REPORT OF THE 32nd MEETING OF THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES

CGMS XXXII

Sochi, Russian Federation
17-20 May 2004

Cover page photo:
view from tea plantation in Sochi

Please note that this report is published together
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at CGMS XXXII.

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TABLE OF CONTENTS

TABLE OF TABLES AND FIGURES

FINAL REPORT OF THE PLENARY SESSION

A. INTRODUCTION

A.1 Welcome

The thirty-second CGMS meeting was officially opened by Dr. A. Bedritsky, Head of Roshydromet and President of WMO, on 17 May 2004 at 10 a.m. in Sochi, Russian Federation. On behalf of Roshydromet and WMO, Dr. Bedritsky welcomed all the participants warmly to the beautiful resort of Sochi located on the northern coast of the Black Sea. He recalled that since 1972 CGMS had provided the world largest forum for the coordination of the operation and development of the international global space system for Earth observation. It had made a significant contribution to the development and maintenance of the international, coordinated and operational constellation of meteorological satellites providing global Earth observation data to users worldwide. This global meteorological data made available to the international user community through the efforts of the CGMS members was of great importance for sustainable socio-economic development and enhanced quality of life. He mentioned that Russia was one of the first countries to open the era of satellite meteorology and that this year it had celebrated the 35th anniversary of the Meteor satellite system. The latest decisions of the Russian government were aimed to further develop the Russian Federation's constellation of meteorological satellites and fulfil the international commitments of the Russian Federation in this field. Dr. Bedritsky praised the achievements of CGMS and WMO in coordinating sustainable and operational collaboration in Earth observation. Concluding his address, he wished CGMS every success for the discussions and for the strengthening and enhancement of the international cooperation in satellite meteorology and Earth observation. On behalf of Roshydromet, Dr. Bedritsky expressed special appreciation and thanks to Dr. Mohr for all his fruitful work and activities within CGMS over the past several years and presented him with an award from Roshydromet. On behalf of Rosaviakosmos, Dr. Polishchyuk, Deputy Director-General of Rosaviakosmos, also thanked Dr. Mohr for contributing so much to the development of satellite observing systems also honouring him with an award from Rosaviakosmos.

On behalf of the CGMS Secretariat, Dr. Tillmann Mohr welcomed all the participants. He was, in particular, pleased to welcome the new members NASA and JAXA at CGMS XXXII. CGMS had extended in a significant way from being a small group of members that had been very effective in serving the needs of users worldwide and now included IOC (in 2001) and the R&D agencies (in 2003). It should see itself able and ready to serve the user community on a wider scale. CGMS should be able to help and develop further the space component of GOS of the new Global Earth Observation System of Systems (GEOSS). GEOSS will be the outcome of the new intergovernmental Group on Earth Observations (GEO) initiated at the first Earth Observation Summit in Washington, D.C. in July 2003. On behalf of CGMS Dr. Mohr thanked Dr. Bedritsky for his time and interest in CGMS. The opening session on 17 May 2004 was closed with a wish for a very successful 32nd CGMS meeting.

Following the working group sessions on 17 and 18 May 2004, the Plenary meeting of CGMS XXXII was opened on 19 May 2004 at 8:40 a.m. by Dr. Dyaduchenko, Deputy Head of Roshydromet.

A.2 Election of Chairmen

Dr. Dyaduchenko was unanimously elected as Chairman of CGMS XXXII with Dr. Tillmann Mohr as a Co-Chairman. 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; Dr. Alexander Uspensky 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; Dr. Tillmann Mohr as Chairman for Working Group III on Global Contingency Planning, with Dr. Donald Hinsman as Rapporteur; and Mr. Michael Williams who replaced 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 Adoption of Agenda

The agenda (see annex 1) was adopted. The meeting recalled that the four working groups had met previously on 17 and 18 May 2004.

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

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 ESA-WP-12, EUM-WP-01, JMA-WP-01, CMA-WP-01, ROSH-WP-01, NOAA-WP-01 and WMO-WP-02.

(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.

   Closed.

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.

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.

Closed. See NOAA-WP-18.

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

   Ongoing.

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

   Closed. *See NOAA-WP-04.*

6. All CGMS satellite operators to review the Transition Tables for LRIT/LRPT (appendix A of CGMS XXXI WMO-WP-03) and provide any updates as appropriate at every CGMS plenary meeting.

   Closed.

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.

   Closed. Updates not required at CGMS XXXII, *as EUM-WP-11 presents a new structure.*

8. CGMS satellite operators to update Table 5 for polar-orbiting satellite equator crossing times on an annual basis.

   Closed.

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

   Ongoing. *See NOAA-WP-16.*

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

    Ongoing.

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.

(ii) Actions from CGMS XXX

30.18 CGMS members to consider FWIS as well as the WMO Core Metadata profile within the context of the ISO Standard for Geographic Metadata (ISO 19115), when changing/implementing processing and dissemination systems (after FWIS approval).

***Closed** and reformulated in Action 31.46 and 31.47. See WMO-WP-23 and NOAA-WP-22.*

30.33 NOAA/NESDIS is invited to present a paper on AMVs from both MODIS instruments on Terra and Aqua satellites, respectively, at IWW7. New deadline: 14 June 2004

***Closed.** A paper will be presented at IWW7 in June 2004.*

30.38 WMO to develop a detailed description of the goal for data, product and services expected from each of the nominal positions for both polar and geostationary orbits for use in contingency planning.

***Closed.** There will be an agenda item at next session of OPAG IOS Expert Team on Satellite System Utilisation planned in 2004.*

(iii) Actions from CGMS XXXI

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.

Open.

31.02 NOAA to consider maintaining the GEO coverage (including sounder data) in the Pacific region and not de-orbit the GOES-8 satellite.

***Closed.** See NOAA-WP-08.*

31.03 NOAA to study the request for data coverage sounder in the southern hemisphere from GOES-9. Current requirements came from NOAA's National Weather Service.

***Closed.** See NOAA-WP-09.*

31.04 New members of CGMS to provide information on their R&D satellites.

Closed.

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.

***Open.** NOAA-WP-06 withdrawn. **New deadline: 31 December 2004**.*

31.06 WMO to propose a template to contain detailed information on CGMS satellite systems (incl. the R&D satellites), noting data available in the CEOS database.

Closed. *See WMO-WP-26.*

31.07 CGMS Members to complete the required information in the template by CGMS XXXII.

Closed. *Discussed in WG III.*

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

Open *for EUMETSAT, as need for discussion in EUMETSAT Council in June 2004.* ***Closed for NOAA*** *(NOAA-WP-10).* ***New deadline: 30 June 2004.***

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

Closed for JMA *(JMA-WP-08),* ***ESA*** *(ERS-2 operations funded until mid 2005),* ***NOAA*** *(NOAA-WP-11).* ***Open for EUMETSAT****, as need for discussion in EUMETSAT Council in June 2004.* ***New deadline: 30 June 2004.***

31.10 R&D satellite operators are encouraged to make their data available for routine near real time use.

Closed for ESA and NASA *(NASA-WP-01 and ESA-WP-03).*

31.11 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).

Closed for ESA *(ESA-WP-04) and NOAA (NOAA-WP-12).* ***Ongoing. CGMS agreed to make this a permanent action.***

31.12 CGMS Members to indicate their activities aimed at completion of the actions and timetable described in the Implementation Plan for the Virtual Laboratory, approved by CGMS-XXIX and contained as Appendix B to WMO-WP-17.

Closed for ESA *(ESA-WP-05),* ***EUMETSAT*** *(EUM-WP-10),* ***for JMA*** *(JMA-WP-06)* ***and NOAA*** *(NOAA-WP-13).*

31.13 CGMS Members to support, as appropriate, the second session of the CGMS VL Focus Group to be held 15-16 December, 2003 in Barbados.

Closed.

31.14 CGMS Members were asked to update their contact information for the CGMS Consolidated Report Drafting Committee and for the new CGMS members to nominate a point of contact for the Drafting Committee.

***Closed** for ESA, EUMETSAT, NOAA, IOC, JMA, WMO, CMA.*

31.15 CGMS Secretariat to develop a new structure for the CR.

***Closed.** See EUM-WP-11.*

31.16 CGMS members to form a focus group to further examine the Global Education and Science Network, which should meet before CGMS XXXII and present a way forward at CGMS XXXII.

***Closed**. See WMO-WP-24.*

31.17 CGMS Secretariat to invite CNES to CGMS XXII.

***Closed.** CNES has accepted to become a member and was invited to CGMS XXXII.*

31.18 CGMS Members to notify the ITU (if required) before 1 January 2004 of those Met-Sat Earth Stations operating in the band 1670 – 1675 MHz.

***Closed for NOAA** (email of 11/02/04**). N/A for JMA** (email of 14/04/04).*

31.19 KARI to take into account ITU Recommendation SA.1158 when finalising its downlink frequency plan for the meteorological payload of the planned Geostationary satellite.

***Closed.** KARI sent an email on 1 May 2004.*

31.20 CGMS Members are invited to raise the problems of a potential implementation of Short Range Radar equipment operating in the frequency band 21 – 27 GHz with their responsible national frequency administrations.

Closed for NOAA** (email of 11/02/04). **N/A for JMA.

31.21 KARI and CMA to co-ordinate their frequency plans for FY-2 at 123° East and the planned Korean spacecraft COMS, to be operated at 116° East.

***Closed.** KARI sent an email on 1 May 2004.*

31.22 USA to provide more precise details of its requirement for the temporary use of IDCS channels to assist the transition of DCP operators to HDR systems, including a schedule of implementation.

***Closed.** See NOAA-WP-17.*

31.23 WMO and IOC are tasked with a review of requirements for the IDCS in the near and long term (up to 15 years).

Closed. *ASAP Panel wish to retain existing IDCS channel and frequency allocations for ASAP in the medium term. ASAP will return to IDCS in future because of cost factor.*

31.24 Satellite operators to nominate experts i) as point of contact for visible and infrared calibration of operational and R&D sensors, and ii) participants to the relevant meeting of the CEOS Cal/Val Working Group in 2004.

Closed for ESA, EUMETSAT, NOAA, JMA. *There will not be a participant from JMA this year.*

31.25 Satellite operators to generate a bibliography of calibration papers/reports and submit them at the next CGMS.

Closed for NOAA *(email of 05/02/04 and NOAA-WP-19),* ***EUMETSAT*** *(EUM-WP-17),* ***JMA*** *(email of 14/04/04),* ***ESA*** *(ESA-WP-06).*

31.26 Satellite operators to present papers at the next CGMS relating experiences using R&D sensors (such as AIRS, MODIS, MERIS, MISR, MTVZA, …) to improve calibration of operational sensors). **Deadline: 30 April 2004**

Closed for ESA *(ESA-WP-07),* ***EUMETSAT*** *(EUM-WP-12),* ***NOAA*** *(NOAA-WP-20).*

31.27 EUMETSAT to request, in written form, from all geostationary satellite operators (hourly) VIS channel observations for a common period of one month in late 2002 when MODIS, MISR and MERIS data are also available.

Closed. *Report in EUM-WP-14.*

31.28 All geostationary satellite operators to provide the VIS data requested according to Action 31.27 to EUMETSAT.

Closed*. N/A for ESA.*

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 webpage. (3) CGMS Members to provide information to the IPWG Rapporteur on areas for future consideration by the IPWG.

Open. New deadline: October 2004*. See also ESA-WP-08, NOAA-WP-21.*

31.30 Satellite operators to review the satellite data BUFR descriptors in the WMO Codes Forms used for exchange of satellite data (as detailed in WMO-WP-10) and provide suggestions, remarks, or requests as necessary to the WMO Satellite Programme for communication to the CBS Chair OPAG ISS.

Closed *for EUMETSAT (EUM-WP-15), NOAA (NOAA-WP-22). N/A for ESA.*

31.31 Satellite operators to report on their plans to consider the metadata recommendations in EUM-WP-22 when re-transcribing their data archives.

Closed for NOAA *(NOAA-WP- 23)* ***and EUMETSAT.*** *Verbal report to be given in WG II. N/A for ESA.*

31.32 All space agencies to provide information specifically addressing the ten GCOS climate monitoring principles related to the space based component of the Global Observing System in a manner similar to EUM-WP-10.

Closed for EUMETSAT, ESA *(ESA-WP-09),* ***JMA*** *(JMA-WP-08) and* ***NOAA*** *(NOAA-WP-24 and NOAA-WP-11).*

31.33 CGMS XXXI requests IWW7 to address the following AMV related topics within the break-out working groups at IWW7 and/or on the basis of contributed papers to IWW7:

- Meso-scale and nowcasting applications
- Regional scale modeling
- Height assignment
- Polar winds
- Rapid scans
- Re-analysis of AMVs
- AMV versus radiance asimilation in 4-d var systems
- Upper level wind divergence (climatologies and other applications)
- Image pre-processing (e.g. cloud filtering)

Closed. *Agenda for IWW7 has been fixed. It was discussed in WG II.*

31.34 CGMS XXXI requests NESDIS to consider submission of paper to IWW7 on preparatory work on the derivation of AMVs from high-spectral resolution IR sounding instruments (e.g. GIFTS).

Closed. *See NOAA-WP-25.*

31.35 CGMS to request that Windsat Coriolis evaluation be performed in the manner similar to AIRS (with distribution of data sets for outside evaluation as soon as possible) as a matter of urgency. NOAA is asked to report on pertinent steps at the next CGMS.

Closed. *See NOAA-WP-26.*

31.36 CGMS satellite operators to inform CGMS XXXII on plans to achieve the goal that all geostationary imagers should be upgraded to at least the level of SEVIRI by the 2015 timeframe; and frequent IR sounding should be made by high resolution spectrometers within the same timeframe.

***Closed for EUMETSAT** and **NOAA** (NOAA-WP-29). N/A for ESA.*

31.37 EUMETSAT, NESDIS and WMO to prepare a paper on the International Geostationary Laboratory (IGL) that would be a joint undertaking to provide a platform for demonstrations from geostationary orbit of new sensors and capabilities.

***Closed.** See EUM-WP-18 and NOAA-WP-30.*

31.38 ESA to report to CGMS XXXII on its activities related to a MW sounder from geostationary orbit.

***Closed.** See ESA-WP-10.*

31.39 CGMS Secretariat and WMO to assemble all materials related to Global Contingency Plans, including those found in CGMS and in WMO reports, and consolidate them into a CGMS Global Contingency Plan.

***Closed.** See WMO-WP-05.*

31.40 EUMETSAT and NESDIS to investigate whether due to the increased dissemination bandwidth on NPOESS L-band the frequency overlap issues could cause any problems for operational orbit scenarios.

***Closed.** (EUM-WP-19 and NOAA-WP-32).*

31.41 NESDIS to raise the issue of using the full ISO standard for geographic metadata in the framework of the FWIS inter programme task team.

***Closed.** Email was sent on 11 May 2004.*

31.42 NESDIS to provide CGMS with further details of its MCUT development.

***Closed.** See NOAA-WP-33.*

31.43 WMO to modify the layout of the LRIT/LRPT transition tables taking ADM into account.

***Closed.** See WMO-WP-03.*

31.44 CGMS Members to include information on ADM services in the CGMS transition tables for LRIT/LRPT and WMO to make this information available via the WMO website.

***Closed.** EUMETSAT and NOAA sent emails.*

31.45 CGMS Members to indicate actions enabling global networking of the ADM implementations in view of a smooth exchange of specific ADM contents among differing ADM systems.

***Closed for ESA** (ESA-WP-11), **EUMETSAT** (EUM-WP-20) **and NOAA** (NOAA-WP-34).*

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

***Ongoing.** CGMS agreed to make this a permanent action.*

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

***Ongoing.** CGMS agreed to make this a permanent action.*

31.48 CGMS Members to actively pursue the issue of ADM on a global basis and to ensure the interoperability of those systems.

***Closed for EUMETSAT** (EUM-WP-20), **NOAA** (NOAA-WP-34).*

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

Open.** The questionnaire responses due in 09/2004. Closed for NOAA (NOAA-WP-34). **New deadline: November 2004

31.50 NOAA to inform WMO on its latest schedule for LRIT transition.

***Closed.** See NOAA-WP-34, JMA-WP-03.*

31.51 CGMS Members to consider the use of off the shelf components for ADM user stations because this would allow easier adaptation of the station to match future growth in the dissemination system and to accommodate changing user requirements and report to CGMS XXXII.

***Closed for EUMETSAT** (EUM-WP-20), **JMA** (JMA-WP-09) and **NOAA** (NOAA-WP-34).*

31.52 CGMS to investigate further data protection techniques appropriate for a global “alternative distribution system” and report to CGMS XXXII.

***Closed for EUMETSAT** (EUM-WP-20) **and NOAA** (NOAA-WP-34).*

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 satellites FY-1C and FY-1D, launched in May 1999 and May 2002, respectively. Both satellites carry 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. Both FY-1D and FY-1C transmit Chinese High Rate Picture Transmission (CHRPT) to users worldwide and also transmit GDPT and LDPT, which are received only by the National Satellite Meteorological Center of CMA (NSMC). FY-1C has been operating for over five years, well exceeding its two-year design lifetime. The satellite is still operating according to specification, however, some MVISR channels have attenuated. This has been corrected through calibration of the instrument. An update of calibration coefficients was included in the working paper.

Roshydromet informed CGMS in ROSH-WP-02 on 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 a.m. ascending node. The payload includes several instruments of which the MIVZA and MTVZA radiometers have limited capabilities due to technical problems related to their scanning mode. Due to the none-functioning 466 MHz transmitter, the satellite has limited capabilities for MR-2000M and KLIMAT data direct broadcast.

NOAA reported in NOAA-WP-02 on 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-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 a.m. ascending node (morning orbit) and carries a Solar Backscatter Ultraviolet Spectral Radiometer (SBUV). On 15 February 2003 DTR#5 failed to operate and on 28 April 2003 the STX3 power degraded to 2 Watts. On October 28, 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 p.m. 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.

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. Given the continued anomalous operation of AVHRR on NOAA-16 and the failure of AMSU-A1 on NOAA-17, NOAA is preparing to request NASA to arrange for the NOAA-N' launch as soon as possible. This spacecraft will be renamed NOAA-18 once it achieves orbit.

Table 1: Current Polar-Orbiting Satellites Coordinated Within CGMS
(as of 20 May 2004)

Orbit type **(equatorial crossing times)**	**Satellites in orbit** (+operation mode) P=Pre-operational Op=operational B=back-up L=limited availability R= R&D	**Operator**	**Crossing Time** A=Northw D=Southw +Altitude	**Launch date**	**Status**
Sun-synchr. "Morning" (6:00 – 12:00) (18:00 – 24:00)	NOAA-17 (Op)	USA/NOAA	10:20 (D) 812 km	6/02	Functional. AMSU-A1 Failed.
	NOAA-15 (B)	USA/NOAA	06:37 (D) 808 km	05/98	Functional (intermittent problems with AVHRR, AMSU-B & HIRS)
	NOAA-12 (L)	USA/NOAA	04:44 (D) 805 km	05/91	Functional (except sounding).
	DMSP-F15 (Op)	USA/NOAA	21:24 (A) 850 km	12/99	Defense satellite. SSMT2 (microwave water vapor sounder) non-functional. Data available to civilian users through NOAA.
	DMSP-F14 (B)	USA/NOAA	19 :52 (A) 852 km	04/97	Defense satellite. SSMT1 (microwave temperature sounder) non-functional. SSMT2 non-functional. Only 1 functional onboard recorder. Data available to civilian users through NOAA.
	DMSP-F12 (L)	USA/NOAA	18:15 (A) 850 km	8/94	Defense Satellite. SSMI (microwave imager) and SSMT1 non-functional. Non-operational (no onboard recorders).
	Meteor-3M-N1 (P)	Russia	9:15	12/01	Functional (with limited capabilities).
Sun-synchr. "Afternoon" (12:00 –16:00) (00:00 – 04:00)	NOAA-16 (Op)	USA/NOAA	14:11 (A) 850 km	09/00	Functional, no APT. Intermittent problems with AVHRR.
	NOAA-14 (B)	USA/NOAA	19:30 (A) 845 km	12/94	Functional. AVHRR and SBUV only (degraded mode).
	NOAA-11 (L)	USA/NOAA	23:04 (A) 841 km	09/88	Decommissioning scheduled for 16 June 2004 at 1610z.
Sun-synchr. "Early morning" (4:00 - 6:00) (16:00 – 18:00)	DMSP-F13 (Op)	USA/NOAA	18:24 (A) 850 km	03/95	Defense satellite. On orbit 101 months – estimate 7 months of mission life remaining. Data available to civilian users through NOAA.
	FY-1D (Op)	China/CMA	08:20 (D) 866 km	5/02	Functional. CHRPT

B.2 Geostationary Meteorological Satellite Systems

EUMETSAT reported in EUM-WP-02 on the operations of the Meteosat System, which currently consists of four satellites: Meteosat-8, Meteosat-7, -6 and -5.

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 end of 2005. Meteosat-6 performs the operational Rapid Scanning Service and is the primary service back-up at 10°E. Meteosat-5 continues the Indian Ocean Data Coverage Service at 63°E.

The inclination of Meteosat-7 at the end of October 2003 was 0.22° and decreasing. The remaining hydrazine fuel on board is estimated to be 9.55 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 until the year 2005.

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 January 2004 was 3.53° and increasing. The remaining hydrazine fuel on board is estimated to be 6.75 kg. The on-board fuel reserve limit of Meteosat-6 will be re-assessed during 2005.

The orbital inclination of Meteosat-5 at the end of January 2004 was 6.42° and increasing. The remaining hydrazine fuel on board is estimated to be 4.80 kg, of which a 4 kg reserve will be required to de-orbit the spacecraft at the end of its useful life. The on-board fuel reserve limit of Meteosat-5 will be re-evaluated towards the end of 2004.

Meteosat-8, launched on 28 August 2002, has become fully operational on 29 January 2004. After the Solid State Power Amplifier (SSPA) had failed in October 2002, an alternative dissemination mechanism was developed: MSG SEVIRI HRIT and LRIT data is transmitted via EUMETCast, a satellite Direct Video Broadcast (DVB) system using Hotbird-6, providing coverage over Europe, Africa, the Middle East and parts of North and South America.

Following the successful Routine Operations Readiness Review, a decontamination of the SEVIRI instrument was performed and Meteosat-8 was relocated from 10.5°W to 3.4°W. On 29 January 2004 the commissioning of the satellite was fully completed and MSG-1 was renamed Meteosat-8. Performance figures over the last months of the commissioning are given in the working paper.

India reported on the status of INSAT and the KALPANA-I (Metsat) satellites in IND-WP-01.

INSAT-2E, which is the last satellite of the INSAT-2 series carrying a meteorological payload, is currently providing useful cloud imagery data in three channels at 1 km resolution. It is operating at 83°E.

A dedicated meteorological satellite called METSAT (now 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 is operational since 24 September 2002 and is positioned at 74°E. The imaging mission is working satisfactorily and it 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.

INSAT-3A, belonging to the third generation of INSAT satellites, was successfully launched on 10 April 2003. Its meteorological payloads are identical to those 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 has been declared operational in May 2003.

WMO informed CGMS that, in a letter to WMO, India had recently indicated its commitment to make half-hourly data available to the user community within the next 3 to 4 years and thereby join the space-based component of the GOS. CGMS welcomed this very positive signal from India towards the GOS.

JMA reported on the status of GMS-5 in JMA-WP-02. GMS-5, launched in 1995, has been operating at 140°E well beyond its design lifetime of five years. GMS-5 operations were affected by lubricant building up in the mirror scanning mechanism in 2000. To avoid the risk of the expected high scan mirror motor-torque, JMA has reduced the observation frame and introduced some changes to some Full Disk observations of the Northern Hemisphere in June 2000 and July 2001. JMA managed to keep the lubricant build up to a safe level. On 22 May 2003 VISSR observations from GMS-5 were discontinued, as back-up operations in cooperation with NOAA/NESDIS using GOES-9 was started on 22 May 2003. Since then GOES-9 has taken over the earth observations over the western Pacific. However, both the data collection function and the WEFAX signal relay functions of GMS-5 are continuously maintained. The remaining propellant of GMS-5 is about 7.94 kg, i.e. not enough to keep the spacecraft at its nominal geostationary position until the commencement of the operation of MTSAT-1R, the successor to GMS-5. To save propellant, the north-south station keeping manoeuvres have not been conducted since October 2001. As of 25 March 2004 the orbital inclination of GMS-5 is around 2.72 degrees and increasing.

Since 22 May 2003 GOES-9 has been operated at 155°E. JMA is producing meteorological products such as Atmospheric Motion Vectors from GOES-9 GVAR data. GMS-5 provides users with WEFAX pictures and relays DCP data. In place of the S-VISSR dissemination via GMS-5, S-VISSR type data files are now being disseminated to registered National Meteorological and Hydrological Services through the Internet/ FTP server of JMA. They are posted on the server within 10 to 15 minutes of observation by GOES-9. It is planned to continue the back-up of GMS-5 with GOES-9 until the start of the operations of MTSAT-1R.

In CMA-WP-03, CGMS was informed of the status of FY-2B, the second Chinese geostationary meteorological satellite, launched in June 2000. The satellite is spin-stabilised and is stationed at 105°E. On 8 June 2003 the scan mirror of the VISSR got stuck due to insufficient lubrication, thereby affecting the quality of the image. The

VISSR was subsequently reset to recover the image quality. In order to prevent this problem recurring, scanning is now limited to the Northern Hemisphere. Furthermore, as the transponder is susceptible to temperature changes and has to be kept within a very narrow range, the S-VISSR data is not transmitted during eclipse periods.

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 stabilized 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 ready for the replacement of the older operational spacecraft if necessary. In cooperation with Japan, GOES-9 is stationed over the western Pacific Ocean to provide data until the next Japanese MTSAT can be launched (see NOAA-WP-09). GOES-3 and GOES-7, spin-stabilised satellites from the previous GOES series, continue a track record of more than 55 years of combined service via continued support of non-NOAA users in a data relay mode (non-imaging).

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.

NOAA-WP-08 provided a summary of the NOAA's geostationary satellite coverage for the Pacific Region. NOAA currently has GOES-10 in the operational position at 135° West. This covers a large portion of the Pacific Ocean. Through a cooperative agreement between NOAA and JMA, GOES-9 was stationed over the western Pacific Ocean at 155° East to provide operational data until Japan launches the next MTSAT satellite. Due to limitations of on-orbit fuel, NOAA could not maintain GOES-8 in orbit as a back-up to GOES-9. GOES-8 was de-orbited on 5 May 2004. Currently, NOAA is building the GOES-N series of satellites and planning for the GOES-R series as described in NOAA-WP-07. It is planned to continue populating the 135° West position through these series of satellites.

WMO thanked NOAA and JMA for their excellent back-up arrangement enabling a continuous coverage of the area until MTSAT-1R will be operational.

NOAA-WP-09 reports that NOAA scientists are studying GOES-9 sounder derived products for the Alaska and Hawaii regions. NOAA designed a set of sounding sectors to support the generation of sounder derived products. The sounding sectors (north, central and south) were designed around the GOES-9 imager operations with special emphasis for the northern and central Pacific Ocean. The paper presented

details of these sectors. NOAA developed experimental scenarios to use the information. The Cooperative Institute for Meteorological Satellite Studies (CIMSS) and the National Weather Service (NWS) worked with NESDIS in suggesting possible scanning scenarios for the sounder. The data from the sounder are available via direct broadcast, DOMSAT relay, NESDIS/OSDPD/SSD and at the CIMSS website, http://cimss.ssec.wisc.edu/.

Table 2: Current Geostationary Satellites Coordinated within CGMS
(as of 20 May 2004)

Sector	**Satellites currently in orbit (+type)** P: Pre-operational Op: Operational B: Back-up L: Limited availability	**Operator**	**Loca-Tion**	**Launch date**	**Status**
West –Pacific (108° E-180° E)	GOES-9 (L)	USA/NOAA	155°E	05/95	Now providing Data to Japan.
	GMS-5 (OP)	JAPAN	140°E	3/95	The back-up of GMS-5 with GOES-9 was started on May 2003.
EAST -PACIFIC (180°W-108°W)	GOES-10 (Op)	USA/NOAA	135°W	04/97	Inverted, solar array anomaly, DCP interrogator on back-up
WEST-ATLANTIC (108°W-36°W)	GOES-12 (Op)	USA/NOAA	75°W	7/ 01	Fully Functional
	GOES-11 (B)	USA/NOAA	105°W	05/00	In-orbit back-up, 48 hours availability
EAST ATLANTIC (36°W-36°E)	Meteosat-6 (B)	EUMETSAT	10°E	11/93	Rapid Scanning Service minor gain anomaly on IR imager
	Meteosat-7 (Op)	EUMETSAT	0°	02/97	Functional
	Meteosat-8 (Op)	EUMETSAT	3.4°W	28/08/02	EUMETCast, no LRIT
INDIAN OCEAN (36°E-108°E)	Meteosat-5 (Op)	EUMETSAT	63°E	03/91	IODC, functional but high inclination mode
	GOMS-N1 (B)	RUSSIA	76°E	11/94	Since 9/98 in stand-by
	FY-2B (Op, L)	CHINA/CMA	105°E	06/2000	Hemispheric scanning only since 6/03. Image transmission stops in eclipse periods.
	FY-2A (B, L)	CHINA/CMA	86.5°E	06/97	
	INSAT II-B (B)	INDIA	111.5°E	07/93	Back-up satellite. But inclined orbit mode of operation. IR channel not available.
	INSAT II-C	INDIA	48.0°E	12/95	No meteorological payload. Back-up satellite for communications only.
	INSAT II-E (Op)	INDIA	83°E	04/99	Imagery data from three channel CCD payload (1km res.) available for operational use. 3 channel VHRR not available for operational use.

continued Sector	Satellites currently in orbit (+type) P: Pre-operational Op: Operational B: Back-up L: Limited availability	Operator	Loca-Tion	Launch date	Status
INDIAN OCEAN (36°E-108°E)	INSAT III-C	INDIA	74°E	24/01/02	No meteorological payload. Used for dissemination of processed meteorological data in broadcast mode only over India and neighbouring countries. No WEFAX broadcast capability in L-band.
	Kalpana-1 (Op) (METSAT)	INDIA	74°E	12/09/02	Dedicated meteorological satellite.
	INSAT-3A (Op)	INDIA	93.5°E	10/04/03	Operationalisation date: 24/04/03. A 3 channel VHRR imager and CCD payload available for use similar to II-E.

B.3 Research and Development Satellite Systems

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

The second ERS 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, Arctic and western North America. Since 22 August 2003 the wind scatterometer data distribution that had been interrupted from January 2001 until 21 August 2003 is operating again.

Envisat was successfully launched on 1 March 2002 and since then is orbiting in its assigned 35-day repeat cycle, 30 minutes ahead of the ERS-2 satellite. During 2003, the services to users were gradually open and have now reached a stable status with satisfactory data acquisition and product generation performances. A total of 77 different types of products are generated amounting to about 140 GBytes of product data per day. Several of these products have been tailored for 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. 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 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 2003, a new Science Program has been elaborated and

implemented for 2004. The 2004 program addresses major objectives identified by ESA including furthering hyperspectral multi-angular mission concepts (e.g. Earth Explorer Candidate SPECTRA), wetland monitoring, retrieval studies, monitoring of forest fires together with the German national satellite BIRD and support to disaster monitoring as part of the International Charter on Space and Major Disasters.

WMO thanked ESA for its contribution to the space-based component of the Global Observing System. Furthermore, WMO praised the high value of ESA's recent successful research announcement of opportunity to WMO users worldwide and said it was looking forward to the next announcement of opportunity.

ESA-WP-03 gave a brief overview on the status of near real time (NRT) access to Envisat and ERS selected products. Here NRT means within 3 hours of data acquisition.

JAXA reported in JAXA-WP-01 on the TRMM, the AMSR-E and ADEOS-II. The Tropical Rainfall Measuring Mission (TRMM) was launched in November 1997. It is a joint program between JAXA (former NASDA) and NASA and is the first mission to carry precipitation radar to monitor tropical rainfall from Space. JAXA provided the Precipitation Radar (PR) equipment for the satellite, while NASA provided the satellite bus and sensors other than PR. The Advanced Microwave Scanning Radiometer (AMSR-E) is a microwave scanning radiometer, a modified version of AMSR installed on ADEOS-II. NASA's Aqua satellite carrying AMSR-E was successfully launched in May 2002. It is expected to improve the accuracy of modelling and forecasting of rainfall, typhoons and other climate changes.

ADEOS-II was launched by the H-IIA Launch Vehicle Flight No.4 on December 14, 2002. ADEOS-II was placed into the planned orbit successfully and named "Midori-II". The objective of ADEOS-II, as a successor to the Advanced Earth Observing Satellite (ADEOS) launched in August 1996, was to acquire data to contribute to international global climate change research, as well as for applications such as meteorology and fishery. Its routine operation was started in April 2003, however, its observation stopped unexpectedly on 25 October 2003 because not sufficient electric power was available. At the end of May 2004 an official study on the problem will be available.

NASA reported in NASA-WP-02 on its Earth Observation satellite missions in operation, near launch and under development. NASA initiated the report on their R&D satellites by introducing the overall research strategy and its linkage to the applications program. NASA stated that their Earth science research has six focus areas e.g., climate variability and change, atmospheric composition, carbon cycle and ecosystems, global water and energy cycle, weather and Earth surface and interior. The applications programme has twelve application areas ranging from air quality, disaster management, energy management, invasive species, public health, water management and others are poised to get direct benefit from science products for societal benefits.

NASA reported that there are currently 18 missions in orbit with about 70 instruments on board. Three missions are near launch and nine missions are under development. These are presented under section C.3. NASA specifically pointed out the Aura

launch scheduled for 19 June 2004. It should contribute to improve the understanding in atmospheric chemistry. NASA-WP-02 provides a comprehensive catalogue of all NASA missions, some of these are listed below: ACRIMSAT (Active Cavity Radiometer Irradiance Monitor Satellite), Terra satellite providing global data on the state of the atmosphere, land, and oceans, Jason-1, Aqua, ERBS mission, Landsat 7, NMP-EO-1, ICESat, QuickSCAT, SAGE III, SeaWinds (Geographic coverage of ocean wind speed and direction, TOPEX/Poseidon (Topographic Experiment/Poseidon), TOMS – EP (Total Ozone Mapping Spectrometer – Earth Probe), SRTM (Shuttle Radar Topography Mission) GRACE (Gravity Recovery and Climate Experiment), TRMM (Tropical Rainfall Measuring Mission), UARS (Upper Atmosphere Research Satellite). The missions near launch include Aura (Measure Earth's ozone, air quality and climate), CloudSAT (Measurements of global cloud properties), CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations).

CGMS thanked NASA for its contribution to the space-based GOS. CGMS encouraged NASA to continue its efforts and pointed out that for maximum utilisation it would be appropriate if R&D agencies would provide the data in the codes used by WMO for transmission in the GTS. In this respect, CGMS thanked ESA for providing its data in the BUFR code, as recommended by WMO.

Table 3: Current R & D satellites discussed within CGMS
(as of 3 June 2004)

Satellites in orbit (+operation mode)	**Operator**	**Crossing Time** A=Northw D=Southw +Altitude	**Launch date**	**Application/ instruments**	**Status, application and other information**
ERS-1	ESA	10:30 (D) 785 km	07/91	Altimeter, SAR, SAR-wave,ATSR, Scatterometer	Replaced by ERS-2 in 03/00 after an overlapping period
ERS-2	ESA	10:30 (D) 785 km	04/95	Altimeter, SAR, SAR-wave, ATSR, Scatterometer, GOME	Due to OB recorder problems in 06/03, the LBR mission is ensured over ESA agreed acquisition stations.
ENVISAT	ESA	10:000 (D) 800 km	03/02	10 instruments for Environment	
PROBA	ESA	10: 30 (D) 615 km	10/01	CHRIS	Drifting orbit. Technology experiment. AO Science mission since 2003.
TRMM	JAXA/ NASA	402 km non-sun-synchronous	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.

continued **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-synchronous	20/12/1999	ACRIM III	Active Cavity Radiometer Irradiance Monitor Satellite measures total solar irradiance, studies incoming solar radiation and adds measurements of ocean and atmosphere currents and temperatures as well as surface temperatures.
Terra	NASA	705 km sun-synchronous	18/12/1999	CERES, MISR, MODIS, MOPITT, ASTER	Measurement of Earth' climate system, atmoshpere, land, oceans and interactions with solar radiation
Jason-1	NASA/ CNES	1336 km non-sun-synchronous	07/12/2001	Laser retroreflector array Poseidon-2 solid state radar altimeter DORIS receiver Jason Microwave Radiometer BlackJack GPS Receiver tracking system	Ocean surface topography follow-on mission to TOPEX/POSEIDON monitor global ocean circulation for global climate prediction
Aqua	NASA	705 km sun-synchronous	04/05/2002	AMSR-E (JAXA) AIRS, AMSU-A, CERES, HSB, MODIS	collects data on Earth's water cycle, precise atmospheric and oceanic measurements
ERBS (Earth Radiation Budget Satellite)	NASA	585 km non-sun-synchronous	05/10/1984	ERBE SAGE II	studies how energy from the Sun is absorbed and re-emitted by the Earth
Landsat 7	NASA	705 km sun-synchronous	15/04/1999	Enhanced Thematic Mapper Plus Instrument (ETM+)	well-calibrated, multispectral, moderate resolution, substantially cloud-free, sunlit digital images of the Earth's continental and coastal areas
NMP EO-1 (New Millennium Program Earth Observing-1)	NASA	705 km sun-synchronous	21/11/2000	Advanced Land Imager Hyperion LAC	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-synchronous	Jan. 2003	Geo-science Laser Altimeter System 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-synchronous	19/06/1999	SeaWinds	sea surface wind speed and direction data for global climate research and operational weather forecasting and storm warning

continued **Satellites in orbit** (+operation mode)	**Operator**	**Crossing Time** A=Northw D=Southw +Altitude	**Launch date**	**Application/ instruments**	**Status, application and other information**
SAGE III (Stratospheric Aerosol and Gas Experiment)	NASA/ FSA	1020±20 km	10/12/2001	SAGE III	One of nine experiments on Russian Meteor-3M spacecraft measures ozone and aerosols in high lattitudes
SORCE (Solar Radiation and Climate Experiment)	NASA	600 km non-sun-synchronous	25/01/2003	- XPS (Extreme Ultraviolet (XUV) Photometer System) - TIM (Total Irradiance Monitor) - SIM (Spectral Irradiance Monitor A&B) - SOLSTICE (Solar Stellar Irradiance Comparison Experiment A&B)	will provide total irradiance measurements and full spectral irradiance measurements. Continuation of ACRIMSAT measurements.
TOPEX/ POSEIDON	NASA/ CNES	705 km sun-synchronous	10/08/1992	- Microwave radiometer - GPS receiver - Laser retroreflector array - Dual frequency NASA radar altimeter - Single frequency CNES radar altimeter - DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite) receiver	Measures ocean surface topography and monitors global ocean circulation for global climate predictions
TOMS - EP (Total Ozone Mapping Spectrometer - Earth Probe)	NASA	740 km sun-synchronous	02/07/1996	Total Ozone Mapping Spectrometer	measurements of total column ozone and its variation on a daily basis
GRACE (Gravity Recovery and Climate Experiment)	NASA/ DRL	300-500 km near polar non-sun-synchronous	17/03/2002	- Star Camera Assembly - GPS BlackJack Receiver - Instruments Processing Unit - Laser Retro-Reflector Assembly - K-Band Ranging Instruments - SuperSTAR Accelerometers	accurate global and high-resolution determination of static and time-variable components of Earth's gravity field measurement of: - Gravitational field - GPS atmospheric and ionospheric limb sounding

continued **Satellites in orbit** (+operation mode)	**Operator**	**Crossing Time** A=Northw D=Southw +Altitude	**Launch date**	**Application/ instruments**	**Status, application and other information**
UARS (Upper Atmosphere Research Satellite)	NASA	585 km non-sun-synchronous	15/09/1991	- ISAMS (Improved Stratospheric and Mesospheric Sounder) - MLS (Microwave Limb Sounder) - HALOE (Halogen Occultation Experiment) - HRDI (High Resolution Doppler Imager) - WIND II (Wind Imaging Interferometer) - ACRIM (Active Cavity Radiometer Irradiance Monitor) - SOLSTICE (Solar-stellar Irradiance - Comparison Experiment) - SUSIM (Solar Ultraviolet Spectral Irradiance Monitor) - PEM (Particle Environment Monitor) - CLAES (Cryogenic Limb Array Etalon Spectrometer)	study of stratosphere, provision of mesosphere and thermosphere data
SRTM (Shuttle Radar Topography Mission)	NASA	233 km non sunsynchron ous	11/02/2000 (11 day duration)	X-SAR SIR-C GPS BlackJack Receiver	Topographic mapping of the Earth. Data currently used by various Government Agencies

B.4 Anomalies from solar and other events

NOAA-WP-04 informed CGMS that the space weather storms of late October to early November 2003 constituted the highest levels of activity seen to date for solar cycle 23. This high activity interval began with the appearance of three large, complex sunspot regions. Of these three, Region 486 grew to be the largest sunspot region of the current solar cycle and became the dominant producer of spectacular solar events, which also produced significant geophysical consequences.

NOAA discussed a number of specific deep space missions and near-earth satellites, which were affected. Perhaps of greatest significance are the loss of the MARIE instrument on the Mars Odyssey mission and the loss of the ADEOS-2 satellite, which had cost about $640 million for its development. The impact of this interval on airline operations is also particularly noteworthy. Airline routes and schedules were significantly affected because of communication degradation in the day light and Polar Regions.

HF/VHF communication systems, LF/VLF communications, Global Positioning System (GPS) applications, and electrical power systems were also affected.

WMO commented that space weather will be also included as a topic in the Global Earth Observing System of Systems (GEOSS) and that CGMS satellite operators should anticipate an increasing demand for space weather observations in future.

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, Metop-1, has been set for November to December 2005. With an expected 45-month lifetime of NOAA-M, launched in June 2002, and a launch of the first Metop satellite in 2005, there should be no (or little) gap in the morning orbit service.

All major contracts for the Space Segment, the Launcher and the Ground Segment are signed and respective developments are well underway. The Launch and Early Orbit Phase (LEOP) service contract was kicked off in December 2002.

The second part of the EPS System Critical Design Review (CDR-2) was concluded in March 2004. It was declared successful with no major remaining design or interface issues but with however a challenging schedule. Good progress was achieved in the planning and definition of the Integration, Verification and Validation (IV&V) activities. All Calibration and Validation plans could be released except the GRAS Validation Plan that is planned to be released in the summer of 2004. The first Satellite System Validation Tests (SSVT) was held successfully in December 2003. It involved the Metop Satellite Service module and the Monitoring and Control System and allowed the verification of the data flows between them. The first Metop satellite to be launched will be Metop-2. Metop-1 will go into storage. EUMETSAT reminded CGMS that the first Metop satellite was an ESA development programme.

ESA took this opportunity to inform CGMS of the joint ESA/EUMETSAT Research Announcement of Opportunity on Data for Metop, Envisat and ERS, which is under preparation and will become available at the end of May 2004.

In CMA-WP-04-01, China informed CGMS on the development of the FY-3 series of satellites. FY-3 is a new series of polar orbiting meteorological satellites of China. There are seven satellites starting with FY-3A and end with FY-3G to cover the period of 2006-2020. This paper describes the mission and the instruments of FY-3. Compared with 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). According to the plan, FY-3A is to be launched in 2006. CMA-WP-04-02 gives information on the transmission characteristics of the FY-3A satellite. It will broadcast AHRPT, Medium Resolution Picture Transmission (MPT) and Delayed Picture Transmission (DPT).

Rosaviakosmos informed CGMS in ROSS-WP-01 on the future polar-orbiting meteorological satellite series, Meteor-3M. In 2002 the original Meteor-3M satellite design was revised considerably. It is planned to develop two Meteor-3M satellites on the basis of a “Resurs”-type of unified heavy platform. The satellites will operate in a sun-synchronised orbit and provide operational hydro-meteorological and helio-

geophysical information on the atmosphere, Earth surface and the oceans. The working paper includes information on the Low Resolution Multi-Spectral Scanner (MSU-MR), the Onboard Radar Complex (OBRC), Multi-channel Spectral Imaging System (KMSS) with medium resolution, atmosphere temperature and humidity sounding module (MTVZA), Fourier-spectrometer, Helio and geophysical observation facilities.

The next satellite in this series, Meteor-3M N2, is planned for launch in 2005. It will provide LRPT and AHRPT direct broadcast data. Meteor-3M N3 is planned to be launched in 2008.

NOAA-WP-05 discussed NOAA's future polar-orbiting meteorological satellite systems. NOAA mentioned once again that NOAA-N will be called up for launch as soon as possible. With regard to NOAA-N', which had suffered major damage in a mishap on 6 September 2003 when it fell during test, plans on how to overcome the effects of this mishap are being finalised.

Information was provided on the 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. In June 2003 EUMETSAT and NOAA signed the Joint Transition Activities (JTA) Agreement, which extends the cooperation to the Metop-3 satellite and the NPOESS timeframe.

NOAA-WP-05 also presents the development and implementation plans for NPOESS. Beginning later this decade, the 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 enabling 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, 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 mentioned that the NPOESS Preparatory Project (NPP) is planned to be launched in late 2006. The earliest possible launch date for NPOESS is 2009 for the mid-morning orbit satellite and in June 2011 for the afternoon orbit satellite. It is planned to continue with NPOESS-C3 in 2013, NPOESS-C4 in 2015, NPOESS-C5 in 2018 and NPOESS-C6 in 2019.

Table 4: Future Polar-Orbiting Satellites Coordinated Within CGMS
(as of 20 May 2004)

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)	METOP-2	EUMETSAT	10-12/2005	(827 km) (9:30) AHRPT
	METOP-1	EUMETSAT	2010	(827 km) (9:30) AHRPT
	METOP-3	EUMETSAT	2015	(827 km) (9:30) AHRPT
	FY-3A	China/CMA	2006	(870 km) (9:30) AHRPT/MPT
	FY-3B	China/CMA	2009	(870 km) (TBD) AHRPT/MPT
	METEOR 3M-N2	Russia	2005	(10:20) AHRPT
	METEOR 3M-N3	Russia	2008	(10:20) or (16:30) AHRPT
	DMSP S-16	USA/NOAA	09/2003	(SSMI/S)
	DMSP S-18	USA/NOAA	10/2006	(SSMI/S)
	NPP – NPOESS Preparatory Project	USA/NOAA/ NASA	10/2006	(833 km) (10:30 D) (VIIRS, CrIS, ATMS, OMPS) HRD
	NPOESS-1	USA/NOAA	11/2009	(833 km) (9:30 D) LRD (AHRPT), HRD
	NPOESS-4	USA/NOAA	11/2015	(833 km) (9:30 D) LRD (AHRPT), HRD
Sun-synchr. "Afternoon" (12:00 – 16:00) (00:00 – 04:00)	NOAA-N	USA/NOAA	12/2004	(14:00)
	NOAA-N'	USA/NOAA	2008 (TBC)	(14:00)
	NPOESS-2	USA/NOAA	06/2011	(833 km) (13:30 A) LRD (AHRPT), HRD
	NPOESS-5	USA/NOAA	01/2018	(833 km) (13:30 A) LRD (AHRPT) HRD
Sun-synchr. "Early morning" (4:00 - 6:00) (16:00 – 18:00)	DMSP-S17	USA/NOAA	10/2004	(SSMI/S)
	DMSP-S19	USA/NOAA	10/2008	(SSMI/S)
	DMSP-S20	USA/NOAA	10/2010	(SSMI/S)
	NPOESS-3	USA/NOAA	03/2013	(833 km) (5:30 D) LRD (AHRPT) HRD
	NPOESS-6	USA/NOAA	~2019	(833 km) (5:30 D) LRD (AHRPT) HRD

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. The preparations for MSG-2, scheduled for launch on 15 February 2005, are well underway. A modified design was established for the Solid State Power Amplifiers (SSPA) as a result of investigations after the in orbit failure on one amplifier on Meteosat-8, and the new design has been extensively tested. The MSG-2 System Validation Test is due in June/July 2004. Work on the MSG LEOP Service for MSG-2 with ESOC has started. With regard to MSG-3, scheduled for launch in

2009, the satellite integration and system test phase has been completed and the Pre-Storage Review has started. MSG-3 will be likely to be placed in an intermediate storage configuration until the end of the MSG-2 launch campaign. In March 2003 the MSG Programme Extension to include an additional satellite (MSG-4) and extend operations until 2018 was put to the vote at the 52nd EUMETSAT Council. It is expected that the full Programme Extension will be reached this year.

Once MSG-2 is fully operational, it will be possible to move Meteosat-7 over the Indian Ocean, this would allow EUMETSAT to provide coverage of the Indian Ocean beyond 2005, until at least 2008. This plan is to be proposed to the EUMETSAT Council in June 2004. Once approved EUMETSAT will inform CGMS.

EUM-WP-09 informed CGMS of the joint preparatory activities between EUMETSAT and ESA for the definition of the Meteosat Third Generation (MTG) geostationary mission, which is expected to be available in the 2015 timeframe. The pre-phase A studies to be conducted by ESA and EUMETSAT in 2004-2005 are driven by high level user needs and priorities established in 2000-2003 throughout the post-MSG user consultation process. At system level these pre-phase A studies are still of exploratory nature, aiming at providing relevant information for Delegate Bodies to decide on the relevant and affordable mission concepts to be further studied during feasibility (phase A) studies in the 2005-2007 timeframe. They will be contracted out by ESA and conducted under the supervision of EUMETSAT and ESA. Up to three competitive studies will be kicked off in the summer 2004 and will continue into 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. Currently, it is being explored to include a very high spacial resolution imager and a hyper spectral sounder. The development of the space segment and ground segment is envisaged for the time frame 2014.

An open workshop is planned in 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 results of pre-phases A studies. This will narrow the uncertainties on the scope of the mission concepts to be further considered and traded off during feasibility (phase A) studies.

India informed CGMS of its future plans for 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 1km resolution imagery in visible band and 4 km resolution in the IR bands. The sampling rate of the imaging mission of INSAT-3D is every half an hour. INSAT-3D is scheduled for launch in the middle of 2006 and will provide much improved capabilities to the users of meteorological data from satellites.

JMA provided a report on its future plans for the Multifunctional Transport Satellites in JMA-WP-03. MTSAT-1R, the successor to GMS-5, is presently stored in Tanegashima Space Centre (TNSC). It had been planned to launch MTSAT-1R and MTSAT-2 in the first quarters of 2004 and 2005, respectively. However, due to the failure of a Japanese H-2A rocket in 2003, this has been postponed and it is expected

that by the second half of 2004 new launch dates will be announced. MTSAT-2 is planned to remain in stand-by mode for four years and enter operational service in the 2010 timeframe. Information on the image data dissemination plan of both satellites was provided in the working paper. The working paper includes the plan for the launch, service and image data dissemination plan on MTSAT-1R/2.

CMA reported in CMA-WP-05 on its plan for developing the Chinese FY-2C Geostationary Meteorological Satellites. The FY-2 satellite series will be continued with FY-2C, to be launched in October 2004, replacing FY-2B (at 105°E). Its mission will be very similar to that of FY-2B. The number of channels of the Visible and Infrared Spin Scan Radiometer (VISSR) will be increased from three to five. Further changes include an enhancement of the satellite power supply, the cancellation of the S-Fax broadcast, replacement of the WEFAX service with Low Rate Information Transmission (LRIT) and a change in the specification of the VISSR instrument. Currently, the ground segment refurbishment was ongoing with enhanced product processing.

Rosaviakosmos informed CGMS, in ROSS-WP-02, on its continued development of the new geostationary meteorological satellite GOMS N2/Electro-L. The satellite is planned to be launched in 2006 and will be placed into geostationary orbit at 76°E. The spacecraft will be a three-axis stabilised platform, equipped with MSU-G, a multi-zonal scanner with the parameters close to those of the SEVIRI-scanner, as well as with a standard DCS. GOMS N2/Electro-L will also relay the data between the weather centres, poll the autonomous meteorological stations, pick up and retransmit signals from the Search and Rescue beacons of the COSPAS/SARSAT system. In addition to that, the satellite will carry seven helio-geophysical sensors.

NOAA-WP-07 reported on the future GOES system. The first two spacecraft of the follow-on GOES-N series, GOES-N and -O, are being prepared for thermal-vacuum testing. The GOES-N spacecraft is scheduled to be available for launch by December 2004 and GOES-O by December 2005.

Instrumentation will continue with the present five channel imagers and eighteen channel filter wheel Sounders. Horizontal resolution of the imagers will be 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.

The GOES-R series satellites will each carry a new Advanced Baseline Imager (ABI). The ABI will have approximately 16 channels. Channel selection will be based, in part, on EUMETSAT's SEVIRI instrument. The GOES-R series will also fly a Hyperspectral Environmental Suite (HES), which is being planned to serve five purposes: full disk soundings, soundings for severe weather and mesoscale systems, open ocean soundings, coastal zone imaging, and land imaging. HES will be a hyperspectral instrument leveraging technology from NASA's Geosynchronous Imaging Fourier Transform Interferometer (GIFTS).

Table 5: Future Geostationary Satellites Coordinated Within CGMS
(as of 20 May 2004)

Sector	Future additional satellites	Operator	Planned launch	(Planned location) Other remarks
EAST PACIFIC (180°W-108°W) AND WEST ATLANTIC (108°W-36°W)	GOES-N	USA/NOAA	2/2005	135°W or 75°W
	GOES-O	USA/NOAA	12/2005	135 W or 75°W
	GOES-P	USA/NOAA	2008	135°W or 75°W
	GOES-R	USA/NOAA	2012	135°W or 75°W
	MSG-2	EUMETSAT	02/2005	0°
	MSG-3	EUMETSAT	01/2009	0°
	MSG-4	EUMETSAT	2010/2011	0°
INDIAN OCEAN (36°E-108°E)	GOMS-N2	Russia	2006	76°E
	INSAT-3D	India	2006	Location TBD. Dedicated meteorological mission. Improved 6 channel imager and a 19 channel sounder.
	FY-2C	China/CMA	10/2004	Improved FY-2 series, 5 channel VISSR, LRIT
	FY-2D	China/CMA	2006	Improved FY-2 series, 5 channel VISSR, LRIT
	FY-2E	China/CMA	2009	Improved FY-2 series, 5 channel VISSR, LRIT
WEST PACIFIC (108°E- 180°E)	MTSAT-1R	Japan	02/2004	Multifunctional Transport Satellite 140°E
	MTSAT-2	Japan	2005 (FY)	Multifunctional Transport Satellite 140°E. It will be acting as back-up to MTSAT-1R until 2009. MTSAT-1R will be used as back-up.

NOAA noted that the GIFTS program was on hold, pending a NASA reassessment. NOAA hopes that at a minimum, NASA will construct a GIFTS Engineering Development Unit and characterise it through vacuum testing.

GOES-R procurement activities are underway. Three contractors were awarded ABI Formulation Phase (formerly known as Phase B) contracts for system trades and preliminary designs. A single contractor will be selected for the implementation contract by early 2005. Procurement activities for the HES are now being initiated with the formulation phase award scheduled for mid-CY 2004. For the spacecraft, three contractors were awarded accommodation study contract to provide an understanding of weight and power issues. For the Spacecraft and Ground segments, 12 contractors were awarded for advanced architecture studies. NOAA will use the study results to refine requirements for the GOES-R space, launch, command and control, product generation and distribution, archive and access, and user interfaces to reduce design, cost, and schedule risk. The study results will ensure that viable architectural options are examined for the end-to-end system. The spacecraft formulation phase will be initiated in 2005; GOES-R is planned to be ready for launch in 2012.

C.3 Future Research and Development Satellite Systems

ESA-WP-02 informed CGMS of the status of the future European Space Agency Earth Observation missions. Two of them, MSG and Metop are in cooperation with EUMETSAT. The Living Planet Program has three lines of implementation: Earth Explorer satellites, Earth Watch satellites, plus services & applications demonstration. The Earth Explorer satellites include GOCE (Gravity field and steady-state Ocean Circulation Explorer), ADM-Aeolus (Atmospheric Dynamics Mission), Cryosat (Polar Ice Monitoring) and SMOS (Soil Moisture and Ocean Salinity). Since January 2002 the Earth Watch line includes the Global Monitoring for Environment and Security (GMES) services element. The Explorer missions are being developed according to plan. Cryosat is to be launched in November 2004 (TBC). Another six missions have recently been scientifically reviewed in a consultation held in Frascati last April. ESA bodies are about to make the selection of the next missions to be implemented. Regarding the various lines of the Earth Watch element it is worth noting the release of an ITT for the pre-phase A study of post-MSG as well as for a VIRI-M instrument. The GMES second phase has started, with the aim to have the service operational by 2008.

JAXA-WP-02 reported on the Advanced Land Observing Satellite (ALOS), scheduled to be launched in the Japanese fiscal year 2004, the Greenhouse Gases Observing Satellite (GOSAT), provisionally scheduled to be launched in the Japanese fiscal year 2007 and the Global Precipitation Measurement (GPM) to be launched in the Japanese fiscal year 2007. 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. Further 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 observation.

WMO encouraged JAXA to consider the inclusion of GOSAT and ALOS as part of the space-based GOS.

Rosaviakosmos informed CGMS in ROSS-WP-03 that it planned to launch four new R&D satellites in the near future. The first one is the Russian-Ukrainian spacecraft Sich-1M designed for oceanography, meteorology and monitoring of various Earth atmosphere, surface and ionospherical parameters. The satellite is planned to be launched in September 2004. At present Russian and Ukrainian space agencies are fulfilling the final complex testing and checking of the spacecraft and its vehicle.

It was mentioned that scientists in Russia, Ukraine and other countries had the possibility to have their experimental projects added to the scientific programme on the satellite Sich-1M. Further information on this can be obtained from the following email address: tishchen@ire.rssi.ru and also from the Sich-1M website: http://ire.rssi.ru/cpssi.

The second satellite, Monitor-E, is being developed for ecology, extreme situation monitoring, natural resources investigation, cartography and other economical purposes. It is planned to be launched in the first quarter of 2005. The development of "Monitor-E" and its main subsystems is almost completed, and the program of complex testing has already started.

The third spacecraft, Kompas-2, which the Russian Federal Space Agency plans to launch at the end of 2004, is a microsatellite for measuring and investigation of high and low frequency electromagnetic radiation, electron concentration in the ionosphere and nuclear particles in the near-Earth space.

Resurs-DK, to be launched in the second quarter of 2005, will receive panchromatic and multispectral images of the Earth at a high spatial resolution in a wide swath. Russian and other users worldwide will have access to the data from all of the above-mentioned satellites.

NASA reported in NASA-WP-02 on its future Earth Observation missions. It reported on the OCO (Orbiting Carbon Observatory) to be launched in August 2007. The Orbiting Carbon Observatory (OCO) provides space-based observations of atmospheric carbon dioxide (CO2). Further information was provided on HYDROS (The Hydrosphere State Mission), which will provide first global views of the Earth's changing soil moisture and land surface freeze/thaw conditions and is planned to be launched in December 2006. Also mentioned was the GPM (Global Precipitation Measurement), Aquarius (Global maps of salt concentration of the ocean surface), the NPOESS Preparatory Project, Landsat Data Continuity Mission, Ocean Surface Topography Mission (OSTM) and the Deep Space Climate Observatory.

Table 6: Future R&D satellites discussed within CGMS

(as of 3 June 2004)

Satellites	Operator	Crossing Time	Planned launch date	Application and other information
Monitor-E	Russia	(550 km) (10:30)	2005	Land Observing Satellite
GOCE	ESA	250 km (dawn-dusk)	02/2006	Gravity mission
SMOS (R)	ESA	755 km (6:00 A)	02/2007	Salinity & Soil moisture
ADM	ESA	405 km (18:00 A)	10/2007	Wind profile
Sich-1M	Russia/Ukraine	(650 km)	2004	Oceanographic Satellite
Resurs-DK	Russia	(350 km)	2005	Land Observing Satellite
CRYOSAT	ESA	717 km	11/2004 (TBC)	Polar ice monitoring
Aura	NASA	705 km sun-synchronous	19/06/2004	Comprehensive measurements of atmospheric chemistry and trace gasses
CloudSAT	NASA/ CSA	705 km sun-synchronous	04/2005	global cloud properties (applications: air quality, aviation safety, disaster management, energy and water management)
CALIPSO	NASA/ CNES	705 km sun-synchronous	04/2005	Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations for climate predictions
OCO	NASA	705 km sun-synchronous polar	08/2007	Orbiting Carbon Observatory (observations of atmospheric carbon dioxide)
HYDROS	NASA	6 AM/ 6 PM sun-synchronous	12/2006	Hydrosphere State Mission Earth's changing soil moisture and land surface freeze/thaw conditions
ALOS	JAXA	692 km sun-synchronous (10:30 am ±15 min.)	2004 (JFY)	Advanced Land Observing Satellite (mapping, precise land coverage observation, disaster monitoring, resource surveying)
GOSAT	JAXA & Japanese Ministry of Environment	618 km non-sun-synchronous (incl. 65 deg.)	02/2008	Greenhouse Gases Observing Satellite monitoring the distribution of the density of carbon dioxide
GPM	NASA/JAXA	400-500 km sun-synchronous (incl. 65 deg.) (core satellite)	2008	Global Precipitation Measurement, follow-on and expanded mission of the current on-going TRMM
Aquarius	NASA	600 km sun-synchronous	09/2008	global sea surface salinity (SSS)
NPOESS Preparatory Project (NPP)	IPO	824 km sun-synchronous	10/2006	bridge between NASA's Aqua mission and NPOESS. Studies longterm climate trends such as ozone, ecosystem and atmospheric temperature

continued Satellites	Operator	Crossing Time	Planned launch date	Application and other information
LDCM (Landsat Data Continuity Mission)	NASA/US Geological Survey	705±5 km (at equator) sun-synchronous	TBD	Extension of Landsat record of multispectral 30m resolution
OSTM (Ocean Surface Topography Mission)	NASA/ NOAA/ EUMETSAT/ CNES	1336 km non-sun-synchronous	10/2007	follow-on of Jason-1 mission sea surface topography measurement
Glory	NASA	824 km sun-synchronous	12/2007	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)	1 million mile journey to reach L1	TBD	Measure how solar radiation affects climate by using Sun-Earth libration point L1 from which it will observe Earth

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

This agenda item was discussed in WG III on Global Contingency Planning.

Drawing upon the conclusions resulting from the presentations in WG III, WMO remarked that CGMS Members were moving towards the development of a robust GOS. WMO pointed out that with the provision of so much new data there was now a challenge for members to improve their utilisation of satellite data.

D. OPERATIONAL CONTINUITY AND RELIABILITY

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

This topic was already discussed in WG III on Global Contingency Planning and can be found under the relevant section in this report.

D.2 Inter-regional contingency measures

This topic was also discussed in WG III on Global Contingency Planning and can be found under the relevant section in this report.

D.3 Long-term global contingency planning

This topic, too, was discussed in WG III on Contingency Planning. The result of this discussion is presented in the relevant section of this report.

E. SATELLITE REQUIREMENTS OF WMO PROGRAMMES

E.1 World Weather Watch

WMO-WP-07 presented a summary of the outcomes from the third World Meteorological Organization Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction, which took place in Alpbach, Austria, 9 – 12 March 2004. Results from Observing System Experiments (OSEs) both with global and regional aspects were presented. Messrs. H. Boettger, J. Pailleux, and P. Menzel were the conference organisers; 31 papers covering global NWP, regional NWP, and observing network design studies were presented. Some of the satellite-related highlights were as follows: (1) ECMWF showed that one AIRS added to a Global Observing System without satellites provides more impact than one AMSU; (2) Five numerical weather prediction centres are using MODIS winds in operations or case studies with a majority reporting significant positive impact; (3) Surface pressure observations from ships or buoys are still needed to anchor satellite surface wind observations; (4) GPS is beginning to show skill in defining the tropopause thus complementing satellite infrared and microwave measurements; and (5) Including data that arrive after cut-off times in NWP models increases the forecast accuracy substantially. Proceedings of the workshop will be published by WMO on a CD-ROM.

CGMS noted the importance of satellite systems that could meet the timeliness requirements (especially for NWP) and nowcasting. R&D satellite operators should also strive to meet these same requirements.

ESA added that it was aware of the timeliness requirements and would make all efforts to achieve them as far as possible.

In WMO-WP-12, CGMS was informed of results from the sixteenth session of the WMO RA I Tropical Cyclone Committee for the South-West Indian Ocean. The Tropical Cyclone Committee had thanked EUMETSAT for agreeing to maintain its coverage over the Indian Ocean at least until 2005. It however reiterated its concern about the absence of any permanent geostationary satellite coverage over the Indian Ocean and requested WMO to make representations to CGMS in order to find a solution ensuring geostationary coverage of the Indian Ocean beyond 2005. CGMS was also informed that the Panel on Tropical Cyclones for the Bay of Bengal and the Arabian Sea at its thirty-first session had expressed its appreciation to EUMETSAT for agreeing to keep Meteosat-5 in its present position until 2005 and again requested WMO to make efforts towards continued coverage beyond 2005.

WMO was pleased to see the efforts of several CGMS satellite operators to ensure coverage over the Indian Ocean Region beyond 2005.

E.2 Other WMO Programmes

In WMO-WP-06, CGMS reviewed the current status of the WMO Space Programme including its Implementation Plan and establishment of a new CBS OPAG IOS Expert Team on Satellite Systems. It noted that the WMO Space Programme commenced activities on 1 January 2004.

CGMS was of the opinion that the WMO Space Programme Implementation Plan for 2004 - 2007 adequately described the scope and breadth of the new programme. Some sections such as the description of the integrated global data dissemination service were well structured and appropriately detailed. An opportunity now existed to improve data dissemination while integrating existing mechanisms. CGMS agreed that its Working Group on Integrated Strategy for Data Dissemination from Meteorological Satellites should remain involved in WMO's progress towards an integrated global data dissemination service.

CGMS noted the plans by WMO to restructure the present Open Programme Area Group on Integrated Observing Systems (OPAG IOS) Expert Team on Satellite Systems Utilization and Products into two groups, the Expert Team on Satellite Utilization and Products (ET-SUP) and a new OPAG IOS Expert Team on Satellite Systems (ET-SAT) that would provide the necessary satellite expertise (both for operational and R&D satellites) to ensure an integrated WMO Global Observing System that would encompass all present observing systems.

CGMS satellite operators noted the need to support the activities of the WMO Space Program in terms of resources and agreed to consider further possible means. NOAA stated that it fully supported the WMO Space Program initiatives and agreed to consider further possible means.

WMO-WP-16 reported an update on the status of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), including its interactions with satellite operators and CBS concerning oceanographic satellites. The third session of the JCOMM management Committee took place in Geneva in March 2004. As part of its review of satellite data requirements and related remote sensing activities, the Committee was presented with a report by the JCOMM Satellite rapporteur. The Committee discussed how JCOMM should continue to consider the requirements for future satellite missions, and other matters associated with remote sensing, and decided to form a Task Team. Its Terms of Reference are: (i) take responsibility for oversight of the space-based remote sensing activities that are essential for JCOMM services and products, (ii) maintain JCOMM satellite remote sensing data requirements based on regular contact with CGMS, the WMO Space Programme, the IOC Remote Sensing Plan, CEOS, the relevant IGOS Themes, the WMO high level policy meetings, the COOP and OOPC, and other appropriate groups, (iii) advise on the distribution and dissemination of satellite data and relevant data products, in consultation with other JCOMM Programme Areas, (iv) report to the JCOMM Management Committee. The Secretariat for the group should be provided by the WMO Space Programme Office.

WMO-WP-28 informed CGMS Members on the status and activities of the THORPEX and sought CGMS involvement in THORPEX. It recommended that

CGMS Members should request representation with observer status, on the THORPEX ICSC and designate a Rapporteur for that purpose. CGMS Members were asked to contribute to development of the THORPEX Implementation plan in coordination with the WMO Space Programme. The paper provided background information on THORPEX, established in May 2003 by the Fourteenth World Meteorological Congress as a ten-year international global atmospheric research and development programme under the auspices of the WMO. The paper pointed out 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 one day to two weeks, and likely into seasonal to inter-annual scales. Results from THORPEX will help guide the utilisation of satellite data and future satellite roles as part of the Global Observing System. Information gleaned from THORPEX will help guide the future development of satellite systems.

To ensure maximum realisation of satellites potential as a part of the THORPEX programme, it was agreed that CGMS would request observer status on the THORPEX ICSC and contribute to the THORPEX planning in coordination with the WMO Space Programme.

Action 32.01 The CGMS Secretariat to request observer status in the THORPEX ICSC. Deadline: 30 June 2004

CGMS recommended that CGMS Members should review the draft THORPEX implementation plan (distributed at the meeting, upon request).

Action 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. Deadline: 31 July 2004

E.3 IOC Programmes

In IOC-WP-01, IOC informed CGMS of the satellite requirements of the IOC GOOS programmes. The GOOS coastal applications require satellite products with high spatial resolution and quick delivery of sea state information. Establishing and improving the GOOS coastal module are critically dependent on the coordinated development of GOOS Regional Alliances (GRAs) that contribute to and benefit from the Global Observing System, e.g. satellite-based remote sensing.

CGMS was informed that a plan for the use of remote sensing in oceanography by developing countries has been submitted to the thirty-seventh session of the IOC Executive Council (June 2004). This plan was developed in response to IOC Assembly Resolution XXII-13 (June 2003) "A Strategy for the Use of Remote Sensing in Oceanography", the Secretariat has prepared a plan to improve the use of remote sensing in oceanography by developing countries in pursuit of sustainable development. The plan involves six main elements: 1) Sponsoring attendance of developing country representatives at space-based conferences; 2) Sponsoring courses in remote sensing techniques, for developing countries; 3) Supporting the regional

development of remote sensing for IOC programme applications; 4) International coordination of capacity building activities with space agencies; 5) Development of training materials; and 6) Raising financial support for capacity building initiatives in remote sensing. The 37th IOC Executive Council will be asked to endorse the plan, and the financial implications. The plan is available from the website of the IOC Executive Council.

IOC was pleased to note that its request that CGMS satellite operators consider the IOC satellite requirements, especially the data dissemination methods, bearing in mind the ongoing formation of GOOS Regional Alliances (GRA), had now become a permanent action.

NOAA-WP-12 responded to Action 31.11, which reads: CGMS satellite operators to consider the IOC satellite requirements, especially the data dissemination methods, incorporating also the ongoing formations of GRAs.

NOAA reviewed the satellite parameters for the GOOS coastal modules that require high spatial resolution. Considering that these data are critical to improve the safety and efficiency of marine operations and more effectively control and mitigate the effects of natural hazards, the quick delivery of the sea state information is essentially important. Recalling the World Summit on Sustainable Development Implementation, IOC member states need to make best use of satellite data and remote sensing has to be made a new focus for IOC's capacity building efforts. NOAA plans to support the IOC requirements for satellite data and satellite-derived products. The working paper also summarised mapping of U.S. satellites against the data requirements from IOC.

Most of users of the satellite-derived information are in the coastal seas. To enable IOC members to routinely and systematically collect satellite data for their coastal regions, NOAA is developing a Multi-Constellation User Terminal (MCUT) capable of receiving environmental satellite data from multiple polar-orbiting and geostationary satellites. The MCUT will allow IOC members to acquire coastal seas information from environmental satellites in real time. NOAA is in the process of investigating an Alternative Dissemination Methods (ADM) system for distribution of environmental data by means of Internet, commercial space communications and/or dedicated landlines. The ADM communications are separate from the technology utilised in Direct Readout (DR) services, which is a broadcast from government owned satellites.

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. Seven SAFs are currently under development in the EUMETSAT member states and 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 and Land Surface Analysis. SAFs will use data from Meteosat, MSG and EPS, or other meteorological satellites, where appropriate. Until relevant data become available, information from current satellites will be used for development. The Pilot SAFs on "Nowcasting and Very Short Range Forecasting" and "Ocean and Sea Ice" have entered their Initial Operations Phase (IOP) in March and July 2002, respectively. For the SAF on "Nowcasting and Very Short Range Forecasting" System Testing activities were successfully completed in 2003 and validation of MSG related software packages is now under finalisation. With regard to the SAF on "Ocean and Sea Ice" a pre-operational chain has been set up and tested at system level at Météo-France in Lannion, validation activities started in summer 2003. It is planned to achieve operational readiness for MSG-based products in first half of 2004 for NOAA and MSG-based products.

The SAF on Climate Monitoring completed its development phase in December 2003 and its IOP was kicked-off in January 2004. First validated products will be available in the course of 2004. The SAF on Numerical Weather Prediction completed its development phase in February 2004 and started its IOP in March 2004.

During the IOP the development for the EPS related products will be finalised while MSG products will be put into operations after their validation using the real data provided by the MSG instruments.

EUMETSAT reported that it was actively and positively studying the possibility of a new SAF on Hydrology with its Member States.

F.2 Search and Rescue (S&R)

There were no presentations under this agenda item.

F.3 Meteorological Data Distribution via satellite

IND-WP-01 included a report on the Indian Meteorological Data Distribution (MDD) system. Its processing system is also being used for generating analogue cloud imagery from the METSAT(Kalpana-I) satellite and INSAT - 3A data, transmitted through to field stations using the S-band broadcast capability of the satellite along with other conventional meteorological data and FAX charts. There are about 90 MDD receiving stations in India being operated by different agencies. Three MDD receiving stations are also operating in neighbouring countries at Sri Lanka, Bangaladesh and Male under bilateral agreements. In general, the processed images are sent to these stations every three hours, and every hour during cyclone periods. These stations are receiving direct broadcasts of cloud imagery, weather facsimile charts and meteorological data on an operational basis.

It is planned to replace the existing analogue MDD service with a state of the art Digital MDD system to transmit digital imagery, satellite data and weather data for forecasting offices in HRIT/LRIT formats.

F.4 Training

ESA informed CGMS in ESA-WP-05 of its participation as an observer in the second VL Focus Group Meeting in Barbados from 2 - 12 December 2004. The working paper concluded with a list of potential training activities related to ETR for coordination with EUMETSAT. ESA and EUMETSAT had started discussions on the joint development of training material addressing the Metop instruments, with a view to making them available to the Virtual Laboratory (VL) and future training activities.

EUM-WP-08 reported on training activities carried out by EUMETSAT over the last year. Since CGMS XXXI training courses were conducted or supported in Krakow, Poland; Fortaleza, Brazil; Muscat, Oman and Zagreb, Croatia. It was also reported that at its November 2003 Council Meeting a new five-year training plan had been approved for the timeframe 2004 to 2008. The training plan allowed EUMETSAT to continue supporting the training centres in Nairobi and Niamey and included further development of VL activities. It also included a training project (EUMetrain) under the leadership of the Austrian Meteorological Institute (ZAMG). A PUMA coordination meeting was held at EUMETSAT in January 2004 to coordinate PUMA and EUMETSAT training activities. It is expected that in 2004 and 2005 EUMETSAT will support eight MSG applications training events, each of one week duration, for African meteorologists, the main subject being MSG image interpretation and data applications. Information was also provided on a MSG Interpretation Guide on MSG applications, created in a joint project under the leadership of Dr. V. Zwatz-Meise (ZAMG) in January 2004. This online guide was available on the EUMETSAT website. A new cooperation with NOAA will be formalised in 2004 aiming at the joint production of satellite meteorology training resources addressing polar satellite Systems.

EUMETSAT reported in EUM-WP-10 on the various activities it had carried out relating to the implementation plan for the VL. The working paper also lists EUMETSAT's recommendations from the VL-2 for the timeframe 2003 to 2006.

JMA-WP-06 reported on the progress in the Computer Aided Learning (CAL) tool for the use of satellite data called Satellite Animation and Interactive Diagnosis (SATAID), which it has developed in cooperation with the Commonwealth Bureau of Meteorology, Australia (CboM). SATAID has become compatible with most of meteorological satellite data through RAMSDIS/McIDAS data format, which is the common platform in VL. A SATAID data server was established in CBoM near the end of 2003 (http://www.bom.gov.au:50005/MSC). VL users can download the satellite images of GOES-9 near real time by a general Internet web browser. They can also get and use the data on SATAID using the SATAID auxiliary software LRITAPL to access the data seamlessly via the Internet. JMA has procured the technique of the provision and utilisation of near real time data and is willing to provide the technique to other VRL operators if they request.

NOAA-WP-14 highlights NOAA's support to the CGMS Virtual Lab effort. NOAA's support was demonstrated during the Regional Training Course on the Use of Environmental Satellite Data in Meteorological Applications held in Barbados from December 2 - 12, 2003. The Regional Meteorological Training Centre (RMTC) in Barbados hosted and organised the workshop. NOAA and Cooperative Institute for

Research in the Atmosphere (CIRA) scientists played an active role in the workshop. Prior to the workshop, several NOAA/CIRA staff assisted with the planning and preparation activities. During the workshop, NOAA and CIRA staff provided support, lectures and workshops on the following topics: interpretation of GOES and POES imagery and products, products from meteorological sounders, hyper-spectral imagery, identifying mesoscale weather features in satellite imagery, tropical weather systems, volcanic ash detection and fire detection as well as the use of the VISITview software tool. Many of the labs utilised the "Satellite Imagery and Satellite Products" resources of the VL to locate imagery sources on the Internet. The students and the workshop organisers were very pleased with the opportunity to learn how VISITview works and how to build and run their own lessons. NOAA will continue to support the WMO Virtual Laboratory activities. This support includes development and support of the VISITview software, the WMO Virtual Laboratory web server and website at CIRA, and support for virtual and physical workshops as scheduled by WMO. NOAA support includes ongoing interaction with the RMTCs in Costa Rica and Barbados and support of the research and ingest RAMSDIS systems located there.

WMO-WP-17 informed CGMS Members of the assessment by the Virtual Laboratory for Training in Satellite Meteorology (VL) Focus Group on the VL and on the status of activities within the CGMS VL. The paper noted that the VL continued to meet the established milestones for its implementation plan and in several cases had surpassed expectations.

CGMS Members noted with enthusiasm the progress toward implementation that had occurred within the VL and made a number of positive comments concerning the progress made by the VL. CGMS Members endorsed and supported the specific recommendations of the second VL Focus Group Meeting (VL-FG 2)paying particular attention to recommendations within sections that addressed servers; tools; virtual resource library; connectivity; future training event guidelines; electronic workbook; major training event; and endorsed the plans for a Third Session of the VL Focus Group. CGMS confirmed and noted the importance of the roles of the VL partners as put forth in Appendix B of the VL-FG 2 report and enthusiastically supported the three year VL goal of staging a Global High-Profile VL Training Event that would link all centres of excellence.

Since CGMS XXXI, a major successful training event was undertaken in Barbados, hosted by the Caribbean Institute for Meteorology and Hydrology. In Barbados, the VL achieved another major milestone in continuing its pre-emince in meeting the WMO Space Programme's training objectives. SATAID, RAMSDIS ONLINE and VISITView were among the major VL tools that were effectively used during the course. The participants in the WMO Satellite training program in Barbados were so buoyed by the new capabilities presented with the training that they established a new Caribbean Focus Group to perpetuate and build a new and stronger dialogue amongst trainers and forecasters in the region, another first for the VL. Since the Barbados training event the Caribbean Focus Group has met every three to four weeks in a virtual laboratory environment using VISITView.

NOAA-WP-13 responded to the CGMS request for the Virtual Lab team to report on activities and status with regard to the Virtual Lab implementation plan. Specific

items summarised in the paper were: 1) the resource library -its role, how it is structured, how it is "peer reviewed," and other pertinent matters; 2) VISITview - its role, the Virtual Laboratory construct, etc.; 3) expectations for the RMTCs that are participating in the Virtual Laboratory especially in the area of a review of the questionnaire to help focus their training, and as an input to WMO; coordination of training activities that could lead to a schedule of "classes" for each year; 4) Virtual Laboratory participant roles and responsibilities; 5) archiving of training class presentations as a future training resource; and 6) development of a web-based training resource available to WMO and others - how it is managed, and what is the corresponding role of the "centre of excellence".

A survey of the regional training centres showed that all centres were using the VL but some a lot more than others due to slow communication lines. These slow lines were a major problem for Nanjing, Nairobi and Niamey with it taking considerable time to load even the simplest pages. Barbados and Costa Rica were experiencing some problems but not as acute as the African centres. All centres are using the VL, mainly for lecturer information rather than classroom; this was at least partially due to slow line speed.

The Co-Chairmen of the VL Team were of the opinion that the VL had achieved much in the first 30 months of its existence and were proud to have been Co-Chairmen during this period. In order to maintain the same rate of achievement in the next three years, there would be a need for sustained or even accelerated:

- commitment (commitment to put effort and resources into the VL);
- cooperation (by asking each other for help and sharing material); and
- collaboration (agreeing to work on joint projects or priorities)

between all parties within the VL, particularly the "centres of excellence". Many of the achievements in the initial 30 month period had been concerned with the technical challenges of placing servers online, sharing data and applications etc. For the next three-year period, the challenge will be to utilise the physical infrastructure to deliver training remotely and improve the effectiveness of face-to-face training events. Technical challenges in the next three-year period will include improvement of VRL content and increase Internet bandwidth to centres such as Nairobi, Barbados and Costa Rica.

The next meeting of the CGMS VL Focus Group will be in 2006.

CGMS expressed its appreciation for the VL activities carried out to date. NOAA urged participants to contribute to the VL. CGMS endorsed all the recommendations presented in the report.

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 Weimar, Germany, in September 2003. The

next Satellite Data User Conference will be held in Prague, Czech Republic, from 31 May to 4 June 2004. In addition, EUMETSAT provided a list of its publications.

In EUM-WP-11 EUMETSAT presented a new structure for the CGMS Consolidated Report, which also integrates relevant information from the R&D agencies. CGMS approved this new structure.

Action 32.03 CGMS Members to provide points of contact responsible for updating the CGMS Consolidated Report. Deadline: 30 June 2004

Action 32.04 CGMS Members to send inputs to the CGMS Consolidated Report to the CGMS Secretariat. Deadline: 31 August 2004

WMO described the latest status of the database for satellite receiving equipment in WMO-WP-01. Since the last meeting of CGMS (CGMS XXXI, November 2003), WMO has added information for 132 new satellite receiving stations and made corrections or updates to 126 existing receiving stations based on the registration form submitted by WMO Members. The database of receiving stations now contained 1360 stations that were operational as of April 2004. A diskette version of the database was distributed at CGMS XXXII to all Members.

In WMO-WP-04, CGMS Members were informed of the various list servers used by CGMS groups, i.e. the plenary, wind and frequency. CGMS Members were requested to regularly review their contact details on the list servers and update them as necessary.

WMO-WP-08 presented the status of satellite-related WMO publications since the last meeting. CGMS Members noted that the update to WMO Publication No. 411 had been completed and was available on the WMO Space Programme webpages at http://www.wmo.ch/hinsman/411_Contents.htm. CGMS Members also noted that the new technical document WMO/TD No. 1177 entitled "The Role of Satellites in WMO programmes in the 2010s" had been finalised and had an initial distribution during WMO EC-LXVI.

In WMO-WP-15, CGMS was informed of the results of the fourth session of the WMO Consultative Meetings on High-level Policy on Satellite Matters (CM-4) and in particular information related towards the space component of an integrated WMO Global Observing System. CGMS noted that the fourteenth WMO Congress (Cg-XIV) had specifically assigned as an overall objective of the WMO Space Programme "To review the space-based components of the various observing systems throughout WMO Programmes and WMO-supported Programmes, e.g., WWW's GOS, AREP's GAW, GCOS, HWR's WHyCOS, JCOMM's Implementation of GOOS, etc., with a view towards the development of an integrated WMO Global Observing System that would encompass all present observing systems". CGMS noted that WMO's Commission for Basic Systems had started development in consultation with all other relevant WMO and co-sponsored bodies, of the space-based component of the integrated WMO Global Observing System on the basis of space-based observation components for three earth-system domains (atmosphere, ocean and land) and two cross-cutting (climate and natural disasters) sets of requirements.

WMO-WP-24 proposed to establish an exciting, worldwide, hands-on education and science programme, through involved scientist-school partnerships globally. The Global Education and Science Network (GESN) will engage senior personnel that include highly committed scientists and educators with substantial experience in the effective leadership of large national and international programmes. CGMS is asked to consider supporting this initiative. There are two principal elements of the proposed effort: (a) a commitment to providing equal opportunities in science, mathematics and technology education for all of the world's children and (b) a focus on establishing a worldwide science and education infrastructure by supporting six globally dispersed Regional Coordinator offices. To further this activity, it was suggested that a focus group be established to study this proposal and report back to CGMS XXXIII. Since the GESN relies on the Virtual Lab, it would be beneficial for a member of the GESN focus group to attend the next Virtual Lab focus group meeting to solicit support from the Centres of Excellence.

CGMS Members were asked to explore the feasibility to provide a list of secondary schools that might be contacted for inclusion in the GESN by CGMS XXXIII.

ESA informed CGMS of its existing initiative in this field and offered to coordinate its activity with GESN. JMA indicated that it would be ready to provide its SATAID software.

F.6 Any other business

No working papers were discussed under this item.

PARALLEL WORKING GROUP SESSIONS

WORKING GROUP I: TELECOMMUNICATIONS

I/0 Introduction

Mr. Robert Wolf from EUMETSAT was elected Chairman of Working Group I (WG I) on Telecommunications, with Mr. Gordon Bridge from EUMETSAT appointed as Rapporteur. WG I comprised representatives of the satellite operators from China, Japan, Russia, USA, Korea and EUMETSAT together with a representative of 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)

Expansion of MetSat Allocation

EUMETSAT working paper EUM-WP-22 gives an overview on preparations for WRC 2007. As already reported at CGMS XXXI, the next generation geostationary meteorological satellites to be launched in the time-frame 2015 - 2020 are expected to have bandwidth requirements in excess of 200 MHz. This is primarily due to transmission of data from high resolution sensors. A primary allocation to the geostationary meteorological satellite (space-to-Earth) service exists already in the band 18.1 - 18.3 GHz in No. 5.519. Activities were started to obtain an expansion of the MetSat allocation in the band 18.0 – 18.4 GHz to a bandwidth of 300 MHz.

WRC-03 recognised that the bandwidth of the existing allocation for geostationary meteorological satellites in the band 18.1 - 18.3 GHz is insufficient to support the required data rates and that sharing between geostationary meteorological satellites and the fixed, fixed-satellite and mobile services is likely to be feasible in the band 18 - 18.4 GHz considering in particular that the number of earth stations deployed to support these meteorological satellites will be low (on the order of five per Region).

Consequently WRC-03 agreed to establish WRC-07 agenda item 1.2, dealing with the planned expansion of the band.

WRC-03 resolved to invite ITU-R to conduct sharing analyses between geostationary meteorological satellites operating in the space-to-Earth direction and the fixed, fixed-satellite and mobile services in the band 18 - 18.4 GHz to define appropriate sharing criteria with a view to extending the current 18.1 - 18.3 GHz geostationary meteorological satellites allocation in the space-to-Earth direction to 300 MHz of contiguous spectrum.

Compatibility studies for submission to ITU Working Party 7B as well as the appropriate CEPT preparatory groups were prepared by EUMETSAT. It is also planned to prepare contributions to SFCG with the objective to obtain support from other space agencies. Study results were forwarded to the spring meeting of ITU WP 7B.

ITU Working Party 7B was dealing with an input from EUMETSAT with proposed modifications to ITU-R Recommendations SA.1159, 1160, 1161 for inclusion of the performance, interference and sharing criteria for direct readout systems in the MetSat (GSO) service at 18 GHz. These criteria will form the basis for the sharing studies with the other allocated services in the band 18.0 – 18.4 GHz.

The proposed criteria were supported in WP7B resulting in Preliminary Draft Revised Recommendations (PDRRs) for ITU-R Recommendations SA. 1159, 1160, 1161 which will be subject for further discussion at the next meeting of WP7B in autumn 2004.

Furthermore, the background information with regard to system parameters and link budget examples provided by EUMETSAT for next generation geostationary MetSat systems as well as the corresponding performance, interference and sharing criteria were retained in the WP7B Chairman's Report for future reference.

It is expected that ITU WP7B will finalise the Draft Revised Recommendations SA. 1159, 1160,and 1161 during the meeting in September 2004. The new recommendations will then be used for the production of sharing studies between the expanded MetSat service and services already allocated in the band.

Working paper JMA-WP-05 also addresses preparation activities towards WRC-07. JMA pays attention to some items in WRC-07 Agenda approved in WRC-03 under agenda items 1.2, 1.4, and 1.7:

- WRC-07 Agenda Item 1.2: This agenda item is for the Earth Exploration Satellite Service (passive) in the band 10.6-10.68 GHz and 36-37 GHz and the MetSat (space-to-Earth) in the 18.1-18.3 GHz band. Especially, JMA pays attention to study and frequency allocation activities relevant to the 18.1-18.3 GHz band within ITU-R.

- WRC-07 Agenda Item 1.4:Studies for the allocation to the Earth Exploration Satellite Service (EESS) (passive) in the 420-470 MHz band. JMA is closely following this activity.

- WRC-07 Agenda Item 1.7: Studies for the result of ITU-R studies regarding sharing between the MSS and the MS in the band 1668.4-1675 MHz

JMA pays attention to the study activities in ITU-R, since the 1670-1675 MHz band is also the sharing band between MetSat (space-to-Earth) and MSS (Earth-to-space).

Concerning the planned expansion of the MetSat allocation around 18 GHz as described above, JMA has presently no plan to use the above frequency band for MTSAT-1R and MTSAT-2. The frequency plan for the next generation meteorological satellite will only be started from this year in Japan. However, JMA believes that the expansion of the frequency band in the 18.0 – 18.4 GHz band would be very useful for the world-wide exploitation of MetSat.

JMA started to appeal to the Authorities in Japan that Japan should support the proposal from EUMETSAT regarding expansion of bandwidth for MetSat in the 18

GHz band at WRC-07. As the Japanese Authorities are watching the status of studies in ITU-R and other countries' responses, they keep a neutral position on this matter at the present time.

JMA will provide CGMS members with the status of related activities of the Asia Pacific Telecommunity (APT) and relevant bodies in Japan whenever appropriate.

Other Frequency Management Issues

KARI provided an update on their activities concerning the COMS programme, which will include a meteorological payload. Information was provided on the development schedule, on the meteorological mission and on the notification process. It is planned to operate the COMS spacecraft at orbital position 116° or 128°E. At this moment, the preferred orbital location is 128°E in order to achieve the highest elevation angle from the Korean peninsular.

The Advanced Publication information for COMS was forwarded to the ITU on 24 February 2004 and was distributed by the ITU to all member administrations on 6 April 2004.

The Advanced Publication for COMS includes the frequency bands 1670 – 1710 MHz, 2025 – 2110 MHz, and 2200 – 2290 MHz. Due to the fact that these are the complete band allocations for MetSat downlinks and TM/HKP, it has to be expected that there will be many coordination requests. During the working group meeting it was already apparent that most CGMS members are planning to submit coordination requests, however, KARI noted that the operation frequency band for COMS, would occupy some portions of the notified band. Therefore the coordination request would be minimised.

Concerning the use of the 2 GHz space operations frequencies KARI was invited to seek the advice of the Space Frequency Co-ordination Group to select a suitable pair of TM/HKP frequencies.

The Advance publication for COMS also includes many orbital positions: 74°, 86°, 98°, 110°, 122°, 134°, 146°, 158°, 170°, and 182° East. It was explained that the orbital position, which would be within plus/minus 6 degrees of one of these positions would be selected after the feasibility studies with the operating satellite networks. This may also be subject to coordination requests from CGMS members in the Asian region. Discussions took already place between KARI and CMA concerning orbital position 123.5° East. JMA is also concerned that there may be conflicts with GMS-5 operations.

Recalling the presentation from KARI on its COMS satellite program and, in particular, its proposed frequencies and orbital positions, Russia expressed concern at the possibility of a COMS satellite location at 74°E, bearing in mind the GOMS/Electra N2 registered location of 76°E. KARI stated that the final satellite location was still undecided and, in any case, full application procedures would be followed with the ITU to ensure there would be no harmful interference with the Russia system at 76°E.

During CGMS XXXI a list of orbital positions was edited and included into the report. JMA replied that there was also a GMS-5 position at 120°E, which was not included in this list. JMA also informed that after the successful launch of MTSAT-1R (140°E), GMS-5 would be moved to 120°E for backup operations.

There is also a list of orbital positions of operational meteorological satellites maintained by WMO. It was made clear that this list only includes the actual operational positions but not those of backup satellites.

It was concluded that CGMS Members need to identify all occupied orbital positions in the tables of LEO and GEO satellite positions in the CGMS webpage and in the Final Report, to allow coordinated planning for future systems.

The WMO invited KMA to consider the inclusion of the meteorological payload on-board the COMS satellite to become part of the space-based Global Observation System (GOS).

Action 32.05 KMA to inform WMO whether the national payload of COMS could become part of the space-based GOS.
Deadline: 30 June 2004

Introduction of Automotive Short Range Radar Devices (SRR) operating in the frequency band 21–27 GHz

During CGMS meetings XXX and XXXI several documents were presented by ESA, NOAA, and EUMETSAT reporting on plans to implement automotive Short Range Radars (SRR) in the frequency band 23.6 - 24 GHz and the potential impact to passive sensor measurements in this band. EUM-WP-21 provided an update on the situation in Europe.

As reported at the last meeting the European administrations have recognised that SRR sharing with other services in the band 23.6 – 24 GHz is only feasible up to a certain level of market penetration. Discussions were focused on the allowed penetration rate and the possible end date of usage. It was concluded that the final SRR application should be around 77 GHz and regulatory provisions were made for SRR in this band.

Pushed by the automotive industry organised in SARA and supported by a mandate of the European Commission the Frequency Management Working Group (WGFM) of CEPT has worked at its meeting end April 2004 on an interim solution for the use of automotive Short Range Radar (SRR) applications in the 24 GHz band

The European Earth Observation community (ESA, CNES, EUMETSAT and EUMETNET) and WMO were participating at the Conference to represent/defend their interests against those of the automotive industry.

After three years of extensive discussions the conclusion of a report to the European Commission and a corresponding ECC-Decision for an interim implementation of SRRs was prepared containing the following conditions:

- the maximum penetration levels for SRR is fixed to 5.9%,
- the reference date when no new SRR shall be introduced is fixed to 1 January 2012,
- an automatic deactivation function shall be introduced for all vehicles equipped with SRR from the beginning of their introduction,
- the center frequency 24.125 GHz shall be used for the UWB as well as the narrow band component of the system,
- a review process of the Radio Spectrum Committee (RSCom) of the EU in 2009 to consider and confirm that the number of equipment in use on a national basis is still consistent with the agreed solution. This review is not intended to relax the penetration rate or to extend the reference date.

This framework for the interim introduction of SRRs at 24 GHz constitutes an acceptable compromise. This regulation would be in accordance with sharing studies. No harmful interference to passive sensors would be expected. Nevertheless, it has to be noted that such licensing would set precedence in such a way that active service operations would be allowed in a band, which is protected by footnote 5.340 in the ITU Radio Regulations. This footnote states that "no emissions are allowed in this band".

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. EUMETSAT working paper EUM-WP-19 reports on studies, which were performed by EUMETSAT to estimate the impact of such interference.

An interference assessment from the meteorological satellite system NPOESS into Metop Earth stations receiving around 1.7 and 7.8 GHz has been conducted by means of the radio frequency interference assessment tool RFIAT. One METOP satellite with an orbital altitude of 825 km and an ascending equator crossing time of 21:30 hrs has been assumed. Three NPOESS satellites with orbital heights of 828 km and ascending equator crossing times of 13:30 hrs, 17:30 hrs and 21:30 hrs have been considered. All satellites transmit both in the band 1698-1710 MHz and 7750-7850 MHz and interference will therefore occur for some time when the orbital positions of the Metop and NPOESS satellites overlap. This happens in general every approximately 113 days. Minimum elevation angles of 5 degrees were assumed for all Earth stations. Polarisation and atmospheric losses were not taken into account. Exact spectral overlap and Doppler effects can be taken into account with the interference assessment software so that the actual spectral interference component has been assessed.

The main results were as follows:

- Worst cases are obtained when both satellites have the same equatorial crossing times as the orbits will occasionally overlap. For the selected orbit heights, this would occur approximately every 113 days.

- Significant data loss for up to 3 % of time will occur around 1.7 GHz

- Data loss for up to 0.23 % of time will occur around 7.8 GHz

- Interference levels and statistics are rather independent of station locations.

- Interference could be minimised by phasing the satellites in a way that they have identical orbital periods but a small orbital separation angle. This technique is already successfully applied to a number of low Earth orbiting satellites operating around 8.2 GHz. At 7.8 GHz. less than 1 degree orbital separation would already be sufficient for a 10-m antenna to reduce interference levels by more than 30 dB.

While data losses of up to 3 % every 113 days at HRUS and HRD user stations appear to be acceptable, the interference into the main data downlink of Metop by NPOESS needs to be avoided by implementation of operational procedures.

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 XXXIII

The EUMETSAT studies were submitted to NOAA for consideration. In working paper NOAA-WP-32 it was announced that the study results need to be carefully analysed. NOAA will report back to CGMS as soon as analysis is completed.

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

I/2 Telecommunication techniques

No working papers were presented under this agenda topic.

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

In its working paper ROSH-WP-03, Russia informed CGMS that the first batch of 20 DCPs had been installed at hydro-meteorological stations in the European and Ural regions of Russia. At present, DCPs are working on an experimental basis with the major objective of developing and testing the DCS ground segment in preparation for the launch of GOMS/Electro N2. Data collection, via Meteosat-7, is carried out at the SRC Planeta ground receiving station near Moscow. The decoded DCP data (messages) are transmitted to the Roshydromet Main Communication Center for the subsequent transmission (in GTS code form) via terrestial telecommunication channels to the GTS.

As a result of DCS tests, it has been noted, that there is unsatisfactory quality of data collection from DCPs located near the northern fringe of the Meteosat–7 telecoms field

of view and operated using channel I26. It is planned to relocate these DCPs at new positions in the European part of Russia and to continue channel I26 usage. On the basis of exploitation results the existing DCPs have been modernised and the testing of these platforms is now underway.

The GOMS/Electro N2 DCS will, in due course, support the operation of 300 Regional and 33 International channels. Also, it is planned to develop two ground receiving centres in Russia (Moscow and Novosibirsk) and to eventually allocate not less than 800 regional data collection platforms.

In order to further enhance the Russian DCS, Roshydromet, Russian Aviation and the Space Agency plan to use other Russian (telecommunications) geostationary satellites to complement the meteorological geostationary satellite communication capabilities.

I/3.1 Status and Problems of the IDCS

EUM-WP-07 presented a status report on the performance of the International Data Collection System (IDCS). CGMS were informed that as of the beginning of April 2004, there were 395 International DCP (IDCP) registered worldwide for use with the IDCS, actively using 20 of the 33 available channels. This is 18 more DCP than one year ago. Of the remaining, 44 DCP are Aeronet DCP operating on channels I23-I24, 20 are operated by ROSHYDROMET on I25, and 180 are "Regional" DCP belonging to WMO agro-meteorological and hydro-meteorological networks and operating over channels I27-I33.

CGMS 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, until such time that all these DCPs can be transferred to the MSG Data Collection and Retransmission Services provided by MSG-2 (currently expected late 2005).

CGMS further recalled that following the failure of an SSPA on board MSG-1, it is currently not possible to operate the direct broadcast services, nor the IDCS mission. However, EUMETSAT plans to implement the baseline Data Collection and Retransmission Service with MSG-2,3 and 4. DCP messages acquired via Meteosat-7 are also re-broadcast via EUMETCast.

JMA-WP-04 reported on the status of IDCPs registered for use with the GMS IDCS and the replacement of the DCS ground data processing system. As of the beginning of April 2004, 65 IDCPs were registered on the GMS IDCS and operated on 8 of the 33 international channels. The numbers of registered IDCPs are 57 ships and 8 aircraft (ASDAR).

JMA noted that the numbers of both IDCPs and messages disseminated via the GMS IDCS have decreased to less than half during the past year. There were only three reports, two from ships and one from an aircraft, in the area where GMS-5 was responsible for collection during the period. Also, during the reporting period, JMA noted severe interference affecting some data transmission, including continuous and temporary ones observed on 4 of 33 IDCS channels, i.e. Channel 1, 29, 31 and 33.

Finally, JMA noted with some concern that the number of operational ASDAR equipped aircraft had been decreasing, while the amount of data from the AMDAR equipped aircraft was increasing. This was seen as important as JMA plans to replace its ageing ground data processing system, including the DCS ground processing system, in March 2005 and JMA is fully examining the technical requirements of the software for the new DCS, including the ASDAR support function. JMA is thus paying great attention to the future activity of the ASDAR and AMDAR programs.

NOAA-WP-17 provided a summary of the NOAA request for the use of 5 international channels to support the transition for 100 bps data collection platform to 300/1200 bps platforms. NOAA has begun the deployment of High Data Rate (HDR) transmitters, at 300 and 1200 bits per second (bps). Currently NOAA has almost 3000 transmitters assigned at the two higher data rates. In order to ease the transition, NOAA requested that CGMS grant permission to temporarily utilise unused international channels for staging of 100 bit per second transmitters. NOAA requested the use of international channels I1 – I5 to support the transition for 100 bps data collection platform to 300/1200 bps platforms.

NOAA proposed to the CGMS Plenary to use these channels until June 1, 2013 and invite CGMS to endorse the proposal. If all the NOAA 100 bps channels are converted to high data rate before that time, then the international channels would be freed up sooner.

CGMS considered that since Russia was using I25 and I 26 in the Russian region, there was no reason why NOAA could not make use of these same channels for DCP transition activities in the USA, since national regional DCPs would not be in telecommunications field of view of each others satellite systems. The remaining channel allocation for USA DCP transition activities would then be allocated to channels I 1 - 3 only.

Action 32.08 The Secretariat to study the feasibility of using IDCS channels I25 and I26 simultaneously in the Russian and USA regions. Deadline: 30 October 2004

NOAA-WP-18 provided a status report on the performance of the International Data Collection System (IDCS). Anticipating the delivery and installation of the DCS Automatic Processing System II (DAPS II), the current monitoring procedures were interrupted several times, and were termination upon delivery of DAPS II (which is yet to be installed). Due to indefinite delays in the deployment of DAPS II, NOAA is investigating the possibility of running the Channel Interference Monitoring System (CIMS) portion of the DAPS II system in a stand alone mode. As previously noted, a conflict in the addressing scheme makes it difficult for the NOAA to include new addresses generated by EUMETSAT. Some of the addresses generated for the IDCS by EUMETSAT already exist in the NOAA database, assigned to US platforms that have been operating for decades. This conflict was not recognised by the NOAA representatives to the CGMS at the time that the scheme was agreed upon, and has been recognised as a serious problem in database coordination among the satellite operators. NOAA plans to address this discrepancy after the completion and phase-in of DAPS II.

I/3.2 Ships, Including ASAP.

No working papers were presented under this topic.

I/3.3 ASDAR

WMO-WP-09 informed CGMS about the current status of the ASDAR Programme. There are currently only two equipped aircraft reporting routinely. The extent of the decline led the AMDAR Panel annual meeting in October 2003 to decide that it no longer had the resources to spend on keeping the very small programme going and declared the programme closed as of 31 December 2003. Therefore, there will be no new installations and the 2 remaining reporting systems will be allowed to continue for as long as they operate reliably but without maintenance support from the Panel. Of the 7 ASDAR units still installed, 4 have reported during the 6 months prior to February 2004 and only 2 have reported since then providing valuable data in data sparse areas.

The two ASDAR aircraft are still reporting over Africa, the western, northern and southern Indian Ocean, and parts of Asia. Much of this area is either infrequently covered by in situ upper air observations or not at all, but the volume of data has declined from around 710 observations per day in June 2002 to 370 in July 2003 and 230 in January 2004. The good news is that at least five of the ASDAR airlines are actively working to replace older ASDAR equipped aircraft with much larger fleets of AMDAR equipped aircraft. Significant improvement in coverage in data sparse areas has been achieved over the past two years as more AMDAR aircraft replaced decommissioned ASDAR systems.

In conclusion, it is likely that only four channels are required for ASDAR in the next 12 months and it is likely that additional units will be decommissioned during the next 12 months. However, 3 units, ASDAR/SV003, ASDAR/SV023 and ASDAR/AR006 will not report again and will be formally decommissioned thus their three IDCS channels are no longer required for ASDAR.

The Chairman recalled CGMS Action 31.23 related to the long term requirements for IDCS channels. He added that EUMETSAT was currently studying the user requirements for an IDCS on its third generation Meteosat system, scheduled to operate in the period 2015 to 20030.

Referring to WMO-WP-02, WMO commented that the ASAP Panel (part of the JCOMM Ship Observations Team) wished to retain the existing IDCS channel and frequency allocations for ASAP in the medium term (to 10 years). Although all operating ASAP units currently use Inmarsat rather than IDCS (because of unreliabilities of data return using the IDCS), they will return to the IDCS in the future when the reliability problems are solved, because of the cost factor.

NOAA informed CGMS that NASA was planning an increase in its number of shuttle support DCPs using International channels in the near future, and more details on actual allocations would be provided in due course. NASA also considered that there

was longer term potential for the use of IDCS channels, although at present no other specific programme had been identified.

The Chairman commented that in the light of statements made by CGMS members on the possible future use of the IDCS, whilst some growth was foreseen in some areas, other users were declining. The Group considered that perhaps the time was right to promote the use of the IDCS to a wider user community. It noted that, clearly, there was a need to clarify future user requirements.

Action 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 XXXIII accordingly. Deadline: CGMS XXXIII

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

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

No working papers were presented under this topic.

WORKING GROUP II: SATELLITE PRODUCTS INCLUDING SATELLITE DERIVED WINDS

II/0 Introduction

Working Group II on Satellite Products was chaired by Dr. Alexander Uspensky of Roshydromet. Greg Mandt, Xu Jianmin, Eva Oriol-Pibernat, Bizzarro Bizzarri, Don Hinsman, Hiroshi Kawamura, Hideyuki Hasegawa, Victor Saulskiy, Johannes Schmetz, Paul Menzel, Jim Purdom, Byung-Sun Kim, Myoung-Hwan Ahn, Nina Novikova, Rashid Salikhov, Alexey Yanitsky, Vassily Asmus, Vassily Sobolev, Valery Dyadyuchenko, William Chu and Shahid Habib participated in the WG discussions. 29 working papers were discussed. Several of these papers were in response to actions from CGMS XXXI (regarding calibration paper bibliographies, satellite data product formats, metadata for satellite data archives, and using research satellites to improve operational satellite data and products). In addition the preparations for the July 2004 International Winds Workshop and the October 2004 International Precipitation Working Group were discussed. All past actions were addressed. Eight new actions were suggested.

II/1 Image Processing Techniques

CMA-WP-07 gives an overview of destriping techniques for multi-sensor imaging spectro-radiometer data and presented some results with their SZ-3 data (a 34 spectral band sensor using 22 sensors). Using an empirical distribution function approach and adjusting for the bowtie effect, CMA showed impressive results in image enhancement. These SZ-3 tests will prepare CMA for processing FY-3 data. WG II appreciated this contribution from CMA and noted that preparing measurements from multiple detectors into coherent images (e.g. de-striping) and the discrimination of features therein (e.g. clouds over snow or ice covered regions) remain challenges for many future sensors.

II/2 Satellite Data Calibration

ESA-WP-06, EUM-WP-17, CMA-WP-06, and NOAA-WP-19 list bibliographies of environmental sensor calibration papers/reports in response to an action from CGMS XXXI. JMA indicated that they had also submitted a complementary listing of publications to the CGMS Secretariat. WG II agreed that these papers should be posted on a CGMS website with the key publications identified.

Action 32.11 (1) CGMS Members to identify key calibration publications. (2) Calibration papers from CGMS Members should be posted on a CGMS website by the Secretariat. Deadline: 31 July 2004

CMA-WP-06 presents a calibration method for FY meteorological satellites. Pre-launch calibrations are conducted for visible channel (not in vacuum) and infrared channels (in vacuum). In orbit calibrations are implemented with field measurements and inter-calibrations with NOAA satellites. The field measurements for visible sensors include the surface reflectivity, atmosphere optical thickness, and water vapour content. 6S model is used to calculate the incoming radiation at the satellite.

The field measurements for IR channel include lake water surface temperature, atmospheric optical thickness and air water vapour content. MODTRAN model is used to calculate the satellite incoming radiance. The operation-oriented inter-calibration study uses NOAA satellite data to calibrate FY-2 geo-stationary satellite. The Global Area Coverage (GAC) data of AVHRR channel 4 from NOAA-16, -17 were used for calibrating FY-2 long-wave IR channel. The CH12 (WV) of HIRS/3 of NOAA-17 was used to calibrate WV channel of FY-2. An effort is made to use inter-calibration operationally. Access to timely NOAA satellite data for operational use of inter-calibration method for the FY-2 satellite is the major concern.

ESA-WP-07 announces a CEOS Cal/Val Workshop will be taking place in Noordwiijk, Netherlands on 12 - 14 October 2004. WG II recalled CGMS XXXI had recommended that CGMS Cal/Val experts coordinate information exchange with the CEOS Cal/Val Working Group and thus encouraged member contributions to the October Workshop on experiences with inter-comparing and calibrating moderate resolution optical environmental satellites. The website http://www.congrex.nl/04c32/ is open for information and submission of papers.

Action 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. Deadline: 12 October 2004

EUM-WP-12 presents an evaluation of the method for calibrating the solar channels of SEVIRI on the Meteosat Second Generation (MSG) satellites, the first of which became operational end of January 2004. Calibration of the SEVIRI solar channels (i.e. 0.6, 0.8, 1.6µm and a broadband high resolution visible channel) is based on a vicarious method. It uses well-characterised surface targets (desert sites), atmospheric profiles, and a radiative transfer model to calculate radiances at the top of the atmosphere for comparison with satellite observed radiances. These simulated radiances over desert sites represent a reference for the visible channel calibration. EUM-WP-12 presents an evaluation of the performance of the reference calculations against similar spectral radiance observations from satellites with on-board calibration (ATSR-2, SeaWiFS, VEGETATION and MERIS). Excluding ATSR-2 data agreement is between -0.2 +/- 4.9 % for the 0.6 µm channel and 1.1 +/- 6.3 % for the 0.8 µm channel.

II/3 Vertical sounding and ITWG matters

EUM-WP-13 summarises the status of the EUMETSAT ATOVS Retransmission Service (EARS), highlighting the main activities since the last meeting of CGMS. EARS is a satellite data service to provide the meteorological community with satellite datasets from the US National Oceanic and Atmospheric Administration (NOAA) polar-orbiting satellites covering data-sparse areas around Europe. It provides ATOVS level 1a and 1c data with a timeliness of 30 minutes, to cover the needs of EUMETSAT Member States' Regional NWP operators for NOAA sounder data. In December 2003 the initial target of 10 EARS HRPT stations was achieved with the addition of data from Gilmore Creek in Alaska and Wallops Island in

Virginia. At the end of 2003, 97 users were registered to receive EARS data via EUMETCast. Several NMSs are continuing to establish reception and processing systems and many already use the data in their Numerical Weather Prediction (NWP) schemes. EUMETSAT Delegate Body Working Groups recently agreed to extend EARS beyond the current Pilot Phase. In addition to the continuation and extension of the current ATOVS Retransmission Service, the proposal also covers new pilot AVHRR and ASCAT Retransmission Services. WG II noted that EARS is an extremely effective example of alternative data dissemination and asked whether the service could be extended to cover the complete northern Asian area.

Finding: The success of the EARS program points to the possibility of extending such activity globally. Near real time access to ATOVS data are important for Global Data Processing Systems (e.g. ECMWF, NCEP,...) as well as other WMO Members with NWP capability. Access to near real time ATOVS data are also important for WMO activities such as implementation planning for the redesign (evolution) of the GOS and THORPEX.

Action 32.13 CGMS Members to form local consortia to develop regional ATOVS Retransmission Services in conjunction with EARS and report back to CGMS XXXIII. This activity is focused within the WMO Space Programme. Deadline: CGMS XXXIII

NOAA-WP-25 reports on the successful operational use of the MODIS polar winds at several numerical weather prediction centres and presented preliminary results of research to infer atmospheric motions from successive AIRS overpasses in polar regions. Initially, features are being tracked in *radiance space* in the same manner as has been done with MODIS. Further work will attempt to track features in *retrieval space*; i.e., track water vapour features in images of the water vapour profile. This would improve the height assignment. This work will be presented at the upcoming June 2004 meeting of the International Winds Working Group.

NOAA-WP-26 provides an overview of the Coriolis WindSat mission, evaluation of the calibration/validation modes and discusses the potential distribution of data sets for outside evaluation. It reports that once the WindSat calibration/validation team is confident in the validation and characterisation of the wind vector product, the WindSat data will be made available to the science and user community for further evaluation. WG II urged early distribution of the data so that feedback from outside users could guide algorithm and calibration improvements and determine the utility of the WindSat products. NASA representatives agreed to provide information on the likely release date of WindSat data.

NOAA-WP-27 provides an update on the operational GOES East and West sounding performance. Soundings continue to be produced nearly every hour at approximately 50 km resolution in clear skies. Additionally, hourly GOES-9 (over the western Pacific at 155° E since May 2003) experimental soundings are also available. Data and products including Total column Precipitable Water vapour (TPW), atmospheric stability (Lifted Index, LI), and cloud-top pressure and amount (CTP) information. can be found at http://cimss.ssec.wisc.edu/goes/realtime/grtmain.html#gsall). Radiances and sounding retrievals are being assimilated in numerical weather prediction models with positive impact; GOES Sounder impact in the Eta regional

model is as large as RAOB impact to 24 hour forecasts of relative humidity in a four season study. GOES Sounder detection of Sulfur Dioxide (SO_2), often associated with volcanic eruptions, is being explored; differences in 7.5 and 13.3 micron images are revealing locations of upper atmospheric volcanic ash.

WG II noted the progress made in assimilation of clear sky radiances and/or soundings from infrared sensors and proposed that work on NWP utilisation of cloud affected radiances should be accelerated. Papers on this subject were encouraged for CGMS XXXIII.

Action 32.14 CGMS Members are encouraged to present papers on NWP utilisation of cloud affected radiances at CGMS XXXIII. Deadline: CGMS XXXIII

II/4 Other parameters and products

ESA-WP-04 lists ERS (at http://earth.esa.int/ers/) and ENVISAT (at http://envisat.esa.int/) ocean data currently available and summarises future Explorer missions (listed at http://www.estec.esa.nl/explorer/). The Global Ocean Observing System (sponsored by WMO and IOC) has designed a global ocean module and a coastal module, and defined present satellite data requirements. The tables presented in this paper provide a summary of the ESA ocean remote sensing capabilities.

ESA-WP-08 provides an update on the European contribution to the Global Precipitation Measuring mission (GPM) that has the objective of measuring precipitation on a global basis with sufficient quality, Earth coverage, and sampling to improve prediction of the Earth's climate, weather, and specific components of the global water cycle. The mission focuses on light rain and solid precipitation. The EGPM will likely consist of a single satellite in a sun-synchronous low Earth orbit, which carries a scanning thirteen channel precipitation microwave radiometer at frequencies between 18.7 and 150 GHz and a precipitation radar at 35 GHz to provide global rainfall observations. The launch of EGPM spacecraft will be decided if and when it has been selected.

EUM-WP-14 (responding to Actions 31.27 and 31.28) reports on the status of the project to process VIS sensor radiances from all geostationary satellites with the goal of producing a first global surface albedo map from geostationary satellites. So far, the requested month (May 2001) of data has been received on tape from the Japan Meteorological Agency and a sample data set for one day of May 2001 for GOES East and West from NOAA/NESDIS has been received. In this first phase, the main effort will be on the generation of daily time series of Top-Of-Atmosphere observations for each pixel required for the inversion process as well as the preparation of all the required look-up tables. This version of the algorithm, referred to as Geostationary Surface Albedo (GSA), should permit the processing of any VIS band observations provided the observations are accurately geo-referenced. The first phase of the project is expected to be completed by the end of 2004. In a second phase, the consistency among these various products will be addressed. The challenges and problems associated with different spectral, temporal or spatial resolution will have to be carefully examined. WG II thanked EUMETSAT for their

efforts in producing a global pilot data set for this new product. NOAA offered help in obtaining data for the full month of May. CMA indicated that no adequate FY-2 data are available for May 2001, however data for periods after August 2001 and outside the eclipse season are acceptable.

ROSH-WP-04 presents an overview of Roshydromet/SRC PLANETA routine satellite data processing and derivation of operational products. The satellite products are applied by Roshydromet in various application areas, including operational meteorology, NWP, hydrology, agrometeorology, hazards (fires, floods) and pollution monitoring, climate studies. Examples of some of the satellite products were distributed on CD. WG II noted the impressive array of environmental remote sensing applications being demonstrated by Roshydromet.

NOAA-WP-20 introduces early results on intercomparison of the geostationary infrared window and water vapour broadband radiance measurements with high spectral resolution AIRS (Atmospheric Infrared Sounder) data. Convolving each spectral band response function with the high spectral resolution measurements mitigates the need for the very difficult correction for spectral response differences between two broadband instruments. Fifteen coincident data sets indicate that IRW AIRS minus Geo are 0.6, 0.1, 0.1, 0.9, and 1.9 for GOES -9, -10, -12, Meteosat –7, and -5 respectively. Daily intercalibration results for all geostationary instruments with NOAA-15 and –16 HIRS and AVHRR are posted at http://cimss.ssec.wisc.edu/goes/intercal. WG II noted the importance of accurate intercalibration within the Global Observing System; using a well calibrated hyperspectral sensor as a common reference for other broadband sensors represents a significant step in achieving global calibration consistency. It was further noted that IASI in 2006 will provide more extensive spectral coverage and thus enable intercalibration of even more spectral bands.

NOAA-WP-21 reports on the IPWG/GPCP international validation of daily rainfall algorithms. Currently there is validation of daily satellite rainfall estimates over the continental United States and Australia; websites are for Australia http://www.bom.gov.au/bmrc/wefor/staff/eee/SatRainVal/dailyval_dev.html and for USA http://www.cpc.ncep.noaa.gov/products/janowiak/us_web.shtml.

WMO-WP-14 informed CGMS Members on the status of activity related to International Precipitation Working Group (IPWG). IPWG has terms of reference calling for (1) development of better measurements, and improvement of their utilisation; (2) improvement of scientific understanding; and, (3) development of international partnerships. A central data and document database is available: at (main IPWG site) http://www.isac.cnr.it/~ipwg
and (algorithm site) http://www.isac.cnr.it/~ipwg/algorithms/algorithms-invent.html.

Although no IPWG meeting had occurred since CGMS-XXXI, WG II noted the robust, active program within the IPWG and its strong international participation. WG II also noted with appreciation the activities of Dr. Levizzani at CNR who is hosting the IPWG web site. The second IPWG Science meeting and workshop will be held in Monterey, California, from October 24-28, 2004; a call for papers has been issued.

The IPWG Rapporteur was asked to inform the IPWG of CGMS' pleasure with the IPWG's development and that CGMS looks forward to continued activities within the three IPWG working groups. It was also noted that some CGMS Members still need to address the portion of the template "including available web and ftp sites for imagery and data download," and that CGMS Members who have provided algorithm information should check and update their input on a routine basis. Nearly all of the algorithms or techniques do not have any training materials posted. The IPWG Rapporteur was also instructed to pass these thoughts along to the IPWG, while asking it to consider addressing the following science issues: (1) GPCP assessment; (2) solid precipitation; (3) precipitation over complex terrain; and, (4) ongoing validation studies. WG II noted that the process for soliciting support for CGMS working group meetings needed further clarification and thus recommended the following action.

Action 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 XXXIII 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). Deadline: CGMS XXXIII

Further discussion of the IPWG activities focused on the provision of experimental data sets that could support cloud model development / validation as well as future instrument planning and subsequent cal/val. Remote sensing of precipitation over land and light rain or snowfall remain challenging. Exploitation of millimetre and sub-millimetre wave observation from geostationary orbit remains a major challenge. WG II considered that space agencies involved in supporting IPWG should note the need for experimental data sets (e.g. airborne campaigns) as well as instrument development for geostationary orbit.

Action 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 XXXIII. Deadline: CGMS XXXIII

WMO-WP-19 is an informal discussion paper submitted by the World Climate Research Programme (WCRP) containing their proposal for development of global climate products by systematic reprocessing of global observations over the last 30 years. WCRP suggests that an essential element must be international collaboration involving complementary expertise (modelling, data processing, data assimilation techniques, data validation and sensor calibration…). Proper organisational arrangements must be put in place to minimise unnecessary duplication of efforts and resources and building upon existing developments made in the USA, Europe, Japan… WCRP proposes that space agencies be involved in these activities in order to facilitate planning of future space missions for the benefit of climate research. WG II was of the opinion that the WCRP proposal required further development before it could comment. However, in reviewing both the GCOS (WMO-WP-25) and WCRP (WMO-WP-19) papers and the requirements contained within them, WG II was

convinced that a more consolidated and consistent approach for drafting requirements for satellite data and products was urgently required (as noted in the following discussion for WMO-WP-25).

WMO-WP-25 presents the results of the various GCOS meetings. WG II was of the opinion that GCOS had suggested several valuable points for consideration including the possibility of a new global climate product to indicate areas of convection. A demonstration sample of such a global product could be produced on the basis of thermal infrared data, following the example of the global data sets already being prepared by CGMS Members for a new surface albedo product that is based on visible data.

However, with regard to the GCOS/WCRP AOPC recommendation, to establish a network of upper-air stations where high-quality radiosondes would be released during satellite overpasses (Satellite Upper-Air Network [SUAN]), WG II felt that additional research and coordination was required. In particular, WG II suggested that AOPC coordinate such a recommendation with CBS (through its CBS OPAG IOS Expert Team on Observational Data Requirements and Redesign of the GOS), the WMO Space Programme, the International TOVS Working Group, and relevant WMO Regional Association impacted by the financial implications of the recommendation. WG II also suggested that AOPC investigate further the availability of high-precision humidity measurements from the present GUAN network. If the required high-precision measurements are not possible with the present operational radiosondes, then it may be necessary to find additional partners to upgrade the present GUAN stations. WG II noted the understanding that the preferred choice would be to have a so-called SUAN as an addendum to the current GUAN stations with additional launches during satellite overpasses. The number of sites would certainly need careful consideration, however accuracy would be the overriding principle.

In reviewing both the GCOS and WCRP papers and the requirements contained within them, WG II was convinced that a more coordinated and consistent approach in articulating the needs for satellite data and products was urgently required. In particular, WG II was of the opinion that it was essential that a consolidated set of climate observational requirements be maintained. It had already proven difficult to prioritise different sets of climate requirements from WCRP and GCOS. Therefore, WG II recommended that CGMS request GCOS and WCRP to make efforts toward a more concerted process. As a practical way forward the suggestion is for WMO, a major sponsor of both WCRP and GCOS, to coordinate the development of consensus requirements from WCRP and GCOS.

ESA-WP-09 responds to an action from CGMS XXXI and presented how ESA adheres to the GCOS Climate Monitoring Principles (CMPs). ESA is currently operating the ERS-2 and Envisat satellites and is about to launch the first of a series of Earth Explorer satellites that address a range of Earth science issues. ESA also develops satellites for EUMETSAT; the requirements relevant to many of the monitoring principles are defined by EUMETSAT. The item-by-item response explained how ESA adheres to the CMPs.

NOAA-WP-11 also responds to the same action. It gives an item-by-item response as to how NOAA is adhering to the climate monitoring principles with regard to their operation of the POES and GOES system. The paper also encourages CGMS to foster continuation of inter-calibration efforts and to include channels other than the current IRW and WV.

II/5 Coordination of Code forms for Satellite Data

EUM-WP-15 responds to Action 31.30. It recalls that the "de facto standard format" for the international exchange of satellite data on the Global Telecommunications System (GTS) is BUFR. The management of changes to the BUFR tables, required to support the representation of these data and their evolution, could be simplified by the creation of a specific BUFR master table for satellite data. The paper describes a possible introduction of a dedicated BUFR master table for satellite data and proposed that the management of this master table be put under the responsibility of CGMS with assistance from the WMO Space Programme. Furthermore it suggests that the communication between this group and the CBS OPAG ISS Expert Team on Data Representation and Codes be dealt with by a suitable rapporteur to be designated by CGMS. WG II responded favourably to this request and fully supports the motion through the following action:

Action 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. Deadline: CGMS XXXIII

NOAA-WP-22 presents the outcome of the NOAA/NESDIS review of satellite data BUFR descriptors in the WMO Codes Forms used for exchange of satellite data (as detailed in WMO-WP-10 from CGMS XXXI). (1) NESDIS concurs with Appendix A of WMO-WP-10, but requests the addition of the Aqua satellite to the Common Code Table C-5. (2) NESDIS concurs with Appendix B of WMO-WP-10; no changes are requested. (3) NESDIS concurs with Appendix C of WMO-WP-10. NESDIS further notes that it has been routinely providing the Numerical Weather Prediction (NWP) community with near real-time AIRS radiance products from the Aqua satellite in BUFR format using the template described in Appendix B of the WMO WP-10 document.

NASA-WP-02 presents a summary of the NASA Earth Science Enterprise that has launched about 18 missions/satellites over the last two decades for the study of planet Earth. These satellites have carried over 70 highly advanced remote sensing instruments used for multiple studies in the area of physical and biological oceanography, land cover and land use changes, atmospheric chemistry, solar radiation budget, precipitation patterns, hurricanes, surface topography, carbon cycle, and other science areas of interest. Some of this useful data and products are also being used by other operational Agencies such as NOAA (National Oceanic and Atmospheric Administration), USGS (United States Geological Service), and

ECMWF (European Center for Medium Weather Forecast). NASA presented several examples of science data and products being utilized by the user community. For example, Total Ozone Mapping Spectrometer is producing volcanic sulfur maps for NESDIS and USGS to produce hazard warning. This activity will continue with the up coming launch of Ozone Monitoring Instrument on Aura satellites. The Quikscat sea surface winds and Tropical Rainfall Measuring Mission precipitation products are both being utilized by NOAA in their weather forecast models. Similarly, Atmospheric Infrared Sounder on Aqua satellite is providing high resolution temperature profile and radiance data. These products are under consideration for future near real time applications by NOAA, ECMWF and UK Met Office. Moderate Resolution Imaging Spectroradiometer (MODIS) is flying on two separate NASA satellites, Terra and Aqua. These instruments are generating multiple valuable products which are of high value for the user community. These provide rapid fire locations with 30 minutes of its acquisition of real time data through its direct broadcast mode. This feature is available to any one as long as the X band receiving station is available at their respective site. Additionally, it can provide global fire location both in VIS and IR bands four times a day. This information is used on regular basis by the US Forest Service. The dust storms location and transport products have been used by the Department of Defense in some of the recent war theaters. MODIS also generates aerosol optical depth which is further correlated with the EPA's (Environmental Protection Agency) ground based sensors to enhance their air quality index forecast capability. The MODIS ocean color products are utilized by the international ocean community to run their experimental cruises. Similarly, TOPEX and Jason-1 ocean altimetry products are also used by the ocean community as well. In summary, NASA offering many products from their R&D satellites which are useful for weather forecasting, and many other Earth application areas such as hazard warning, air quality forecast, public health, coastal zone management, Agriculture efficiency and invasive species management.

Finding: Most satellite systems have the capability to detect fires: polar systems with higher spatial resolution provide global coverage while geostationary systems are able to characterize their diurnal cycle. WMO Members have the need for such information for both real time disaster monitoring, air quality forecasting and climate purposes.

Action 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 Utilization and Products (ET-SSUP). (2) CGMS Members report on their capability and plans for fire products and their availability at CGMS XXXIII. Deadline: CGMS XXXIII

II/6 Coordination of Data Formats for the Archive and Retrieval of Satellite Data

NOAA-WP-23&24 reports on a concept called Scientific Data Stewardship, consisting of an integrated suite of functions to preserve and exploit the full scientific

value of NOAA's, and the world's, environmental data. These functions include careful monitoring of observing system performance for long-term applications, the generation of authoritative long-term climate records from multiple observing platforms, and the proper archival of and timely access to data and metadata. The metadata standard (derived from ISO Standard 19115) will be finalised in CY 2004/05 and will embrace the parameters suggested in EUM-WP-22 from CGMS XXXI. WG II felt that all members now had agreed on the metadata that should be attached to environmental satellite data to facilitate use for climate monitoring and diagnosis; it is anticipated that this metadata list will evolve in time with CGMS involvement.

II/7 Atmospheric Motion Vectors Derived from Satellite Data

JMA-WP-07 presents the current status of the Atmospheric Motion Vectors (AMVs) extraction system in MSC. The system has been revised and MSC has been disseminating High Density AMVs since 06 UTC 22 May 2003. The revision and the specification of High Density AMVs are shown in CGMS XXXI JMA-WP-10. Since then JMA has operationally utilised GOES-9 operated by NOAA/NESDIS as the backup to GMS-5. GVAR data from GOES-9 are transformed into GMS-5 VISSR format so that spatial resolutions are made equal to those of VISSR data. Although the sub-satellite position of GOES-9 (155E) is different from that of GMS-5 (140E), the AMV extraction domain is the same as that for GMS-5. The process is automated and high-density winds are produced by using EUMETSAT Quality Indicators (QI) and UW-CIMSS Recursive Filter Function (RFF) as quality control indices. Comparisons of both the quality and the number of AMVs between the year 2002 and 2003 reveal steady improvement in the AMVs; WG II commended JMA on the continuous and conscientious approach toward improving their AMV production.

NOAA-WP-28 provides an update on GOES operational winds performance and describes active areas of winds research include the derivation of motion vectors from rapid scan GOES imagery and from polar sequences of the Moderate Resolution Imaging Spectroradiometer (MODIS) images. Steady improvements in the GOES cloud-drift wind algorithms, processing schemes, and quality control algorithms continue to be realised. Operational production and distribution of low level (P > 600mb) cloud drift winds, derived from the 3.9 μm shortwave infrared channel on the GOES imagers, is scheduled to start on 27 July 2004. 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.

The Rapporteur to the International Winds Working Group informed CGMS about the upcoming 7th International Winds Workshop (IWW7) in Helsinki from 14 – 17 June 2004. The specific actions on IWW7 from previous CGMS meetings have been taken up by the two co-chairs, Chris Velden and Ken Holmlund, and their preparatory work indicates that all actions can be met. Furthermore, the rapporteur reported on presentations at a recent WMO Workshop on the Impact of Various Observing Systems on NWP in Alpbach, Austria (9 - 12 March 2004) that reinforced the positive impact of atmospheric motion vectors on NWP.

II/8 Conclusion and preparation of the WG Report

WG II concluded by noting considerable progress on CGMS actions (performing geo intercalibrations with hyperspectral sensors, agreeing on an initial metadata list, posting an inventory and description of operational precipitation algorithms, preparing for the next IPWG and IWWG, documenting the level of adherence to the GCOS climate monitoring principals) but also noting the need for more activity in others (coordination of climate requirements for satellite data, utilisation of cloud affected radiances, participation in a calibration workshop).

WORKING GROUP III: GLOBAL CONTINGENCY PLANNING

The Working Group III on Global Contingency Planning met during CGMS XXXII and reviewed activities related to discussions held at CGMS XXXI as contained in two working papers (NOAA-WP-29, ESA-WP-10). The Working Group further discussed the concept for an International Geostationary Laboratory recalling that initial discussions had occurred at CGMS XXXI (EUM-WP-18 and NOAA-WP-30). The Working Group also discussed three new working papers (NOAA-WP-10, WMO-WP-05 and WMO-WP-26) relevant to global contingency planning.

Responses to discussions occurring at CGMS-XXXI

NOAA-WP-29 provided an overview of the future GOES Advance Baseline Imager (ABI) instrument. With the launch of GOES-R, a new series of high resolution imagers would become operational in about 2012 lasting well beyond 2015. The ABI represented an exciting expansion in geostationary remote sensing capabilities. The ABI addressed the needs of the National Weather Service and others by increasing spatial resolution to better depict a wider range of phenomena, by scanning faster to improve temporal sampling and to scan additional regions and by adding spectral bands to enable new and improved products. Every product that was being produced from the current GOES Imager would be improved with data from the ABI. The ABI was projected to have 16 channels (three in the visible spectrum, three in the near IR, and 10 in the IR). In response to the CGMS-XXXI request to facilitate inter-comparison and calibration adjustments, ABI channel selection would be based, in part, on EUMETSAT's SEVERI instrument and also current polar-orbiting imagers. Spatial resolution would range from 0.5 km in the visible channels to approximately 2 km in the IR channels. Scan rates would increase fivefold over the current imager allowing coverage of the full disk in approximately five minutes. The Working Group agreed that efforts by CGMS satellite operators towards commonalities of instrument channels would be a benefit in efforts for contingency planning.

ESA-WP-10 discussed the status of activities related to a microwave sounder from geostationary orbit. Based on the EUMETSAT user consultation process for the Meteosat Third Generation, ESA had developed mission and instrument concepts focussed on important nowcasting parameters including precipitation, cloud physical parameters, atmospheric motion vectors and temperature- and humidity sounding. ESA noted that in order to optimise coverage and repeat cycle both geostationary and elliptical medium earth orbits were being investigated. The main drivers for a microwave sounding mission from geostationary orbit were the large main reflector, approximately 3.5 m diameter, the scan mechanism and the combination of radiometric accuracy, geographical coverage and repeat cycle. As a consequence ESA had started a comprehensive technology development action in the Technology Research Programme (TRP).

International Geostationary Laboratory

EUM-WP-18 and NOAA-WP-30 outlined, in identical fashions, the concept for an International Geostationary Laboratory (IGEOLab). The concept aimed at stimulating proposals and implementation of geostationary demonstration missions by space

development agencies. It was based on an approach that would facilitate transition to operational status and, ultimately, generalization pertinent to all satellites in geostationary orbit. It offered the opportunity for demonstrations for future missions, i.e. a test-bed.

The concept would enable:

- Cooperation between several space development agencies;
- Cooperation with and involvement of operational agencies (e.g. in the ground segment and real time services);
- International commitment to the scientific aspects of the mission;
- Involvement of the worldwide user community in the evaluation of the new capability in various geographical locations, based on the phased mission approach;
- Sharing and promotion of the results of the pre-operational assessment.

The approach was based on the early involvement of the international scientific and user community and assumed interagency consultation mechanisms aimed at creating opportunities for proposals and implementation of "IGEOLab" missions". The concept paper discussed the rationale for geostationary research missions, outlined necessary steps to achieve a full IGEOLab including possibilities for de-scoping the concept and ways to create opportunities for it.

The Working Group was unanimous in its support for the IGEOLab concept. It felt that the concept was sufficiently mature to seek reactions from appropriate research and development space agencies. The Working Group also agreed in order to demonstrate the benefits and viability of the concept that several "test" proposals should be developed. The "test" proposals should contain clear descriptions and concrete ideas to allow potential participants to judge the merits and level of commitment required for the demonstration. The Working Group suggested that a demonstration of the GIFTS instrument at several geographical locations and the exploitation of a microwave sounding instrument in geostationary orbit were two excellent "test" proposals.

The Working Group noted the need for high-level discussions and agreement in order to progress the IGEOLab concept. It felt that the WMO Consultative Meetings on High-level Policy on Satellite Matters (CM) was the appropriate venue for such high-level discussions and that an advanced indication to CM participants would be required. It also noted the need for involvement of the user communities as well as the potential contribution to the space-based component of the WWW's Global Observing System (GOS) in the framework of the WMO Space Programme.

Thus, the Working Group agreed to the following action items:

Action 32.19 WMO to 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. Deadline: 15 June 2004

Global Contingency Planning

NOAA-WP-10 noted that with two GOES presently being used as the U.S. operational spacecraft and an older satellite providing support to Japan, the only remaining satellite, GOES-11, must remain in storage at 105°W to be readily available as a backup to the two operational satellites should one fail. Thus there were currently no GOES spacecraft available for Indian Ocean support.

Working Group III recalled that CGMS Action 31.39 requested the CGMS Secretariat and WMO to assemble all materials related to Global Contingency Plans, including those found in CGMS and in WMO reports, and consolidate them into a CGMS Global Contingency Plan. It noted that relevant documentation and extracts from reports related to global contingency planning had been assembled in WMO-WP-05. In compiling and consolidating the various reports, the following format had been utilised. A chapter entitled the CGMS Global Contingency Plan Principles had been prepared. It contained major components of the CGMS Global Contingency Plans as well as reference to where the component originated. References, including all relevant text, were contained as Annexes to the Plan in a chronological order, oldest first to newest. It was suggested that as discussions occurred in the future, they should be recorded as new annexes and relevant principles should be inserted into the CGMS Global Contingency Plan Principles chapter. The Working Group thanked the CGMS Secretariat and WMO for the efforts to compile all the reference material. It also noted that contingency planning discussions spanned more than a decade starting in 1989. In order to format for easier use, the Working Group agreed to the following action item.

Action 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. Deadline: CGMS XXXIII

WMO-WP-26 described the status of the space-based component of the Global Observing Systems (GOS) as of 31 December 2003. The Working Group agreed that the working paper was a valuable reference and could serve as a basis of information for contingency planning. Thus, it was important that current data be maintained in the form of a WMO report. The WMO report would serve to:

- provide a framework for structuring the information provided by CGMS Members on satellite programmes, instrument characteristics and radio frequency usage in order to facilitate information update in such a way to allow easy comparisons and assess the degree of compliance of the GOS evolution with WMO requirements; and
- perform an assessment of the GOS status with respect to WMO requirements in terms of both observing coverage and data quality, at the nominal date of December 2003 and as projected in the near-future until 2006.

The Working Group noted that the current issue did not include R&D satellites and instruments, pending availability of information for inclusion in the next issue that will have a nominal date of December 2004. The Working Group also agreed that

there would be a need for a discussion on contingency planning for the LEO satellites at the next session of CGMS especially equator crossing times. It noted the valuable diagrams already available in the working paper and that they should be updated with the latest information for the discussion at CGMS XXXIII.

The Working Group agreed to the following action items:

Action 32.21 Each CGMS satellite operator to provide a point of contact for updating the WMO report resulting from CGMS XXXII WMO-WP-26. Deadline: 31 May 2004

Action 32.22 CGMS satellite operators for operational meteorological satellites to provide WMO (direct to Dr Bizzarri) with updated information for the WMO report resulting from CGMS XXXII WMO-WP-26. Deadline: 30 September 2004

Action 32.23 WMO (Dr Bizzarri) to assemble available information for R&D missions and instruments for inclusion in the WMO report resulting from CGMS XXXII WMO-WP-26 and submit to R&D agencies for validation and update. Deadline: 31 October 2004

Action 32.24 R&D agencies to validate, update and provide response related to action 32.23 to WMO (direct to Dr Bizzarri). Deadline: 30 November 2004

Table 7: Polar-orbiting satellite equator crossing times
(as of 20 May 2004)

Satellite	Service	Start	EOL	Eq. Cross-time	Freq (MHz)	BW MHz	Data rate (Mb/s)
Metop-1	LRPT	2006	2011	0930	137.9125	.150	.072
Metop-2	LRPT	2010	2015	0930	137.9125	.150	.072
Metop-3	LRPT	2015	2020	0930	137.9125	.150	.072
Metop-1	AHRPT	2006	2011	0930	1701.3	4.5	3.5
Metop-2	AHRPT	2010	2015	0930	1701.3	4.5	3.5
Metop-3	AHRPT	2015	2020	0930	1701.3	4.5	3.5
Metop-1	GDS	2006	2011	0930	7800	63	70
Metop-2	GDS	2010	2015	0930	7800	63	70
Metop-3	GDS	2015	2020	0930	7800	63	70
NPP	HRD	2006	2010	1030D	7812	TBD	15
NPP	SMD	2006	2010	1030D	8212.5	375	300
NPOESS-1	LRD	2009	2015	0930D	1706	8.0	3.88
NPOESS-2	LRD	2011	2018	1330A	1706	8.0	3.88
NPOESS-3	LRD	2013	2019	0530D	1706	8.0	3.88
NPOESS-4	LRD	2015	2021	0930D	1706	8.0	3.88
NPOESS-5	LRD	2018	2024	1330A	1706	8.0	3.88
NPOESS-6	LRD	2019	2025	0530D	1706	8.0	3.88
NPOESS-1	HRD	2009	2015	0930D	7812/7830	30.8	20
NPOESS-2	HRD	2011	2018	1330A	7812/7830	30.8	20
NPOESS-3	HRD	2013	2018	0530D	7812/7830	30.8	20
NPOESS-4	HRD	2015	2021	0930D	7812/7830	30.8	20
NPOESS-5	HRD	2018	2024	1330A	7812/7830	30.8	20

Satellite	Service	Start	EOL	Eq. Cross-time	Freq (MHz)	BW MHz	Data rate (Mb/s)
NPOESS-6	HRD	2019	2025	0530D	7812/7830	30.8	20
NPOESS-1	SMD	2009	2015	0930D	25650	300	150
NPOESS-2	SMD	2011	2018	1330A	25650	300	150
NPOESS-3	SMD	2013	2019	0530D	25650	300	150
NPOESS-4	SMD	2015	2021	0930D	25650	300	150
NPOESS-5	SMD	2018	2024	1330A	25650	300	150
NPOESS-6	SMD	2019	2025	0530D	25650	300	150
NOAA-15	APT	1998	2001	0730	137.5 – 137.62	0.034	.017
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	0.34	.017
NOAA-16	HRPT	2000	2004	1400	1698	2.66	.665
NOAA-16	GAC/LAC	2000	2004	1400	1698/1702.5/(1707 failed)	5.32	2.66
NOAA-17	APT	2002	2006	1000	137.50 – 137.62	0.34	.017
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-N	APT	2004	2008	1400	137.1 – 137.9125	.034	.017
NOAA-N	HRPT	2004	2008	1400	1698/1707	2.66	.665
NOAA-N	GAC/LAC	2004	2008	1400	1698/1702.5/1707	5.32	2.66
NOAA-N’	APT	2008	2012	1400	137.1 – 137.9125	.034	.017
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
FY-1C	CHRPT	1999	2001	0830	1698-1710	5.6	1.3308
FY-1D	CHRPT	2002	2004	0900	1698-1710	5.6	1.3308
FY-3A	AHRPT	2004	2007	1010	1698-1710	5.6	4.2
FY-3B	AHRPT	2006	2009	1010	1698-1710	5.6	4.2
FY-3C	AHRPT	2008	2011	1010	1698-1710	5.6	4.2
FY-3D	AHRPT	2010	2013	1010	1698-1710	5.6	4.2
FY-3E	AHRPT	2012	2015	1010	1698-1710	5.6	4.2
FY-3A	MPT	2004	2007	1010	7750-7850	35	18.2
FY-3B	MPT	2006	2009	1010	7750-7850	35	18.2
FY-3C	MPT	2008	2011	1010	7750-7850	35	18.2
FY-3D	MPT	2010	2013	1010	7750-7850	35	18.2
FY-3E	MPT	2012	2015	1010	7750-7850	35	18.2
FY-3A	DPT	2004	2007	1010	8025-8215 / 8215-8400	120	93
FY-3B	DPT	2006	2009	1010	8025-8215 / 8215-8400	120	93
FY-3C	DPT	2008	2011	1010	8025-8215 / 8215-8400	120	93
FY-3D	DPT	2010	2013	1010	8025-8215 / 8215-8400	120	93
FY-3E	DPT	2012	2015	1010	8025-8215 / 8215-8400	120	93
Meteor 3M	Raw	2001	2004	0915	466.5	3	0.080
Meteor 3M	Raw	2001	2004	0915	1700	2	0.665
Meteor 3M N1	Raw	2001	2004	0915	8192	32	15.36
Meteor 3M N2	LRPT	2004	2008	1030	137.89 / 137.1	0.15	0.064
Meteor 3M N2	HRPT	2004	2008	1030	1700	2	0.665
Meteor 3M N2	Raw	2004	2008	1030	8192	2	15.36

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

IV/0 Introduction

Mr. Michael Williams from EUMETSAT was elected Chairman of Working Group IV (WG IV) on Integrated Strategy for Data Dissemination from Meteorological Satellites, with Mr. Gordon Bridge 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 a list of participants).

IV/1 Coordination of Data Dissemination

In WMO-WP-03, WMO discussed the latest status for LRIT/LRPT conversion for satellites in polar and geostationary orbit. An analysis for LRIT conversion indicated that in WMO Regions I (Africa) and VI (Europe) the operation of WEFAX service would terminate in 2005 and an LRIT service had been started in 2004 based upon Meteosat-8 (formerly called MSG-1) data but relayed via the EUMETSAT EUMETCast broadcast.

WMO highlighted the fact that the tables of LRIT/LRPT conversions now contained a column for ADM, as requested by CGMS and invited the Group to approve the format of this modification. This was approved by the Working Group.

WMO Regions II (Asia) and V (Southwest Pacific) had a two-year overlap starting in 2004. For WMO Regions III and IV (South, Central and North America including the Caribbean), time-sharing using GOES-12 (East) is in place since October 2003 and will continue for at least a year. Timesharing using GOES - West is planned to start the 2nd quarter of 2004. Full LRIT only (no WEFAX) is planned to begin late 2005. The Indian Ocean area (RA II) has no overlap starting in 2003. An analysis of the table for LRPT conversion shows that the morning (AM) satellite will start LRPT in 2006 while the afternoon (PM) satellite will transmit two data streams (AHRPT and X-band) starting in 2009. The FY-3 series will only transmit AHRPT and X-Band starting in 2006. The satellites of Meteor-3M system will provide LRPT and AHRPT data direct broadcast to the user stations.

In ESA-WP-11, ESA informed CGMS is about its activities regarding Earth Observation (EO) data distribution. In 2003, the ESA Directorate of Earth Observation has started a series of projects under the Oxygen initiative (see also CGMS-XXXI ESA-WP-07) aimed at achieving the following objectives:

- Facilitate access to EO data and services from ESA and other missions;
- Increase sustainability of EO data provision by widening the range of data sources offered in a global EO based service;
- Ensure efficient operations and services.

The Oxygen Online Data Access Project addresses the need to facilitate the access to EO data and services, supporting the request and distribution of EO products to the user

community at large, and the EO data dissemination between the EO Centres involved in the data processing using electronic means.

The Oxygen Online Data Access Project aims to improve the current infrastructure to allow High Rate products to be distributed to the wide EO user community through a direct access to the different distributed archives using Internet. It should be noted that the user community of EO data is widely distributed over the whole world and any dissemination system must satisfy a high penetration in this potential user community. This is the main reason that a ground Internet solution has priority, also considering that EO users are used to exchanging level 3 and 4 products, and to publish and share their project results through the Internet, noting as well that most of the value-added services currently being consolidated rely on the Internet.

Thus, the ESA approach is to rely mainly on Internet distribution to reach the wider EO user community, dedicating a satellite multicast system, based on DVB-S, to those users in Europe requesting large amounts of EO data, and that have specific requirements for near real-time distribution.

The enhancement of the data distribution system is being performed with the co-ordination and collaboration of the main national space agencies in Europe, and access to the various data sets would be according to the Data Policies of those Agencies providing the data.

EUM-WP-20 reported on the status of the EUMETCast Dissemination Service operated by EUMETSAT, also responding to Actions 31.45, 31.51 and 31.52. Recent enhancements to the service include:

- Acceptance of the C-band turn-around (Africa) service and subsequent start of the operational C-band service in November 2003;
- Start of a DWDSAT (third party) operational service in October 2003;
- Addition of the IODC service to the EUMETCast (LRIT) schedule in November 2003;
- Increase of the Ku-band LRIT channel bandwidth to 386 kbit/s in February 2004;
- Preparation for a terrestrial link for the transfer of Meteosat-8 data to NOAA, and start of trial transmissions in March 2004;
- Supply of H/W, S/W and training to C-band trial users (in Nairobi, South-Africa, Strasbourg) in January 2004;
- Climate Monitoring product added to the LRIT schedule, with a new format "binary file" (existing formats were not suitable for the new product structure), in January 2004;
- Full (1/2 hourly) MET-5 (IODC) and MET-7 schedules started March 2004;
- Global Instability Index product on the LRIT schedule started March 2004;
- Change of some C-Band transmission parameters, i.e. introduction of a better forward-error-correction ratio.

Interference is a non-negligible issue for C-band reception. EUMETSAT has received information from other locations in Europe reporting serious impact through interference. As far as identifiable, radar seems to be its main source, quite often near to airports furnished with such equipment. If non-interfered locations cannot be found, other measures like band-pass filters might be necessary to eliminate or at least

reduce these degradations. The Ku-Band service, whilst more susceptible to degradation by heavy rain or snow fall, is not impacted by this kind of interference, and has thus (in the absence of longer lasting heavy rain/snow conditions so far) achieved better availability figures than the C-Band service for most of the locations equipped with both types of reception stations.

Beyond the services and products actually supported by EUMETCast indicated above, proposals for further extension of services are being developed. The following list indicates the current status of ideas, proposals and initiatives:

- Evolution of Meteosat-8 meteorological products:
  - new products based on prototyping by EUMETSAT, and updates of existing products based on operational experience;
- Dissemination of Vegetation Products:
  - Vegetation products from SPOT, there is a proposal by European Commission for an operational demonstration in the second half of 2004;
- Dissemination of Basic Meteorological Data for WMO Regional Association (RA) VI:
  - RA VI is Europe and Middle East, EUMETCast will be used for the provision of observations and forecasts, an RA-VI ad hoc Working Group is establishing User Requirements and a formal proposal to EUMETSAT Delegate bodies will follow;
- Dissemination of ENVISAT Data:
  - Interest in ENVISAT data in Africa (MERIS for fishery), informal communication ongoing with ESA;
- Dissemination of AEOLUS Data:
  - ESA Wind Lidar mission to be launched in 2007, informal communication ongoing with ESA;
- Re-broadcast of Indian satellite data (INSAT, KALPANA):
  - Backup to Meteosat-5 data, to be provided via NOAA and Météo-France;
- Dissemination of Meteosat-8 data to South America
  - South American Sub-Continent not covered by EUMETCast, discussions are ongoing.

WMO congratulated EUMETSAT on developing a system, based upon new, low cost technology that allowed wide access to many types of data.

WMO also reported that India had established an alternative dissemination scheme, based upon the use of the Worldstar Asiasat satellite system and in 3 to 4 years the distribution of up to half-hourly imagery from Indian satellites was envisaged.

NOAA-WP-34 discussed current and planned activities relating to the NOAA proposed Alternative Dissemination Methods (ADM) system. NOAA has commissioned an ADM study to develop a conceptual design for the distribution of environmental satellite data and products to meteorological users from sources other than direct broadcast. The study took in to account the collection, combining and distribution of multiple sources of hyrometeorological data. These sources include the polar, geostationary and selected research satellites data. In addition, NOAA is planning to include information from EUMETSAT and JMA satellites.

ADM will function as a supplement to Direct Readout broadcast systems from environmental satellites, given that Direct Readout broadcast systems do not have sufficient bandwidth to handle the greatly increasing data rates of the future. ADM can be accomplished via Digital Video Broadcasting – Satellite (DVB-S), landlines, and/or Internet infrastructures, depending on the connectivity available to the user. NOAA will review data dissemination methods in current and planned systems with particular attention to connectivity with end-users. Also, NOAA plans to investigate broadcast systems similar to ADM. These investigations will be performed in order to avoid replicating the functionality of other dissemination systems, take advantage of technologies employed by other dissemination systems, and begin the process of building interface standards with other dissemination systems. This will provide the basic architectures necessary to continue future work in ADM frame structures, functions, interfaces and performance criteria in terms of meeting end-users' needs. Such needs will vary depending upon service level agreements between the users and service providers, and will include issues regarding coverage, capacity, availability, applications, protocols, Quality of Service (QoS), and affordability.

Responding to a query from WMO, NOAA confirmed that other products could also be added to the broadcasts in due course, together with data from other satellite systems.

In WMO-WP-20, CGMS was informed of the development and status of the WMO Space Programme Implementation Plan. CGMS noted that it had been reviewed at the fourth session of the WMO Consultative Meetings on High-level Policy on Satellite Matters (CM-4). One particular section in the Implementation Plan related to an integrated global data dissemination service. CGMS noted that an integrated global data dissemination service could also serve as the core of the new data exchange and dissemination component of the Global Earth Observing System of Systems (GEOSS) presently being developed within the ad hoc intergovernmental Group on Earth Observations (GEO). WMO added that it welcomed any comments from CGMS members relating to the implementation plan for the global data dissemination service and the new data exchange and dissemination component of the GEOSS.

NOAA commented that it welcomed the proposals set out in the WMO-WP-20 adding that they would serve as valuable guidelines when establishing future data dissemination services.

ROSH-WP-05 presented information on status and development plans of Roshydromet/SRC Planeta system for operational satellite images and products dissemination.

The major components of the Roshydromet's ground segment are three Main Regional satellite data receiving and processing Centres at different locations: European (Moscow, SRC Planeta), Western-Siberian (Novosibirsk) and Far-Eastern (Khabarovsk). The ground segment also includes the network of APT, HRPT and WEFAX receiving stations. The visibility circles of these Centres cover the whole territory of Russia as well as Baltic States and major part of Europe. Present SRC Planeta receiving facilities provide on a regular basis the data acquisition from geostationary (Meteosat-7 and Meteosat-5, GOES-E, GOES-W, GOES-9 via Meteosat-7) and polar-orbiting (Meteor-3M N 1, NOAA series, EOS/Terra/Aqua) satellites.

SRC Planeta provides satellite information products for more than 60 users. The operational products are disseminated via widespread network of various communication channels. Since the Hydrometeorological Centre of Russian Federation (one of the main users) is integrated into SRC PLANETA computer network it has the direct access to operational images and products. Various territorial departments of Roshydromet as well as others Federal, regional and local levels users have an access to operational products via on-line systems: websites (http://planet.iitp.ru, http://sputnik1.infospace.ru), FTP server, e-mail server. Hydrometeorological services of Republic Moldova and Uzbekistan have got operational satellites products via FTP server and e-mail server. Clouds nephanalysis maps (derived from NOAA/AVHRR data) and tropical cyclones co-ordinates (derived from acquired geostationary and polar-orbiting satellite data) are disseminated via GTS.

In the near future the following primary factors will specify the development of Roshydromet/SRC Planeta dissemination system:

- Transition to new digital standards of direct broadcast – LRIT, HRIT, LRPT, AHRPT;
- The forthcoming launches of new environmental satellites (including R & D satellites) should provide data direct X-band frequencies broadcast in non-standard formats;
- Intensive development of ground and satellites communication systems.

As for Roshydromet, it is intended to develop the satellite's products dissemination facilities on the basis of on-line systems (websites, FTP server, e-mail server) as well as to investigate the possibilities of TV and others satellite communication systems. The forthcoming geostationary meteorological satellite GOMS/ELECTRO N2 will be used for the exchange of various satellites image data and products between Regional Centres of Roshydromet.

JMA-WP-08 reported on the current practice of satellite data handling at JMA relating to the GCOS (Global Climate Observing System) climate monitoring principles, and responded to Action 31.32. JMA recalled that GCOS had proposed "Climate Monitoring Principles (hereinafter referred to as CMPs)" at CGMS-XXX.

JMA has operated a series of geostationary meteorological satellites for more than 25 years since 1977 and has acquired earth image data continuously. The images have been used for climate monitoring as well as weather watch. JMA will continue to operate geostationary satellites, and to provide users with the data obtained from the satellite.

The working paper described the current activities of JMA with respect to the CMP preface and articles 11 – 20, to which satellite systems for climate monitoring should adhere.

In JMA-WP-09, JMA updated the plan on image data dissemination both through satellite and Internet means, in consideration of the current status of GMS-5 and the forthcoming launch of MTSAT-1R/2, and following the wide popularity and rapid development of Internet technology in recent years. JMA considers to take advantage of

the Internet as a backup dissemination service of the direct broadcasting from the satellite, as data dissemination through the Internet with use of off-the-shelf components would allow users to easily adapt to the current and future growth in the dissemination system and also would become one of the solutions to the actions enabling the Alternative Dissemination Mechanism (ADM) implementation. The working paper included information on:

- Broadcasts to Medium-scale Data Utilization Stations (MDUSs) from the satellite;
- Broadcasts to Small-scale Data Utilization Stations (SDUSs) from the satellite;
- The provision of data to NMHSs through the Internet;
- The provision of data and information to the public through the Internet.

WMO-WP-22 informed CGMS Members that it was expected that the WMO Executive Council, at its fifty-sixth session from 8 to 18 June 2004, would establish an Inter-Commission Group on the Future WMO Information System FWIS. Additionally, CGMS was informed that an initial questionnaire had been sent to the presidents of WMO Technical Commissions seeking information from WMO Technical Commissions about their respective WMO Programmes requirements and systems, at present and for the foreseeable future for FWIS. Responses were expected before 1 September 2004 and would be made available to CGMS.

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

See also EUM-WP-20 describing EUMETCast developments above.

In NOAA-WP-33, NOAA informed CGMS that it had developed 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. The working paper summarised this effort including the advanced technologies employed by the prototype station.

The development effort is proceeding to further extend the MCUT capabilities. Additional meteorological services will be addressed. 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 than 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. Because 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 antenna 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 beam width; 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 specification of the MCUT would be published in due course together with reference documentation and a list of potential manufacturers.

WMO commended NOAA on its development of a low cost user reception capability, adding that in its view, the concept of ADM was not to replace direct broadcast from meteorological satellites, but to complement them, and to bring access to data to a wider user community.

NOAA-WP-31 discussed a transition and implementation plan for the LRIT transmissions that are in the process of commencing on the GOES spacecraft.

Testing of the LRIT Product Processing System live through the GOES-12 satellite ended on 7 October 2003. NOAA began operational transmissions of the LRIT data on 7 October 2003 at 00Z, in a timesharing mode with the WEFAX service. NOAA plans to do timesharing between WEFAX and LRIT on individual spacecraft for a limited time period (e.g., 1 to 2 years) followed by a full transition. The transition from existing WEFAX services to the new LRIT services has considered the requirements and concerns of the existing user communities as well as the availability of NOAA resources (e.g. satellites, ground communications and control systems, and personnel).

Further, the LRIT transition is described as a period of parallel operations for each of the two GOES satellites where both WEFAX and LRIT services would be simultaneously broadcast (i.e. timeshared on the GOES I-M transponder) for a specified transition period, followed by a full and permanent transition to full LRIT services. Currently, using the GOES-East (GOES-12) satellite, NOAA's LRIT data transmissions are scheduled and taking place daily from [HH:45 to HH+1:14] and WEFAX data from [HH:14 to HH:45].

Now that the LRIT is operating regularly in the timesharing mode for the GOES-East satellite, the immediate plans include completing the transition on GOES-East and beginning the transition on GOES-West in 2004. Ultimately, WEFAX will be replaced with LRIT by the end of 2005.

WMO expressed its appreciation to NOAA for its efforts in establishing a user-accommodating WEFAX to LRIT transition plan.

Concluding the discussion, the Chairman remarked that he was pleased to see a significant presence of HRIT/LRIT, A-HRPT and LRPT in existing and upcoming meteorological satellite systems.

The Chairman noted that it was clear that CGMS Members are actively considering the issue of alternative dissemination, and how it fits in with existing and planned developments. Finally, he noted that the GEO initiative and the concept of an integrated global dissemination service seems to be attracting more attention and which will be a very interesting development for those considering future dissemination systems.

G. FINAL SESSION

G.1 Appointment of Chairman of Final Session

Dr. Donald Hinsman was elected as the Chairman of the Final Session, with Dr. Dyaduchenko as Co-chairman.

G.2 Reports from the Working Groups

Reports from the four working groups were presented by Mr. Robert Wolf (WG I on Telecommunications), Dr. Paul Menzel (WG II on Satellite Products), Dr. Donald Hinsman (WG III on Global Contingency Planning) and Mr. Michael Williams (WG IV on Integrated Strategy on Data Dissemination from Meteorological Satellites).

The Senior Officials 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. The senior officials 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

In WMO-WP-18, CGMS was informed that the next WMO Consultative Meeting on High-level Policy on Satellite Matters would be held in Geneva, Switzerland in 2005 at a date to be announced later. All satellite operators were invited to this meeting in their own right. The Director-General of EUMETSAT was designated to represent CGMS at the Fifty-sixth Executive Council of WMO (EC-LVI), Geneva, 8 - 18 June 2004 and Fifty-seventh Executive Council of WMO (EC-LVII), Geneva, 7 - 17 June 2005.

Mr. Robert Wolf was nominated to represent CGMS at the next SFCG meeting in September 2004.

G.4 Nomination of Chairmen of Working Groups for CGMS XXXIII

With regard to the meetings of the Working Groups at CGMS XXXII, it was agreed that:

- Mr. Robert Wolf will chair Working Group I on Telecommunications, with Mr. Gordon Bridge as Rapporteur.
- Working Group II on Satellite Products including Satellite-Derived Winds will be chaired by a designated representative of JMA with Dr. Johannes Schmetz and Dr. Paul Menzel acting as Rapporteurs.
- Working Group III on CGMS Global Contingency Planning will be chaired by Mr. Gary Davis and Dr. Donald Hinsman will act as Rapporteur.

- Working Group IV on Integrated Strategy for Data Dissemination from Meteorological Satellites will be chaired by Mr. Mikael Rattenborg, with Mr. Gordon Bridge as Rapporteur.

G.5 Any Other Business

WMO reported in WMO-WP-21 that at CGMS-XXXI, WMO proposed that CNES be considered for full membership in CGMS. In view of the unanimous decision by CGMS-XXXI, CNES was invited to become a full member and has responded by accepting the invitation from the CGMS Secretariat. WMO noted that China's National Space Agency (CNSA) and the Korean Meteorological Administration (KMA) and the Korea Aerospace Research Institute (KARI) had also expressed an interest to participate in the space-based component of the Global Observing System at CGMS XXXI. However, no further indications had been received from CNSA, KMA or KARI. CNSA attended the fourth session of the WMO Consultative Meetings on High-level Policy on Satellite Matters, as well two representatives from the Korea Meteorological Administration.

The Secretariat recalled the two possible ways to become a Member of CGMS as stipulated in the CGMS Charter:

1. Organisations operating meteorological satellites and prospective operators having a clear commitment to develop and operate such satellites could join CGMS directly.
2. Space agencies operating either operational or R&D systems that have the potential to contribute to WMO and supported programmes could join through WMO, i.e. through first making a commitment to participate in the space-based component of the Global Observing System (GOS).

KMA indicated its intention to become a member by CGMS XXXIII, after declaring its intention to make the Korean satellite data available to the WMO space-based GOS. KARI would consider this eventuality in the longer term.

In WMO-WP-27, CGMS Members were informed of activities related towards the development of a comprehensive, coordinated and sustained Earth observation system or systems covering various sciences, disciplines and related issues facing our planet. This activity has been conducted by the ad hoc intergovernmental Group on Earth Observation (GEO) within which WMO is a participating organisation. CGMS noted that as of 1 May 2004, there had been four sessions of GEO (GEO-1 through -4) and two Earth Observation Summits (EOS-I and -II). Summaries of each of the sessions and summits were provided to CGMS Members.

G.6 Summary List of Actions from CGMS XXXII

(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.

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.

3. 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.

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

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

6. All CGMS satellite operators to review the Transition Tables for LRIT/LRPT and provide any updates as appropriate at every CGMS plenary meeting.

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.

8. CGMS satellite operators to update table 7 (formerly table 5) for polar-orbiting satellite equator crossing times on an annual basis.

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

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

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

New permanent actions

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).

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

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

(ii) Actions from CGMS XXXI

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.

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.

31.08 CGMS Members to consider continued geostationary coverage over the Indian Ocean beyond 2005 in order to provide WMO Members the necessary satellite data in support of their national mandates. **New deadline for EUMETSAT: 30 June 2004**

31.09 CGMS Members to consider processing of data from functioning satellite instruments for as long as possible. **New deadline for EUMETSAT: 30 June 2004**

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 webpage. (3) CGMS Members to provide information to the IPWG Rapporteur on areas for future consideration by the IPWG. **New deadline: 31 October 2004**

31.49 WMO to report on the output of the questionnaire on dissemination requirements to CGMS. **New deadline: 30 November 2004**

(ii) Actions from CGMS XXXII

32.01 The CGMS Secretariat to request observer status in the THORPEX ICSC. **Deadline: 30 June 2004**

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. **Deadline: 31 July 2004**

32.03 CGMS Members to provide points of contact responsible for updating the CGMS Consolidated Report. **Deadline: 30 June 2004**

32.04 CGMS Members to send inputs to the CGMS Consolidated Report to the CGMS Secretariat. **Deadline: 31 August 2004**

32.05 KMA to inform WMO whether the national payload of COMS could become part of the space-based GOS. **Deadline: 30 June 2004**

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 XXXIII**

32.07 NOAA to report back on the analysis of study results concerning potential interference between polar orbiting meteorological satellites. **Deadline 31 December 2004.**

32.08 The CGMS Secretariat to study the feasibility of using IDCS channels I25 and I26 simultaneously in the Russian and USA regions. **Deadline: 30 October 2004**

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 XXXIII accordingly. **Deadline: CGMS XXXIII**

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

32.11 (1) CGMS Members to identify key calibration publications. (2) Calibration papers from CGMS Members should be posted on a CGMS website by the CGMS Secretariat. **Deadline: 31 July 2004**

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. **Deadline: 12 October 2004**

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. **Deadline: CGMS XXXIII**

32.14 CGMS Members are encouraged to present working papers on NWP utilisation of cloud affected radiances at CGMS XXXIII. **Deadline: CGMS XXXIII**

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-XXXIII 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). **Deadline: CGMS XXXIII**

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 CGMSXXXIII. **Deadline: CGMS XXXIII**

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. **Deadline: CGMS XXXIII**

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 Utilization and Products (ET-SSUP). (2) CGMS Members to report on their capability and plans for fire products and their availability at CGMS XXXIII**. Deadline: CGMS XXXIII**

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. **Deadline: 15 June 2004**

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**. Deadline: CGMS XXXIII**

32.21 Each CGMS satellite operator to provide a point of contact for updating the WMO report resulting from CGMS XXXII WMO-WP-26. **Deadline: 31 May 2004**

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 XXXII WMO-WP-26. **Deadline: 30 September 2004**

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 XXXII WMO-WP-26 and submit to R&D agencies for validation and update. **Deadline: 31 October 2004**

32.24 R&D agencies to validate, update and provide response related to action 32.23 to WMO (Dr. Bizzarri: bibizzar@tin.it). **Deadline: 30 November 2004**

G.7 Approval of Draft Final Report

The Senior Officials, together with the plenary, 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 three weeks later, after which time the Final Report will be published and distributed by the Secretariat. It was further agreed that the final version of the report would be provided to participants via electronic mail and via CD-ROM which would also contain all CGMS XXXII Working Papers and presentations.

G.8 Date and Place of Next Meeting

CGMS was pleased to accept an offer from JMA and JAXA to host CGMS XXXIII in Japan in 2005, at a location close to Tokyo, and at a date to be announced later. CMA offered to host CGMS XXXIV in China in 2006, at a date and a place to be decided.

The Chairman thanked all participants for their cooperation and fruitful participation in the thirty-second meeting of CGMS, adding that there had been many important and interesting discussions during the working group and plenary sessions. He also thanked the Rapporteurs and Secretariat for preparing the Final Report. The participants thanked Russia for hosting the meeting in such an interesting and beautiful place as Sochi and for organising it so well in cooperation with the CGMS Secretariat. Special appreciation was also expressed to Dr. Mohr, who will retire at the end of July 2004. CGMS Members thanked him warmly for all his work within CGMS and his support and guidance, which had significantly shaped the development of CGMS over the past several years. The meeting was adjourned at 13.15 hours on 20 May 2004.

ANNEXES:

AGENDA OF THE 32ND CGMS MEETING
17 – 20 May 2004

---------- 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 7th 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

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 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 CGMS XXXIII
G.5 Any Other Business
G.6 Summary List of Actions from CGMS XXXII
G.7 Approval of Draft Final Report
G.8 Date and Place of Next Meetings

WORKING PAPERS SUBMITTED TO CGMS-XXXII

ESA

ESA-WP-01	Status of the current ESA Earth Observation Missions	B.3
ESA-WP-02	Status of the Future ESA Earth Observation Missions	C.3
ESA-WP-03	Status of NRT access to ENVISAT & ERS selected products	B.3
ESA-WP-04	Oceanographic information provided by ERS & ENVISAT	II/4
ESA-WP-05	ESA's contribution to the WMO training events	F.4
ESA-WP-06	Bibliography of calibration papers/reports for MERIS and AATSR on ESA's ENVISAT	II/2
ESA-WP-07	Workshop on Inter-comparison of large scale optical sensors at ESA ESTEC in October 2004 - Plans to extract experiences using large scale R&D sensors to improve calibration of operational sensors.	II/2
ESA-WP-08	Status of ESA programs contributing to precipitation estimates	II/4
ESA-WP-09	Status of implementation of GCOS Climate monitoring principles by ESA	F.5 or III/5
ESA-WP-10	Status of ESA activities related to a MW sounder from GEO orbit	III/2
ESA-WP-11	Status of activities at ESA regarding Alternative Dissemination Methods	IV/1
ESA-WP-12	Review of Action Items	A.5

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 Preparation of MSG-2, MSG-3, 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 and Problems of the IDCS	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	Activities relating to implementation plan for the Virtual Laboratory	F.4
EUM-WP-11	Proposal for a new structure of the CGMS Consolidated Report	F.5
EUM-WP-12	Evaluation of the MSG/SEVIRI solar calibration reference with respect to other radiometers	II/2
EUM-WP-13	Status Report on EARS	II/3
EUM-WP-14	Derivation of global surface albedo maps from geostationary weather satellite	II/4
EUM-WP-15	Creation of a BUFR Master Table for Satellite Data	II/5
EUM-WP-17	A bibliography on Meteosat calibration	II/2
EUM-WP-18	Report on the plans for the International Geostationary Laboratory	III/5
EUM-WP-19	Report on potential problems for operational orbit scenarios caused by frequency overlap issues due to increased dissemination bandwith on NPOESS L-band	I/1
EUM-WP-20	Status Report on EUMETCast	IV/1&2

EUM-WP-21	Updates on the implementation process of Short Range Radars in Europe	I/1
EUM-WP-22	Expansion of the Met Sat Frequency Allocation in the Band 18 GHz	I/1

INDIA

IND-WP-01	Current status of INSAT and KALPANA-I (METSAT) satellites for meteorological applications	B.2
IND-WP-02	Future plans for INSAT satellites for meteorological applications	C.2

IOC/UNESCO

IOC-WP-01	Satellite Requirements of IOC	E.3

JAPAN - JAXA

JAXA-WP-01	Status of the current JAXA Earth Observation Missions	B.3
JAXA-WP-02	Status of the future JAXA Earth Observation Missions	C.3
JAXA-WP-03	GOSAT Mission Objectives *(sent after meeting)*	C.3

JAPAN - JMA

JMA-WP-01	Review of Action Items from Previous CGMS Meetings	A.5
JMA-WP-02	Status of Geostationary Meteorological Satellite	B.2
JMA-WP-03	Plan on the Multi-Functional Transport Satellites	C.2
JMA-WP-04	Status of the GMS IDCS	I/3.1
JMA-WP-05	Preparatory activities for WRC-07	I/1
JMA-WP-06	Activities of JMA on Virtual Laboratory	F.4
JMA-WP-07	Status of Atmospheric Motion Vector	II/7.2
JMA-WP-08	Review of Current Satellite Data Application in view of Climate Monitoring Principles	IV/1.1
JMA-WP-09	Overview of the Image Data Dissemination	IV/1.1

PEOPLE'S REPUBLIC OF CHINA - CMA

PRC-WP-01	Review of Action Items	A.5
PRC-WP-02	Current Status of FY-1 Polar Orbiting Satellites Meteorological Satellite	B.1
PRC-WP-03	Current status of FY-2 Geostationary Satellites	B.2
PRC-WP-04-01	Development of FY-3A Meteorological Satellite, Mission and Instruments	C.1
PRC-WP-04-02	Development of FY-3A Meteorological Satellite, Data Transmission	C.1
PRC-WP-05	Geostationary Meteorological Satellite FY-2C	C.2
PRC-WP-06	Calibration for FY Meteorological Satellites	II/2
PRC-WP-07	Destripe Multi-Sensor Imaging Spectrometer Data	

RUSSIAN FEDERATION - ROSAVIAKOSMOS

ROSS-WP-01	Future Polar–Orbiting Meteorological Satellite Systems	C.1
ROSS-WP-02	Future Geostationary Meteorological Satellite Systems	C.2
ROSS-WP-03	Future Research and Development Satellite Systems	C.3

RUSSIAN FEDERATION – ROSHYDROMET

ROSH-WP-02	Status of Russian polar orbiting meteorological satellite system	B.1
ROSH-WP-03	Roshydromet DCS current status and development plans	I/3
ROSH-WP-04	Satellite products and application: Roshydromet activities	II/4
ROSH-WP-05	Roshydromet's system for dissemination of operational satellite images and products	IV/1.4

USA - NASA

NASA-WP-01	Action 31.10: R&D satellite operators are encouraged to make their data available for routine near real time.	E.1
NASA-WP-02	Action 31.04 New members of CGMS to provide information on their R&D satellites.	B.3& C.3

USA - NOAA

NOAA-WP-01	Review CGMS XXXI Action Items	A.5
NOAA-WP-02	Polar Orbiting Operational Environmental Satellite (POES)	B.1
NOAA-WP-03	Geostationary Operational Environmental Satellite (GOES)	B.2
NOAA-WP-04	Anomalies from Solar Events	B.4
NOAA-WP-05	Future Polar Orbiting Meteorological Satellite System	C.1
NOAA-WP-07	Report on the status of future Geostationary Meteorological Satellite System	C.2
NOAA-WP-08	Geostationary Satellite Coverage for the Pacific Region	D.1
NOAA-WP-09	Sounder Support for the Southern Hemisphere from GOES-9	D.2
NOAA-WP-10	Geostationary Coverage over the Indian Ocean Beyond 2005	D.3
NOAA-WP-11	Processing of Satellite Data from Functional Satellites	D.3
NOAA-WP-12	Consideration of IOC Satellite Requirements	E.1
NOAA-WP-13	Implementation Plan for the Virtual Laboratory	F.4
NOAA-WP-14	NOAA Support for the CGMS Virtual Laboratory Focus Group (Session II)	F.4
NOAA-WP-16	Input to the WMO Database for Satellite Receiving Equipment	F.5
NOAA-WP-17	Requirements for the Temporary Use of IDCS Channels	I/3.1
NOAA-WP-18	Status and Problems of IDCS	I/3.1
NOAA-WP-19	NOAA Bibliography of Calibration Papers/ Reports	II/2
NOAA-WP-20	NOAA Experience Using R&D Sensors	II/4
NOAA-WP-21	NOAA Inventory of Routinely Produced Precipitation Estimates	II/4
NOAA-WP-22	NOAA Review of Satellite data BUFR Descriptors in WMO Codes Forms	II/5
NOAA-WP-23	NOAA Review of Metadata Recommendations	II/6

NOAA-WP-24	Review of the GCOS Climate Monitoring Principles	II/6
NOAA-WP-25	IWW7 Report on the Derivation of AMVs from High Spectral Soundings	II/3
NOAA-WP-26	Windsat Coriolis Evaluation	II/3
NOAA-WP-27	2001/2002 Report 0n NOAA/NESDIS GOES Soundings	II/3
NOAA-WP-28	2001/2002 Report on NOAA/NESDIS Satellite Derived Winds	II/7.4
NOAA-WP-29	Geostationary Imagers Upgrades for 2015 Timeframe	III/1
NOAA-WP-30	International Geostationary Laboratory	III/5
NOAA-WP-31	The Current Status of the GOES LRIT Service	IV/1
NOAA-WP-32	NOAA Evaluation of NPPOES L-band Frequency Overlap	IV/1.1
NOAA-WP-33	Multi-Constellation User Terminal (MCUT) Development	IV/2
NOAA-WP-34	NOAA proposed Alternative Dissemination Methods (ADM) System	IV/2

WMO

WMO-WP-01	CGMS satellite ground receiving database	F.5
WMO-WP-02	Review of action items 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/III
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	ASDAR status report	I/3.3
WMO-WP-12	Tropical Cyclone Programme requirements	E.1
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 Commission	E.2
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	WCRP Satellite Working Group	II/4
WMO-WP-20	Alternative Dissemination methods	IV/1
WMO-WP-21	CGMS Membership expansion and expanded space-based component of the Global Observing System	G.5
WMO-WP-22	FWIS	G.5
WMO-WP-24	WMO Global Education and Science Network (GESN)	F.5
WMO-WP-25	Global Climate Observing System (GCOS)	F.5
WMO-WP-26	Status of the Space-Based Component of the Global Observing System (GOS)	D.1
WMO-WP-27	Ad Hoc Intergovernmental Group on Earth Observations (GEO)	G.5
WMO-WP-28	THORPEX, A Global Atmospheric Research Programme	E.2

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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. List of Abbreviations and Acronyms

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 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,

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

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 XXXI 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 down-link 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:

EUMETSAT	joined 1987, currently CGMS Secretariat
India Meteorological Department	joined 1979
Japan Meteorological Agency	founder member, 1972
China Meteorological Administration of the PRC	joined 1989
NOAA/NESDIS	founder member, 1972
Hydromet Service of the Russian Federation	joined 1973
WMO	joined 1973
IOC/UNESCO	joined in 2001
ESA	re-joined in 2003
NASA	joined in 2003
JAXA	joined in 2003
Rosaviakosmos	joined in 2003
CNES	joined in 2004

In some cases delegates are supported by other Agencies, for example SRC Planeta (with Hydromet Service of the Russian Federation) and ISRO (with India Meteorological Department).

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Appendix 7

LIST OF ABBREVIATIONS AND ACRONYMS

AAPP	Advanced ATOVS Processing Package
AboM	Australian Bureau of Meteorology
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
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
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
Aqua	Earth's water cycle observing mission (NASA)
Aquarius	global sea surface salinity measuring mission (NASA)
AOPC	Atmospheric Observation Panel for Climate (GCOS)
APT	Automatic Picture Transmission
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
BBC	Black Body Calibration (Meteosat)
BCCP	Business Continuity and Contingency Plan (USA)
BUFR	Binary Universal Form for data Representation
CAL	Computer Aided Learning
CALIPSO	Cloud-Aerosol Lidar and Infrared Pathfinder Satellite (NASA/CNES)
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
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
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
CMD	Cyclone Warning Dissemination Service
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
CNSA	China National Space Administration
COOP	Coastal Oceans Observations Panel (GOOS)
COP	Conference of the Parties (GCOS)
COSPAR	Committee on Space Research
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
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)
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
EBB	Electronic Bulletin Board
EC	Executive Council (WMO)
ECP	European Common Proposal (CEPT)
ECT	Equator crossing time
ECMWF	European Centre for Medium-Range Weather Forecasts
EDR	Environmental Data Records (NPOESS)
EEIS	EUMETSAT External Information System
EESS	Earth Exploration Satellite Service (Frequency Management)
EMWIN	Emergency Manager Weather Information Network (NOAA)
ENVISAT	ESA future polar satellite for environment monitoring
EO	Earth Observation
EOS	Earth Observation System
EPS	EUMETSAT Polar System
ERBE	Earth Radiation Budget Experiment
ERBS	Earth Radiation Budget Satellite (NASA)
ERS	ESA Remote Sensing Satellite
ESA	European Space Agency
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-SAT	OPAG IOS Expert Team on Satellite Systems (WMO)
ET-SUP	OPAG IOS Expert Team on Satellite Utilisation and Products (WMO)
EU	European Union
EUMETSAT	European Meteorological Satellite Organisation
FAA	Federal Aviation Authority (USA)
FAO	Food and Agriculture Organisation (UN)
FAX	Facsimile
FOV	Field of View (NOAA)
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 Progr.)
GCOM	Global Change Observation Mission (NASDA)
GCOS	Global Climate Observing System
GDPT	Chinese Delayed Picture Transmission Format (Global Data) (FY-1C)
GEO	inter-governmental Group on Earth Observation

GEOSS	Global Earth Observation System of Systems
GESN	Global Education and Science Network
GIFTS	Geosynchronous Imaging Fourier Transform Spectrometer (GOES-R)
GIMTACS	GOES I-M Telemetry and Command System
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.)
GOOS	Global Ocean Observing System
GOS	Global Observing System
GOSAT	Greenhouse Gases Observing Satellite (JAXA/Jap. Ministry of Env.)
GSLMP	Global Sea Level Monitoring Programme
GPCP	Global Precipitation Climatology Project
GPM	GRAs GOOS Regional Alliances
GPM	Global Precipitation Measurement (JAXA/NASA)
GPS	Global Positioning System
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
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
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
IDN	International Directory Network (CEOS)
IDPS	Interface Data Processing Segment (NPOESS)
IFRB	International Frequency Registration Board
IGACO	Integrated Global Atmospheric Chemistry Observations (IGOS)
IGL	International Geostationary Laboratory
IKFS-2	advanced IR atmospheric sounder
IMT-2000	International Mobile Telecommunication 2000 (before FPLMTS)
INSAT	Indian geostationary satellite
IOC	Intergovernmental Oceanographic Commission (UNESCO)
IOP	Initial Operations Phase (SAF, EUMETSAT)
IPO	Integrated Program Office (NOAA)
IPOMS	International Polar-orbiting Meteorological Satellite Group
IPWG	International Precipitation Working Group
IQGSE	Image Quality Ground Support Equipment (EUMETSAT)
IR	Infrared
IRTS	Infrared Temperature Sounder (EPS)
IRW	Infrared Window
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
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
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 Intitute
KLIMAT	scanning Infrared radiometer on Meteor-3M N1 (Russia)
KMA	Korea Meteorological Administration
LAN	Local Area Networks (Telecommunication)
Landsat	NASA Earth observing Satellite
LDCM	Landsat Data Continuity Mission (NASA/US Geological Survey)
LDPT	Chinese Delayed Picture Transmission Format (Local Data Coverage) FY-1C
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
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)
MERIS	Medium Resolution Imaging Spectrometer (ENVISAT)
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)
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 (Rosaviakosmos)
MPEF	Meteorological Products Extraction Facility (EUMETSAT)
MSC	Meteorological Satellite Centre (Japan)
MSC-CAL	Computer Aided Learning system by MSC/JMA
MSG	Meteosat Second Generation
MSMR	Multichannel Scanning Microwave Radiometer (OCEANSAT-1=
MSS	Mobile Satellite Services (frequency regulation)
MSU	Microwave Sounding Unit
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)
MWR	Microwave Radiometer (ERS, ESA)
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
NMC	National Meteorological Centre
NMHS	National Meteorological & Hydrological Service

NMP EO-1	New Millenium 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
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
PROBA	Project for On-Board Autonomy (ESA EO satellite)
PTT	Post Telegraph and Telecommunications authority
QI	Quality Indices (EUMETSAT)
QuickSCAT	Quick Scatterometer (NASA)
RA	Regional Association of 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 (Rosaviakosmos)
RFI	Radio Frequency Intereference
RLAN	new wireless LANs
RMS	Root Mean Square
RMTC	Regional Meteorological Training Centre (WMO)
Rosaviakosmos	Russian Aviation and Space Agency
RSB	Reflective Solar Bands (MODIS NOAA)

RSMC	Regional Specialised Meteorological Centre
RSO	Rapid Scan Operations (NOAA)
RSS	Rapid Scan Service (EUMETSAT)
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
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)
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
SICH-1M	Russian oceanographic satellite (Rosaviakosmos)
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)
SRF	Spectral Response Function
SRR	Short Range Radar (frequency management)
SRS	Space Research Service (frequency regulation)
SRTM	Shuttle Radar Topography Mission (NASA)
SSM/I	Special Sensor Microwave/Imager (India)
SSP	Sub-Satellite Point
SST	Sea Surface Temperature
SSU	Stratospheric Sounding Unit
STC	semi-transparent correction (NOAA)
S-VISSR	Stretched VISSR
SXI	Solar X-Ray Imager (GOES-12)
TERRA	Earth climate measuring satellite (NASA)
TD	Technical Document
TIROS	Television Infrared Observation Satellite
THORPEX	International global atmospheric r & d programme (WMO CAS)
TOMS	Total Ozone Mapping Spectrometer (NASA)
TOR	Terms of Reference

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
UNISPACE	Third 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
VHF	Very High Frequency
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
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)
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)