CGMS Members to continue interacting with WMO (Dr Bizzarro Bizzarri < bibizzar@tin.it >) in order to resolve any doubtful or missing information to complete the next issue of the "Status of the space-based component of the Global Observing System (GOS)". Any further updates**

**submitted as part of Agenda items B1, B2, B3, C1, C2 and C3 should be delivered, if possible, at least one month in advance of CGMS-34 to allow final tuning of the report before CGMS plenary.**

### D.2 Inter-regional contingency measures

WMO submitted, in WMO-WP-05, a first draft of the CGMS global contingency plan, in response to CGMS Action 32.20. This draft was intended to consolidate, in a single document, the outcome of previous WMO and CGMS discussions held over the last 15 years on contingency planning, and to present it in a structured way. CGMS Members were invited to review the proposed format, structure and content of this draft. It was agreed to submit it first to review by WG III on contingency planning. CGMS also noted that the proposed document planned an annual review of the implementation of the global space-based component of the GOS with an assessment of the margins or risks of gaps in coverage and potential needs for contingency measures.

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

Please refer to section D.2 above.

## E. SATELLITE REQUIREMENTS OF WMO PROGRAMMES

### E.1 World Weather Watch

In WMO-WP-07, CGMS Members noted that the Commission for Basic Systems, at its thirteenth session held in February 2005, in St. Petersburg, Russian Federation, had agreed to an Implementation Plan for the evolution of the Global Observing System. The Implementation Plan included 47 recommendations with twenty recommendations for the space-based component of the GOS, twenty-two for the surface-based component and five for interactions with NWP. The twenty recommendations relevant to the space-based sub-system of the GOS built upon known plans of the operational and R&D satellite operators and called for rigorous calibration of remotely sensed radiances as well as improved spatial, spectral, temporal, radiometric accuracies. Wind profiling and global precipitation measurement missions were singled out for their importance to the GOS. CGMS Members noted that implementation of most of these recommendations would be realised through the WMO Space Programme working with space agencies, via CGMS. CGMS Members were informed of the status for each of the twenty recommendations as well as the schedule for further activities.

**Action 33.02 WMO to send a copy of the "Implementation plan for evolution of space and surface-based sub-systems of the GOS" (WMO/TD No. 1267) to CGMS Members.**

**Action 33.03 CGMS Members to provide feedback to WMO on the various proposals presented in WMO-WP-07 concerning the evolution of the spaced based system of the GOS.**

NOAA stressed to the meeting that this was an important document, providing a roadmap for the future development of the Global Observing System.

IMD commented that information on this subject should also be sent to its Department of Space and agreed to provide WMO with contact details.

WMO-WP-12 reported on requirements expressed by the Tropical Cyclone Programme via its ESCAP Panel on Tropical Cyclones as well as the Tropical Cyclone Committees of WMO Regional Associations RA-1 and RA-V.

The Tropical Cyclone Programme specifically expressed three requirements related to geostationary coverage of the Indian Ocean, availability of TRMM data and ocean surface winds from scatterometer data. The Tropical Cyclone Programme noted with appreciation that the EUMETSAT plan to relocate Meteosat-7 over the Indian Ocean would allow continuation of the IODC mission, originally provided via Meteosat-5, until 2008, but recalled its requirement for long-term coverage of the Indian Ocean area. The Tropical Programme requested that NASA continue its TRMM mission as long as the satellite remains functional, and CGMS noted the positive response of NASA that accepted to extend the operation until 30 September 2009. The Tropical Cyclone Programme also recommended encouraging the development of future plans for deployment of scatterometer sensors, and other satellite surface wind vector retrievals.

CGMS also noted the report from NOAA on the positive influence of MODIS water vapour polar winds toward significantly reducing tropical cyclone trajectory forecast errors (in light of recent work at the Joint Center for Satellite Data Assimilation). In addition it was noted that the current MODIS capabilities would likely expire before NPOESS capabilities in this regard can be initiated.

CGMS suggested an action for the WMO (Space Programme Office) to inform the WMO Tropical Cyclone Programme of this recent progress and to incorporate a requirement for water vapour sensitive measurements from polar-orbit.

**Action 33.04 WMO (Space Programme Office) to inform the WMO Tropical Cyclone Programme of the benefit of using water vapour polar winds for improving the accuracy of tropical cyclone forecasting.**

CGMS were pleased to learn from Roshydromet that it intended to ensure long-term coverage of the Indian Ocean Region, with its Electro L-N1 and N2 satellites, currently scheduled for launch in 2007 and 2009 respectively.

## E.2 Other WMO Programmes

In WMO-WP-06, CGMS was informed of the status of the WMO Space Programme. It recalled that the WMO Congress (Cg XIV) established the WMO Space Programme (WMO SP) as new crosscutting activity starting on 1 January 2004. CGMS Members noted that several important events had occurred since its last session including an increase in the Space Programme staff with two seconded experts (from China and France) and two new professional posts that were expected to be filled in early 2006 as well as activities related to IGEOLab. Finally, CGMS Members noted that the WMO Commission for Basic Systems (CBS) Open Programme Area Group on Integrated Observing Systems (OPAG-IOS) had 3 Expert Teams dedicated to the Evolution of the Global Observing System (ET-EGOS), Satellite Systems (ET-SAT), and Satellite Utilisation and Products (ET-SUP), respectively.

In WMO-WP-09, CGMS Members were informed of activities related to implementation of the new crosscutting WMO Natural Disaster Prevention and Mitigation Programme (DPM) approved by the thirteenth WMO Congress in May 2003. CGMS Members noted that all WMO major programmes were involved with different aspects of disaster prevention and mitigation. As DPM's first goal, it aims to coordinate the activities of WMO programmes towards clear strategic goals at regional and national levels, such that WMO could enhance its contribution to disaster prevention and mitigation decision making at the national, regional and international levels. As a first step, DPM Programme has initiated three major fact-finding projects, including regional-level assessments, country-level assessments, and a mapping of DPM activities within WMO Major Programmes. CGMS Members noted that the three major fact-finding projects should lead to a set of "disaster prevention and mitigation" observational requirements.

NOAA commented that whilst it was important to ensure adequate observation systems in support of disaster prevention and medication, focus should equally be on the warning systems that will be based upon these observations. In response, WMO confirmed that this aspect was being addressed by the public weather services of the National Meteorological Services concerned.

EUMETSAT added that in response to this type of proposal it had activated its DCS on Meteosat-5, located over the Indian Ocean, and that the IDCS was also a means of communication of this type of warning.

WMO-WP-25, presented a summary of recent developments in the Global Climate Observing System (GCOS) and World Climate Research Programme (WCRP) relevant to CGMS. GCOS has developed an Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC which addresses the requirements identified in the Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC and, in particular, the Essential Climate Variables and their associated products defined therein. The full Plan and its Executive Summary are available

through the GCOS Web site (www.wmo.int/web/gcos). The Implementation Plan details the need for long-term continuity and stability of high quality observation systems compliant with the GCOS Climate Monitoring Principles, and for derived global data products. It calls for some 131 actions to address the critical issues related to global observing systems for climate, namely: improving key satellite and in situ networks for atmospheric, oceanic and terrestrial observations; generating integrated global climate analysis products; enhancing the participation of least-developed countries and small island developing states; improving access to high-quality global data for essential climate variables; and strengthening national and international infrastructure. Several key actions are directly relevant to CGMS Members. CGMS expressed support to those issues and looks forward to an update on further evolutions at the next CGMS meeting.

The following CGMS-relevant conclusions and recommendations were furthermore, agreed by the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC):

- satellite operators should establish a process (e.g. via CGMS) to provide Level 1b products (i.e. navigated and calibrated radiances) needed for climate applications. In addition, priority Level 2 products (geophysical quantities) should be generated and reprocessed in the light of advanced understanding of the data characteristics.

- the development of enhanced cloud products including cloud microphysics, should be pursued, recognising the GCOS requirement for improved cloud monitoring. In particular the evaluation of climate cloud products with advanced research satellite missions, like Cloudsat, is recommended.

- CGMS should request its members to define and commence the development of a climate data set from hyperspectral IR instruments (AIRS, IASI, CrIS) that is substantially reduced in terms of data volume, in order to make climate processing of long time series tractable.

- CGMS should invite satellite agencies to report on current efforts to establish and/or enhance global aerosol products suitable for climate applications.

- It is important to have independent observations and analyses of the Essential Climate Variables (ECVs) in order to be able to take maximum advantage of new observing technology. Only with independent information can confidence be given to data obtained by new systems.

- It is important that satellite agencies undertake appropriate risk analyses of potential gaps and overlaps in mission continuity in order to assist in achieving the GCOS goals of sustained provision of satellite-based observations of ECVs.

The AOPC also noted the results of the joint EUMETSAT/WMO/GCOS/CM-SAF (Climate Monitoring Satellite Application Facility) workshop in July 2004 and welcomed the efforts of the CM-SAF towards delivering integrated global climate products. At the second EUMETSAT-WMO-GCOS meeting convened in September 2005, it was recommended that satellite operators re-calibrate archived satellite data to make them usable for climate studies, and that this could be proposed as an action on satellite operators at the next CGMS meeting.

In response to CGMS-relevant conclusions from the GCOS/WRCP Atmospheric Observation Panel for Climate (AOPC), CGMS agreed to the following actions and recommendations:

**Action 33.05 In response to WMO-WP-25 and EUM-WP-05, CGMS satellite operators are requested to analyse the steps needed to make their archived satellite data usable for climate studies, and report to CGMS accordingly.**

**Action 33.06 In response to WMO-WP-25, CGMS operators are invited to report on current efforts to establish and/or enhance aerosol products suitable for climate applications.**

**Recommendation 33.03 In response to WMO-WP-25, CGMS Members are encouraged to pursue the development of enhanced cloud products including cloud microphysics, recognising the GCOS requirement for improved cloud monitoring.**

**Recommendation 33.04 CGMS Members are encouraged to define and commence the development of a climate data set from hyperspectral IR instruments (AIRS, IASI, CrIS) that is substantially reduced in terms of data volume, in order to make climate processing of long time series tractable. It might be appropriate to defer this matter to the ITWG.**

In WMO-WP-27, CGMS Members were informed of the status and activities of THORPEX. CGMS was reminded that THORPEX is an exceptionally important International programme in which satellite observations will play a major role. The programme's success will help ensure optimal utilisation of satellite data across forecast scales from 1 day to two weeks and possibly into seasonal to inter-annual time-scales. Results from THORPEX will help guide the utilisation of satellite data and help define the future role of satellites as part of an increasingly integrated and optimised Global Observing System. CGMS was brought up-to-date on THORPEX plans to develop a global, multinational, multi-model ensemble weather prediction system (TIGGE – the THORPEX Interactive Grand Global Ensemble), on THORPEX contributions to IPY, and their scientific field programme investigations. On the organisational side THORPEX has

established an Executive Board, responsible for the day-to–day management of the Programme on behalf of the International Core Steering Committee. It will coordinate programme activities and ensure delivery of the Programme in accordance with the Implementation Plan. To ensure maximum realisation of satellites potential as a part of the THORPEX Programme, CGMS previously requested observer status on the THORPEX ICSC and to contribute to the THORPEX planning in coordination with WMO Space Programme. THORPEX has invited CGMS to join the THORPEX ICSC as an observer and awaits CGMS appointment of a Rapporteur to the ICSC.

### E.3 IOC Programmes

WMO-WP-16 reported on the status of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). CGMS was informed that JCOMM had established four Programme Areas (Services, Observations, Data management and Capacity building) as well as a crosscutting team in charge of satellite data requirements. Interaction between JCOMM and the satellite operators would mainly take place through this integrated team. JCOMM noted with appreciation the significant role played by the Rapporteur of this integrated team, Prof. Hiroshi Kawamura, and welcomed the Permanent action from CGMS to consider the IOC satellite data requirements, including those of the GOOS Regional Alliances (GRA).

## E/F. INTERACTION WITH GEO

In EUM-WP-18, EUMETSAT proposed a working relationship between CGMS and GEO, based on the GEO 10-year implementation plan for the development of a Global Earth Observation System of Systems (GEOSS) which is based upon the requirements in nine societal benefit areas, one of which is Weather.

The GEO Secretariat have produced a work plan for 2006 which includes activities directly related to the Weather Societal Benefit area including sections such as Architecture, and Data Management, Disasters, Water and Climate. CGMS has a clear opportunity to act as a mechanism in support of GEO objectives and input could be made to the 2006 GEO work plan (by 11 November 2005). It further stated that the CGMS Secretariat would be prepared to support such an input regarding the following aspects of the plan:

i) Which specific actions proposed would fall within the ambit of CGMS for implementation.
ii) Whether these specific actions are correctly stated.
iii) How, and in what time-scale, CGMS could address any of the specific actions.

On the basis of a first analysis, and if agreed by CGMS Members, the CGMS Secretariat would prepare a short input to the GEO Secretariat by 11 November 2005. This would also formally state that CGMS would wish to be

involved in the specification and implementation of relevant activities in support of GEO objectives in future meetings. This may also imply that CGMS should seek membership in GEO as a participating organisation.

JMA, supported by other CGMS Members, agreed that the Secretariat reply on behalf of CGMS. NOAA requested that the Secretariat provide CGMS Members with a copy of the letter for review and approval in advance of its submission to GEO.

## F. OTHER ITEMS OF INTEREST

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

EUM-WP-05 presented the status of the network of approved EUMETSAT Satellite Application Facilities (SAFs) and presented an updated list of the SAF products. It was highlighted that five out of eight SAFs are currently in their Initial Operations Phase (IOP) and started distribution of their products based on NOAA and MSG data. The IOP gives a major opportunity for users to initiate/conduct their activities based on SAF Products and Services. The remaining three SAFs are still under development, one of which is new: the SAF on Support to Operational Hydrology and Water Management which was approved by EUMETSAT's Council in July 2005. Full SAF operational activities will start in 2007, after final validation of the EPS/MetOp based products.

The SAFs address the following topics: Support to Nowcasting and Very Short Range Forecasting; Ocean and Sea Ice; Ozone Monitoring; Climate Monitoring; Numerical Weather Prediction; GNSS Receiver for Atmospheric Sounding (GRAS) Meteorology; Land Surface Analysis and support to Operational Hydrology and Water Management.

The SAF product list was also presented in the document.

### F.2 Search and Rescue (S&R)

There were no Working Papers presented under this agenda item.

### F.3 Meteorological Data Distribution via satellite

There were no Working Papers presented under this agenda item.

It was further agreed that in future this particular item would be removed from the draft order of business and addressed elsewhere.

## F.4 Training

EUM-WP-08 reported on training activities carried out by EUMETSAT over the last year. Since CGMS-32 training courses were conducted or supported in Niger, Latvia, Germany, Switzerland, USA, Kenya, Romania, the Republic of Congo, Lithuania, Russia, South Africa, UK, Egypt, Finland, Brazil, Turkey, Norway, Estonia, and Spain. In January 2005, priority was given to the production of Distance Learning material, namely VISITView sessions which allows interactive live tuition over the Internet. Much attention was also given to the production of training material by investigating interesting meteorological situations and phenomena as received by the Training Group's EUMETCast receiving station which are frequently used in the training courses. Furthermore, EUMETSAT also started to provide distance learning lectures using the VISITView tools. It can be noted that from October 2005 onwards regular training lectures will be offered via EUMETSAT's new Internet pages at:
http://www.eumetsat.int/idcplg?IdcService=SS_GET_PAGE&nodeId=532&l=en

In JMA-WP-07, JMA reported on its activities related to the Virtual Laboratory, support to the new centre of excellence in Oman, and its plans for supporting the Virtual Private Network pilot project.

The paper explained that SATAID (Satellite Animation and Interactive Diagnoses) is a set of software to access and display digital satellite data developed by the Meteorological Satellite Center of JMA and it has been used widely for lectures and training sessions on satellite data utilisation. As a result, SATAID is being spread among the National Meteorological and Hydrological Services (NMHSs) for educational and training purposes, as one of the main training tools in the Virtual Laboratory (VL) activities. Furthermore, in support of Oman's activities, the SATAID software and training materials was provided by JMA to the National Meteorological Service of Oman in April 2005. At the request of the CGMS Virtual Laboratory Focus Group (VLFG), JMA and EUMETSAT have undertaken an exchange to also allow the use of Meteosat data. JMA-WP-16 also describes the further use of SATAID in support to the Virtual Private Network pilot project. The latest version of the software is available to all NMHS, upon request to the Meteorological Satellite Center of JMA (calmstr@dpc.kishou.go.jp).

WMO-WP-17 informed CGMS Members on the status of activities within the CGMS Virtual Laboratory for Training in Satellite Meteorology and Implementation Planning for a High Profile Training Event to occur in October 2006. CGMS was pleased to hear about the success of the Costa Rica training event that was held in February 2005, and the successful trial of electronic notebooks at that event. In invoking this paradigm shift in training, all training materials, tools and presentations delivered during the training event, along with a number of stand alone tutorials as well as Internet links to product and digital satellite data were placed onto the electronic notebooks which were then provided to the VL trainees for their use during the training course and for their subsequent use in training, technology transfer and

communication within the newly formed Costa Rica Training VL focus group upon their return to their native countries. As was documented to CGMS this has been exceptionally successful. CGMS was informed that following the Costa Rica training event, electronic notebooks were provided to the RMTC's at Barbados, Niamey and Nairobi, and the sponsoring agency NSMC. Copies of the electronic notebook contents were also provided to other VL participants: EUMETSAT, the WMO Space Programme and the Australia Bureau of Meteorology Training Centre (BMTC). CGMS was further informed of the success of the Regional Focus Groups in continuing training in satellite data utilisation that had developed as a result of the Barbados 2003 and Costa Rica 2005 training and looked forward to the development of similar Regional Focus Groups at all COEs prior to the High Profile Training Event.

CGMS endorsed the growth of the VL through the formation of additional space operator sponsors and new centres of excellence, confirming a new centre of excellence in Oman sponsored by EUMETSAT and India, and were encouraged by considerations for the formation of new centres of excellence in Argentina, sponsored by NOAA and CONAE, and in Russia sponsored by Roshydromet.

CGMS Members strongly endorsed and supported the specific recommendations for the High Profile Training Event, in particular the requests for assistance in the development and translation of the core lectures, and implementation of the foundation VISITview server software as detailed in the report. JMA added that it was willing to provide lecturing support to the high profile training event. Finally CGMS agreed to the change in name of the Virtual Laboratory Focus Group to the Virtual Laboratory Management Group.

IMD commented that as a co-sponsor of the Centre of Excellence in Oman it was willing to provide additional lecturing sessions for the training events and training resources carried out by this centre.

China informed CGMS that it was prepared to translate the training resources on the notebook into Chinese.

**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.**

## F.5 Information

EUM-WP-06 provided a brief account of the EUMETSAT conferences that had taken place since the last meeting of CGMS. Included was a summary of the EUMETSAT Satellite Data Users' Conference held in Dubrovnik, Croatia, on 19-23 September 2005. The next Satellite Data User Conference will be held in Helsinki, Finland, from 12-16 June 2006. In addition, EUMETSAT provided a list of its recent publications and announced that it had significantly reorganised and enhanced the EUMETSAT Internet site.

In WMO-WP-01, WMO recalled the database on ground receiving equipment developed and maintained by WMO Secretariat and available on the WMO website. The database indicates the number and geographic distribution of satellite receiving equipment, with the view to assist WMO in identifying where adequate reception equipment or gaps exist and providing advice on ways to improve the utilisation of satellite data, to assist the satellite operators in identifying users; to provide an impetus to register satellite receiving equipment with national telecommunication administration and to inform ITU as to the utilisation of frequencies allocated to environmental satellites.

The current database is now maintained in a Microsoft Access 2000 running under Windows 2000, which is made up of tables, queries, forms, reports, modules and macros. It currently contains 11,554 stations that are operational as of October 2005. WMO intends to update the database in 2006 through contact with WMO Permanent Representatives as well as other cited sources.

The meeting recalled Permanent Action 6 requesting CGMS Members "to provide information for WMO database for satellite receiving equipment, as appropriate". (As a result, **Action 33.08 CGMS Members are invited to update the database on ground receiving equipment via the WMO**, has been closed).

WMO-WP-04, informed the CGMS Members of the various list servers used by the CGMS groups, i.e. the plenary, wind, virtual laboratory and frequency. CGMS Members were requested to regularly review their contact details on the list servers and inform the CGMS Secretariat and WMO of any changes accordingly.

**New permanent action 11** **CGMS Members are invited to review and update the CGMS list servers on a regular basis. It is suggested that the CGMS Secretariat carry out this action at the time of the call-up of the CGMS working papers.**

In WMO-WP-08, WMO informed CGMS that WMO had finalised and distributed the "Report of Consultative Meetings on High-level Policy on Satellite Matters, fifth session, Geneva Switzerland, 24-25 January 2005", (see http://www.wmo.ch/hinsman/publications/CM-5_Final_Report.doc), and that two publications were about to be issued:

(i) Status of the Availability and Use of Satellite Data and Products by WMO Members, 2005 (WMO TD No. 1296 (*SP-2*);
(ii) Application of Satellite Technology, Progress Report, 2003.

In WMO-WP-15, CGMS Members were informed of relevant results of the 5$^{th}$ session of the WMO Consultative Meetings on High-level Policy on Satellite Matters (CM-5). CGMS Members noted that CM-5 reviewed a summary of activities within the WMO Space Programme including a description of an

Integrated Global Data Dissemination Service (IGDDS), the Virtual Laboratory for Education and Training in Satellite Meteorology (VL) and the International Geostationary Laboratory (IGEOLab). CGMS Members also noted that the Permanent Representatives of China and France with WMO had nominated Dr Liu Jian, Associate Professor at China's National Satellite Meteorological Center, and Mr Jérôme Lafeuille from Météo-France, respectively, as senior seconded experts to the WMO Space Programme Office for one-year periods.

In WMO-WP-26, CGMS Members were provided with an update on the formation and early work of the intergovernmental Group on Earth Observations (GEO) towards building a Global Earth Observation System of Systems (GEOSS) over the next 10 years. GEO's membership continues to grow and as of September 2005 involved 58 countries, the European Commission, and 47 international organisations. Following nearly 2 years of planning, GEO was endorsed and formally established at a Ministerial-level Summit held in Brussels in February 2005. At GEO-I, held on 3-4 May 2005, delegates elected a new Executive Committee to oversee the administrative workings of GEO. The Executive Committee consists of twelve members representing various regions of the world from which 4 Co-chairs were chosen. The members chosen are: Brazil, Germany, Italy, Honduras, Japan, Morocco, Russian Federation, Thailand, and the Co-chairs are from China, European Commission, South Africa, and the United States of America.

CGMS Members also noted that with regard to the GEOSS space component, the fifty seventh session of the WMO Executive Council (EC-LVII) held in June 2005 agreed that the similarities of objectives of GEOSS and WMO fully justified the willingness of WMO, through its recently established WMO Space Programme, to make a significant contribution as one of the core contributors.

CGMS Members noted that the proposed GEO Structure will include a GEO Plenary consisting of GEO Members and Participating Organisations, an Executive Committee (described above), and 4 Standing Committees including: (1) Architecture and Data; (2) Capacity Building and Outreach; (3) Science and Technology; and, (4) User Interface, and finally a Director and GEO Secretariat. The Terms of Reference for the Standing Committees will be approved at the next meeting of the GEO Plenary to be held in Geneva 14-15 December 2005.

Finally, CGMS Members were informed that the draft GEO Work Plan for 2006 (Version 1) based on the recommendations of the Executive Committee, was available for review and comment. The Plan will be presented for approval by the GEO Plenary in December 2005. The GEO Executive Committee also discussed the concept of a GEONetcast to serve all nine societal benefit areas of GEO, and WMO informed that, in this regard, its Integrated Global Data Dissemination Service (IGDDS) concept is considered to be relevant for the weather societal benefit area.

With reference to the above discussions and item number E/F - Interaction with GEO, the CGMS Secretariat tabled a draft letter addressed to the GEO Secretariat.

**Action 33.09 CGMS Members to review and comment upon the letter to the GEO Secretariat at the very latest by Tuesday 8 November 2005.**

### F.6 Consolidated report/CGMS web site

In EUM-WP-12, the CGMS Secretariat presented a proposal for the creation of a dedicated CGMS Internet homepage. It described the current situation and proposals to enhance the external visibility of CGMS, the establishment of a further information channel for CGMS Members and an improved display and update facility for the CGMS Consolidated Report.

**Action 33.10 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.**

### F.7 Any other business

There were no topics for discussion under this item.

## G. FINAL SESSION

### G.1 Appointment of Chairman of Final Session

Mr Kazunobu Nakamura, JMA, and Dr Donald Hinsman, WMO, were unanimously elected as co-Chairmen of the Final Session.

### G.2 Reports from the Working Groups

Reports from the four working groups were presented by Mr Robert Wolf (WG I on Telecommunications), Mr Hideyuki Hazegawa (WG II on Satellite Products), Mr Gary Davis (WG III on Global Contingency Planning) and Mr Mikael Rattenborg (WG IV on Integrated Strategy on Data Dissemination from Meteorological Satellites).

The CGMS-33 Co-Chairmen took note of the reports and thanked the participants, Chairmen 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.

## G.3 Nomination of CGMS Representatives at WMO and other meetings

WMO-WP-18 recalled that CGMS should nominate a representative for the Fifty-eighth Executive Council of WMO (EC-XLVII), to be held in Geneva, Switzerland, on 20-30 June 2005. CGMS also noted that the Sixth session of the Consultative Meetings on High-level Policy on Satellite Matters would be held in Buenos Aires, Argentina, 16-17 January 2006.

CGMS agreed that Dr. Lars Prahm, Director-General of EUMETSAT, will represent CGMS at the WMO Executive Council, 20-30 June 2006 in Geneva, Switzerland.

CGMS further agreed that Dr. James Purdom would be CGMS Rapporteur to THORPEX.

## G.4 Nomination of Chairmen of Working Groups for CGMS-34

With regard to the meetings of the Working Groups that would take place at CGMS-34, it was agreed that:

- Working Group I on Telecommunications will be chaired by Mr Marlin O. Perkins,
- Working Group II on Satellite Products including Satellite-Derived Winds will be chaired by Prof Xu Jianmin,
- Working Group III on CGMS Global Contingency Planning will be chaired by Mr Gary Davis,
- Working Group IV on Integrated Strategy for Data Dissemination from Meteorological Satellites will be chaired by Mr Mikael Rattenborg,

- Dr Mitch Goldberg will be the Rapporteur for the ITWG.
- Dr Johannes Schmetz will be the Rapporteur for the IWWG.
- Dr James Purdom will be the Rapporteur for the IPWG.

## G.5 Any Other Business

No items were discussed.

## G.6 Summary List of Actions from CGMS-33

### (i) Permanent actions

1. 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 of Satellites. 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.

2. CGMS Members to update the CEOS/WMO Consolidated Database as appropriate and at each CGMS meeting.

3. 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.

4. CGMS Members to report on anomalies from solar events at CGMS meetings.

5. CGMS Members to update their relevant sections of the CGMS Consolidated Report as appropriate and to send their updates to the Secretariat at least 2 months prior to every CGMS plenary meeting.

6. CGMS Members to provide information for WMO database for satellite receiving equipment, as appropriate.

7. CGMS Members to review the list of available list servers used by CGMS groups and update as appropriate.

8. 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).

9. CGMS Members to consider the WIS concept (notion of DCPC, catalogue/metadata standards, protocols) when changing/implementing processing and dissemination systems.

10. CGMS Members to consider WMO Core Metadata profiles within the context of the ISO Standard for Geographic Metadata (ISO 19115).

**New permanent actions:**

11. CGMS Members are invited to review and update the CGMS list servers on a regular basis. It is suggested that the CGMS Secretariat carry out this action at the time of the call-up of the CGMS working papers.

**(ii) Actions from CGMS-32**

32.02 CGMS Members to provide points of contact responsible for updating the CGMS Consolidated Report.

***Closed*** *for all Members except IOC/UNESCO and NASA. The Secretariat will request this information.*

### (iii) Actions and Recommendations from CGMS-33

Action 33.01 CGMS Members to continue interacting with WMO (Dr Bizzarro Bizzarri < bibizzar@tin.it >) in order to resolve any doubtful or missing information to complete the next issue of the "Status of the space-based component of the global observing system (GOS)". Any further updates submitted as part of Agenda items B1, B2, B3, C1, C2 and C3 should be delivered if possible at least one month in advance of CGMS-34 to allow final tuning of the report before CGMS plenary. **Deadline: 15 September 2006**

Action 33.02 WMO to send a copy of the "Implementation plan for evolution of space and surface-based sub-systems of the GOS" (WMO/TD No. 1267) to CGMS Members. **Deadline: CGMS-34**

Action 33.03 CGMS Members to provide feedback to WMO on the various proposals presented in WMO-WP-07 concerning the evolution of the spaced based system of the GOS. **Deadline: CGMS-34**

Action 33.04 WMO (Space Programme Office) to inform the WMO Tropical Cyclone Programme of the benefit of using water vapour polar winds for improving the accuracy of tropical cyclone forecasting. **Deadline: CGMS-34**

Action 33.05 In response to WMO-WP-25 and EUM-WP-05, CGMS satellite operators are requested to analyse the steps needed to make their archived satellite data usable for climate studies, and report to CGMS accordingly. **Deadline: CGMS-34**

Action 33.06 In response to WMO-WP-25, CGMS operators are invited to report on current efforts to establish and/or enhance aerosol products suitable for climate applications. **Deadline: CGMS-34**

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. **Deadline: CGMS-34**

Action 33.08 CMGS Members are invited to update the database on ground receiving equipment via the WMO. ***Closed – addressed in permanent action 6.***

Action 33.09 CGMS Members to review and comment upon the letter to the GEO Secretariat at the very latest by Tuesday 8 November 2005. **Deadline: 8 November 2005**

Action 33.10 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. **Deadline: 31 December 2005**

Action 33.11 CMA to provide as a matter of urgency technical and operational parameters of the planned data transmissions in the frequency band 7750-7850 MHz to CGMS Members. **Deadline: 1 December 2005**

Action 33.12 EUMETSAT to perform sharing studies for X-band operations at MetOp stations and propose technical and operational measures to avoid interference. **Deadline: 1 February 2006**

Action 33.13 WMO to provide a forum for discussion on data transmission from meteorological satellites, with a goal of resolving radio frequency conflicts, well in advance of notification to ITU, and adopting approaches to avoid them. **Deadline: CGMS-34**

Action 33.14 Satellite operators participating in the IDCS and WMO to each nominate an expert to the IDCS contact group, and inform the Secretariat accordingly. **Deadline: 31 December 2005**

Action 33.15 CGMS Members to establish a Task Force lead by NESDIS (Mr Mitch Goldberg) with participation by EUMETSAT (Dr Johannes Schmetz), JMA (Mr. Toshiyuki Kurino), CMA (Academician Xu Jianmin) and assisted by the WMO Space Programme to prepare a draft Implementation Plan for GSICS by 1 July 2006 for review by CGMS Members by 1 August 2006 and approval at CGMS-34. **Deadlines: 1 July 2006; 1 August 2006; and CGMS-34**

Action 33.16 The ITWG should also help to formulate priorities for future satellite product developments related to the use of cloudy radiance in NWP. The ITWG Rapporteur should inform the ITWG co-chairs of this new action. **Deadline: CGMS-34**

Action 33.17 CGMS Members are requested to ensure adequate participation at the upcoming 8$^{th}$ International Winds Workshop in Beijing from 24 – 28 April 2006. Participation from NWP centres and relevant research institutes should be encouraged and requested by CGMS operators with indications of attendance and support by 31 December 2005. **Deadline: 31 December 2005**

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. **Deadline: CGMS-34**

Action 33.19 EUMETSAT to make the algorithm to derive the surface albedo from geostationary satellites available upon request. **Deadline: CGMS-34**

Action 33.20 EUM, CMA, NOAA and WMO to establish a task force to draft terms of reference for a potential new working group on data handling for direct data broadcast and pertinent formats (e.g. BUFR) that could be considered at the next meeting of CGMS. **Deadline: CGMS-34**

Action 33.21 WMO, through the WMO Space Programme, to organise a two-day Workshop in Geneva in (2nd Quarter 2006) to facilitate regional discussions for optimised operations of geostationary (1 day) and polar-orbiting satellites (1 day) to include discussions on close cooperation on instruments for future satellite missions. Two-day agenda to be developed by CGMS Secretariat in consultation with CGMS satellite operators. **Deadline: 28 February 2006**

Action 33.22 All CGMS satellite operators to update, as a matter of urgency, the WMO generated tables indicating transition of broadcast services of satellites in polar and geostationary orbit, and inform the Secretariat accordingly. **Deadline: 31 December 2005**

Action 33.23 Within the context of the WMO December 2005 RARS Workshop, WMO to invite China, Japan, Korea and Australia, together with other interested CGMS partners, to specifically discuss possibilities for supporting a regional ADM Service for the Asia-Pacific Region. **Deadline: 10 December 2005**

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. **Deadline: CGMS-34**

Action 33.25 CGMS Satellite Operators to review the content of the CGMS Global Contingency Plan, as contained in WMO-WP-05, and provide WMO with comments by 1 January 2006. **Deadline: 1 January 2006**

Action 33.26 WMO to finalise and provide the CGMS Secretariat the final manuscript for publication. **Deadline: 28 February 2006**

**RECOMMENDATIONS**

Recommendation 33.01 It is recommended that CGMS encourages its Space Agency Members to provide continuity of funding for the scientific studies, pending the establishment of a consolidated study programme once a space agency has accepted the role of the lead space agency in the implementation of the IGEOLab GEO microwave project.

Recommendation 33.02 CGMS Members are encouraged to ensure that the description of their programmes on their websites contains an adequate level of technical information.

Recommendation 33.03 In response to WMO-WP-25, CGMS Members are encouraged to pursue the development of enhanced cloud products including cloud microphysics, recognising the GCOS requirement for improved cloud monitoring.

Recommendation 33.04 CGMS Members are encouraged to define and commence the development of a climate data set from hyperspectral IR instruments (AIRS, IASI, CrIS) that is substantially reduced in terms of data volume, in order to make climate processing of long time series tractable. It might be appropriate to defer this matter to the ITWG.

Recommendation 33.05 CGMS Members are kindly requested to provide support to the three CGMS sponsored International Working Groups, by providing travel support etc. to selected scientists.

Recommendation 33.06 CGMS Members are encouraged to provide the location of their web sites on real time fire detection to the WMO.

Recommendation 33.07 CGMS Members are requested to consider the production of a long-term surface albedo data set from archived VIS channel data of geostationary satellites with the help of the software developed by EUMETSAT.

Recommendation 33.08 CGMS Members planning for next generations of geostationary meteorological satellites to consider implementing a lightning mission and to coordinate the selection of the observation areas so as to realise optimal coverage of all low and middle latitudes.

## G.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 within two weeks, so that a finalised version can be distributed electronically after three weeks by the Secretariat. 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-33 Working Papers and presentations.

## G.8 Date and Place of Next Meeting

CGMS was pleased to accept an offer from CMA to host CGMS-34 in Shanghai, China, in the first half of November 2006.

The Co-Chairmen thanked all participants for their cooperation and fruitful participation in the 33rd meeting of CGMS, adding that there had been many interesting discussions and important developments during the working group and plenary sessions. They also thanked the Rapporteurs and Secretariat for preparing the Final Report. All parties warmly thanked Japan for hosting the meeting in Tokyo and for the excellent organisation and cooperation with the CGMS Secretariat.

Noting that this was his last participation in CGMS meetings, special appreciation was also expressed to Mr Robert Wolf, EUMETSAT, for his long service and many valuable contributions to CGMS.

The meeting was adjourned at 12.30 pm on 4 November 2005.

# PARALLEL WORKING GROUP SESSIONS

## WORKING GROUP I: TELECOMMUNICATIONS

## I/0 Introduction

As agreed at CGMS-32, Mr. Robert Wolf (EUMETSAT) and Mr Gordon Bridge (EUMETSAT) were elected as Chairman and Rapporteur, respectively, of Working Group I (WG I) on Telecommunications. WG I comprised representatives of the satellite operators from China, Japan, Russia, USA, Korea and EUMETSAT together with WMO (see Annex 4 for list of participants).

## I/1 Co-ordination of Frequency Allocations

### Preparation of future World Radio Conferences (WRC-07 and WRC 2010)

Documents WMO-WP-11, NOAA-WP-07, and JMA-WP-08 included information related to the preparation process for the World Radio Conference 2007 (WRC-07). A summary of the inputs is provided in this report to give information to CGMS Members who are not closely following the preparation process. The documents contained also information on the progress done within the regional groups (such as CITEL, CEPT, and APT) dealing with WRC preparations.

Among WRC-07 agenda items, the following three items concern frequency bands or issues of prime interest for Meteorological satellites co-ordinated by CGMS:

- agenda item 1.2: Extension of the 18 GHz METSAT allocation and protection of the 10.7 and 36 GHz EESS (passive) bands;
- agenda item 1.17: Protection of the 1.4 GHz EESS (passive) band;
- agenda item 1.20: Unwanted emissions in EESS (passive) bands.

In addition, the following agenda items do not directly concern Meteorological interests but, due to their wide open scope in terms of frequency ranges under study, might have an impact on frequency bands used for meteorological purposes.

- agenda item 1.5: Possible additional allocations for aeronautical telecommand and high bit-rate aeronautical telemetry between 3 and 30 GHz;
- agenda item 1.8: High Altitude Platform Stations (HAPS) in the 28 and 31 GHz band;
- agenda item 1.18: Pfd limits for Highly Elliptical Orbit (HEO) satellites in the frequency band 17.7-19.7 GHz.

WRC-07 is scheduled for the end of 2007 and the Conference Preparatory Meeting (CPM) early 2007. The year 2006 will be crucial for finalising the different positions and support from CGMS Members via their national frequency administrations to the relevant meetings will be of prime importance to support meteorological views.

**Agenda item 1.2 (CPG/PT2)**

**a) Issue 1: Resolution 742 (WRC-03) on frequency band 36-37 GHz**

As part of global passive measurements, the band 36-37 GHz is vital for the study of global water circulation since this band is able to monitor the rain, the snow, the ocean ice and the water vapour for ocean and land surfaces. Observations in the band for sensing the melting of snow near the surface are of very high interest. A number of passive sensors and radio altimeters are already using or are planned to use this frequency band in the near future (e.g., CMIS, MIMR, AMSR, AMSR-E, AMR, SMMR, SSM/I, SSMI/S, TMI, MEGHA-TROPIQUE and MWRS) for such measurements. These measurements are fully operational (regular use of the data, continuity of service, several usable data products) and are used on a worldwide basis. The retrieved data are used and exchanged between the meteorological organisations in all regions. The retrieved parameters are actually derived from a set of measurements performed at five frequencies which are interrelated (6, 10, 18, 24 and 36.5 GHz).

This band is shared between Earth Exploration Satellite Service (EESS) (passive) and Fixed (FS) and Mobile Services (MS). Studies are still ongoing to identify the maximum e.i.r.p for FS and MS links that could provide a means to ensure the protection of passive sensors in the 36-37 GHz.

**b) Issue 2: Resolution 746 (WRC-03) on METSAT allocation at 18 GHz**

This issue is the follow-up of a European proposal to WRC-03 and aims at covering next generation geostationary meteorological satellites requirement for satellites that are to be launched from 2015 onwards. These systems would require bandwidth of at least 300 MHz. This exceeds the 200 MHz (18.1-18.3 GHz) allocation as currently given in Radio Regulations footnote 5.519.

The required bandwidth of 300 MHz is mainly determined by the use of IR and UV sounding units and high-resolution imagers with a higher repetition rate of measurements and a higher number of spectral channels compared to present satellite systems. The spatial resolution will also be significantly increased compared to the current generation of geostationary meteorological satellites.

It seems that there is a general consensus to support such 100 MHz extension but the question is whether the extended band should be 18-18.1 GHz or 18.3-18.4 GHz. Some administrations are currently favouring the lower band but

there might be political problems due to the existing allocation of Broadcasting Satellite Service (BSS) in the band 18-18.1 GHz.

### c) Issue 3: Resolution 746 (WRC-03) on frequency band 10.6-10.68 GHz

As part of global passive measurements, the band 10.6-10.7 GHz is of primary interest to measure rain, snow, sea state and ocean wind for ocean and land surfaces. A number of sensors are already using or are planned to use this frequency band in the near future (e.g. CMIS, MIMR, AMSR, AMSR-E and TMI) for such measurements. These measurements are fully operational (regular use of the data, continuity of service, several usable data products) and are used on a worldwide basis. The retrieved data are used and exchanged between the meteorological organisations in all regions and are actually derived from a set of measurements performed at five frequencies which are interrelated (6, 10, 18, 24 and 36.5 GHz).

A part from the 10.68-10.7 GHz band that is covered by the RR footnote **5.340** under which all emissions are prohibited, the band 10.6-10.68 GHz is also shared between Earth Exploration Satellite Service (EESS) (passive) and Fixed and Mobile Services. It has to be stressed that current deployments of Fixed Service links in certain administrations already create significant levels of availability degradation of passive measurements in this band. Additional constraints on the 10.6-10.68 GHz passive band would hence not be acceptable. Studies are still ongoing to identify the maximum e.i.r.p for fixed and mobile links or other regulatory solutions that could provide a means to ensure the protection of passive sensors in the 36-37 GHz.

## Agenda item 1.17 (CPG/PT2): Protection of the 1.4 GHz EESS (passive) band

Under agenda item 1.16 (WRC-03) and acknowledging the non-completion of technical compatibility studies, last WRC-03 made a conditional secondary allocation to FSS for MSS feeder links nearby 1.4 GHz. Agenda item 1.17 (WRC-07) is the follow-up of this issue and request to finalise these technical studies in a view to determine whether these MSS feeder links are compatible with existing services and in particular with the passive service in the 1400-1427 MHz band.

For EESS, this band is a vital resource for measuring salinity and other aspects of the Earth and its atmosphere and, to that respect, is one of the passive bands quoted in footnote **5.340** that prohibits all emissions, emphasising its particular importance for the scientific community. A number of sensors are planned to use this frequency band in the near future (SMOS, HYDROS, AQUARIUS) for such measurements.

Based on a 10% apportionment of the EESS protection criteria, current technical studies have determined power limits for the uplink and downlink that could ensure compatibility between the MSS feeder links and EESS in the 1400-1427 MHz.

**Agenda item 1.20 (CPG/PT2): Unwanted emissions in EESS (passive bands)**

The issue of the protection of the Earth exploration-satellite service (passive) from unwanted emissions of active services has been on the agenda for the three last WRCs for which a number of administrations were supporting regulatory measures for the protection of passive services, and in particular the inclusion in the Radio Regulations of limits on the unwanted emissions of active services.

After difficult discussions up to the last few days of the WRC-03, no agreement to take such action was reached and a compromise solution was to continue the studies according to Resolution 738 and re-visit the issue at WRC-07.

Studies are still on-going in a specific ITU-R Task Group (TG 1/9) and agreement on adequate out-of-band levels to protect EESS passive sensors is likely to occur, at the main exception of the protection of the 1400-1427 MHz band from Fixed Service that might be of great concern.

**Expansion of the Table of Frequencies in the Radio Regulations for Frequency Bands above 275 GHz**

The Preliminary agenda for the World Radiocommunication Conference 2010 (WRC 2010) already includes an agenda item requesting to consider the expansion of the Table of Frequencies in the Radio Regulations of the ITU for frequency bands between 275 GHz and 3 000 GHz. WRC-07 will have to decide whether this agenda item will become part of the final WRC-210 agenda. Due to a very crowded draft agenda the item could be deleted if no sufficient support is received.

EUM-WP-21 summarises the activities carried over at the Space Frequency Co-ordination Group (SFCG) and ITU-R level in the preparation of the WRC-2007 for confirming an agenda item for WRC 2010 to include required frequency band allocations between 275 GHz and 3000 GHz with the appropriate protection measures, as currently there is only a footnote (5.565) that governs the use of a list of frequency bands in the range 275-1000 GHz.

The document also summarises EUMETSAT activities for the identification of appropriate frequency bands for passive sensors above 275 GHz, which recalls the outcome of a special study funded by EUMETSAT in 2001/2002. This study identified characteristics, sharing conditions and protection requirements of passive sensor bands in the 275 GHz to 1000 GHz band for future meteorological and climatological applications (EESS passive). The outcome of the study has been updated by EUMETSAT for the SFCG meeting of October 2005 with the most up-to-date knowledge of the existing and planned sensors, instruments and missions. No alternative study has been identified by EUMETSAT in the same frequency band (275-1000 GHz)

and no study exists for the 1000 GHz to 3000 GHz region of the band. It is worth noticing that for the 36 different frequency allocations identified in this table, 15 of these entries are covered by the RR but 21 entries are not covered by the Radio Regulations (i.e. they are not protected at all).

The Working Group I unanimously recognised the need of fostering, within their respective scientific communities, the need of identifying potential applications, missions and instruments that will be using the 275-3000 GHz (in the frame of EESS passive) and agreed in ensuring that this information is timely available to their SFCG representatives for the WRC-2007 preparation processes in order to secure the corresponding agenda item for WRC-2010.

**Technical Information from the Space Frequency Co-ordination Group and ITU-R**

CGMS is an observer to SFCG. NOAA accepted the task to report SFCG results to CGMS. NOAA-WP-08 discussed inputs to SFCG-24.

In the same document NOAA also provided information on the progress in the ITU-R Working Parties 7B and 7C (WP7B, WP7C). WP7B is concerned with space radio systems, i.e. the transmissions between the Earth and satellites, both uplinks and downlinks. WP7C covers applications in the EESS concerning active and passive sensors as well as MetAids, i.e. radiosondes.

In addition, NOAA discussed the activities of ITU Task Group 1/8 (TG1/8), compatibility between ultra-wideband devices (UWB) and radio communication services and the ITU TG1/9, Compatibility between passive and active services. Finally, NOAA reported on World Meteorological Organization (WMO) Commission for Basic Systems (CBS) Steering Group on Radio Frequency Coordination (SG-RFC). NOAA presented two papers at the meeting, one entitled “Assessment of Interference Potential between Short Range Radars on Automobiles and passive Microwave Sensors in the 23.6 to 24.0 GHz Band” and one entitled “Sample Characteristics and Sharing Criteria for Geostationary Meteorological Satellites in the Band 18-18.4 GHz”.

**Other Frequency Management Issues**

**Introduction of UWB technology in passive sensor bands**

As already reported during recent CGMS meetings Ultra Wide Band (UWB) applications represent new technologies that transmit very low power over very large bandwidth, up to several GHz. It represents a new challenge for frequency management since it is not possible to regulate these applications under the current Radio Regulations or national regulations. Apart from very specific devices, these applications are expected to be deployed on a very large scale and hence intended to operate on a licence exempt basis that would not allow any control (in number in particular) while authorised.

On this basis, and concerning meteorological satellites, these UWB devices can present a risk of for both passive sensors and Earth Stations receptions due to the aggregation of interference produced by multiple devices.

International discussions have been held in ITU-R within a specific Task Group 1/8 (TG 1/8), debate somehow complicated by the fact that the US Administration has already issued in 2002, its own regulations and authorised the use of such UWB applications on the basis of EIRP (Effective isotropically-radiated power) limits.

TG 1/8 has recently finalised its work, recognising the different national or regional regulations (US, Europe or Japan) and summarising up to date compatibility technical studies.

Two different bands are currently considered:
- 10.6 GHz band for “generic” UWB devices mainly for telecommunications and location tracking applications,
- 21.6-26.6 GHz for Automotive Short-Range Radars (SRR).

For the first band, it appears that the US regulations is not sufficient to protect most of the radiocommunications services but would be sufficient for meteorological satellites, either for the 1.4 GHz and 10.6 GHz passive bands or reception stations. Europe and Japan are currently in the process of adopting their own regulations and have either confirmed or even tightened the EIRP limits proposed by the US. It hence appears that, currently, the meteorological satellite operations would be safeguarded.

This is certainly not the case for the second band (21.6-26.6 GHz) covering the 23.6-24 GHz passive band. Indeed, this issue has been one of the most sensitive and discussed issues between the powerful automotive lobby and the whole scientific and meteorological community. In this case, the EIRP level regulated in the US has been shown as by far not being sufficient to protect the 24 GHz passive sensors band acknowledging the high car density and noting that between 4 and 8 radars are expected per car. On this basis, after tremendous amount of discussions and political pressure, Europe has also allowed in 2004 such use but only on a limited basis, in number (maximum 7% of the cars equipped) and in time (only up to 2013) after which SRR will have to be deployed in the 79 GHz band. It can also be noted that Canada has recently authorise such 24 GHz SRR but with a “notch” in the 23.6-24 GHz band with lower EIRP levels assumed to ensure the protection of passive sensors.

However, at this stage, and recognising the by nature worldwide measurements performed in this band, the US regulation still put at risk the global integrity of the measurements in the 23.6-24 GHz band. This is without saying that the European Regulations will not be jeopardised in the future and make sure that the limitations will be strictly applied. The meteorological community will certainly have to be vigilant with this respect.

It is finally worth noting that the ITU-R TG 1/8 has confirmed the non compatibility between these SRR and EESS (passive) presenting a negative margin higher than 30 dB!

**COMS frequency notification process**

At CGMS-32, KARI informed CGMS about the issue of the advanced publication for the COMS series with the ITU-R. In response to AI 32-05, KMA informed CGMS that the national meteorological payload of COMS would become part of the space-based GOS of the WMO.

KMA representative reported progress on the frequency coordination for the COMS satellite with concerned parties. KMA and KARI have had two informal technical meetings and one official Japan-Korea Satellite Frequency Co-ordination meeting with JMA and two meetings with CMA. Most part of the issues with CMA have been resolved, although further meeting is required to resolve the remained issues. Although many progresses have been made with JMA, there are still issues to be discussed, especially issues on the interference scenario between COMS-128.2 E and MTSAT-B-135 E. KMA representatives also commented that KMA and KARI would like to have next informal technical meeting with JMA as soon as possible. JMA commented that the schedule for this meeting was not yet fixed.

**Potential problems for operational scenarios caused by frequency overlaps**

Frequency plans for future polar-orbiting satellite systems indicate that there is potential for harmful interference of one system into another. Potential problems to the operations of polar-orbiting meteorological satellites were reported to CGMS-32. These could be caused by transmissions of direct readout services in frequency bands close to those used for the transmissions to main Earth stations. A particular problem was identified between future NOAA and EUMETSAT operations.

At the CGMS-32 Meeting in Sochi, Russian Federation, 17-20 May 2004, NOAA received the following two actions relating to interference from the NPOESS HRD downlink to the MetOp GDS downlink:

Action 32.06 NOAA and CMA to develop operational procedures to avoid interference of their direct broadcasts into the main data dump transmissions of MetOp in the frequency band 7750-7850 MHz. Deadline: CGMS-33

Action 32.07 NOAA to report back on the analysis of study results [by EUMETSAT] concerning potential interference between polar-orbiting meteorological satellites. Deadline: 31 December 2004.

NOAA-WP-18 and NOAA-WP22 were in response to AI 32.06 and AI 32.07. The working group was informed that studies were refined and an agreement

was implemented between NOAA and EUMETSAT by an exchange of letters. This agreement includes agreed changes of technical specifications including the reduction of transmission bandwidth as well as the change of centre frequencies.

Applying the new parameters it can be expected that interference in case of transmissions in the band 1698 -1710 MHz will be in the order of <3% which is acceptable for this type of service.

In the case of interference in the X-band the expected maximum interference after the agreed modifications would be 16 min /year calculating into 0.03 %. This would be at a level acceptable to EUMETSAT.

It was also noted that in case of interference exceeding the above levels there would be the technical feasibility to temporary switch off transmissions via operational means.

At CGMS-32 CMA indicated that they are also planning a direct read-out broadcast in the frequency band 7750 – 7850 MHz. For this reason CMA was included into AI 32.06. No response was received before CGMS-33. During the working group meeting CMA announced that the planned launch date for FY-3 is 2007. This creates the need for urgent co-ordination similar to the one performed between NOAA and EUMETSAT in this matter. It was agreed that CMA would provide a set of technical parameters of the planned X-band broadcast as a matter of urgency to allow studies. It will be necessary to agree operational measures to avoid interference to the data main data downlink of MetOp at the earliest possible date.

**Action 33.11 CMA to provide as a matter of urgency technical and operational parameters of the planned data transmissions in the frequency band 7750 -7850 MHz to CGMS Members. Deadline: 1 December 2005**

**Action 33.12 EUMETSAT to perform sharing studies for X-band operations at MetOp stations and propose technical and operational measures to avoid interference. Deadline: 1 February 2006**

ROSHYDROMET announced that they are also planning main data dump transmissions to their main data acquisition station operating in the band 7750 – 7850 MHz. There would be also a potential for interference from direct broadcast services into the planned ROSHYDROMET service. The impact of such interference needs to be evaluated. Study results therefore need to be made available to ROSHYDROMET to support their sharing studies.

It was stressed that for future use of the frequency band 7750 – 7850 MHz early co-ordination would be essential and SFCG Resolution 19-7R2 needs to be strictly applied. It was agreed that WG I will annually review the status of

frequency band use and plans for new systems to detect possible conflicts at the earliest possible time.

**Action 33.13 WMO to provide a forum for discussion on data transmission from meteorological satellites, with a goal of resolving radio frequency conflicts, well in advance of notification to ITU, and adopting approaches to avoid them.**

Concluding the discussion of frequency co-ordination matters, WMO announced that a workshop on radio frequency matters would be held on 20 – 21 March 2006, tentatively in Geneva (Switzerland). CGMS representation would be appreciated with presentations on current and future use of frequency bands for meteorological satellites.

## I/2 Telecommunication techniques

There were no topics for discussion under this item.

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

In working paper ROSH-WP-02, Russia informed CGMS that a batch of modernized DCPs had been installed at hydro-meteorological stations in the European and Ural regions of Russia. These DCPs are designed for operation within the Russian DCS via Meteosat (in a first phase) and, in a second phase, via the Electro-L N1 geostationary satellites. DCP signals are transmitted using Meteosat–7 International channels I25 and I26 (according to an Agreement between EUMETSAT and Roshydromet, and supported by CGMS). At present, these DCPs are working on an experimental basis, the major objective being to develop and test the Russian DCS ground segment up to the time Electro-L N1 is launched.

Data collection is carried out using the SRC PLANETA ground receiving station near Moscow. The decoded data (messages) are transmitted to the Roshydromet Main Communication Center for the subsequent transmission (in GTS code form) via ground telecommunication channels to GTS.

As stated at a previous meeting, satisfactory quality of data collection was not ensured for the DCPs allocated near the northern polar boundary of Meteosat-7 field of view. This is most likely the result of the higher Meteosat-7 inclination, which is no longer controlled. These DCPs have been re-allocated to new locations in European Russia.

On the basis of test results, DCPs have been modernized and, at present, they operate on an experimental basis.

ROSH-WP-02 also noted that the tentative launch date of the Electro-L N1 satellite is 2007, and according to current planning, the Electro-L N1 DCS will support the operation of 300 national, and 33 international channels, with the

bandwidth of each channel being 3 kHz. It is planned to develop two data reception centres in Russia (Moscow and Novosibirsk) and to allocate not less than 800 national DCPs.

In order to ensure further development of the Russian DCS, Roshydromet and the Russian Space Agency plan to use other Russian (telecommunication) geostationary satellites to complement the capabilities of the meteorological geostationary satellite communication systems. It was noted that in the longer term, Russia intends to deploy in the region of 3000 Regional DCPs.

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

In NOAA-WP-09, a status report on the performance of the International Data Collection System (IDCS) was provided. During the last year, NOAA continued to improve the GOES DCS service for the environmental community. Projects to improve the Regional DCS service include the transition to High Data Rate transmitters, a technical study for the development of Narrow Band Transmitter specifications and the coordination of design characteristics for a minimal backup of the DCS distribution subsystem. The transition to the Regional High Data Rate (HDR) transmitters has progressed rapidly, with over 9000 assignments now in the system for 300 baud and 1200 baud transmitters. With approximately 25,000 transmitters assigned, this now comprises approximately 1/3 of the operating GOES DCS platforms. Most transmitters are assigned 5 or 10-second transmission windows, and with hourly reporting cycles. NOAA continues to clear the 100 baud channels to make room for 300 baud channels. Of the 200 domestic channels NOAA manages, almost every channel above channel 100, with the exception of the random channels, has been reprogrammed for use by 300 or 1200 baud transmitters. NOAA added that it would completely phase out all 100 bps DCPs from its Regional DCS over a period of about 10 years. They would remain in use, however, for the IDCS, until agreed otherwise by CGMS.

It will be recalled from CGMS-32, that NOAA “borrowed” a block of 5 IDCS channels with the intention of using them as random channels during the transition of DCP to High Data Rate. With extreme appreciation to the CGMS Members and the Secretariat, NOAA would like to thank everyone involved in making this request a reality. However, NOAA would now like to return the five (5) IDCS channels to the CGMS community for immediate re-use, as appropriate. In the light of the Indian Ocean Tsunami and the earthquake in Pakistan and the West India regions, NOAA believes CGMS can use these resources more effectively. NOAA would like to thank CGMS Members for their hard work and cooperation on this matter.

JMA-WP-09 reported on the current number of registered Data Collection Platforms within the MTSAT IDCS (formerly, the GMS IDCS (before 27 April 2005)), the operational status of the system, and interference to MTSAT IDCS channels.

By the end of August 2005, 64 IDCPs were registered on the MTSAT IDCS, and they operated on 8 of the 33 international channels. The registered IDCPs included 57 on ships and 7 on board aircraft, i.e. Aircraft to Satellite Data Relay (ASDAR) units. WG I noted that there had been very little change in the number of registered IDCPs over the last reporting period.

Concerning channel use, it was noted that ASDARs are assigned to channel 18, and ships are assigned to channels 6, 7, 10, 14, 15, 16 and 20. Received IDCP messages, except for invalid and/or duplicated messages, are then disseminated via the GTS.

Concerning interference to the IDCS, in the period April 2004 to July 2005, severe interference causing the failure of data collection, was observed in channels 1, 2, 31 and 33. Monitoring is carried out on all channels. More general information can be found in the "GMS/MTSAT Monthly Operations Report" from the Meteorological Satellite Centre (MSC) web site (http://mscweb.kishou.go.jp/operation/opr_report.htm).

In EUM-WP-07, EUMETSAT presented a status report on the global performance of the International Data Collection System (IDCS). CGMS were informed that as of the beginning of September 2005, there were 144 International DCP (IDCP) registered worldwide for use with the IDCS, using 10 of the 33 channels available. The following DCP programmes use the International channels for regional purposes:

- 52 DCP allocated on channels I23 and 24, operated by the Aeronet programme.
- 20 DCP allocated on channels I25 and I26, operated by ROSHYDROMET.
- 181 DCP allocated on channels I27-I33, operated by WMO agro-meteorological and hydro-meteorological networks.

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

| Channel | 06 | 07 | 10 | 12 | 13 | 14 | 15 | 16 | 18 | 20 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | 12 | 26 | 10 | 17 | 6 | 9 | 9 | 34 | 9 | 12 | 30 | 22 | 20 | 0 | 45 | 29 | 12 | 31 | 31 | 14 | 19 |
| | Regular IDCS | | | | | | | | | | Aero | | ROS | | WMO Networks | | | | | | |

As an example of use, during September 2005, EUMETSAT processed 10,901 messages from 144 IDCP transmitting in the Meteosat field of view. In addition, there were 51,867 Aeronet messages and 6,215 WMO network messages. The number of Aeronet DCP messages have significantly increased from the last report (March 2004), mainly due to new DCP allocations. There were 915 ROSHYDROMET messages received, all of which could not be recognized or rebroadcast due to inappropriate ID information. Russia confirmed future IDCS allocations would contain correct ID information. These messages are, however, received locally in Moscow and rebroadcast via the GTS.

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

During the last twelve months the levels of interference affecting users of IDCS channels within the Meteosat telecommunications field of view has been higher than in previous years, with interference detected on channel I30 and I33.

CGMS Members also noted that in order to use the increased bandwidth and reduced frequency separation of the MSG DCS, users must use DCP transmitters that have been certified for use with the MSG system. Currently, there are only two manufacturers who have DCP transmitters that are certified for use with MSG. For details please email OPS@eumetsat.int. CGMS further noted that DCPs that are currently allocated for regional use on the International channels are not certified for MSG use and, therefore can only be allocated to MSG-2 (Meteosat-9 once operational) channels when replaced by certified DCP transmitters.

CGMS also recalled that following the failure of an SSPA on board MSG-1, it is currently not possible to operate the direct broadcast services, nor an IDCS mission using Meteosat-8 (formerly MSG-1). However, EUMETSAT plans to implement the baseline Data Collection and Retransmission Service with the introduction of MSG-2 (launch currently expected in late December 2005). In the meantime, DCP messages acquired via Meteosat-7 are re-broadcast via EUMETCast as well as via the Meteosat-7 DCRS. WG I also noted that Meteosat-7 broadcast services are currently scheduled to terminate on 14 June 2006, prior to relocation of this satellite to 63 degrees east.

Concerning IDCS Coverage over the Indian Ocean, EUM-WP-07 further reported that in response to the Asian Tsunami disaster on December 26$^{th}$ 2004, EUMETSAT activated the DCP transponder on board Meteosat-5 in March 2005. This allows more frequent transmissions than is possible on Meteosat-7, which now has limited DCS capacity. Several tidal gauges operated by the Pacific Tsunami Warning Centre (PTWC) were reallocated to International channels 8, 9 and 11 with the agreement of CGMS, transmitting every 15 minutes via Meteosat-5. The DCP messages are relayed as bulletins to the GTS via the EUMETSAT Fucino (Italy) ground station and EUMETSAT Control Centre in Darmstadt, Germany. In addition these DCP messages are retransmitted via Meteosat-7 DCRS and via EUMETCast.

TWC currently plans to have 14 DCPs operating in the Indian Ocean region by the middle of 2006. Gauges are being deployed as far East as 115°E, which is generally outside of the field of view of Meteosat-7. In addition, the Indian Ocean Tsunami Warning Centre, currently being established, will almost certainly make use of the IDCS, for transmission of tidal gauge data.

WG I noted that this support to the Tsunami Warning Systems now leads to a long-term requirement to support a DCS over the Indian Ocean, however the following constraints have to be recalled:

- As mentioned above, Meteosat-7 will be relocated to the IODC position around 63°E during 2006 to take over from Meteosat-5, which will be removed from orbit by mid 2007. Additionally, Meteosat-7 cannot support the DCS service during the eclipse period (up to 2 hours per day for the two 42 day eclipse seasons), due to satellite amplifier performance limitations. Meteosat-5 can act as back-up during these periods until it is removed from orbit. Then an alternative strategy is required.

- The capabilities of the Chinese, Japanese, Indian and Korean Data Collection Systems to potentially act as a back-up to Meteosat-7.

In the following discussion, WG I was pleased to note that CMA was willing to look at the possibility of providing support to the Tsunami warning system in the region using the IDCS capability on board FY2, especially at times when there might be interruptions in the service provided by Meteosat-7.

Concerning the future use of the IDCS, EUM-WP-07 noted the following issues:

- Several satellite operators now use IDCS channels for regional purposes, ostensibly on a temporary basis. There are far fewer truly mobile DCPs, using the services of more than one satellite, making use of international channels.
- Several satellite operators are moving away from 100bps DCPs to higher bit rates, in line with evolving user requirements – this, in turn, raises problems with a common IDCP certification.
- The common IDCS database, maintained by EUMETSAT, has been hardly used in recent years, mainly due to the lack of new International DCP allocations.

WG I members were invited to discuss the issues concerning the future operation and support to the IDCS and examine the possible need for an ad-hoc DCS focus group, comprising DCP experts from CGMS satellite operators and WMO, who would analyze requirements, in particular those needed to set up short notice disaster monitoring systems (see later discussion) and to address requirements for a medium (2-5 years) and a long term (over 10 years) IDCS. It was suggested that this ad hoc focus group would work mainly by email.

NOAA-WP-10 also discussed requirements for near and long term capacity of the IDCS channels. NOAA's near-term use of the IDCS includes plans to provide support to devastated areas where regional DCS support is not feasible. Considering the operational state and transitional flux of the domestic DCS service, the IDCS, with approval from the CGMS Members and

the Secretariat, can be utilised to provide data needed for hazard relief, with the actual level-of-support determined by the severity of the event(s).

The long-term use of the IDCS depends on how well new users are attracted to the System. After all, it is a valuable resource, capable of supporting international as well as global programmes. Like other CGMS Members, NOAA, as an environmental agency, believes that these resources should be fully exploited.

JMA-WP-10 reported on the collection of tidal/tsunami data using JMA's Data Collection System on board MTSAT-1R and the introduction of its Operational Tidal/tsunami Data Collection System.
It is, sadly, well known that the Indian Ocean Tsunami, caused by the earthquake off Sumatra on 26 December 2004, resulted in devastating loss of life and damage in many countries, and has drawn worldwide attention to the importance of monitoring tidal/tsunami data. Consequently, the positive role of tidal/tsunami data collection, using the MTSAT DCS is now more important than ever. During the UN World Conference on Disaster Reduction held from 18 through 22 January 2005 in Kobe, Japan, JMA announced that it would actively push forward the acquisition of tidal/tsunami data in the Indian Ocean region through the MTSAT DCS, as part of JMA's supportive actions toward the establishment of the international tsunami early warning system in the Indian Ocean region. As a first step, JMA had already allocated eight new addresses, time-slots, and WMO headers to tidal/tsunami DCPs after the Indian Ocean Tsunami. Moreover, JMA started collecting data from DCP at Colombo, Sri Lanka operated by the University of Hawaii using MTSAT DCS and distributing them to the Pacific Tsunami Warning Center (PTWC) via the GTS in January 2005. JMA also started collecting and distributing tidal/tsunami data from a DCP at Sibolga, Indonesia in April 2005. JMA also started to operate a tidal/tsunami DCP to observe sea level at Minami Torishima Island (24º17' N, 153º 58' E) in 1996 in order to detect tsunamis caused by earthquakes and to issue tsunami warning with sufficient lead time before the tsunami strikes land. In 2002 JMA upgraded the tidal/tsunami DCP on the island, with a transmission rate of 300bps and installed a new function of collecting seawater temperature data, in addition to sea level. The data transmission rate of 300bps shortened the transmission time from 50 seconds to 20 seconds. WG I noted that both 300bps DCP as well as 100bps DCP are available within the MTSAT DCS.

Very much appreciating the contribution made by JMA in establishing this important warning service, WG I, whilst noting that this was largely a Regional DCS system, agreed that advantage could be taken of the wide experienced gained by JMA in setting up such a system, when establishing a broader IDCS-based system in this or, indeed, in other regions of the world.

NOAA-WP-11 also discussed possibilities for the expanded use of the IDCS channels. In order to support a broader use of the International Data Collection Service channels, NOAA recognised the critical importance of real time observations during catastrophic events. The IDCS had the capability to provide authorities with meaningful information on natural as well as man-

made events. Furthermore, the system can be used as an instrument for obtaining data on events that may lead to loss of life. As an observational tool, the IDCS can be used to monitor global events that impact regions or whole nations.

NOAA-WP-11 also recalled that during the darkest days surrounding “9/11”, the pollution from the rubble and debris created an environmental nightmare in the New York area and the US Environmental Protection Agency (EPA) had to monitor the quality of the air to determine any serious health threats. Such monitoring required a vast network of sensors to track pollutants. NOAA provided special support to the EPA via the GOES Data Collection System to support this operation. A platform was mounted at “ground zero” in New York to provide real time monitoring of the air quality throughout the period of clean-up operations.

NOAA currently maintains a tsunami warning system that consists of a series of environmental platforms stationed in the Pacific Ocean which contain wave monitoring instruments. When a tsunami event is triggered, the PTWC issues bulletins to Pacific Rim countries. For example, within minutes of getting a recent seismic signal that an earthquake had occurred off the west coast of Northern Sumatra, Indonesia, NOAA issued a bulletin indicating no threat of a tsunami to Hawaii, the West Coast of North America or to other coasts in the Pacific Basin. The primary support for the PTWC is done through the GOES Data Collection System.

After the Indian Ocean tsunami, NOAA proposed a plan to provide support through the use of the IDCS channels and the GOES-9 spacecraft. That proposal would enable NOAA to better detect and provide notification of dangerous tsunamis in the Western Pacific and Eastern Indian Oceans. Using the same analogy, NOAA believes the IDCS should be used as the basis for international support for catastrophic events worldwide. As an international tool for the collection of in-situ data, the IDCS is ideal for monitoring dangerous events worldwide, since the IDCS is designed to support mobile data collection platforms on ships, ocean buoys, aircraft or balloons, which move from the telecommunications field of view of one geostationary spacecraft to another. Along with using the existing NOAA DCS facilities and infrastructure, the IDCS is the ideal tool to provide continuous international support for catastrophic events.

NOAA, therefore, believes that CGMS should further investigate the possibilities of using the IDCS, along with the existing DCS infrastructure and existing technologies, to provide international support of catastrophic events. This may entail the development of real time event monitoring and/or resource coordination and access to inexpensive “off the shelf” equipment which can be deployed within a period of a few days.

### I/3.2 Ships, Including ASAP

WMO-WP-13 provided a status report on ASAP operations over the last year. Operational statistics of radiosoundings performed in 2004 within the framework of the EUMETNET ASAP Programme show that the number of corrupted call-signs has been smaller in 2004 compared to 2003. The number of reports at 500 hPa level in 2004 increased by 824 for temperature data and 449 for wind data, compared to the previous year, but decreased by 321 for temperature data and 440 for wind data at 20 hPa. Even so, the quality of the data has continued to be good. Statistics for vertical profiles of temperature and wind, for the period January to December 2004, show a generally good performance of ASAP units.

The purpose of this EUMETNET-operated ASAP project is to combine the various European ASAP operations under a central management. This will be achieved by integrating national ASAP systems, and procuring new systems on behalf of EUMETNET. The overall target is to receive 6,300 soundings per year, from 18 ships, by 2006.

It was noted that in the past few years, there had been frequent changes in the routes of ASAP units. Consequently, NMHSs had to find new maritime companies to host the units and new routes. However, ASAP routes are not selected without scientific considerations, in fact EUCOS, in Europe, and WMO recommend new ASAP units to be enlisted on specific maritime routes selected on the basis of scientific studies or practical advice of forecasters.

### I/3.3 ASDAR

Whilst no working papers were presented under this topic, WMO commented that the ASDAR project was now drawing to a close and at the present time only one ASDAR unit was operational.

### 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

Concluding the business of WG I, the Chairman summarised the discussions relating to the potential future use of the IDCS. The system was being used, though not to full capacity. It was now actively being used for real time disaster event monitoring. WG I members agreed that the IDCS was a valuable asset of CGMS which should be maintained, at least into the medium term, and possibly even into the long term. Additionally, the future role of the IDCS for disaster monitoring scenarios and the protection of life should be addressed within the context of GEO/GEOSS, however, WG I members already considered that such a role could be significant, especially in disaster situations which occurred within overlapping coverage zones of two or more satellites.

In order to move this issue forward, WG I proposed the allocation of a block of, e.g. 5 IDCS channels, for use by emergency/disaster monitoring systems, which could be supported by all CGMS satellite operators, and the continued use of which would be confirmed by WG I, on behalf of CGMS, on a yearly basis. Channels and a set of IDs would be pre-arranged and used by any certified emergency IDCPs. WG I stressed that, like all other IDCS users, only DCP certified for use with the IDCS could make use of disaster/emergency monitoring IDCS channels.

It was also proposed that an IDCS contact group, comprised of members of participating satellite operators, and WMO, should be created, to address management issues relating to disaster monitoring systems, the need, or otherwise, for a common IDCS certification process, to address the medium and longer term development of the IDCS, and other tasks that might be assigned to it by CGMS and its WG on Telecommunications. It was expected that this contact group will carry out its business mainly by email and will report to WG I on a regular basis.

**Action 33.14 Satellite operators participating in the IDCS and WMO to each nominate an expert to the IDCS contact group, and inform the Secretariat accordingly by 31 December 2005.**

# WORKING GROUP II: SATELLITE PRODUCTS INCLUDING SATELLITE DERIVED WINDS

## II/0 Introduction

Working Group II on Satellite Products (WG II) was chaired by Hideyuki Hasegawa, JMA, and Paul Menzel, NOAA, and Johannes Schmetz, EUMETSAT, assisted as secretaries. 35 working papers were presented and discussed. Several of these papers were in response to actions from CGMS-32: In addition reports from the International TOVS Working Group, the International Precipitation Working Group, and the International Winds Working Group were presented. All past actions were successfully addressed and closed. Five new actions and five recommendations were suggested.

## II/1 Image Processing Techniques

CMA-WP-16 summarised status of image registration and navigation for the FY-2C meteorological satellite that are based on the solution of a rigorous mathematical model. Through careful work, image registration and navigation quality for FY-2C was improved. After the navigation parameter is derived, in VIS images, the coastlines in all parts of the image are well matched. But, after orbital and attitude control, additional measures are necessary including updating initial parameters and dispatch procedures of operations. Atmospheric correction is computed over 8x8 pixels providing smooth products and keeping the computing within limits.

CGMS was informed of discussions within the WMO ET-SUP on the use of Red Green Blue (RGB) colour composites to bring forth information within multi-channel imagery for presentation to forecasters. This is particularly relevant with the increase of multi-channel data available from today's generation of geostationary satellites. The session noted that many schemes existed for displaying the imagery, and interpretation was sometimes difficult for forecasters who may not be acquainted with the particular colouring. The session discussed a possible approach in the long-term towards standardisation of RGB compositing and the development of a "toolbox" of methods and guidelines for RGB compositing. Toward that end, WMO will convene a workshop to address RGB compositing.

## II/2 Satellite Data Calibration and Validation

ESA-WP-03 informed the group about the experimental campaigns organised by ESA, which datasets could be of potential interest for IPWG. They come out of ESA Earth Observation campaigns that provide support for the preparation of future space programmes and their users. ESA does not own nor operate facilities but collaborates with national institutes and international organisations to conduct these campaigns; these include CLARE 2000 (Cloud Lidar And Radar Experiment) and WALEX 2002 (WAter vapour Lidar EXperiment). ESA is organising a centralised archive of data sets that will be

made available in 2006. More information about these data sets can be found at:

http://www.esa.int/esaLP/SEM49L1DU8E_LPcampaigns_0.html
http://envisat.esa.int/workshops/acve2/
http://envisat.esa.int/pub/ESA_DOC/envisat_val_1202/proceedings/
http://envisat.esa.int/calval/proceedings/

JMA-WP-11 presented a report on MTSAT-1R navigation and calibration after review of the performance in the first three and a half months. The latest evaluation shows that the image location error is within a pixel. No systematic error is found in the MTSAT-1R IR1, IR2 and IR3 calibration. The brightness temperature of MTSAT-1R IR4 is around 9 K lower than that of GOES-9 IR4. From September, the trend of MTSAT-1R visible channel sensitivity corresponds to that of GOES-9, and no clear change is recognised. JMA is currently reviewing the calibration and navigation processes. WG II commended JMA on the fact that the new satellite which realises new technology that had not been used before. KMA sought clarification on the quantisation of VIS data made available in the operational image data stream. It was agreed that JMA and KMA address the matter bilaterally.

CMA-WP-12 reported on FY2 satellite calibration status. For solar channels, pre-launch calibration is conducted outdoors; while post-launch calibration is based on field measurement. For IR channels, the pre-launch calibration is conducted in a vacuum container simulating the space environment; post-launch calibration of FY2C mainly depends on the inter-calibration with NOAA satellites. Regular comparisons are performed for the same observation areas, time, and viewing angles, and histograms of FY2C observations are maintained compatible with NOAA observations.

WMO WP-21 presented a draft concept and strategy for a Global Space-based Inter-calibration System (GSICS); the paper contained a description of GSICS objectives, users, current status, benefits, guiding principles, pre-requisites, and building blocks. GSICS would be an operational global space-based inter-calibration system that would be a critical step towards a total inter-calibration system. One proposed purpose of inter-calibration was to quantitatively relate the radiances from different sensors viewing the same target to allow consistent measurements to be taken over the globe by all elements of the space-based observing system. GSICS would be part of an end-to-end capability consisting of: on-board calibration devices (e.g., black bodies, solar diffusers); in situ measurements of the state of the surface and atmosphere (e.g. the Cloud and Radiation Test-bed (CART) site, aircraft instruments with NIST calibrations); radiative transfer models that enable comparison of calculated and observed radiances; and assimilation systems that merge all measurements into a cohesive consistent depiction of the Earth-atmosphere system. The objectives for the operational GSICS are: to improve the use of space-based global observations for weather, climate and environmental applications through operational inter-calibration of the space component of the WWW's GOS and GEOSS; and to provide for the ability to

retrospectively re-calibrate archive satellite data using the operational inter-calibration system in order to make satellite data archives worthy for climate studies.

CGMS Members agreed with the draft GSICS concept and strategy and noted that while the utilisation of radiances as a key element in GSICS would be suitable for radiometers, it may be appropriate to utilise other parameters for active instruments. CGMS Members strongly agreed that it was necessary to formalise inter-calibration activities under the aegis of GSICS within CGMS. It also stressed the need to avoid duplication with other inter-calibration efforts while complementing previous existing activities such as ISCCP and CEOS Cal/Val. CGMS Members were informed of a recent American Meteorological Society Bulletin article that cited the need for future reference networks for inter-calibration. Thus, CGMS Members agreed to the development of an Implementation Plan for GSICS. It suggested the need for a draft Implementation Plan to be available for review by CGMS Members well before the next session of CGMS.

**Action 33.15 CGMS Members to establish a Task Force lead by NESDIS (Mr Mitch Goldberg) with participation by EUMETSAT (Dr Johannes Schmetz), JMA (Mr. Toshiyuki Kurino), CMA (Academician Xu Jianmin) and assisted by the WMO Space Programme to prepare a draft Implementation Plan for GSICS by 1 July 2006 for review by CGMS Members by 1 August 2006 and approval at CGMS-34.**

EUM-WP-11 informed the WG that the initial EUMETSAT ATOVS Retransmission Service (EARS) is now called EUMETSAT Advanced Retransmission Service. This reflects its success and the resulting service expansion. In addition to the processed ATOVS data, AVHRR and ASCAT data will also be made available to the users. EUMETSAT informed the WG further that its Council has agreed to continue this service at least until the end of 2008. Furthermore it is planned to increase the coverage of the EARS by possible inclusion of additional receiving sites at Muscat (Oman), Moscow (Russia) and South Africa.

JMA-WP-14 explained about JMA's activities for Asia-Pacific Regional Advanced Retransmission Service of ATOVS data. Current status of AP-RARS and data processing at MSC/JMA are explained. Phase-1 data exchange will be started by the end of 2005. WG II noted with pleasure the contribution of JMA to the ongoing efforts toward a more rapid data dissemination and circulation.

### II/3 Vertical sounding and ITWG matters

EUM-WP-13 presented a note provided by J.-N. Thépaut of ECMWF summarising the current and future activities at ECMWF on the assimilation of cloud-affected radiances. The paper responded to Action 32.14. It formulated

requirements related to observational products, provided an overview of model developments and presented the status of current work at ECMWF, which covers the assimilation of rain radiances and advanced and fast forward models for cloudy atmospheres.

JMA-WP-15 presented work at JMA regarding satellite imagery simulation from Numerical Weather Prediction (NWP) outputs. The paper was submitted in response to Action 32.14. The simulated imagery has been produced during the process of development of satellite data assimilation. It is used as a monitoring tool of the NWP models of JMA since it visualises the cloud and water vapour distributions. Moreover it is used as a reference material of weather forecast operation at JMA. Since radiative calculation in NWP models contains cloud effects, it is possible to calculate satellite infrared brightness temperature and visible reflectivity at cloudy regions by applying the radiation scheme of NWP models. The radiative transfer models were developed based on radiation schemes of the Global Spectral Model (GSM) to estimate satellite brightness temperature and reflectivity. The simulation has been performed experimentally for the Meso-Scale Model (MSM) also.

NOAA-WP-12 gave a review the progress toward indirect or direct assimilation of cloudy radiances into NWP models. It noted that current infrared sounders with fov size greater than 14 km are likely to make cloud free measurements less than 5 to 10 % of the time. Cloud clearing extrapolates clear sky spectral radiances from cloudy spectra with differing cloud contamination; it accounts for the cloud effects with a clear sky replacement strategy. But replacing the whole globe of cloudy profiles with cloud cleared profiles, without the benefit of ancillary cloud property data, is essentially providing the NWP model with initial states not consistent with the truth. Thus direct assimilation of cloudy infrared radiances needs to be developed; this requires a cloudy forward model that is both fast and accurate. So far both one-layer and two-layer fast cloudy forward model are under development, the limitation of the accuracy of the fast cloudy sky radiative transfer model and its practical application into the radiance assimilation process still require considerable study and attention. The validation of these cloudy fast models remains a major challenge.

CGMS discussion of these papers on the use of cloudy radiance in NWP prompted the recommended action that the ITWG coordinate studies of radiative transfer in cloudy atmospheres and formulate priorities for future product developments related to the use of cloudy radiances in NWP.

**Action 33.16 The ITWG should also help to formulate priorities for future satellite product developments related to the use of cloudy radiance in NWP. The ITWG Rapporteur should inform the ITWG co-chairs of this new action.**

NOAA-WP-13 reported on the fourteenth International TOVS Study Conference, ITSC XIV, was held on the Chinese Meteorological Administration campus in Beijing, China from 25 - 31 May 2005. The ITSC-

XIV presentations, Working Group meetings and discussions documented significant gains in many areas and noted areas for future activity. Highlights included:

a) Several NWP centres have started using ATOVS radiances from the EUMETSAT Advanced Retransmission Service, EARS, in order to provide more timely data (within 30 minutes) to their NWP models.

b) All satellite agencies should be urged to provide their data to NWP centres as part of the cal/val programme. Recent experience with SSMI(S) data has once again shown the value of NWP to help diagnose unforeseen instrument characteristics.

c) A Community Radiative Transfer Model is being developed at the Joint Centre for Satellite Data Assimilation (JCSDA); this is in response to guidance that all radiative transfer (RT) modelers must standardize interfaces to their models to make it easier for users to incorporate the RT models into their own applications and to facilitate comparisons.

d) ITSC XIV reiterated the importance of using more data over land. There were no major advances reported in the use of infrared radiances over land however promising results were presented for the use of more microwave radiances over land.

e) ITSC XIV recommended placing NPP into a 1430 UTC ascending orbit (instead of the planned 1030 UTC descending orbit) in order to complement the MetOp/IASI with NPP/CrIS and to provide continuity with Aqua/AIRS.

There were several specific actions and recommendations to the CGMS. They are itemised below:

ITWG1 Research and operational satellite operators should make data available in a layout that makes data sets from a given time and location easy to find.

ITWG2 The WMO, with CGMS assistance, should continue to promote the implementation of a globally coordinated system of RARS.

ITWG3 CGMS should continue to provide a forum for discussion and coordination among satellite operators to avoid orbit overlap as much as possible.

ITWG4 There is a strong need for enhancing the capabilities of the space based component of the GOS through distribution of new remote sensing development tasks amongst the space operators and R&D agencies. Those agencies contributing to the polar component should distribute the development tasks necessary to best serve

user needs with the resources available. CGMS should consider discussion of the distribution of development tasks.

CGMS thanked the ITWG for its work on behalf of improved utilisation of remote sensing data and noted that ITWG actions 2-4 were already under consideration at this meeting. It further noted that the WMO Space Programme Office would be asked to look in to Action ITWG1.

EUM-WP-14 responds to Action 32.15 and provides guidelines for hosting workshops under the auspices of CGMS. Three International Working Groups (International Precipitation Working Group, International TOVS Working Group, and International Winds Working Group) organise workshops on a regular basis, at intervals of about 18 – 24 months. The three International Working Groups have concentrated their efforts on enhancing the utilisation of and improvement in the quality of satellite products in three main areas: i) satellite soundings, ii) satellite tracked winds, iii) satellite derived precipitation. The workshops facilitate the exchange of recent progress in the science and utilisation of the products in the pertinent areas.

**Recommendation 33.05 CGMS Members are kindly requested to provide support to the three CGMS sponsored International Working Groups, by providing travel support etc. to selected scientists.**

### II/4 Precipitation and IPWG matters

WMO-WP-14 informed CGMS Members on the status of activity related to International Precipitation Working Group (IPWG). The paper provided a summary of the "Second International Precipitation Working Group Workshop", Monterey, California, USA, in October 2004. Over 50 participants from 19 countries took part in this 3½-day workshop. The workshop addressed operational, validation and research issues. In addition, the workshop addressed science issues that were posed by CGMS-32: 1) GPCP assessment; 2) solid precipitation; 3) precipitation over complex terrain; and, 4) ongoing validation studies. In addressing operational issues, the group reviewed various techniques for estimating precipitation, including blended techniques that combine information from microwave and infrared sensor systems. The status of the IPWG website was reviewed and it was noted that the precipitation algorithm inventory, while it has grown significantly since the first meeting, needs to be updated to reflect technique modifications and new methods. Considerable activity is underway with respect to validation/intercomparison studies with three IPWG validation sites (Australia, the United States of America and northern Europe, with five additional validation sites proposed: S Korea, S. Africa, Japan and surrounding waters, Taiwan, and southern Brazil. CGMS Members should note and support these ongoing Validation activities. In the research area the workshop addressed new sensor technology, including the potential of geostationary microwave. Finally, WMO-WP 14 reminded Members to note and support the IPWG science meeting scheduled to take place in Melbourne Australia in October

2006. A portion of the workshop will overlap with the Asian Pacific Satellite Training (APSATS-2006) event that is also scheduled for that month.

EUM-WP-24 informed the WG that it has recently implemented an operational algorithm for derivation of hourly rain rates from first generation Meteosat data. Implementation was in response to recommendations by the IPWG of the CGMS and requests from the African Users Forum. The derivation method uses DMSP SSMI microwave data for the calibration of the Meteosat infrared data. The data are available via the EUMETCAST web site in graphical form and for download as GRIB2 data. The resulting rain rates are available for Meteoast-7 at $0^o$ and Meteosat-5 at $63^o$E. The implementation for Second Generation Meteosat, making use of the full multispectral image potential of SEVIRI, will be done during the next months. The algorithm will be based on developments in the IPWG and previous studies at the Consiglio Nazionale delle Ricerche (CNR) and the University of Bologna (Italy).

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

EUM-WP-16 summarises the outcome of the 7th International Winds Workshop (IWW7). This workshop took place in June 2004 in Helsinki, Finland. The paper presents the response of IWW7 to actions from CGMS-32. The second part of the paper suggests topics for the upcoming IWW8 in Beijing in April 2006. In particular it is suggested to stimulate and re-enforce research on the derivation and use of Atmospheric Motion Vectors (AMVs); to this end the paper listed specific issues that should be addressed. WG II discussed the suggestions for enhanced research in some detail and tried to provide guidance with regard to priorities. In particular the following recommendations were made for consideration at IWW8:

a) Satellite constellations provide novel opportunities to explore critical issues for AMV derivation, notably an accurate height assignment of cloud tracers with active instruments.

b) The use of geometric approaches to height assignment should be further pursued and, if possible, independent reference methods should be established for the validation of cloud height assignments using operational multi-spectral techniques.

c) AMV quality is an integrated result of many steps, starting with navigation. WG II recalled that it is important to keep those steps in a balanced perspective. It is suggested to revisit the individual processing steps. CMA was referred to as an example on how to progress through a comprehensive approach considering all processing steps.

d) Target identification should be revisited considering the errors due to pattern evolution in time.

e) The potential to utilise derivatives from AMVs (e.g. divergence and vorticity) should be further explored.

f) A general comment suggested that better ways to derive the atmospheric motions at different scales are needed, however WG II did not feel in the position to propose a particular method.

g) Last but not least WG II recalled that good AMVs often get rejected in the preprocessing for NWP models because of too large a difference to the model background. Better description of AMV errors and a better accuracy per se would help to alleviate that situation.

WG II concluded that other areas for future research on AMVs, as listed in EUM-WP-16, should also be considered in the specific working groups at IWW8 when a broader attendance of specialists is expected. With regard to the upcoming IWW8 WG II encourages active participation by satellite operators and their partners in the NWP and research communities. Therefore the following action:

**Action 33.17 CGMS Members are requested to ensure adequate participation at the upcoming 8th International Winds Workshop in Beijing from 24 – 28 April 2006. Participation from NWP centres and relevant research institutes should be encouraged and requested by CGMS operators with indications of attendance and support by 31 December 2005.**

JMA-WP-13 reported on the status of MTSAT-1R AMVs. The key changes from GOES-9 AMVs are 6-hourly AMV retrieval using shorter time interval images, 15 minutes, and new product, the hourly AMVs. The MTSAT-1R AMVs were evaluated. The 6-hourly MTSAT-1R AMVs are slightly worse than those of GOES-9, but the number of vectors has increased. The hourly AMVs have better quality than the 6-hourly AMVs. JMA will continue evaluating MTSAT-1R AMVs during the on-going tune-up of MTSAT-1R and report to the CGMS Members in due course. Use of the additional infrared channel with wavelength 3.8 microns for the AMVs products at night time is planned. The papers also notes that the shortened time interval causes the ratio of high quality AMVs to be smaller, a result which is corroborated by a similar study based on GOES-9 image data.

NOAA-WP-15 reported on the continued efforts to improve the quality of Atmospheric Motion Vectors (AMVs) derived from NOAA's Polar and Geostationary Operational Environmental Satellites as well as from NASA's Terra and Aqua polar-orbiting satellites. Operational production and distribution of low level (P > 600mb) cloud drift winds, derived from the 3.9 µm shortwave infrared window channel on the GOES imagers, started in 2005. Experiments with Super-Rapid-Scan Operations (SRSO), providing limited-area coverage of one-minute interval sampling over meteorological events of interest, are enabling wind vector estimates that are having positive impact in regional numerical weather prediction tests. Active areas of winds research include investigating optical flow approaches to the problem of feature

tracking, derivation of AMVs from rapid scan GOES imagery, and derivation of AMVs from the Moderate Resolution Imaging Spectroradiometer (MODIS).

CMA-WP-11 introduced the status of AMVs in CMA. FY-2C AMV products are operational now. The products have been well distributed in China. The overlap display of AMVs and images has been widely used in the daily forecasts at different levels of weather observation. BUFR codes containing FY2C AMVs are shown in the discussion. In the discussion CMA noted that internal quality control sometimes dismisses very good wind vectors. WG II felt this point needs consideration at the next IWW8.

IMD-WP-03 provided an update on the status and recent developments of the satellite winds derived at the India Meteorological Department. AMVs are being derived operationally using Kalpana-1 and INSAT-3A IR data. AMVs are very useful for a better depiction of the monsoon related circulation. The quality of winds is constantly monitored and agreeable with accepted standard performance. IMD also reported on the usefulness of wind products from Meteosat-5, in particular the WV AMVs provide important information on the steering current of the circulation pattern.

WMO-WP-28 highlighted the importance of achieving an orderly transition in the generation and distribution of satellite data and products during changes to the configuration of the space-based Global Observing System, particularly relevant for the Numerical Weather Prediction (NWP) community. When new products are declared operational and predecessor products withdrawn there exists the potential to degrade NWP model performance if the new products are of a lower quality than the predecessor ones. It is proposed that satellite operators assign a period of time during which products from new satellites are distributed in parallel with those from predecessor satellites and moreover that activities are initiated during this period to ensure new products achieve at least the quality of predecessor products (by common agreement) before the latter are withdrawn.

## II/6 Other parameters

### II/6.1 Ocean related parameters

ESA-WP-04 gave a summary of the ocean related parameters provided or planned by ESA missions. These include ERS, Envisat, Explorer and the GMES Space programme. The status of the ERS mission is to be found in paper ESA-WP-01. The most complete information about the ERS mission, system, instruments, its products, user services and latest news can be found at http://earth.esa.int/ers/. The Envisat mission, system, instruments, its products, user services and latest news are described in http://envisat.esa.int/. Information about the Explorers mission can be found at http://www.estec.esa.nl/explorer/; relevant missions include GOCE (Geoid and Altimeter), SMOS (Soil Moisture and Ocean Salinity), and Cryosat which suffered a launch failure 8 Oct 2005. ESA is defining the contents and arrangements of the missions that will encompass the GMES (Global

Monitoring or the Environment and Security) Space Programme aimed at providing data for operational services to cover a number of sectors. GMES will likely include (a) an Imaging radar C-band interferometric mission, relevant to: water pollution, ocean surveillance, coastal zone management and ice monitoring, (b) an optical sensor suite operating at medium (250 m) to low (1000 m) spatial resolution, ranging from VIS to thermal IR part of the spectrum. It provides continuity to MERIS, AATSR and VGT sensors, and (c) a radar altimeter to provide continuity to ERS-1 and ERS-2.

### II/6.2 Fire related parameters

In ESA-WP-05, it was noted that ESA has not embarked on developing specific sensors to detect fires but ERS and Envisat can provide useful information for fire monitoring. In addition ESA has co-operated with EUMETSAT in the development of the MSG series with the SEVIRI radiometer that features channels appropriate for fire detection. ESA announced that demonstration products are available on the ESA web site. Further ESA informed that an IR-fire element is included in the GMES proposed programme.

EUM-WP-17 provided an overview of current work on a new Fire Radiative Energy (FRE) product that will be developed at EUMETSAT in 2006. The product will be based on MSG/SEVIRI observations and is targeted to support to the global change research community, atmospheric pollution tracking, air quality forecasting and the assessment of carbon emissions. This paper has been written in response to Action 31.18. In addition EUMETSAT informed WG II that it had recently implemented a first version of a fire detection product. The data are available via FTP transfer in GRIB2 format. This new product needs still further refinement and validation during this initial phase. These activities will be performed during the next three months. Thereafter the data will become available in graphical form on the EUMETSAT Web site and will also be disseminated via EUMETCast and via GTS/RMDCN.

CMA-WP-15 provided a brief summary of fire monitoring activities at CMA. Fire monitoring using meteorological satellite data has become routine operation since 1987; inputs from FY-1D, FY-2C, NOAA satellites and EOS/MODIS are used. Fire monitoring products are generated covering China and adjacent areas in boundary countries. CMA provides 10,000 fire reports on average in one year. A variety of fire statistics are generated using GIS. WG II congratulated CMA on the exemplary performance of their service to the community.

NOAA-WP-16 summarised past efforts by the international environmental monitoring and scientific research communities for utilising operational satellites to produce routine fire products and to ensure long-term stable records of fire activity for applications in hazards monitoring, global change research, aerosol and trace gas modelling efforts, land-use and land-cover change detection studies, resource management, and policy and decision-making. This includes polar-orbiting AVHRR on POES, VIRS on TRMM,

ATSR on ERS, AATSR on ENVISAT, and most recently MODIS on EOS. From geostationary orbit the GOES fire detection algorithm is being adapted to Meteosat-8 (2006) and MTSAT-1R (2006) and demonstration of a global geostationary fire monitoring network is planned that will include FY-2C (2004), INSAT-3D (2006), and the GOMS Electro N2 (2006).

**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.**

**Recommendation 33.06 CGMS Members are encouraged to provide the location of their web sites on real time fire detection to the WMO.**

### II/6.3 Cloud and dust related parameters

CMA-WP-14 described recent progress on cloud classification with FY2C data. FY-2C cloud classification is performed in three steps: high cloud detection, cloud detection, and cloud classification. High cloud detection separates high cloud from low cloud and surface; cloud detection separates cloud from surface. Those two steps are performed at single pixel bases. The last step of cloud classification is performed at the segment bases which classifies observations into 7 categories (Cb cloud, dense cirrus cloud, thin cirrus cloud, alto stratus cloud low cloud, land surface, and sea surface). An animation of cloud classification results was shown.

In CMA-WP-13, an algorithm for automatically monitoring dust-storms using FY-2C satellite data was introduced. The algorithm uses split window brightness temperature differences (BTD) and Infra-red Difference Dust Index (IDDI) techniques. Currently, dust detection is operational with FY-2C. WG II noted the well-considered approach that appears to exploit the full potential of the available satellite channels.

JMA-WP-12 described the operational MTSAT-1R satellite products. MTSAT-1R carries an imager with a new channel (IR4) observing at 3.8 microns and it is expected to meet the requirement of the detection of low-level clouds in the night time. The quantisation of all channels is improved to 10 bits from the previous 6 bits (VIS) and 8 bits (IR). The spatial resolution at the satellite sub-point is also improved to 1km (VS) and 4km (IR). Half-hourly observations for the Northern Hemisphere were introduced; there are also 15 minute half-disk images for calculating Atmospheric Motion Vectors (AMVs) four times a day. The improved functions of MTSAT-1R are expected to enhance the quality of the satellite products. In the discussion JMA explained that they operationally utilise 3.8 micron image data of MTSAT-1R for nephanalysis, especially to discriminate fog / stratus in night time.

NOAA WP-21 reported on the conclusions from a workshop conducted under the auspices of the GEWEX Radiation Panel assessing global cloud cover properties from the last two decades. Conclusions include (1) within the

physical uncertainty of the different data sets, no trends on the large scale cloud amount are found but regional trends are evident, (2) consistency between different data sets on the global scale variations (at + 1%) implies more accurate estimates of the variations are at hand in the next few years, (3) the increase of available geostationary measurements in the past two decades offers more near nadir views and likely produces a decrease in estimated cloud cover in the International Satellite Cloud Climatology Project (ISCCP) data, (4) ISCCP and other visible/near infrared approaches are detecting low marine stratus clouds more reliably than infrared only techniques, and (5) HIRS CO2 slicing is detecting more high thin clouds than other approaches with a slight increase of 1% per decade. Future plans include detailed comparisons between different data sets to better understand the detectability of small amplitude variations, combination of approaches sensitive to high clouds (e.g. CO2 slicing) with those sensitive to low clouds (e.g. PATMOS-x or ISCCP vis/near IR spatial threshold and continuity techniques), expansion of trends in cloud cover to include time variations of cloud properties (these are especially sensitive to calibration), and special efforts in the polar regions as some regional changes above the uncertainty are evident. All the data sets examined are public and links to the different data sets are available at: http://isccp.giss.nasa.gov/assessment.html. The workshop made recommendations regarding consistency of cloud detection trends as instruments and algorithms improve, historical inter-satellite calibration initiatives resulting in reprocessing the entire data record, and merging data from complementary satellite instruments.

CGMS-33 lauded the efforts of the GEWEX Radiation Panel and recommended that research funds continue to be made available to support ongoing climate investigations of cloud cover.

### II/6.4 Surface Albedo

EUM-WP-22 reported on the efforts to derive a spatially consistent broadband surface albedo product from different geostationary spacecraft. Ten days of data from GOES-8, -10 and GMS-5 from May 2001 have been delivered to and processed by EUMETSAT. Together with data from Meteosat-5 and -7 this provides the first “global view” of a geostationary surface albedo product. A consistency analysis relies on the comparison of albedo derived over the common areas observed by adjacent satellites. This paper closes the EUMETSAT response to Actions 31.27 and 31.28. EUMETSAT offered to make the surface albedo retrieval algorithm available to the CGMS Members upon request for the processing of their own archived data. The EUMETSAT support would be limited to the algorithm and could not cover the data handling.

EUM-WP-23 paper reported on the EUMETSAT experience handling archived satellite data used for generation of a consistent broadband surface albedo product from five geostationary satellites (Meteosat-5, Meteosat-7, GMS-5, GOES-8, GOES-10); the results of this prototype activity have been described in a separate paper (EUM-WP-22). WG II was invited to discuss the

experience presented in this paper with a view to requirements for the reprocessing of archived satellite data sets for climate analysis and applications. WG II took note and thanked EUMETSAT for conducting this activity and expressed interest to pursue the work further as activity of individual satellite operators.

**Recommendation 33.07 CGMS Members are requested to consider the production of a long-term surface albedo data set from archived VIS channel data of geostationary satellites with the help of the software developed by EUMETSAT.**

**Action 33.19 EUMETSAT to make the algorithm to derive the surface albedo from geostationary satellites available upon request.**

### II/6.5 Other parameters

ROSH-WP-03 presented an overview of Roshydromet / SRC PLANETA activities in the area of routine satellite data processing and derivation of operational products. The satellite's informational products are used by Roshydromet in various application areas, including operational meteorology, NWP, hydrology, agrometeorology, hazards (fires, floods) and pollution monitoring, climatological studies. Examples of some satellite products are demonstrated. The verbal presentation was supported by slides showing examples of various products. WG II commended Roshydromet/SRC PLANETA on the achievements and expressed interested to receive an update at the next CGMS.

WMO WP-24 presented the case for international cooperation on lightning observation from geostationary orbit. Dr Bizzarri briefly highlighted the value of lightning observations for cloud classification, support to precipitation retrieval, aeronautical meteorology and research such as $NO_x$ sources and Earth's electrical field. The need for continuous monitoring and the lack of occurrence of lightning at high latitudes make the geostationary platform an ideal observatory. As opposed to ground-based lightning networks, observation from space enables detection of cloud-to-cloud lightning that are much more numerous and closely linked to the degree of maturity of the convective process. Studies from NOAA for GOES-R and EUMETSAT/ESA for Meteosat Third Generation indicate that a stand-alone mission to cover the full disk would require an instrument of not insignificant size (~ 100 kg / 200 W), whereas if geostationary satellite operators share the responsibility of covering their respective sectors the instrument would reduce to one half. The impact at system level is minimal (no moving parts, low data rate). Discussion highlighted that, although the lightning mission has been demonstrated in low orbits, it should be carefully assessed whether the performance achievable from geostationary orbit meets users requirements. In addition, the aspect of data utilisation deserves focused studies. WG II was informed that, in addition to NOAA and EUMETSAT, also CMA is considering

a lightning mission on the future FY-4 geostationary series. This produced the following action.

**Recommendation 33.08 CGMS Members planning for next generations of geostationary meteorological satellites to consider implementing a lightning mission and to coordinate the selection of the observation areas so as to realise optimal coverage of all low and middle latitudes.**

It is understood that Recommendation 33.07 addresses a geostationary payload of much lower priority than those previously recommended (i.e. all VIS/IR imagers to be upgraded to at least the SEVIRI level and all future satellites to carry a hyperspectral IR sounder). This implies also that a realisation should be achieved at relatively low cost.

### II/7 Coordination of Code forms for Satellite Data

EUM-WP-15 noted that the CBS Expert Team on Data Representation and Codes decided to allocate part of the existing BUFR master table 0 for the representation of satellite data. It was felt that a task force should co-ordinate the requirements of satellite data providers and users and make a suggestion on how to populate the available BUFR space (see **Action 33.20**).

WMO-WP-10 reminded CGMS Members of Action 32.17 from CGMS-32 that proposed "A working group of CGMS Members should be established to draft a master BUFR table for satellite data. CGMS should designate a Rapporteur between this group and the CBS ET on Data Representation and Codes. CGMS Member designated experts will be asked for input and to submit updates at upcoming CGMS meetings. The WMO Space Programme will compile the input and maintain the master BUFR table for satellite data." Similarly, EUM-WP-15 proposed to WG II that CGMS establish such a working group and designate a Rapporteur.

NOAA-WP-24 summarised the International EOS/NPP Direct Broadcast Meeting hosted by the Mediterranean Agency for Remote Sensing and Environmental Control in Benevento, Italy, 3-6 October 2005. The purpose of the meeting was to assemble the worldwide community of X-band direct broadcast users who acquire, process, and disseminate data from the Terra and Aqua spacecraft currently, and the NPP and NPOESS spacecraft in future. The meeting was attended by 101 participants from 19 countries. The meeting heard progress on science research, enabling technologies, real time redistribution, and collaborations within the international user community. The meeting surfaced a number of significant issues including (a) the need for product transport vehicles to move large data sets as efficiently as possible, (b) serving remote areas that could benefit greatly from the data (e.g., Africa and South America), (c) creating an index of direct broadcast resources, and (d) expanding communications and collaboration.

CGM-33 noted that an International Direct Broadcast Working Group that plans meetings like the one in Benevento on a regular basis would provide a forum for the international direct broad cast users to exchange vital technical planning information regarding achieving access to and maintaining consistency of level 0 and level 1 data. Further it noted that this working group could possibility be tasked to draft a master BUFR table for satellite data (see EUM-WP-15).

**Action 33.20 EUM, CMA, NOAA and WMO to establish a task force to draft terms of reference for a potential new working group on data handling for direct data broadcast and pertinent formats (e.g. BUFR) that could be considered at the next meeting of CGMS.**

### II/8 Conclusion and preparation of WG report

WG II concluded with thanks from the chairman to all participants for good and open discussions. Considerable progress was made on past CGMS actions (utilisation of cloud affected radiances, summary of remote sensing of fires, global surface albedo derivation from geos, and organisation of an operational intercalibration activity). Good dialogue with each of the working groups (TOVS, Winds, and Precipitation) fostered several actions. The expansion of direct broadcast activities suggested a potential need for another working group; to this end a task force was assigned to draft possible terms of reference.

## WORKING GROUP III: GLOBAL CONTINGENCY PLANNING

Working Group III on Global Contingency Planning met during CGMS-33 and reviewed activities and action items related to discussions held at CGMS-32 as contained in four working papers (JMA-WP-06, NOAA-WP-23, CMA-WP-10 and WMO-WP-05). The Working Group also further considered the need to have regional discussions for optimised operations of geostationary and polar-orbiting satellites comprising the operational space-based component of the Global Observing System. Additionally, the Working Group also considered if such discussions should include close cooperation on instruments for future satellite missions.

In JMA-WP-06, the Working Group was informed of the JMA/NOAA long-term cooperation agreement signed on 23 February 2005 to guarantee continuous geostationary satellite coverage of the East Asia and the Western Pacific in case either agency experienced a spacecraft failure. Under this implementing arrangement, NOAA and JMA agreed to provide geostationary backup coverage in an emergency, and monitor typhoons and other severe weather that threatened both nations. If either a NOAA or JMA geostationary spacecraft stopped operating, and had no available back-up satellite of its own, then the partner agency would temporarily move one of its satellites, if available, toward the appropriate region and provide coverage for up to one year - at no cost - allowing the other agency time to recover from the failure and launch a replacement spacecraft. The long-term implementing arrangement will enter into force when JMA has two operational geostationary meteorological satellites, one operational satellite positioned at 140° East, and one that is not required for any other mission, and therefore available for backup. JMA noted it expected to achieve a two-satellite configuration as described above with the launch of the follow-on satellite to MTSAT-2 planned to be launched by 2015 or earlier. The Working Group noted that NOAA-WP-23 contained the Implementing Agreement between the United States NOAA, Department of Commerce and the Japan Meteorological Agency on the Backup Geostationary Meteorological Satellite System that was invoked as part of the backup from May 2003 through July 2005 of GMS-5 by NOAA's GOES-9 satellite with geostationary satellite coverage for the Western Pacific.

In WMO-WP-05, the Working Group reviewed a draft outline and structure for a CGMS Global Contingency Plan that was intended to consolidate into a single document the outcome of previous WMO and CGMS discussions on contingency planning. The Working Group recalled that the preparation of the draft was in response to CGMS Action 32.20. The Working Group strongly supported the outline and structure and agreed to review the content as a matter of urgency and provide WMO with any comments to allow a final version of the CGMS Global Contingency Plan to be prepared, published and distributed.

**Action 33.25 CGMS Satellite Operators to review the content of the CGMS Global Contingency Plan, as contained in WMO WP-5, and provide WMO with comments by 1 January 2006.**

**Action 33.26 WMO to finalise and provide the CGMS Secretariat the final manuscript for publication by 28 February 2006.**

The Working Group then discussed present and future satellite mission plans to identify potential gaps and overlaps in the coverage to be provided by operational geostationary and polar-orbiting satellites. The Working Group identified three geographic regions that could be problematic areas for the geostationary orbit in the future: the Indian Ocean; Pacific Ocean; and South America. In the case of the Indian and West Pacific Oceans, the Working Group noted that there was a potential in the future for more satellites than had been in those areas before. It also recalled a discussion at the fifth session of the WMO Consultative Meetings on High-level Policy on Satellite Matters that highlighted a variety of ways one might keep useful satellites from entering "retirement," especially those in geostationary orbit. Additionally, the issue of equator cross-times for the polar-orbit was deemed a potential problematic area especially in light of recent restructuring for some polar-orbiting series.

Thus, the Working Group considered that it would be appropriate to have regional discussions for optimised operations of geostationary and polar-orbiting satellites comprising the operational space-based component of the Global Observing System. The Working Group also agreed that such discussions should include close cooperation on instruments for future satellite missions.

**Action 33.21 WMO, through the WMO Space Programme, to organise a two-day Workshop in Geneva in (2nd Quarter 2006) to facilitate regional discussions for optimised operations of geostationary (1 day) and polar-orbiting satellites (1 day) to include discussions on close cooperation on instruments for future satellite missions. Two-day agenda to be developed by CGMS Secretariat in consultation with CGMS satellite operators by 28 February 2006.**

## *Table 7: Polar-orbiting satellite equator crossing times*

*(as of 12 January 2006, sorted by organisation)*

| Satellite | Service | Start | EOL | Equator Cross-time | Frequency (MHz) | BW MHz | Data rate (Mb/s) |
|---|---|---|---|---|---|---|---|
| FY-1D | CHRPT | 2002 | 2004 | 0750 | 1698/1710 | 5.6 | 4.2 |
| FY-3A | AHRPT | 2007 | 2010 | 1010 | 1698/1710 | 5.6 | 4.2 |
| FY-3B | AHRPT | 2009 | 2012 | 1410 | 1698/1710 | 5.6 | 4.2 |
| FY-3C | AHRPT | 2011 | 2014 | 1010 | 1698/1710 | 5.6 | 4.2 |
| FY-3D | AHRPT | 2013 | 2016 | 1410 | 1698/1710 | 5.6 | 4.2 |
| FY-3E | AHRPT | 2015 | 2018 | 1010 | 1698/1710 | 5.6 | 4.2 |
| FY-3F | AHRPT | 2017 | 2020 | 1410 | 1698/1710 | 5.6 | 4.2 |
| FY-3G | AHRPT | 2019 | 2022 | 1010 | 1698/1710 | 5.6 | 4.2 |
| FY-3H | AHRPT | 2021 | 2024 | 1410 | 1698/1710 | 5.6 | 4.2 |
| FY-3A | MPT | 2007 | 2010 | 1010 | 7750-7850 | 35 | 18.2 |
| FY-3B | MPT | 2009 | 2012 | 1410 | 7750-7850 | 35 | 18.2 |
| FY-3C | MPT | 2011 | 2014 | 1010 | 7750-7850 | 35 | 18.2 |
| FY-3D | MPT | 2013 | 2016 | 1410 | 7750-7850 | 35 | 18.2 |
| FY-3E | MPT | 2015 | 2018 | 1010 | 7750-7850 | 35 | 18.2 |
| FY-3F | MPT | 2017 | 2020 | 1410 | 7750-7850 | 35 | 18.2 |
| FY-3G | MPT | 2019 | 2022 | 1010 | 7750-7850 | 35 | 18.2 |
| FY-3H | MPT | 2021 | 2024 | 1410 | 7750-7850 | 35 | 18.2 |
| FY-3A | DPT | 2007 | 2010 | 1010 | 8025-8215/8215-8400 | 120 | 93 |
| FY-3B | DPT | 2009 | 2012 | 1410 | 8025-8215/8215-8400 | 120 | 93 |
| FY-3C | DPT | 2011 | 2014 | 1010 | 8025-8215/8215-8400 | 120 | 93 |
| FY-3D | DPT | 2013 | 2016 | 1410 | 8025-8215/8215-8400 | 120 | 93 |
| FY-3E | DPT | 2015 | 2018 | 1010 | 8025-8215/8215-8400 | 120 | 93 |
| FY-3F | DPT | 2017 | 2020 | 1410 | 8025-8215/8215-8400 | 120 | 93 |
| FY-3G | DPT | 2019 | 2022 | 1010 | 8025-8215/8215-8400 | 120 | 93 |
| FY-3H | DPT | 2021 | 2024 | 1410 | 8025-8215/8215-8400 | 120 | 93 |
| Meteor-3M N1 | Raw | 2001 | 2006 | 0915 | 1700 | 2 | 0.665 |
| Meteor-3M N1 | Raw | 2001 | 2006 | 0915 | 8192 | 32 | 15.4 |
| Meteor-M N1 | LRPT | 2006 | 2010 | 1030 | 137.9 / 137.1 | 0.15 | 0.080 |
| Meteor-M N1 | HRPT | 2006 | 2010 | 1030 | 1700 | 2 | 0.665 |
| Meteor-M N1 | Raw | 2006 | 2010 | 1030 | 8128/8320 | 32-250 | 15.4-122.88 |
| Meteor-M N2 | LRPT | 2008 | 2012 | 1030 | 137.9 / 137.1 | 0.15 | 0.080 |
| Meteor-M N2 | HRPT | 2006 | 2012 | 1030 | 1700 | 2 | 0.665 |
| Meteor-M N2 | Raw | 2006 | 2012 | 1030 | 8128/8320 | 32-250 | 15.4-122.88 |
| MetOp-1 | LRPT | 2009 | 2014 | 0930D | 137.1/137.9125* | .150 | .072 |
| MetOp-2 | LRPT | 2006 | 2011 | 0930D | 137.1/137.9125* | .150 | .072 |
| MetOp-3 | LRPT | 2015 | 2020 | 0930D | 137.1/137.9125* | .150 | .072 |
| MetOp-1 | HRPT | 2009 | 2014 | 0930D | 1701.3/1707.0* | 4.5 | 3.5 |
| MetOp-2 | HRPT | 2006 | 2011 | 0930D | 1701.3/1707.0* | 4.5 | 3.5 |
| MetOp-3 | HRPT | 2015 | 2020 | 0930D | 1701.3/1707.0* | 4.5 | 3.5 |
| MetOp-1 | GDS | 2009 | 2014 | 0930D | 7800 | 63 | 70 |
| MetOp-2 | GDS | 2006 | 2011 | 0930D | 7800 | 63 | 70 |
| MetOp-3 | GDS | 2015 | 2020 | 0930D | 7800 | 63 | 70 |
| NPP | HRD | 2009 | 2013 | 1030D | 7812 | TBD | 15 |
| NPP | SMD | 2009 | 2013 | 1030D | 8212.5 | 375 | 300 |
| NPOESS-1 | LRD | 2011(NET) | 2013 | 0930D | 1706 | 8.0 | 3.88 |
| NPOESS-2 | LRD | 2011(NET) | 2018 | 1330A | 1706 | 8.0 | 3.88 |
| NPOESS-3 | LRD | TBD | TBD | 0530D | 1706 | 8.0 | 3.88 |
| NPOESS-4 | LRD | TBD | TBD | 0930D | 1706 | 8.0 | 3.88 |
| NPOESS-5 | LRD | TBD | TBD | 1330A | 1706 | 8.0 | 3.88 |

| Satellite | Service | Start | EOL | Equator Cross-time | Frequency (MHz) | BW MHz | Data rate (Mb/s) |
|---|---|---|---|---|---|---|---|
| NPOESS-6 | LRD | TBD | TBD | 0530D | 1706 | 8.0 | 3.88 |
| NPOESS-1 | HRD | 2011(NET) | 2013 | 0930D | 7812/7830 | 30.8 | 20 |
| NPOESS-2 | HRD | 2011(NET) | 2013 | 1330A | 7812/7830 | 30.8 | 20 |
| NPOESS-3 | HRD | TBD | TBD | 0530D | 7812/7830 | 30.8 | 20 |
| NPOESS-4 | HRD | TBD | TBD | 0930D | 7812/7830 | 30.8 | 20 |
| NPOESS-5 | HRD | TBD | TBD | 1330A | 7812/7830 | 30.8 | 20 |
| NPOESS-6 | HRD | TBD | TBD | 0530D | 7812/7830 | 30.8 | 20 |
| NPOESS-1 | SMD | 2011(NET) | 2013 | 0930D | 25650 | 300 | 150 |
| NPOESS-2 | SMD | 2011(NET) | 2013 | 1330A | 25650 | 300 | 150 |
| NPOESS-3 | SMD | TBD | TBD | 0530D | 25650 | 300 | 150 |
| NPOESS-4 | SMD | TBD | TBD | 0930D | 25650 | 300 | 150 |
| NPOESS-5 | SMD | TBD | TBD | 1330A | 25650 | 300 | 150 |
| NPOESS-6 | SMD | TBD | TBD | 0530D | 25650 | 300 | 150 |
| NOAA-15 | APT | 1998 | 2001 | 0730 | 137.5 / 137.62 | .034 | .0017 |
| NOAA-15 | BTX | 1998 | 2001 | 0730 | 137.35 / 137.77 | | .00832 |
| NOAA-15 | HRPT | 1998 | 2001 | 0730 | 1702.5 | 2.66 | .665 |
| NOAA-15 | GAC | 1998 | 2001 | 0730 | 2247.5 | 5.32 | 2.66 |
| NOAA-16 | APT | 2000 | 2004 | 1400 | Failed | .034 | .017 |
| NOAA-16 | BTX | 2000 | 2004 | 1400 | 137.35 / 137.77 | | .00832 |
| NOAA-16 | HRPT | 2000 | 2004 | 1400 | 1698 | 2.66 | .665 |
| NOAA-16 | GAC/LAC | 2000 | 2004 | 1400 | 1698/1702.5 (1707Failed) | 5.32 | 2.66 |
| NOAA-17 | APT | 2002 | 2006 | 1000 | 137.50 / 137.62 | .034 | .017 |
| NOAA-17 | BTX | 2002 | 2006 | 1000 | 137.35 / 137.77 | | .00832 |
| NOAA-17 | HRPT | 2002 | 2006 | 1000 | 1698 | 2.66 | .665 |
| NOAA-17 | GAC/LAC | 2002 | 2006 | 1000 | 1698 / 1702.5 / 1707 | 5.32 | 2.66 |
| NOAA-18 | APT | 2005 | 2009 | 1400 | 137.1 / 137.9125 | .034 | .017 |
| NOAA-18 | BTX | 2005 | 2009 | 1400 | 137.35 / 137.77 | | .00832 |
| NOAA-18 | HRPT | 2005 | 2009 | 1400 | 1698 / 1707 | 2.66 | .665 |
| NOAA-N | GAC/LAC | 2005 | 2009 | 1400 | 1698 / 1702.5 / 1707 | 5.32 | 2.66 |
| NOAA-N' | APT | 2008 | 2012 | 1400 | 137.1 / 137.9125 | .034 | .017 |
| NOAA-N' | BTX | 2008 | 2012 | 1400 | 137.35 / 137.77 | | .00832 |
| NOAA-N' | HRPT | 2008 | 2012 | 1400 | 1698 / 1707 | 2.66 | .665 |
| NOAA-N' | GAC/LAC | 2008 | 2012 | 1400 | 1698 / 1702.5 / 1707 | 5.32 | 2.66 |

*EUMETSAT/MetOp: Backup frequency.

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

## IV/0 Introduction

As agreed at CGMS-32, Mr. Mikael Rattenborg from EUMETSAT was elected Chairman of Working Group IV (WG IV) on Integrated Strategy for Data Dissemination from Meteorological Satellites, with Mr. Gordon Bridge, also from EUMETSAT appointed as Rapporteur. WG IV comprised representatives of the satellite operators from China, Japan, Russia, USA, Korea, ESA and EUMETSAT together with the representative from WMO (see Annex 4 for the list of participants).

## IV/1 Coordination of Data Dissemination

In EUM-WP-20 EUMETSAT provided information on the products and services distributed via its EUMETCast broadcast system. Further enhancements to the system, to provide coverage over South America, and for the distribution of MetOp global data and products, were also described.

The WP noted that since the start of the EUMETCast broadcast services late 2002, there had been a significant evolution of the system over the last couple of years. In June 2004 there was an increase of EARS/RSS channel bandwidth to 300 Kbps and in July 2004 the routine dissemination of the Ocean and Sea Ice SAF product “Merged Atlantic Product - Sea Surface Temperature” (MAP-SST) commenced. In August 2004 there was a change of Ku-band transponder on Hotbird-6 and in October 2004 improved timeliness for Met-5 and Met-7 image segments was achieved. November 2004 saw the start of a trial dissemination (3 times per month) of the “Vegetation Index Product” (S10DVI) for African Users, provided by VITO (Belgium). In January 2005 there was the first end-to-end test (adding 8 Mbps) to simulate the provision of EPS (MetOp) Global Data to meteorological services, with a total system data rate of 12 Mbps.

Commercial digital TV geostationary satellites are used for data reception and transmission. The Up-link service satellite is Hotbird-6, located at 13˚E and a Ku-Band transponder is used. For the turn-around service, Atlantic Bird-3 is used, located at 5˚W, where a C-Band transponder used.

Current EUMETCast services, with average daily data rates (Kbs) are:

- High Rate SEVIRI Image Data - data from Meteosat-8 (710)
- Low Rate SEVIRI Image Data - data from Meteosat-8 (15)
- Rapid Scanning Service (RSS) - data from Meteosat-6 (48)
- High Resolution Image (HRI) - data from Meteosat-7 (40)
- Indian Ocean Data Coverage (IODC) - data from Meteosat-5 (42)
- EUMETSAT ATOVS Retransmission Service (EARS) (30)
- Foreign Satellite Data (FSD)-data from GOES-n (MTSAT1-R to come) (14)
- Data Collection and Retransmission (DCP) (7)

- Meteorological Data Dissemination (MDD) (4)
- Meteorological Products from MSG MPEF (39)
- Meteorological Products from Satellite Application Facilities (55)
- DWDSAT (190)
- Basic Meteorological Data (BMD) for WMO RA VI (10)
- Vegetation Product (3 times per month) (3)

EUM WP 20 also briefly described the current allocation of services to channels, the management of bandwidth and service directories, encryption and decryption of data, currently licensed services and those classified as WMO "Essential", and service performance figures.

Concerning the EUMETCast coverage of South America, EUM-WP-20 recalled that South America remained the most significant imaged area, to which Meteosat-8 data is not disseminated, particularly Brazil, with similar viewing angles as Spain and Portugal. Whilst the MSG-2 (to become Meteosat-9 once operational) LRIT data will be available to South America, it is not suitable for quantitative applications (i.e. only half-hourly, 5 out of 11 channels, no HRV, lossy compression). However, in the summer of 2005, the EUMETSAT Council endorsed the setting up of a EUMETCast South America service. This will be a Pilot service of 3 years. An ITT was issued at the beginning of August 2005, aiming for a start of this service in January 2006. The service will, again, be based upon DVB turn-around, like the C-Band Africa service, with up-link from Europe. Only one High Rate channel of 2.1 Mbps, Ku-Band or C-Band, will be used. Service provision will either come from satellite operators such as Eutelsat, Hispasat, NewSkies, Panamsat, or from capacity resellers such as Telespazio, T-Systems or Globecast. There will be User registration/administration, as for the European Ku- and African C-Band services (i.e. a EUMETSAT Key Unit will be required to access data).

Concerning EPS-EUMETCast Convergence, it is planned that there will be dissemination of EPS (MetOp) Global Data via the EUMETCast system. This effectively replaces the originally foreseen (baseline) EPS Near Real Time (NRT) system. A contract has been placed with the current Ku-Band service provider, providing an additional 3 Mbps (permanent) from August 2005 (previous bandwidth was 3.75 Mbps). There will be a permanent 12 Mbps data rate capability as from 1 April 2006 (or later if the MetOp launch is delayed), allowing comprehensive testing of EPS Global Data dissemination with full/maximum data stream end-to-end performance testing. There is one beneficial side effect – it will allow the temporary dissemination of MSG-2 (Meteosat-9) data during the commissioning of that satellite in the first half of 2006.

EUMETSAT added that whilst EUMETCast will be the baseline broadcast service for MSG-2 and 3 data, these satellites will also provide a basic LRIT service to the full satellite field of view.

WMO expressed the appreciation of its members in Europe, Africa and South America for the rapid implementation of the EUMETCast service in the last

year or so by EUMETSAT. Additionally, EUMETCast had provided members of CGMS with a very useful model upon which other ADM services could be built.

NOAA-WP-17 discussed the final transition for LRIT on the GOES I-M spacecraft. The full LRIT service, on the GOES-west spacecraft, commenced on 3rd October 2005, so LRIT is now operational on both GOES-east and GOES-west spacecraft and NOAA will no longer support WEFAX operations through it environmental satellites. Current planning will focus on improving data dissemination in the future and providing low cost systems to acquire the NOAA broadcasts. NOAA added that a typical LRIT user station was expected to cost in the region of $5000 (antenna, front end, demodulator and low cost PC).

Now that NOAA's LRIT is operational on both the GOES-east and GOES-west spacecraft, immediate plans include continuing the transition from the 128 kbps to 256 kbps during the GOES-N era. Other items being considered for future implementation include expanding the product suite, adding higher resolution imagery (e.g. 1km), adding other compression algorithms (e.g. JPEG2000, zip), improving navigation information, and adding a web server for LRIT files. These are just some of the ideas for future enhancements, and as LRIT becomes increasingly utilised by the user community, so shall the range of capabilities offered.

WMO-WP-03 described the status of activities related to the conversion of the APT/WEFAX services from analogue to digital scheduled to occur during the decade. An Appendix to the document showed the latest status for LRIT/LRPT conversion for satellites in polar and geostationary orbit. WG IV recalled that similar tables were reviewed at CGMS-32 (May 2004). These tables are also available on Internet through the WMO Space Programme home page: http://www.wmo.int/web/sat/APT_WEFAXstatus.html.

WG IV agreed that the tables should be reviewed by CGMS Members during CGMS-33 and amended as necessary.

**Action 33.22 All CGMS satellite operators to update, as a matter of urgency, the WMO generated tables indicating transition of broadcast services of satellites in polar and geostationary orbit, by 31 December 2005, and inform the Secretariat accordingly.**

### IV 1.1 Dissemination of Satellite Images

JMA WP-04 recalled that MTSAT-1R had been operational since 28 June 2005 and JMA had started providing HRIT and LRIT imagery on an operational basis. JMA had also started the operational broadcast service of the High Resolution Imager Data (HiRID), which is compatible with S-VISSR imagery. JMA added that it would continue to broadcast both HiRID and

WEFAX imagery until the end of 2007, in order to facilitate users' preparations for the transition to the new formats.

### IV/2 Development of the Integrated Strategy for Data Dissemination from Meteorological Satellites

WMO WP-19 recalled the scope of the Integrated Data Dissemination Service (IGDDS) which includes various types of satellite data collection, inter-regional data exchange and data dissemination mechanisms such as Advanced Dissemination Means (ADM). Regarding data collection, the WP reported, in particular, on recent progress regarding the development of a Regional ATOVS Relay Services (RARS) in the Asia-Pacific and South American Regions, following the model of the EUMETSAT EARS. It was noted that a test of the Asia-Pacific RARS concept was foreseen already in 2006. The document also proposed further steps to be taken in order to complete the IGDDS in the framework of the future WMO Information System (WIS, and which implies, in particular, extending ADM coverage to all WMO Regions by January 2007, in line with the WMO Space Programme Implementation Plan, and ensuring full interoperability through a coordinated approach of metadata and user management. The IGDDS, and broadly speaking the WIS, are also expected to be core components of the Global Earth Observation System of Systems (GEOSS) developed within the ad hoc intergovernmental Group on Earth Observations (GEO).

WMO informed WG IV that a RARS Workshop was planned in December 2005, in Geneva, to advance the establishment of RARS and ADM systems in other regions of the World, to further refine ADM system specifications and to look for potential ADM system operators.

In the following discussion, WG IV noted that in establishing global coverage, the variety of technical infrastructures needed for data reception by the users had to be kept to a minimum. This can be achieved either by commonly available Internet, or more importantly, by ADM based upon direct broadcast (DVB) systems. For particular geographical regions, a data dissemination service would have to take into account the collection, processing and dissemination of satellite data to a level which meets the requirements of the different user communities. Data collection and processing would be implemented in dedicated Data Collection and Processing Centres (DCPC). The Advanced Dissemination Methods used for the dissemination of the satellite and other data would be implemented in regional areas by the operators of operational geostationary and polar satellite systems within that region, or consortia including such operators.

The Integrated Global Data Dissemination Service (IGDDS) is, in effect, a network of regional ADMs covering the whole globe and, as such, it ensures the availability of relevant satellite and other information in a timely manner, on the global scale. It was suggested that the globe could be covered by ADM in the following regions: the Americas, Europe and Africa (EUMETCast), Indian Ocean and Asia-Pacific.

An inherent feature of the IGDDS would be its interconnectivity and the ease by which data can be relayed from one region to another. Thus, the scalability of the ADMs would be an essential feature to ensure sufficient flexibility to adapt the systems to changing user requirements arising out of additional user communities and/or additional data sources.

It was anticipated that not only the amount of satellite data, but also the amount of processed data into intermediate and final products would increase significantly in the years to come. Furthermore, non-satellite information, such as the basic meteorological data in WMO RA VI, was becoming an important add-on to the satellite data and products within the IGDDS.

WMO stressed that the implementation of the regional ADMs should proceed without further delay. It was recognised that for the European, Africa and North Atlantic area, the EUMETCast service as operated by EUMETSAT, already existed as an ADM and it was highly desirable to aim for an operational implementation of the remaining ADMs for the other regions by 2007.

WMO recalled that the APSDEU-6 meeting, held in Seoul in June 2005, invited WMO to investigate possible options for trials of ADMs in the Asia-Pacific region. This implementation should be seen as the next priority for implementation because in that area a multitude of satellites (e.g. FY-2, MTSAT-1R, the Korean COMSAT) exist. A single, regional dissemination system would be a distinct advantage to RA II and RA V Members, where a large user community exists.

Additionally, it was noted that ADMs are of special value for providing an operational infrastructure for the distribution of data from the R & D satellites. It was further noted that the implementation of the WMO RARS service could pave the way for the operational implementation of the IGDDS, however, the volume of data flowing within a RARS Service would be far smaller than a conventional ADM. WMO concluded by stating that the implementation of the IGDDS would, in fact, constitute the backbone of the WIS. Responding to this topic, ESA informed WG IV that ERS and Envisat data are disseminated since long through a DVB system to Europe, to Africa, and with trial planned for South America. Other dissemination methods are Internet, f.t.p. services and physical media.

Concerning the apparent speed of implementation, Japan expressed some concerns over the proposed implementation of an Asia-Pacific ADM service by January 2007. Japan informed CGMS about its alternative dissemination activities, such as the provision of Internet access, to high resolution data, and its preparations for the RARS. Japan sought an explanation of the proposed implementation schedule of ADM. WMO commented that this schedule had been agreed as part of the Space Programme Implementation Plan by the Consultative Meeting on High Level Policy Matters and endorsed by the WMO Executive Council. This was, in effect, a target date and WMO expected

potential operators to establish their ADM systems a best effort basis. Establishing an ADM system was not difficult from a technical point of view and, based on the experience of EUMETSAT, one could be implemented in a relatively short time frame once the proper funding scheme and/or a cooperation framework has been identified.

The meeting recalled that one clear benefit of establishing a regional ADM was the fact that the Geostationary meteorological satellites in the region would no longer have to consume onboard fuel to stay in the required inclination band necessary for direct broadcast, and, in the case of EUMETSAT, an increase in the lifetime of a satellite by some 2 years could be expected as a result. Another benefit was the significant enlargement of the user community making use of the satellite data.

CMA-WP-17 described the CMA Shine Tek DVB system, developed to disseminate meteorological satellite data received by the China Meteorological Satellite Ground System, which consists of three ground receiving stations located respectively in Beijing, Guang Zhou, and Urumuqi. Raw data acquired by the three ground stations is processed into level 1A/1B formats and broadcast nation-wide via the DVB System. Coverage of the system includes a large part of central and eastern Asia and the west Pacific. Users equipped with DVB terminals can receive near real time data and process it to generate products meeting their needs. Currently there were over 100 users of CMA ShineTek DVB-S in China, and data transmitted via the system included data from FY-1D CHRPT, FY-2C, MTSAT-1R, NOAA-16/17 HRPT, EOS/AM1- MODIS, EOS/PM1-MODIS.

The data from FY-1, -2, NOAA, MTSAT and EOS/MODIS is transferred via fibre optic cable to the central station located at CMA/NSMC. The collected data files are packed and sent to the ChinaStar-1 telecommunications satellite. At the user station, a DVB-S antenna receives the ChinaStar-1 transmission and front-end software unpacks the transmission to recover the data files from various data packages, displays the incoming image, and uploads the data files to the back end system, where processing is carried out to generate products for various applications.

A complete DVB-S user station includes the dish antenna, an LNB to convert the 11GHz signal to 1 GHz and to amplify for cable loss, the satellite cable terminated with F-connectors to connect the LNB to the DVB card, and the DVB card then fits into one of the PCI slots inside the PC.

WMO, noting that this was an example of an integrated ADM being used nationally, queried whether China had any plans to extend the area of coverage within the Asia-Pacific region. China responded that currently there were no such plans. The current focus was more on developing the user base in China. In due course, there may well be a requirement to seek user funding for the service as the current State funding of the system was not assured long term. WMO recalled that a meeting to discuss, amongst other topics, the development of the Asia Pacific RARS and ADM, would take place in Geneva

in December 2005, and China, Japan, Korea and Australia (representing an important user community) would be invited.

**Action 33.23 Within the context of the WMO December 2005 RARS Workshop, WMO to invite China, Japan, Korea and Australia, together with other interested CGMS partners, to specifically discuss possibilities for supporting a regional ADM Service for the Asia-Pacific Region.**

NOAA-WP-20 reported that the NOAA ADM System was an on-going development of a communications system for the dissemination of environmental satellite data from NOAA, EUMETSAT, JMA, and research satellites. The current development of the NOAA ADM was based on a two year ADM Study conducted by NESDIS. ADM will function as a supplement to Direct Readout broadcast systems from environmental satellites and will be accomplished using DVB satellite, Landline, and/or Internet infrastructures, depending on the connectivity available to the user. In this development phase of the NOAA ADM, the primary concern of NESDIS has been to demonstrate the viability of the ADM System, which has been demonstrated by the successful construction of an ADM User Terminal (currently receiving satellite data at 10.23 Mbps), architectural descriptions for the software in the ADM User Terminal, the development of the ADM Center, and an end-to-end computer simulation of the ADM System to include Data Sources, Data Processing, and Data Dissemination. Currently, the ADM frame structures, interfaces and performance criteria are still under investigation by the NESDIS ADM Team. NOAA added that planned ADM footprints would cover most of the Pacific, North, Central and South America, and possibly North and South Atlantic. Implementation was currently foreseen by 2008, but the phased approach adopted for implementation would likely allow some elements to be in place during 2007. The content of the service would be primarily GOES-W and GOES-E data. NOAA was coordinating the implementation and data exchange mechanisms with EUMETSAT and the IGDDS concept was being followed, in order to ensure a seamless transition (after around three years) from EUMETCast to the NOAA ADM for the South American users of EUMETCast. The following action was agreed:

**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-34.**

JMA-WP-16, reported on the status of the WMO Information System (WIS) VPN Pilot Project in Regions II and V. The WP recalled that the Future WMO Information System (renamed WMO Information System (WIS) at the 57th Session of the Executive Council in June 2005) was a single coordinated global infrastructure that would serve all relevant WMO programmes. It would facilitate international exchange of meteorological and hydrological data. The WIS consists of diverse types of communication links as available, appropriate and cost effective, including dedicated links and networks, satellite-based systems and the Internet. In particular, communication

component of the WIS would build upon the WMO GTS with respect to the requirements for highly reliable delivery of time-critical data and products, and the Improved MTN GTS would be the basis for the core communication network. Further development and implementation of WIS would be pursued through relevant pilot projects.

Triggered by the Implementation Coordination Meeting on the GTS and the Information Systems and Services (ISS) in Region V (Wellington, December 2003), the WIS Virtual Private Network Pilot Project (VPN-PP) has started, in collaboration with GTS Centres and National Meteorological Centres in Regions II and V on a voluntary basis, and aiming at evaluating the feasibility of Internet-VPN and related technologies to be applied to WIS as a means of communication. The purpose of the project is to contribute to WIS development through a feasibility study of the WIS concepts. JMA added that data exchange would include data from MTSAT-1R, conventional meteorological data and some experimental NWP data.

In NOAA WP-19 described the development of a prototype Multi-Constellation User Terminal (MCUT) to help facilitate, explore and promote technology that could enable the commercial development of Direct Readout user stations that would receive and process signals from multiple satellite constellations.

NOAA added that development effort was proceeding to further extend the MCUT capabilities. The ability to operate at higher data rates and to use other error correction decoding will be investigated to meet the requirements of future services such as MetOp and the NPOESS LRD systems. Presently, the GOES GVAR service is the highest data rate service at L-band frequencies. This service, however, requires a larger aperture antenna (5m) than the other services. The existing antenna feed and receiver will be installed in a suitable reflector antenna to demonstrate the flexibility with which this prototype technology can be applied. Since a positioner capable of tracking polar satellites is not required for GOES GVAR reception, the implementation cost would actually be less than a design capable of tracking polar satellites. Other future high data rate services will be available at X-band. An examination will be made of technology for a similar architecture for these services. The existing high resolution Geostationary services and these future X-band services require about the same aperture size. A dual frequency L- and X-band design would provide a higher resolution capability for polar satellites and a higher resolution refresh capability following the same design philosophy as the existing MCUT prototype. Antenna tracking requirements are more stringent with the narrower X-band antenna beamwidth; application of open loop antenna tracking techniques is being done as a lower cost alternative to the traditional closed loop tracking designs. NOAA added that the system was also designed for the reception of MetOp and MSG LRIT data streams. It was assumed that, in future, the regional data users would acquire their direct broadcast data via a MCUT, whilst global data users would take advantage of an ADM system. For this reason direct

broadcast was expected to play an important role for data dissemination for many years to come.

Concluding the discussions of WG IV, its Chairman noted that significant progress in the planning of future ADM systems had been achieved at this meeting and he greatly appreciated the willingness for cooperation amongst CGMS Members and which indicated that the creation of several regional ADM systems, covering much of the globe, would become a reality in the coming years.

# ANNEXES:

# DRAFT ORDER OF BUSINESS OF THE 33RD CGMS MEETING
# 1-4 November 2005

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

## WORKING GROUP I: TELECOMMUNICATIONS

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)

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

II/1 Image processing techniques
II/2 Satellite Data Calibration
II/3 Vertical sounding and ITWG matters
II/4 Other parameters and products
II/5 Coordination of code forms for satellite Data
II/6 Coordination of data formats for the Archive and Retrieval of Satellite Data
II/7.1 Preparation of the 8th International Workshop on Winds
II/7.2 Wind Statistics
II/7.3 Procedures for the exchange of inter-comparison data
II/7.4 Derivation of Wind Vectors
II/8 Conclusion and preparation of WG report

## WORKING GROUP III: CONTINGENCY PLANNING

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 GCOS Climate Monitoring Principles and IGL
III/6 Conclusion and preparation of WG report

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

IV/1 Coordination of Data Dissemination
IV/1.1 Dissemination of satellite images
IV/1.2 Dissemination of satellite products
IV/1.3 Global exchange of satellite image data
IV/2 Development of the Integrated Strategy for Data Dissemination from Meteorological Satellites

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

## A. INTRODUCTION

A.1 Welcome
A.2 Election of Chairmen
A.3 Adoption of Agenda
A.4 Nomination of Drafting Committee
A.5 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
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

## E/F. INTERACTION WITH GEO

## F. OTHER ITEMS OF INTEREST

F.1 Applications of Meteorological Satellite Data for Environment Monitoring
F.2 Search and Rescue (S&R)
F.3 Meteorological Data Distribution via satellite
F.4 Training
F.5 Information
F.6 Consolidated report/CGMS web site
F.7 Any other business

## G. FINAL SESSION

G.1 Appointment of Chairman of final session
G.2 Reports from the Working Groups

G.3 Nomination of CGMS Representatives at WMO and other meetings
G.4 Nomination of Chairmen of Working Groups for 34th CGMS
G.5 Any Other Business
G.6 Summary List of Actions from 33rd CGMS
G.7 Approval of Draft Final Report
G.8 Date and Place of Next Meetings

# WORKING PAPERS SUBMITTED TO CGMS-33

## CMA

| | | |
|---|---|---|
| CMA-WP-01 | Review of Action Items | A.5 |
| CMA-WP-02 | Current Status of FY-1D Polar-orbiting Satellite | B.1 |
| CMA-WP-03 | CMA update for Table 1: Current Polar-Orbiting Satellites Coordinated Within CGMS | B.1 |
| CMA-WP-04 | Current Status of FY-2C Geo-stationary Satellite | B.2 |
| CMA-WP-05 | CMA update for Table 2: Current Geostationary Satellites Coordinated Within CGMS | B.2 |
| CMA-WP-06 | Future Chinese Polar-orbiting Meteorological Satellite | C.1 |
| CMA-WP-07 | CMA update for Table 4: Future Polar-Orbiting Satellites Coordinated Within CGMS | C.1 |
| CMA-WP-08 | Future Chinese Geo-stationary Meteorological Satellite | C.2 |
| CMA-WP-09 | CMA update for Table 5: Future Geostationary Satellites Coordinated Within CGMS | C.2 |
| CMA-WP-10 | CMA update for Table-7 of the polar-orbiting satellite equator crossing times | III |
| CMA-WP-11 | Progress of AMV Derivation for FY-2C Meteorological Satellite | II/7.4 |
| CMA-WP-12 | FY-2C Meteorological Satellite Calibration | II/2 |
| CMA-WP-13 | Dust Remote Sensing with Geostationary Satellite | II/4 |
| CMA-WP-14 | Cloud Classification with FY-2C Satellite Data | II/4 |
| CMA-WP-15 | Operation and Products for Fire Monitoring | II/4 |
| CMA-WP-16 | Status of Image Registration and Navigation for FY-2C | II/1 |
| CMA-WP-17 | CMA ShineTek DVB System | IV/2 |

## ESA

| | | |
|---|---|---|
| ESA-WP-01 | Status of the current ESA Earth Observation Missions | B3 |
| ESA-WP-02 | Status of the Future ESA Earth Observation Missions | C3 |
| ESA-WP-03 | Experimental datasets of potential IPWG interest | II/2 |
| ESA-WP-04 | Oceanographic information provided by ESA missions | II/4 |
| ESA-WP-05 | Potential of ESA missions for fire products | II/4 |
| ESA-WP-06 | List of ESA actions | A5 |

## EUMETSAT

| | | |
|---|---|---|
| EUM-WP-01 | Review of Action Items | A.5 |
| EUM-WP-02 | Status of the Meteosat System | B.2 |
| EUM-WP-03 | Status of Preparation of EPS | C.1 |
| EUM-WP-04 | Status of MSG-2 and preparations for MSG-3 and MSG-4 | C.2 |
| EUM-WP-05 | Status of the EUMETSAT Satellite Applications Facilities | F.1 |
| EUM-WP-06 | EUMETSAT Conferences and Publications | F.5 |
| EUM-WP-07 | Status, Problems and Future of the IDCS (incl. Actions 32.09 and 32.10) | I/3.1 |
| EUM-WP-08 | Report on EUMETSAT Training Activities | F.4 |
| EUM-WP-09 | Plans for Meteosat Third Generation (MTG) | C.2 |
| EUM-WP-10 | Plans for Post-EPS | C.1 |

| | | |
|---|---|---|
| EUM-WP-11 | Report on EARS | II/3 |
| EUM-WP-12 | Outline proposal for a new CGMS Homepage (incl. Consolidated Report) | F.6 |
| EUM-WP-13 | Report on NWP utilisation of cloud affected radiances (Action 32.14) | II/3 |
| EUM-WP-14 | Requirements for hosting future science/working group meetings (IPWG, ITWG and IWWG) proposed by Task Team (Action 32.15) | II/4 |
| EUM-WP-15 | Terms of Reference for new Working Group for drafting a master BUFR table for satellite data (Action 32.17) | II/4 |
| EUM-WP-16 | Report on IWW7 and Preparations of IWW8 | II/7.1 |
| EUM-WP-17 | The development of a fire radiative energy product | II/4 |
| EUM-WP-18 | Interrelationships between CGMS and GEO/GEOSS | E/F |
| EUM-WP-20 | Update on EUMETCast | IV/1 |
| EUM-WP-21 | Frequency spectrum requirements for passive sensors in bands above 275 GHz | I/1 |
| EUM-WP-22 | Surface Albedo from Geostationary Satellites (Follow-on to Action 31.28) | II/4 |
| EUM-WP-23 | Data handling experience from the Global Surface Albedo Project | II/4 |
| EUM-WP-24 | Implementation of a near-real time precipitation algorithm by EUMETSAT | II/4 |

**IMD**

| | | |
|---|---|---|
| IMD-WP-01 | Current operational satellites of India | B.2 |
| IMD-WP-02 | Future plans of INSAT satellites for meteorological applications | C.2 |
| IMD-WP-03 | Current status of Cloud Motion Vectors (CMVs) derived from KALPANA-1 and INSAT-3A satellites | II/7.4 |

**JAXA**

| | | |
|---|---|---|
| JAXA-WP-01 | Status of Advanced Land Observing Satellite (ALOS) | C.3 |
| JAXA-WP-02 | Status of Greenhouse gases Observing Satellite (GOSAT) | C.3 |

**JMA**

| | | |
|---|---|---|
| JMA-WP-01 | Review of Action Items | A.5 |
| JMA-WP-02 | Operation of MTSAT-1R | B.2 |
| JMA-WP-03 | Ground System at the Meteorological Satellite Center | B.2 |
| JMA-WP-04 | Transition Schedule of Dissemination of Satellite Imagery | IV/1.1 |
| JMA-WP-05 | Plan on MTSAT-2 | C.2 |
| JMA-WP-06 | Long-term satellite activities of JMA to materialise a robust satellite observing system | III (& C.2) |
| JMA-WP-07 | Activities of JMA on Virtual Laboratory | F.4 |
| JMA-WP-08 | Preparatory Activities for WRC-2007 | I/1 |
| JMA-WP-09 | Status of the IDCS | I/3.1 |
| JMA-WP-10 | Tidal/Tsunami Data Collection using the Data Collection System | I/3.1 |
| JMA-WP-11 | Preliminary Validation Report on MTSAT-1R Imagery Data | II/2 |
| JMA-WP-12 | Operational Satellite Products from MTSAT-1R | II/4 |
| JMA-WP-13 | Status of Atmospheric Motion Vectors | II/7.2 |
| JMA-WP-14 | JMA's Activities for ATOVS Data Exchange | II/3 |
| JMA-WP-15 | Satellite Imagery from Numerical Weather Prediction Models | II/3 |

| | | |
|---|---|---|
| JMA-WP-16 | Outline of the WMO Information System (WIS) VPN Pilot Project in Regions II and V | IV/2 |

## NOAA

| | | |
|---|---|---|
| NOAA-WP-01 | Review CGMS-32 Action Items | A.5 |
| NOAA-WP-02 | Report on the Current Polar-orbiting Operational Environmental Satellites (POES) | B.1 |
| NOAA-WP-03 | Report on the Current Geostationary Operational Environmental Satellites (GOES) | B.2 |
| NOAA-WP-04 | Anomalies from Solar Events | B.4 |
| NOAA-WP-05 | Report on the Future Polar-orbiting Meteorological Satellite System | C.1 |
| NOAA-WP-06 | Report on the Future Geostationary Meteorological Satellite System | C.2 |
| NOAA-WP-07 | Preparation for WRC 2008 | I/1 |
| NOAA-WP-08 | Technical Input to the Space Frequency Coordination Group and ITU-R | I/1 |
| NOAA-WP-09 | Status and Problems of IDCS | I/3.1 |
| NOAA-WP-10 | IDCS Channel Capacity: Near and Long-Term | I/3.1 |
| NOAA-WP-11 | Broader Use of the IDCS Channels | I/3.1 |
| NOAA-WP-12 | Use of Cloudy Soundings in the NWP | II/2 |
| NOAA-WP-13 | Report on the ITSC-14 | II/4 |
| NOAA-WP-14 | 2004/2005 Report on NOAA GOES Soundings | II/3 |
| NOAA-WP-15 | 2004/2005 Report on NOAA Satellite Derived Winds | II/7.4 |
| NOAA-WP-16 | Fire Detection with Global Observing Systems | II/7.4 |
| NOAA-WP-17 | The Current Status of the GOES LRIT Service | IV/1 |
| NOAA-WP-18 | Report on the Analysis of Study Result Concerning Potential Interference between Polar-Orbiting Meteorological Satellites | I/1 |
| NOAA-WP-19 | Development of the NOAA Multi-Constellation User Terminal (MCUT) | IV/2 |
| NOAA-WP-20 | Update on the NOAA Alternative Dissemination Methods (ADM) System | IV/2 |
| NOAA-WP-21 | Assessment of Global Cloud Cover and Properties | II/2 |
| NOAA-WP-22 | Report on the Analysis of the Study Result Concerning Interference Between Polar –orbiting Meteorological Satellites - Interference Analysis between NPOESS and MetOp at X-Band | I/1 |
| NOAA-WP-23 | Implementing Agreement between the United States NOAA, Department of Commerce and the Japan Meteorological Agency on the Backup Geostationary Meteorological Satellite System | III |

## ROSCOSMOS

| | | |
|---|---|---|
| ROSS-WP-01 | A New Russian Research and Development satellite “Monitor-E” | B3 |
| ROSS-WP-02 | “Meteor-M” – a New stage of Russian Operating Meteorological Satellites | C1 |
| ROSS-WP-03 | Status of development of geostationary meteorological satellite “Electro-L” (GOMS N2) | C2 |
| ROSS-WP-04 | Future Russian Research and Development Satellites | C3 |

Annex 2

## ROSHYDROMET

| | | |
|---|---|---|
| ROSH-WP-01 | Status of Russian polar-orbiting meteorological satellite system | B1 |
| ROSH-WP-02 | Roshydromet DCS current status and development plans | I/3 |
| ROSH-WP-03 | Satellite products and application: Roshydromet activities | II/4 |

## WMO

| | | |
|---|---|---|
| WMO-WP-01 | Satellite ground receiving database | F.5 |
| WMO-WP-02 | Review of actions from previous CGMS meetings | A.5 |
| WMO-WP-03 | Matters related to APT/WEFAX and conversion | IV/1 |
| WMO-WP-04 | CGMS List Servers and Home Pages | F.5 |
| WMO-WP-05 | CGMS Working Group on Global Contingency Planning | D.1/D.2/ D.3 |
| WMO-WP-06 | WMO Space Programme | E.2 |
| WMO-WP-07 | Redesign of the WWW Global Observing System | E.1 |
| WMO-WP-08 | Review of satellite related WMO publications | F.5 |
| WMO-WP-09 | Disaster Prevention and Mitigation Programme | E.2 |
| WMO-WP-10 | WMO Code Form Changes | II/5 |
| WMO-WP-11 | Radio Frequency Matters | I/1 |
| WMO-WP-12 | Tropical Cyclone Programme Requirements | E.1 |
| WMO-WP-13 | ASAP Status report | I/3.2 |
| WMO-WP-14 | International Precipitation Working Group | II/4 |
| WMO-WP-15 | WMO Consultative Meetings on High-level Policy on Satellite Matters | F.5 |
| WMO-WP-16 | Other Programmes, Joint WMO/IOC Technical WMO-Commission | E.3 |
| WMO-WP-17 | Virtual Laboratory Focus Group | F.4 |
| WMO-WP-18 | Nomination of CGMS Representatives at WMO and other Meetings | G.3 |
| WMO-WP-19 | Towards and Integrated Global Data Dissemination Service (IGDDS) | IV/1.1 |
| WMO-WP-21 | Global Space-based Inter-Calibration System (GSICS) | II/2 |
| WMO-WP-22 | International Geostationary Laboratory (IGEOLAB) | C.2 |
| WMO-WP-22 Add 1 Rev 1 | International Geostationary Laboratory (IGEOLAB) | C.2 |
| WMO-WP-22 Add 2 Rev 1 | Update on the Status of the Initiative for an International Geostationary Laboratory (IGEOLAB) GIFTS on Electro- L (2) | C.2 |
| WMO-WP-23 | Status Report for Space-based component of the GOS | D.1 |
| WMO-WP-24 | Lightning observations from geostationary orbit | II/4 |
| WMO-WP-25 | GCOS and WCRP | E.2 |
| WMO-WP-26 | Global Earth Observing System of Systems (GEOSS) | F.5 |
| WMO-WP-27 | THORPEX, A Global Atmospheric Research Programme | E.2 |
| WMO-WP-28 | Product quality during operational satellite changes | II/4 |

# LIST OF PARTICIPANTS AT CGMS-33

## MEMBERS

### CHINA METEOROLOGICAL ADMINISTRATION (CMA)

| | |
|---|---|
| Mr. Dongfeng LUO | Chief of International Cooperation Office |
| Mr. Prof. Jianmin **XU** | Chief Engineering, National Satellite Meteorological Center |
| Mr. Jun **YANG** | Director General, National Satellite Meteorological Center |

### EUMETSAT

| | |
|---|---|
| Dr. Gordon **BRIDGE** | User Services Consultant, Operations Department |
| Mr. Volker **GÄRTNER** | Head of User Service |
| Mr. Joaquin **GONZALEZ PICAZO** | System Engineering Support Group Manager |
| Ms. Angela **NICHOLAS** | Assistant to the Director-General, CGMS Secretariat |
| Dr. Lars **PRAHM** | Director-General |
| Mr. Mikael **RATTENBORG** | Director of Operations Department |
| Dr. Johannes **SCHMETZ** | Head of Meteorological Division |
| Ms. Anne **TAUBE** | Strategic and International Relations Assistant, CGMS Secretariat |
| Dr. Piero **VALABREGA** | Strategic and International Relations Officer, CGMS Secretariat |
| Mr. Robert **WOLF** | Frequency Manager |

### EUROPEAN SPACE AGENCY (ESA)

| | |
|---|---|
| Dr. Eva **ORIOL-PIBERNAT** | MetOp and MSG Mission Manager |

### INDIA METEOROLOGICAL DEPARTMENT (IMD)

| | |
|---|---|
| Dr. Ramesh Chander **BHATIA** | Additional Director General of Meteorology |

### JAPAN AEROSPACE EXPLORATION AGENCY (JAXA)

| | |
|---|---|
| Mr. Toshio **DOURA** | Director |
| Dr. Yasushi **HORIKAWA** | Executive Director |
| Mr. Akihiro **ISEKI** | Senior Engineer |
| Mr. Chu **ISHIDA** | Senior Administrator |
| Mr. Kazuo **UMEZAWA** | Engineer |

## JAPAN METEOROLOGICAL AGENCY (JMA)

| | |
|---|---|
| Mr Noboru **FUJIWARA** | Technical Official |
| Mr Hideyuki **HASEGAWA** | Director, Data Processing Department MSC |
| Mr Takahito **IMAI** | Technical Official |
| Mr Tsutomu **JOHMURA** | Director, Communication Department MSC |
| Mr Keiichi **KASHIWAGI** | Director-General, Observations Department |
| Mr Tatsuya **KIMURA** | Assistant Director, Satellite Program Division Observations Department |
| Mr Atsushi **KONYA** | Senior Scientific Officer |
| Ms Tomoko **KOYAMA** | Scientific Officer |
| Mr Toshiyuki **KURINO** | Head, System Engineering Division Data Processing Department MSC |
| Mr Hitomi **MIYAMOTO** | Senior Coordinator for Meteorological Satellite Systems, Satellite Program Division Observations Department |
| Mr Yoshikazu **MORI** | Senior Scientific Officer, Satellite Program Division Observations Department |
| Mr Hidehiko **MURATA** | Technical Official |
| Mr Koichi **NAGASAKA** | Director-General |
| Mr Kazunobu **NAKAMURA** | Director-General, Meteorological Satellite Center |
| Mr Yoji **NAGATA** | Head of Office of Preparation for Meteorological Satellite Operations |
| Mr Akihiko **NAKAZONO** | Senior Coordinator for International Telecommunication Information and Telecommunication Division Forecast Department |
| Mr Toshikazu **NISHIO** | Senior Scientific Officer |
| Mr Nozomu **OHKAWARA** | Senior Scientific Officer System Engineering Division Data Processing Department MSC |
| Mr Takashi **OHSHIMA** | Director, Satellite Program Division Observations Department |
| Mr Masahito **OSUGI** | Examination Chief Clerk |
| Mr Hiroaki **OTA** | Head, Facilities Division Communication Department MSC |
| Ms Hiromi **OWADA** | Senior Scientific Officer, Numerical Prediction Division Forecast Department |
| Mr Yoshishige **SHIRAKAWA** | Senior Scientific Officer, Satellite Program Division Observations Department |
| Mr Yoshihiko **TAHARA** | Senior Scientific Officer, System Engineering Division Data Processing Department MSC |
| Dr Masami **TOKUNO** | Head, Analysis Division Data Processing Department MSC |

| | |
|---|---|
| Mr Naotaka **UEKIYO** | Senior Scientific Officer, Satellite Program Division Observations Department |

**KOREA METEOROLOGICAL ADMINISTRATION (KMA)**

| | |
|---|---|
| Ms. Hyoung-Hwan **AHN** | Senior Researcher of Remote Sensing Laboratory |
| Ms. Hyun-Kyoung **LEE** | Assistant Meteorologist |
| Dr. Mi-Lim **OU** | Senior Research Scientist |
| Ms. Hye Sook **PARK** | COMS Calibration Algorithm Development |

**NOAA**

| | |
|---|---|
| Mr. Gary **DAVIS** | Director, Office of Systems Development |
| Mr. Gregory **MANDT** | Director, Office of Science and Technology |
| Dr. Paul **MENZEL** | Senior Scientist |
| Mr. Daniel **MULLER** | International Relations Specialist |
| Mr. Marlin **PERKINS** | Physical Scientist |

**Russian Federal Space Agency (ROSCOSMOS)**

| | |
|---|---|
| Dr. Valery **FERBEROV** | Leading Specialist, Earth Observation |
| Dr. Alexander **GORBUNOV** | Deputy General Director of General Designer |
| Mr. Igor **MOLDOVANOV** | Leading Specialist, International Department |
| Ms. Nina **NOVIKOVA** | Director of NTS OMZ, Earth Observation |
| Prof. Georgy **POLISHCHUK** | Designer General & Director General, Remote Sensing, Lavochkin Association |
| Dr. Nikolay **POTAPOV** | Head of Department, Earth Observation |
| Dr. Victor **SAULSKIY** | Head of Department, Earth Observation, TSNIIMASH |
| Dr. Sergey **VOLKOV** | First Deputy General Director of General Designer |
| Mr. Alexey **YANITSKIY** | Manager of Electro Project, Remote Sensing, Lavochkin Association |

**Russian Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET)**

| | |
|---|---|
| Dr. Alexander **BELYAEV** | Deputy Director, Department of Defence Industry and High Technologies |
| Dr. Valery **DYADYUCHENKO** | Deputy Head of Roshydromet |
| Dr. Oleg **MILEKHIN** | Deputy Director, SRC “PLANETA” |

**WORLD METEOROLOGICAL ORGANIZATION**

| | |
|---|---|
| Dr. Bizzaro **BIZZARRI** | Consultant, WMO Space Programme |
| Dr. Donald **HINSMAN** | Director, WMO Space Programme |
| Mr Jérôme **LAFEUILLE** | Expert, WMO Space Programme |
| Mr. Brian **O'DONNELL** | Professional Officer |
| Dr. James F. W. **PURDOM** | OPAG IOS Chair, CIRA |

## OBSERVERS

**CHINA NATIONAL SPACE ADMINISTRATION (CNSA)**

| | |
|---|---|
| Dr. Jun **GAO** | Government Employee |
| Dr. Ping **TANG** | Professor, IRSA CAS |
| Dr. Fang **YANG** | Engineer, DFH |

**CHINA AEROSPACE SCIENCE AND TECHNOLOGY CORPORATION (CASC)**

| | |
|---|---|
| Mr. Huoshan **GAO** | Senior Engineer |
| Mr. Boming **XU** | Deputy Director |

**KOREA AEROSPACE RESEARCH INSTITUTE (KARI)**

| | |
|---|---|
| Dr Myung-Jin **BAEK** | Principal Researcher |
| Ms Se-kyoung **PARK** | Consultant |

# LIST OF WORKING GROUP PARTICIPANTS

## MEMBERS OF WORKING GROUP I: TELECOMMUNICATIONS

| | |
|---|---|
| Mr Luo Dongfeng | CMA |
| Mr Yang Jun | CMA |
| Dr Yang Fang | CNSA (DFH Satellite Co Ltd - CAST) |
| Dr Gao Jun | CNSA |
| Mr Robert Wolf (Chairman) | EUMETSAT |
| Dr Gordon Bridge (Rapporteur) | EUMETSAT |
| Mr Joaquin Gonzalez | EUMETSAT |
| Mr Naotaka Uekiyo | JMA |
| Mr Hiroaki Ota | JMA |
| Mr Yoshikazu Mori | JMA |
| Mr Tsutomu Jomura | JMA |
| Mr Atsushi Konya | JMA |
| Mr Masahito Osugi | JMA |
| Ms Hyun-Kyong Lee | KMA |
| Dr Myoung-Hwan Ahn | KMA |
| Mr Gary Davis | NOAA |
| Mr Marlin O. Perkins | NOAA |
| Mr Valery Ferberov | ROSCOSMOS |
| Dr Sergey Volkov | ROSCOSMOS/VNIIEM |
| Dr Alexander Gorbunov | ROSCOSMOS/VNIIEM |
| Dr Alexander Belyaev | ROSHYDROMET/SRC PLANETA |
| Dr Valery Dyadynchenko | ROSHYDROMET/SRC PLANETA |
| Dr Oleg Milekhin | ROSHYDROMET/SRC PLANETA |
| Mr Dmitriy Shcherbinin | RUSSIAN FEDERATION (Embassy) |
| Mr Jérôme Lafeuille | WMO |

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

| | |
|---|---|
| Mr Xu Jianmin | CMA |
| Dr Eva Oriol-Pibernat | ESA |
| Dr Volker Gaertner | EUMETSAT |
| Dr Johannes Schmetz (Rapporteur) | EUMETSAT |
| Dr Ramesh Chander Bhatia | IMD |
| Mr Hideyuki Hasegawa (Chairman) | JMA |
| Mr Kazunobu Nakamura | JMA |
| Mr Toshiyuki Kurino | JMA |
| Dr Masami Tokuno | JMA |
| Mr Yoji Nagata | JMA |
| Mr Toshikazu Nishio | JMA |
| Mr Yoshihiko Tahara | JMA |
| Mr Nozomu Ohkawara | JMA |

| | |
|---|---|
| Ms Hiromi Owada | JMA |
| Ms Tomoko Koyama | JMA |
| Mr Hidehiko Murata | JMA |
| Mr Takahito Imai | JMA |
| Mr Noboru Fujiwara | JMA |
| Dr Mi-Lim Ou | KMA |
| Ms Hye-Sook Park | KMA |
| Mr Greg Mandt | NOAA |
| Dr Paul Menzel (Rapporteur) | NOAA |
| Mr Daniel Muller | NOAA |
| Dr Victor Saulskiy | ROSCOSMOS/TSNIIMASH |
| Dr Oleg Milekhin | ROSHYDROMET/SRC PLANETA |
| Dr Bizzarro Bizzarri | WMO |
| Dr James Purdom | WMO |

## MEMBERS OF WORKING GROUP III: GLOBAL CONTINGENCY PLANNING

| | |
|---|---|
| Dr Lars Prahm | EUMETSAT |
| Mr Mikael Rattenborg | EUMETSAT |
| Mr Takashi Ohshima | JMA |
| Mr Hitomi Miyamoto | JMA |
| Mr Tatsuya Kimura | JMA |
| Dr Myung-Jin Baek | KARI |
| Mr Gary Davis (Chairman) | NOAA |
| Mr Daniel Muller | NOAA |
| Dr Valery Dyaduchenko | ROSHYDROMET/SRC PLANETA |
| Dr Oleg Milekhin | ROSHYDROMET/SRC PLANETA |
| Dr Donald Hinsman (Rapporteur) | WMO |
| Mr Jérôme Lafeuille | WMO |

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

| | |
|---|---|
| Dr Gao Jun | CNSA |
| Dr Eva Oriol-Pibernat | ESA |
| Dr Gordon Bridge (Rapporteur) | EUMETSAT |
| Dr Volker Gaertner | EUMETSAT |
| Mr Joaquin Gonzalez | EUMETSAT |
| Mr Mikael Rattenborg (Chairman) | EUMETSAT |
| Mr Tsutomu Johmura | JMA |
| Mr Tatsuya Kimura | JMA |
| Mr Atsushi Konya | JMA |
| Mr Yoshikazu Mori | JMA |
| Mr Hidehiko Murata | JMA |
| Mr Hitomi Miyamoto | JMA |

| | |
|---|---|
| Mr Yoji Nagata | JMA |
| Mr Akihiko Nakazono | JMA |
| Mr Toshikazu Nishio | JMA |
| Mr Takashi Ohshima | JMA |
| Mr Masahito Osugi | JMA |
| Mr Hiroaki Ota | JMA |
| Mr Naotaka Uekiyo | JMA |
| Dr Myoung-Hwan Ahn | KMA |
| Mr V Ferberov | ROSCOSMOS |
| Mr I Moldovanov | ROSCOSMOS |
| Dr N Novikova | ROSCOSMOS/NTsOMZ |
| Dr Valery Dyadynchenko | ROSHYDROMET/SRC PLANETA |
| Dr Oleg Milekhin | ROSHYDROMET/SRC PLANETA |
| Mr Daniel Muller | NOAA |
| Mr Marlin O. Perkins | NOAA |
| Dr Don Hinsman | WMO |
| Mr Jérôme Lafeuille | WMO |

# APPENDIX: GENERAL CGMS INFORMATION

1. Charter for CGMS
2. CGMS Membership
3. Addresses for Procuring 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, and the China have launched polar-orbiting meteorological satellites, that Europe has initiated plans to launch an operational polar-orbiting mission 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

[1] This Charter was amended at CGMS-31 to take into account new membership of the R&D agencies ESA, NASA, JAXA and Rosaviakosmos.

* Note by the CGMS Secretariat: The Charter will be amended to take into account the membership of CNES and KMA at CGMS-32 and -33 respectively.

effective utilisation of these operational systems, through the coordination and standardisation of many services provided, can be assured,

**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,

**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 Chairman 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 |
| 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 (formerly Rosaviakosmos) | 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

**CMA**
Mr. Luo Dongfeng
National Satellite Meteorological Center
China Meteorological Administration
46 Zhong Guan Cun South Ave.
Beijing, 100081
People's Republic of China
E-mail: dfluo@nsmc.cma.gov.cn
http://www.cma.gov.cn/

**EUMETSAT**
Dr. Volker Gärtner
Head of User Service
EUMETSAT
Am Kavalleriesand 31
D-64295 Darmstadt
Germany
E-mail: volker.gaertner@eumetsat.int
http://www.eumetsat.int/

**IMD**
Mr. L.R.Meena
Director (Satellite Meteorolgy)
Satellite Meteorolgy Division
India Meteorological Department
Lodi Road, New Delhi-110003
India
Email: lr_meena2001@yahoo.co
lrmeena@imdmail.gov.in

**JAPAN- JMABSC**
Japan Meteorological Business Support Center
3-17 Kanda Nishiki-cho
Chiyoda-ku
Tokyo 101-0054
Japan
E-mail:
http://www.jmbsc.or.jp/

**NOAA**
Mr. Axel Graumann
Satellite Services Group
National Climatic Data Center
Room 120
151 Patton Avenue
Asheville, North Carolina 28801-5001
USA
Tel.: +1 828-271-4850,
Fax: +1 828-271-4876
E-mail: ncdc.satorder@noaa.gov
http://www.noaa.com/

**ROSCOSMOS**
Ms. Olga Margun
Central Scientific Research Institute of Machine Building (TsNIIMash)
4, Pionerskaya St.
Korolev, Moscow region,
141070, Russia
E-maiil: margun@tsniimash.ru
http://www.rosaviakosmos.ru

**ROSCOSMOS**
Ms. Nina Novikova
Research Center for Earth Operative Monitoring
82, Building 25, Dekabzistor St.
127490 Moscow, Russia
E-mail: novikova@ntsomz.ru
http://www.rosaviakosmos.ru

**ROSHYDROMET/SRC PLANETA**
Dr. Vassily Asmus
Director
SRC Planeta
B. Predtechenskii Per. 7
123242 Moscow
Russia
E-mail: asmus@planet.iitp.ru

## CONTACT LIST FOR OPERATIONAL ENGINEERING MATTERS

**CMA**
Mr. Xu Jianmin
Member of Chinese Academy of Engineering
Satellite Meteorological Center
China Meteorological Administration
46 Zhong Guan Cun South Ave.,
Beijing, 100081, People's Republic of China
Tel: +86 10 68406367
Fax: +86 10 6217 2724
E-mail: xujm@cma.gov.cn
http://www.cma.gov.cn/

**CMA**
Dr. Yang Jun
Director-General
National Satellite Meteorological Center
China Meteorological Administration
46 Zhong Guan Cun South Ave.,
Beijing, 100081, People's Republic of China
Tel.: +86 10 6840 7108
Fax: +86 10 6217 2724
E-mail: yangjun@nsmc.cma.gov.cn
http://www.cma.gov.cn/

**EUMETSAT**
Mr. Mikael Rattenborg
Director of Operations
EUMETSAT
Am Kavalleriesand 31
D-64295 Darmstadt, Germany
Telex: 4197335 emet d
Tel.: +49 6151 807-368
Fax: +49 6151 807 304
E-mail:
mikael.rattenborg@eumetsat.int
http://www.eumetsat.int/

**IMD**
Mr L R Meena
Director (Satellite Meteorology)
India Meteorological Department
Lodi Road
110003 New Delhi, India
Phone no. 91-11-2469 8247
Fax No. 91-11-2464 2249
Tx: 3166 494
E-mail:
lr_meena2001@yahoo.com or
lrmeena@indmail.gov.in
http://www.imd.gov.in/

**JAPAN-JAXA**
Mr. Chu Ishida
Manager,
Earth Observation Research and application Center (EORC), Office of Space Applications
Japan Aerospace Exploration Agency (JAXA)
Harumi Island Triton Square Office Tower X, 1-8-10 Harumi, Chuo-ku,
Tokyo 104-6023, Japan
Tel.: +813 6221 9138
Fax: +813 6221 9191
E-mail: ishida.chu@jaxa.jp
http://
http://www.jaxa.jp/index_e.html

**JAPAN-MSC/JMA**
Mr. Toshiyuki Kurino
Head of System Engineering Division
Meteorological Satellite Center (MSC)
Japan Meteorological Agency (JMA)
3-235 Nakakiyoto, Kiyoseshi
Tokyo 204-0012 , Japan
Tel.: +81 424 93 4970
Fax: +81 424 92 2433
E-mail:
cgmsplen@dpc.kishou.go.jp
http://www.jma.go.jp/jma/indexe.html

**NOAA/NESDIS**
Mr. Gary Davis
Director, Office of Satellite
Operations and Systems
Development
NOAA/NESDIS
SSMC1, Room 8340
1325 East/West Highway
Silver Spring, Maryland, 20910,
USA
Tel: +1 301 713 2010
Fax: +1 301 713 1249
E-mail: gary.davis@noaa.gov
http://www.noaa.com/

**ROSHYDROMET/SRC PLANETA**
Mrs. Tatjana Bourtseva
SRC Planeta
7, Bolshoy Predtechensky Per.
Moscow, 123242, Russia
Tel: +7 095 255 2421
Fax: +7 095 200 42 10
E-mail: burc@planet.iitp.ru

**RUSSIAN FEDERATION**
Ms. Olga Margun
Central Scientific Research
Institute of Machine Building
(TsNIIMash)
4, Pionerskaya St.
Korolev, Moscow region,
141070, Russia
Tel: +7 095 513 5250
Fax: +7 095 513 43 93
E-mail:margun@tsniimash.ru

## ADDRESS LIST FOR THE DISTRIBUTION OF CGMS DOCUMENTS

**CGMS Secretariat**
EUMETSAT
Dr. Piero Valabrega
Strategic & International Relations Officer
Am Kavalleriesand 31
64295 Darmstadt, Germany
Tel: +49 6151 807-604
Fax: +49 6151 807-866
E-mail: piero.valabrega@eumetsat.int
anne.taube@eumetsat.int
http://www.eumetsat.int/

**CHINA**
Mr. Xu Boming
Shanghai Bureau of Astronautics
222 Cao Xi Road
Shanghai 200235
People's Republic of China
Tel: +86 21 64 70 81 88
Fax: +86 21 64 5138 30
E-mail:Lutongshan@sina.com

**CMA**
Dr. Wenjian Zhang
Director-general,
Department of Observation and Telecommunication,
China Meteorological Administration
No. 46 Zhongguancun South Avenue, Haidian
Beijing 100081
People's Republic of China
Tel: +86 10 684 07324 (O)
Fax: +86 10 621 797 86
E-mail: wjzhang@nsmc.cma.gov.cn
http://www.cma.gov.cn/

**CMA**
Mr. Yang Jun
Director General
National Satellite Meteorological Center
China Meteorological Administration
No. 46 Zhongguancun South Avenue, Haidian
Beijing, 100081
People's Republic of China
Tel: +86 10 6840 7108
Fax: +86 10 6217 2724
E-mail: yangjun@nsmc.cma.gov.cn
http://www.cma.gov.cn/

**CMA**
Mr. Xu Jianmin
Member of Chinese Academy of Engineering
National Satellite Meteorological Center
China Meteorological Administration
No. 46 Zhongguancun South Avenue, Haidian
Beijing, 100081
People's Republic of China
Tel: +86 10 6840 6367
Fax: +86 10 6217 2724
E-mail: xujm@cma.gov.cn
http://www.cma.gov.cn/

**CMA**
Mr. Luo Dongfeng
International Cooperation Department
National Satellite Meteorological Center
China Meteorological Administration
No. 46 Zhongguancun South Avenue, Haidian
Beijing, 100081
People's Republic of China
Tel: +86 10 6840 6877
Fax: +86 10 6217 2724
E-mail: dfluo@nsmc.cma.gov.cn
http://www.cma.gov.cn/

**CNES**
Mrs. Pascale Ultré-Guérard
Head of Earth Observation Programmes
CNES
2, place Maurice Quentin
F-75039 Paris Cedex 01
France
Tel.: +33 1 44 76 75 33
Fax:+33 1 44 76 78 67
E-mail: pascale.ultre-guerard@cnes.fr

**CNES**
Didier Renaut
Responsible for Meteorological
Atmosphere and Climate
CNES
2, place Maurice Quentin
F-75039 Paris Cedex 01
France
Tel.: n/a
Fax: +33 1 44 76 78 67
E-mail: vincent.casse@cnes.fr

**ESA**
Dr. Stephen Briggs
Head of Earth Observation Science
and Applications Department
EOP-S
ESA/ESRIN
Via Galileo Galilei
I-00044 Frascati (Rome)
Italy
Tel: +39 06 94180 400
Fax: +39 06 941 80402
E-mail: Stephen.Briggs@esa.int
www.esa.int

**ESA**
Dr. E. Oriol-Pibernat
MetOp and MSG Mission Manager
ESRIN
Via Galileo Galilei, CP 64
I-00044 Frascati, Italy
Tel: +39 06 941 80 408
Fax: +39 06 941 80 532
E-mail: Evangelina.Oriol-
Pibernat@esa.int or
eoriol@esa.int
www.esa.int

**EUMETSAT**
Dr. Volker Gärtner
Head of User Service
EUMETSAT
Am Kavalleriesand 31
64295 Darmstadt, Germany
Tel: +49 6151 807 583
Fax: +49 6151 807-304
E-mail: volker.gaertner@eumetsat.int
http://www.eumetsat.int/

**EUMETSAT**
Mr. Mikael Rattenborg
Director of Operations
EUMETSAT
Am Kavalleriesand 31
64295 Darmstadt, Germany
Tel: +49 6151 807-368
Fax: +49 6151 807-304
E-mail: mikael.rattenborg@eumetsat.int
http://www.eumetsat.int/

**EUMETSAT**
Dr. Lars Prahm
Director-General
EUMETSAT
Am Kavalleriesand 31
64295 Darmstadt, Germany
Tel: +49 6151 807-600
Fax: +49 6151 807-830
E-mail: lars.prahm@eumetsat.int
http://www.eumetsat.int/

**EUMETSAT**
Dr. Johannes Schmetz
Head of Meteorological Division
EUMETSAT
Am Kavalleriesand 31
64295 Darmstadt, Germany
Tel: +49 6151 807-590
Fax: +49 6151 807-838
E-mail:
johannes.schmetz@eumetsat.int
http://www.eumetsat.int/

**EUMETSAT**
Mr. Ernst Koenemann
Director of Programme Development
EUMETSAT
Am Kavalleriesand 31
64295 Darmstadt, Germany
Tel: +49 6151 807-500
Fax: +49 6151 807-552
E-mail: ernst.koenemann@eumetsat.int
http://www.eumetsat.int/

**EUMETSAT**
Mr. Joaquin Gonzalez
System Engineering Support Group
Manager

EUMETSAT
Am Kavalleriesand 31
64295 Darmstadt, Germany
Tel: +49 6151 807-575
Fax: +49 6151 807-426
E-mail:
joaquin.gonzalez@eumetsat.int
http://www.eumetsat.int/

**IOC/UNESCO**
Dr. Keith Alverson
Director, GOOS Project Office
Head of Section, IOC/UNESCO
C.O.I. de l'UNESCO
1, rue Miollis
F-75732 Paris Cedex 15
Tel.: +33 1 45 68 40 42
Fax: +33 1 45 68 58 13
E-mail: k.alverson@unesco.org
http://ioc.unesco.org/iocweb/index.php

**IOC/UNESCO**
Prof. Dr. Hiroshi Kawamura
Center for Atmospheric and Ocean Studies
Graduate School of Science
Tohoku University
Sendai, 980 8578
Japan
Tel.: +81 22 217 6745
Fax: +81 22 217 6748
E-mail:
kamu@ocean.caos.tohoku.ac.jp
http://ioc.unesco.org/iocweb/index.php

**IMD**
Dr. R.C. Bhatia
Additional Director General of Meteorology (Instruments)
India Meteorological Department
Lodi Road
New Delhi, 110003, India
Tel: +91 011 246 16 602
Fax: +91 011 2464 2249/2469 9216/2462 3220
E-mail: rc_bhatia@hotmail.com, rcbhatia@imd.ernet.in
http://www.imd.gov.in/

**IMD**
Mr L R Meena
Director (Satellite Meteorology)
India Meteorological Department
Lodi Road
110003 New Delhi, India
Phone no. 91-11-2469 8247
Fax No. 91-11-2464 2249
Tx: 3166 494
E-mail: lr_meena2001@yahoo.com or lrmeena@indmail.gov.in
http://www.imd.gov.in/

**JAXA**
Dr. Yasushi Horikawa
Executive Director, Office of Space Applications
Japan Aerospace Exploration Agency (JAXA)
1-1, Sengen 2chome, Tsukuba-city, Ibaraki 305-8505, Japan
Tel.: +81 29 868 5075
Fax: +81 29 868 5963
E-mail: horikawa.yasushi@jaxa.jp
http:// http://www.jaxa.jp/index_e.html

**JAXA**
Mr. Tadahiko Inada
Senior Chief Officer for International Cooperation, Office of Space Applications
Japan Aerospace Exploration Agency (JAXA)
Marunouchi Kitaguchi Building, 1-6-5 Marunouchi, Chiyoda-ku, Tokyo 100-8260, Japan
Tel: +813 6266 6014
Fax: +813 6266 6901
E-mail: inada.tadahiko@jaxa.jp
http:// http://www.jaxa.jp/index_e.html

**JMA**
Mr. Kazunobu Nakamura
Director-General
Meteorological Satellite Center (MSC)
Japan Meteorological Agency (JMA)
3-235 Nakakiyoto, Kiyose-shi
204-0012 Tokyo, Japan
Tel.: +81 424 934990
Fax: +81 424 922433
E-mail: kokusai@dpc.kishou.go.jp
http://www.jma.go.jp/jma/indexe.html

**JMA**
Mr. Nozomu Ohkawara
Meteorological Satellite Center (MSC)
Japan Meteorological Agency (JMA)
3-235 Nakakiyoto, Kiyoseshi
Tokyo 204-0012, Japan
Tel.: +81 424 934970
Fax: +81 424 922433
E-mail: kokusai@dpc.kishou.go.jp
http://www.jma.go.jp/jma/indexe.html

**JMA**
Mr. Takashi Ohshima
Director, Satellite Program Division
Observations Department
Japan Meteorological Agency (JMA)
1-3-4, Otemachi, Chiyoda-ku
Tokyo 100-8122, Japan
Tel: +81 3 3201 8677
Fax: +81 3 3217 1036
E-mail:
takashi.ohshima@met.kishou.go.jp
http://www.jma.go.jp/jma/indexe.html

**JMA**
Mr. Yoshishige Shirakawa
Satellite Program Division
Observations Department
Japan Meteorological Agency (JMA)
1-3-4, Otemachi, Chiyoda-ku
Tokyo 100-8122, Japan
Tel: +81 3 3201 8677
Fax: +81 3 3217 1036
E-mail: yshirakawa@met.kishou.go.jp
http://www.jma.go.jp/jma/indexe.html

**KMA**
Mr. Byung-sun Kim
Director of Remote Sensing Division
Forecast Bureau, Korea Meteorological Administration
460-18, Sindaebang-dong, Dongjak-gu,
Seoul 156-720, Republic of Korea
Tel.: +82 2 841 7042
Fax: +82 2 841 7045
E-mail: kimbs@kma.go.kr

**KMA**
Dr. Myoung-Hwan Ahn
Senior Researcher of Remote Sensing Laboratory
Meteorological Research Institute,
Korea Meteorological Administration
460-18, Sindaebang-dong, Dongjak-gu,
Seoul 156-720, Republic of Korea
Tel.: +82 2 841 2786
Fax: +82 2 841 2787
E-mail: mhahn@metri.re.kr

**KMA**
Mrs. Kum-Lan Kim
Senior Researcher of Remote Sensing Division
Forecast Bureau, Korea Meteorological Administration
460-18, Sindaebang-dong, Dongjak-gu,
Seoul 156-720, Republic of Korea
Tel.: +82 2 841 7042
Fax: +82 2 841 7045
E-mail: kkl@kma.go.kr

**NASA**
Dr. Shahid Habib
Chief
Office of Science Utilization, Code 604
Science and Exploration Directorate
National Aeronautics and Space Administration
Goddard Space Flight Center Greenbelt
Maryland 20771
USA
Tel.: +1 301 614 5392
Fax: +1 301 614 5620
E-mail: shahid.habib-1@nasa.gov
http://www.nasa.gov

**NASA**
Ms. DeVon Caroll
National Aeronautics and Space Administration
Office of External Relations
300 E Street SW
Code IY
Washington, D.C., 20546-0001
USA
Tel.: +1 202 358 1622
Fax: +1 202 358 2798
E-mail: Devon.Carroll@nasa.gov
http://www.nasa.gov

**NASA**
Dr. William P. Chu
MS 475
NASA Langley Research Center
Hampton
Virginia, 23681
USA
Tel.: 1-757 864 2675
Fax: 1-757 864 2671
Email: w.p.chu@Larc.nasa.gov
http://www.nasa.gov

**NASA**
Mr. Michael S. Cisewski
MS475
NASA Langley Research Center
Hampton
Virginia, 23681
USA
Tel.: 1-757 864 1861
Fax: 1-757 864 2671
Email: m.s.cisewski@Larc.nasa.gov
http://www.nasa.gov

**NOAA**
Dr. Mary Colton
NOAA/NESDIS/ORA
Room 701
5200 Auth Road
Camp Springs, Maryland, 20746,
USA
Tel.: +1 301 763 8127
Fax.: +1 301 763 8108
E-mail: marie.colton@noaa.gov
http://www.noaa.com/

**NOAA**
Mr. Gary Davis
Director, Office of Satellite Operations and Systems Development
NOAA/NESDIS
SSMC1, Room 8340
1325 East/West Highway
Silver Spring, Maryland, 20910, USA
Tel: +1 301 713 2010
Fax: +1 301 713 1249
E-mail: gary.davis@noaa.gov
http://www.noaa.com/

**NOAA**
Mr. Daniel Muller
Office of International & Interagency Affairs Office
NOAA/NESDIS (E/IA)
SSMC1, Room 7311
1335 East-West Highway
Silver Spring, Maryland 20910, USA
Tel: +1 301 713 2024 Ext. 209
Fax: +1 301 713 2032
E-mail: Daniel.muller@noaa.gov
http://www.noaa.com/

**NOAA**
Dr. Paul Menzel
Chief Scientist
NOAA/NESDIS
1225 West Dayton St.
Madison, WI 53706, USA
Tel: +1 608 263 4930
Fax: +1 608 262 5974
E-mail: paulm@ssec.wisc.edu
http://www.noaa.com/

**NOAA**
Mr. Marlin Perkins
NOAA/NESDIS (E/SP3)
Room 3320, FB4, Mailstop 9909
5200 Auth Road
Camp Springs, Maryland, 20746, USA
Tel.: +1 301 457 5681
Fax.: +1 301 457 5620
E-mail: marlin.o.perkins@noaa.gov
http://www.noaa.com/

**NOAA/NWS**
Mr. Gregory Mandt
Director, Office of Climate, Water and Weather Services
NOAA/ National Weather Service
1325 East-West Highway
Silver Springs, Maryland 20910, USA
Tel.: +1 301 713 0700
Fax: +1 301 713 1520
E-mail: greg.mandt@noaa.gov
http://www.noaa.com/

**ROSHYDROMET**
Mr. Vadim Bakumov
Chief/International Coop. Dept.
Russian Federal Service for Hydrometeorology and Environmental Monitoring
Novovagan'kovsky Street, 12
123242 Moscow, RUSSIA
Tel: +7 095 252 3873
Fax: +7 095 252 55 04
Email: umc@mecom.ru

**ROSHYDROMET**
Mr. Alexandr I. Gusev
Russian Federal Service for Hydrometeorology & Environmental Monitoring
Novovagan'kovsky Street, 12
123242 Moscow, RUSSIA
Tel: +7 095 255 24 87
Fax: +7 095 252 07 08

**ROSHYDROMET**
Dr. Valery N. Dyaduchenko
Deputy Head
Russian Federal Service for Hydrometeorology & Environmental Monitoring
Novovagan'kovsky Street, 12
123242 Moscow, RUSSIA
Tel: +7 095 255 1935
Fax: +7 095 255 2207
E-mail: dvn@mecom.ru

**ROSHYDROMET/SRC PLANETA**
Dr. Vassily V. Asmus
Director
SRC Planeta
7, Bolshoy Predtechensky Per.
Moscow, 123242, Russia
Tel: +7 095 252 37 17
Fax: +7 095 200 42 10
E-mail: asmus@planet.iitp.ru

**ROSCOSMOS**
Mr. Nikolay Potapov
Head of Department
ROSCOSMOS
Shepkina Str. 42
107996 Moscow
Tel.: +7495 631 8866
Fax: +7495 631 9420
E-mail: potapov@roscosmos.ru
http://www.rosaviakosmos.ru

**ROSCOSMOS**
Dr. Victor Saulskiy
Head of Department
TsNIIMash
4, Pionerskaya St.
Korolev, Moscow region,
141070, Russia
Tel.: +7 095 513 5401
Fax: +7 095 513 73 93
E-mail: saulskiy@tsniimash.ru
http://www.rosaviakosmos.ru

**ROSCOSMOS**
Dr. Alexandr Victorov
Deputy Head of Department
Federal Space Agency (ROSCOSMOS)
Shepkina Str. 42
107996 Moscow
Tel.: +7095 631 9895
Fax: +7095 631 9030
E-mail: perova@roscosmos.ru
http://www.rosaviakosmos.ru

**WMO**
Dr. D. Hinsman
Senior Scientific Officer
WMO Space Programme
WMO
7 bis Avenue de la Paix
Case Postale 2300
CH-1211 Geneva 2, Switzerland

Tel: +41 22 730 8285
Fax: +41 22 730 8181
E-mail: Dhinsman@wmo.int
http://www.wmo.int/index-en.html

**WMO**
Dr. James F. W. Purdom
Chair of OPAG IOS
CIRA, Colorado State University
Fort Collins, CO 80523-1375
USA
Tel: +1 970 491 8510
Fax: +1 970 491 8241
Email: purdom@cira.colostate.edu

## OBSERVERS

**CNSC**
Mr. Lai Yan Sun
Administrator
China National Space Administration
8A Fucheng Road
Haidian District
Beijing 100037
China
Tel.: +86 108858 1377/1379
Fax: +86 10 88 58 13 69/1515
Email: cnsa@cnsa.gov.cn
http://www.cnsa.gov.cn/main_e.asp

**CNSC**
Mr. Gao Jun
China National Space Administration
8A Fucheng Road
Haidian District
Beijing 100037
China
Tel.: +86 10 88 58 1455
Fax: +86 10 88 58 1530
http://www.cnsa.gov.cn/main_e.asp
Email: gaojun@cnsa.gov.cn

**KARI**
Dr. Myung-Jin Baek
Principal Researcher
COMS Program Office, Korea Aerospace Research Institute
45, Eoeun-Dong, Youseong-Gu,
Daejeon, 305-333, Republic of Korea
Tel.: +82-42-860-2346
Fax: +82-42-860-2603
E-mail: mjbaek@kari.re.kr

**KARI**
Ms. Se-kyoung Park
Consultant
Korea Aerospace Research Institute
104, 34 Kajung-dong, Yusung-Gu,
Daejeon, 305-350, Republic of Korea
Tel.: +82-42-863-8660
Fax: +82-42-863-3680
E-mail: sekpark@i-art.co.kr

# E-MAIL LIST SERVERS

## CONTACT POINTS FOR CGMS PLENARY:

**cgmsplen@wmo.int**

mhahn@metri.re.kr
asmus@planet.iitp.ru
k.alverson@unesco.org
mjbaek@kari.re.kr
umc@mecom.ru
rc_bhatia@hotmail.com
Douglas.Brauer@noaa.gov
Gordon.bridge@eumetsat.int
Stephen.Briggs@esa.int
devon.carroll@nasa.gov
vincent.casse@cnes.fr
ishida.chu@jaxa.jp
w.p.chu@Larc.nasa.gov
m.s.cisewski@Larc.nasa.gov
Mary.Cleave@nasa.gov
marie.colton@noaa.gov
gary.davis@noaa.gov
yannick.d-escatha@cnes.fr
dvn@mecom.ru
Volker.gaertner@eumetsat.int
Joaquin.gonzalez@eumetsat.int
shahid.habib-1@nasa.gov
DHinsman@wmo.int
vjay@isro.gov.in
katagi.tsuguhiko@jaxa.jp
kamu@ocean.caos.tohoku.ac.jp
kimbs@kma.go.kr
kkl@kma.go.kr
ernst.koenemann@eumetsat.int
sanko@rssi.ru
vkumar@indiagov.org
Jlafeuille@wmo.int
jliu@wmo.int
dfluo@nsmc.cma.gov.cn
greg.mandt@noaa.gov
paulm@ssec.wisc.edu
daniel.muller@noaa.gov
Evangelina.Oriol-Pibernat@esa.int
sekpark@i-art.co.kr
marlin.o.perkins@noaa.gov
Lars.Prahm@eumetsat.int
lr_meena2001@yahoo.com
Purdom@cira.colostate.edu
mikael.rattenborg@eumetsat.int
saulskiy@tsniimash.ru
Johannes.schmetz@eumetsat.int
Brent.Smith@noaa.gov
anne.taube@eumetsat.int
umezawa@eorc.jaxa.jp
uspensky@imp.kiae.ru
Piero.Valabrega@eumetsat.int
vincent.casse@cnes.fr
david.williams@eumetsat.int
greg.withee@noaa.gov
Lutongshan@sina.com
yangjun@nsmc.cma.gov.cn
wjzhang@nsmc.cma.gov.cn
cgmsplen@dpc.kishou.go.jp
cnsa@cnsa.gov.cn

## CONTACT POINTS FOR CGMS FREQUENCY MATTERS:

**cgmsfreq@wmo.int**

asmus@planet.iitp.ru
richard.barth@noaa.gov
rc_bhatia@hotmail.com
markus.dries@eumetsat.int
Joaquin.gonzalez@eumetsat.int
DHinsman@wmo.int
ishida.chu@jaxa.jp
dave.mcginnis@noaa.gov
marlin.o.perkins@noaa.gov
lr_meena2001@yahoo.com
umezawa.kazoo@jaxa.jp
wjzhang@nsmc.cma.gov.cn
cgmsfreq@dpc.kishou.go.jp
prot@planet.iirp.ru

## CONTACT POINTS FOR CGMS VIRTUAL LABORATORY:

**VL@wmo.int**

a.alharthy@met.gov.om
rc_bhatia@hotmail.com
garba@eamac.ne
Gordon.bridge@eumetsat.int
sdburt@inaccs.com.bb
vcastro@cosmos.ucr.ac.cr
connell@cira.colostate.edu
DIARRAMpi@asecna.org
demaria@cira.colostate.edu
DCHua@nsmc.cma.gov.cn

richard.francis@metoffice.com
Volker.gaertner@eumetsat.int
DHinsman@wmo.int
jochen.kerkmann@eumetsat.int
kongoti@yahoo.com
kploguede@hotmail.com
ryojikumabe@met.kishou.go.jp
cgmsvl@dpc.kishou.go.jp
mostek@comet.ucar.edu
jose.prieto@eumetsat.int
Purdom@cira.colostate.edu
anne.taube@eumetsat.int
henk.verschuur@eumetsat.int
piero.valabrega@eumetsat.int
zhwang@jlonline.com
J.Wilson@bom.gov.au
xujm@cma.gov.cn
Rafael.Zarza@eumetsat.int
qihao@nim02.njim.edu.cn

## CONTACT POINTS FOR CGMS WIND MATTERS:

**cgmswind@wmo.int**

araghizadeh@yahoo.com
atlas@dao.gsfc.nasa.gov
Jeff.Ator@noaa.gov
herve.benichou@meteo.fr
howard.berger@metoffice.com
rc_bhatia@hotmail.com
skrb@123india.com
girmawb@yahoo.de
n.bormann@ecmwf.int
Gerhard.bueche@imk.fzk.de
campbell@cira.colostate.edu
Alexander.Cress@dwd.de
jaime.daniels@noaa.gov
munmun@ncmrwf.ernet.in
roger@jord.jpl.nasa.gov
claire.Delsol@ecmwf.int
stettner@ssec.wisc.edu
russd@ssec.wisc.edu
francoise.desalmand@lmd.jussieu.fr
Arthur.desmet@eumetsat.int
Greg.Dew@eumetsat.int
observations@rmdgroup.nl
jason.dunion@noaa.gov
evans@essc.psu.edu
fawzulhaq@hotmail.com
john.eyre@metoffice.com
Simon.Elliott@eumetsat.int
marleneelias@directnet.com.br
Julia.Figa@eumetsat.int
mary.forsythe@metoffice.com
Volker.Gaertner@eumetsat.int
gerhard.paul@dwd.de
Joergen.gustafsson@eumetsat.int
matee_haq@yahoo.com
charlotte.hasager@risoe.dk
hawkins@nrlmry.navy.mil
DHinsman@wmo.int
ken.holmlund@eumetsat.int
akos@bise.atmo.arizona.edu
paul.ingmann@esa.int
jann@zamg.ac.at
gary.jedlovec@msfc.nasa.gov
pcjoshi@sac.isro.org
graeme.kelly@ecmwf.int
jkey@ssec.wis.edu
Arno.Koch@eumetsat.int
Christina.Koepken@dwd.de
a.korpela@niwa.cri.nz
Bruno.Lacroix@meteo.fr
f.lalaurette@ecmwf.int
henri.laurent@mpl.orstom.fr
yslee@iris.metri.re.kr
J.LeMarshall@bom.gov.au
Jeff.Logan@afwa.af.mil
machado@cptec.inpe.br
john.mecikalski@ssec.wisc.edu
lr_meena2001@yahoo.com
nerushev@obninsk.org
timo@ssec.wisc.edu
paulm@ssec.wisc.edu
Evangelina.Oriol-Pibernat@esa.int
orsolini@nilu.no
christophe.payan@meteo.fr
marlin.o.perkins@noaa.gov
Purdom@cira.colostate.edu
pirkko.pylkko@fmi.fi
florence.rabier@meteo.fr
vrajeshvar@hotmail.com
Mikael.Rattenborg@eumetsat.int
David.S.Richardson@metoffice.com
riishojgaard@gmao.gsfc.nasa.gov
rizvi@ncmrwf.ernet.in
dave.santek@ssec.wisc.edu
real.sarrazin@ec.gc.ca
Johannes.schmetz@eumetsat.int
gepard@gepard.at
tony.schreiner@ssec.wisc.edu
serdan@inm.es
chuck.skupniewicz@fnmoc.navy.mil

bill.l.smith@larc.nasa.gov
bjs@gfdl.gov
dave.stettner@ssec.wisc.edu
Ad.Stoffelen@knmi.nl
xsu@ncep.noaa.gov
y-tahara@naps.kishou.go.jp
terliuc@zahav.net.il
szantai@lmd.polytechnique.fr
jean-noel.thepaut@ecmwf.int
m.uddstrom@niwa.nz
uspensky@mail.imp.kiae.ru
chrisv@ssec.wisc.edu
regis.walter@noaa.gov
jwang@raytheon.com
yogiw@fnmoc.navy.mil
xujianmn@public.bta.net.cn
Qsz@nsmc.cma.gov.cn
wjzhang@nsmc.cma.gov.cn
rajam@tropmet.ernet.in
mom@ecmwf.int
cgmswind@dpc.kishou.go.jp
stett@ssec.wisc.edu
lbremen@ecmwf.int

# 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 Radiometer |
| 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 |
| 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 |
| 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 Agency |
| 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 |
| 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) |
| 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 (USA) |
| DOD | Department of Defense (USA) |
| DOMSAT | Domestic telecommunications relay Satellite (USA) |
| 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) |
| 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 | Future generation of Polar-orbiting Meteorological Satellite |
| 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 | Global 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 |
| 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 |
| 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) |
| 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 |
| 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 (CIS) |
| 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 |
| MOP | Meteosat Operational Programme |
| MODIS | Moderate Resolution Imaging Spectroradiometer (NOAA) |
| MONITOR-E | Land Observing Satellite (Roscosmos) |
| MPEF | Meteorological Products Extraction Facility (EUMETSAT) |
| MSC | Meteorological Satellite Centre (Japan) |
| MSC-CAL | Computer Aided Learning system by MSC/JMA |
| 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) |
| 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) |
| QuickSCAT | Quick 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 |
| 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 |
| SATAID | Satellite Animation and Interactive Diagnosis (Japan) |
| SATOB | WMO code for Satellite Observation |
| 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 |
| 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) |
| SOT | Ship Observation Team (JCOMM) |
| 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 (India) |
| SSMI/S | Special Sensor Microwave Imager/Sounder |
| SSMR | Scanning Multispectral Microwave Radiometer |
| SSMT1 | microwave temperature sounder |
| SSMT2 | microwave water vapour sounder |
| 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 |
| UTC | Universal Time Coordinated |
| UWB | Ultra Wide Band |
| | |
| VAS | VISSR Atmospheric Sounder |
| 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) |