REPORT OF THE 31ST MEETING OF THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES

CGMS XXXI

Ascona, Switzerland
10-13 November 2003

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FINAL REPORT OF THE PLENARY SESSION

A. INTRODUCTION

A.1 Welcome

The plenary session of CGMS XXXI was opened by Dr. D.E. Hinsman, WMO, at 8:00 a.m. on 12 November 2003 in the Centro Stefano Franscini in Ascona, Switzerland. Dr. Hinsman welcomed all participants warmly to the beautiful area of Monte Verità adding that it was especially an honour to welcome the new CGMS Members ESA, Rosaviakosmos, JAXA and NASA.

For the first time the China National Space Administration and the Korea Aerospace Research Institute were present as observers.

A.2 Election of Chairmen

Dr. Hinsman was unanimously elected as Chairman of CGMS XXXI. 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. R.C. Bhatia for Working Group II on Satellite Products, with Dr. Paul Menzel acting as Rapporteur; Mr. Xu Jianmin for Working Group III on Satellite-Derived Winds, with Dr. Johannes Schmetz as Rapporteur; Dr. Tillmann Mohr as Chairman for Working Group IV on Contingency Planning, with Dr. Donald Hinsman as Rapporteur; and Mr. Mikael Rattenborg, Chairman of Working Group V on Integrated Strategy for Data Dissemination from Meteorological Satellites.

A.3 Adoption of Agenda

The agenda (see annex 1) was adopted. The meeting recalled that the five working groups had met previously on 10 and 11 November 2003.

The Secretariat provided a list of working papers submitted to CGMS XXXI (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-11, EUM-WP-01, IND-WP-01, JPN-WP-01, PRC-WP-01, RUS-WP-01, USA-WP-01 &-04 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.

   Ongoing.

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.

   Ongoing. Updated information will be distributed after CGMS XXXI.

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.

   Ongoing.

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

   Ongoing for EUMETSAT, Russia, NOAA. Not relevant for India.

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

   Ongoing. See ESA-WP-10, USA-WP-04.

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

   Ongoing.

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.

   Ongoing. Updates received from EUMETSAT, NOAA, India, Japan. See EUM-WP-06.

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

   Ongoing.

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

   Ongoing.

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

Ongoing.

(ii) Actions from CGMS XXX

30.01 India to provide CGMS with information describing the data communication mission on METSAT, adding Noise Equivalent Delta Temperature (NEDT) values to the tables included in the document.

Closed. *Information was provided in an email on 17/03/03.*

30.02 USA to provide CGMS Members with detailed technical information (when available) on NPOESS receiving stations to enable them to prepare their ground segments in advance.

Closed. *See USA-WP-06.*

30.03 CGMS Members to provide information on the data content (including processing level) of direct broadcast (DB) services (including data on equator crossing time) for each polar-orbiting satellite, by CGMS XXXI.

Closed *for EUMETSAT, NOAA. See EUM-WP-07, USA-WP-08.*

30.04 India, China and the Russian Federation to take into account the Tropical Cyclone Committee's request to consider the possibility of continuing and implementing, on a permanent basis, geostationary coverage of the Indian Ocean, in order to provide the necessary data in support of the national mandates of WMO Members in the region and to report by CGMS XXXI.

Closed *by Russia (email sent on 16/04/03).*

30.05 At CGMS XXXI, all CGMS Members to report on planned geostationary and low earth orbiting satellite coverage to support WMO's Tropical Cyclone programme, including distribution mechanisms for those data. For low earth orbiting systems, this includes multi-channel imagery and sounding data and products, as well as other relevant measurements and products including sea surface temperature, altimetry, salinity, ocean surface winds and precipitation.

Closed *for ESA, EUMETSAT, JMA, Russia, NOAA. See ESA-WP-04, EUM-WP-08, RUS-WP-03,-04,-08, USA-WP-09. JMA has no plans.*

30.06 WMO to provide CGMS Members with the requirements of the various Tropical Cyclone/Typhoon/Hurrican Committees and Panels.

Closed. *See WMO-WP-12.*

30.07 The second session of the CGMS VL Focus Group, to be held in conjunction with 2003 WMO satellite training event in Barbados, to conduct an initial

assessment of the VL and report back to CGMS XXXI. Satellite operators to support their participation as well as that of their respective Centres of Excellence at the VL Focus Group meeting. .

Closed. *The VL Focus Group meeting will take place on 15-16/12/03 in Barbados. A report of the initial assessment of the VL will be given at CGMS XXXII. See also USA-WP-10.*

30.08 CGMS Members to update their contributions to WMO Publication No. 411.

Closed *for ESA, EUMETSAT, Japan, PRC, Russia, NOAA.*

30.09 In view of the increasing use and importance of operational meteorological satellite data for climate research and monitoring, CGMS is invited i) to consider a review of current practice of satellite operators with regard to the climate monitoring principles from satellites, and ii) to provide pertinent reports at CGMS XXXI meeting.

Closed *for EUMETSAT, Japan, Russia. See EUM-WP-10, RUS-WP-07.*

30.10 CGMS Secretariat to write to ESA, NASA, NASDA and Rosaviakosmos, inviting them as contributors to the space-based component of the GOS, to become members of CGMS.

Closed. *Letters were sent on 15 January 2003. ESA, NASA, NASDA and Rosaviakosmos are joining CGMS.*

30.11 CGMS Secretariat to review the CGMS Terms of Reference to reflect the new membership.

Closed. *See EUM-WP-11.*

30.12 CGMS Members to coordinate with their national frequency authorities to promote CGMS positions on WRC 2003 and WRC-2007 agenda items.

Closed *for ESA, EUMETSAT, Japan, NOAA. See ESA-WP-02, EUM-WP-09, JMA-WP-07, USA-WP-13.*

30.13 CGMS Members are urged to discuss the potential problems caused by car radar systems operating in the band 21–27 GHz with their national frequency administrations.

Closed *for ESA, EUMETSAT, Japan, NOAA. See ESA-WP-03, EUM-WP-13, JMA-WP-07, USA-WP-15.*

30.14 CGMS Members to provide relevant information on frequencies used or planned for use in support of CGMS missions in the Indian Ocean region for triggering a discussion on appropriate coordination by CGMS XXXI.

Closed *for EUMETSAT, NOAA. See EUM-WP-14, USA-WP-20.*

30.15 CGMS Members to update the status of LRIT/LRPT conversion as contained in Tables 7 and 8 for satellites in polar and geostationary orbit.

***Closed** for EUMETSAT, Japan, Russia, NOAA*

30.16 CGMS to establish a standing Working Group, chaired by Mr. M. Rattenborg (EUMETSAT) to develop an overall strategy for convergence of planned ADMs as well as an associated implementation plan.

***Closed.** WG V on integrated strategy for data dissemination has been convened on at CGMS XXXI. See EUM-WP-12.*

30.17 CGMS satellite operators to reaffirm commitment to the AHRPT format for data streams from polar-orbiting satellites.

***Closed** for EUMETSAT, NOAA. Email sent by EUMETSAT to WMO on 21/02/2003 and NOAA on 4/09/03.*

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).

***Ongoing.** Report on FWIS status in WMO-WP-23. See also USA-WP-22.*

30.19 Satellite operators should provide a summary of solar calibration approaches for GEO and LEO sensors (research as well as operational) at the next CGMS. The recent results of Moderate Resolution Imaging Spectroradiometer (MODIS) and MERIS visible calibration should be reported and possible opportunities for intercalibration with other less well calibrated sensors should be explored.

***Closed** for ESA, EUMETSAT, NOAA. See ESA-WP-05, EUM-WP-16. USA-WP-23. JMA is working on this.*

30.20 EUMETSAT to invite scientists participating in CHAMP to submit a report on sounding experiences at CGMS XXXI.

***Closed.** See EUM-WP-17.*

30.21 CGMS should initiate a workshop wherein an inventory of the calibration of all sensors is established (including sensor performance over time, sensor operation, calibration algorithm adjustment, sensor to sensor inter-comparisons, collocated radiosonde observations etc.). Moreover, this workshop should help space agencies to make plans to deploy such methods in current and planned operational systems.

***Closed.** Workshop tentatively to be held in second half of 2004. See EUM-WP-18.*

30.22 Space agencies are invited to report at the next CGMS on their approaches to produce satellite data for climate purposes.

***Closed** for ESA, EUMETSAT**.** See ESA-WP-06, EUM-WP-19.*

30.23 Space agencies are invited to establish focal points to ensure that: (a) ingest and pre-processing code for future advanced instrument (in particular sounders and their complementary imagers) is provided, in a form suitable for use with locally-received direct read-out data, and yielding output consistent with global data, and (b) activities are undertaken to integrate this code into processing packages available for international distribution in a timely manner. In addition, these focal points should provide sensor status, navigation and frequently-updated calibration information in a timely manner to users and developers and facilitate efforts to minimise the differences between the global and local calibrated and navigated data.

***Closed** for EUMETSAT. See EUM-WP-20.*

30.24 Data providers are invited to report at next CGMS on their current use of and plans to use NWP monitoring results in their quality monitoring activities.

***Closed** for ESA, EUMETSAT, NOAA. See ESA-WP-08, EUM-WP-21, USA-WP-24.*

30.25 IPO is invited to inform ITWG members, through the ITWG list server, of the location of draft specifications of raw data records and sensor data records for NPOESS/NPP instruments. The ITWG co-chairs will co-ordinate feedback to IPO from ITWG members on the draft specifications (content and format) for the raw data records and sensor data records for NPOESS/NPP instruments.

***Closed**. See USA-WP-25.*

30.26 WCRP is invited to provide further clarification on the requirements for combined infrared and microwave surface skin temperature products and for climate and ocean applications.

***Closed.** WCRP's response:"The requirement for combined infrared and microwave surface skin temperature products allows all-weather products, whereas the present products based on infrared only are limited to clear sky conditions. Products mentioned in the text are for climate applications and not specific of land surfaces or ocean surfaces, but clearly the methods to derive them are dependent on the type of surface."*

30.27 CGMS Members to provide an inventory of routinely produced precipitation estimates, either operational or experimental/research, to the IPWG co-chairs, Arnold Gruber and Vincenzo Levizzani. A template for the responses can be found on the IPWG website.

***Closed** for EUMETSAT, Japan and NOAA.*

30.28 AOPC is invited to consider the consolidated list of metadata (including time of observation, Earth location, observation angles, spectral channel response, calibration coefficients, and field of view size as well as the associated error in each parameter) and to comment on its adequacy for their applications.

Closed. *See EUM-WP-22, WMO-WP-25.*

30.29 ESA/ESRIN is invited to present a paper at the next CGMS on their approach to science data stewardship.

Closed. *See ESA-WP-07.*

30.30 NOAA/NESDIS is invited to report on the 'auto-nowcaster' at CGMS XXXI.

Closed. *See USA-WP-26.*

30.31 The co-chairs of IWW7 are requested to invite representatives of the regional scale modelling community to the next IWW.

Closed. *The first announcement was recently sent out. Formal invitations for the IWW7 in June 2004 will be sent to representatives of the regional scale modelling community at later stage.*

30.32 IWW7 is invited to establish an inventory of all height assignment methods used for low-, medium- and high-level AMVs.

Closed*. See EUM-WP-24.*

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

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

30.34 CGMS invites WMO's OPAG/IOS to establish jointly with the NWP community reanalysis requirements for reprocessing of satellite data and products.

Closed. *This was discussed at the CBS Management Meeting in October 2003.*

30.35 Roshydromet, JMA and NOAA/NESDIS to discuss usage of some DCS channels on GMS-5 and/or GOES-9 for processing by Roshydromet with the expectation that the DCPs would be part of the World Weather Watch and processing be eventually resumed by GOMS N2. WMO to assist**.**

Closed. *Email was sent by JMA on 27 December 2002 and Russia on 7 February 2003.*

30.36 CMA to confirm its plans for polar-orbiting satellites and in particular its willingness to consider the possibility of using the PM orbit while taking into account its respective national requirements.

Closed. *Email was sent by CMA on 28 April 2003.*

30.37 WMO to inform CBS at its 2002 session in Cairns, Australia and the WMO Congress of the recent new developments in contingency planning by CGMS satellite operators.

Closed. *WMO informed CBS in Cairns and the 14th WMO Congress.*

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.

Ongoing. *This will be an agenda item at next session of OPAG IOS Expert Team on Satellite Systems Utilization planned in 2004. No session has taken place since CGMS XXX due to financial constrains.*

B. REPORT ON THE STATUS OF CURRENT SATELLITE SYSTEMS

B.1 Polar-orbiting Meteorological Satellite Systems

In PRC-WP-02 China reported that FY-1D, launched in May 2002, was operating according to specification. On-board instruments are similar to those of FY-1C. FY-1D transmits Chinese High Rate Picture Transmission (CHRPT) to users world-wide and also transmits GDPT and LDPT, which are received only by the National Satellite Meteorological Center of CMA (NSMC). The working paper included information on the multi-channel Visible and IR Scan Radiometer, which is the primary sensor of FY-1D. Furthermore, it included an update of calibration coefficients.

PRC-WP-03 described the current status of FY-1C. FY-1C, which was launched in May 1999 has been operating for more than four years, exceeding the design lifetime of two years. On 17 October 2002 there was a leakage of attitude control gas from the valve of the gas container which lead to a data broadcast interruption. However, the data transmission had already been recovered by 25 October 2002 and since then the satellite has been operating without any problems.

Russia informed CGMS in RUS-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 on the NOAA polar-orbiting meteorological satellite systems in USA-WP-02. The Polar-orbiting Operational Environmental Satellite (POES) spacecraft constellation includes two primary, one secondary, two stand-by and one post-launch spacecraft. These spacecraft are in circular orbits inclined at approximately 98° (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 stand-by 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 10:17 a.m. ascending node (morning orbit) and carries a Solar Backscatter Ultraviolet Spectral Radiometer (SBUV). On 15 February 2003 DTR5 failed to operate and on 28 April 2003 the STX3 power degraded to 2 Watts. Very recently, there was a failure of the AMSU-A instrument.

NOAA-16 is the secondary afternoon satellite and operates in an orbit with a 13:53 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.

Table 1: Current Polar-Orbiting Satellites Coordinated Within CGMS

(as of 13 November 2003)

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	10:02 (D) 812 km	6/02	Functional.
	NOAA-15 (B)	USA/NOAA	07:04 (D) 810 km	05/98	Functional (problems with AVHRR +HIRS)
	NOAA-12 (B)	USA/NOAA	04:47 (D) 808 km	05/91	Functional (except sounding).
	DMSP-F15 (Op)	USA/NOAA	21:31 (A) 850 km	12/99	Defense satellite. Data available to civilian users through NOAA.
	DMSP-F14 (B)	USA/NOAA	20:14 (A) 852 km	04/97	Defense satellite. Data available to civilian users through NOAA.
	DMSP-F12 (L)	USA/NOAA	18:56 (A) 850 km	08/94	Defense Satellite. Non-operational (no on-board recorders).
	Meteor-3M-N1 (P)	Russia	9:15	10/01	Functional (with limited capabilities).
	ERS-1 (R)	ESA	10:30 (D) 785 km	07/91	Replaced by ERS-2 in 03/00 after an overlapping period
	ERS-2 (R)	ESA	10:30 (D) 785 km	04/95	Due to OB recorder problems in 06/03, the LBR mission is ensured over ESA acquisition stations only.
	ENVISAT (R)	ESA	10:000 (D) 800 km	03/02	
	PROBA (R)	ESA	10: 30 (D) 615 km	10/01	Drifting orbit. Technology experiment. AO Science mission: 2003.
Sun-synchr. "Afternoon" (12:00 –16:00) (00:00 – 04:00)	NOAA-16 (Op)	USA/NOAA	13:53 (A) 851 km	09/00	Functional, no APT.
	NOAA-14 (B)	USA/NOAA	18:07 (A) 847 km	12/94	Functional. One OBP is unusable.
	NOAA-11 (B)	USA/NOAA	22:42 (A) 843 km	09/88	Functional. SBUV data limited.
Sun-synchr. "Early morning" (4:00 - 6:00) (16:00 – 18:00)	DMSP-F13 (Op)	USA/NOAA	18:18 (A) 850 km	03/95	Defense satellite. Data available to civilian users through NOAA.
	FY-1D (Op)	China	08:40 (D) 873 km	5/02	Functional. CHRPT
	FY-1C (B)	China	07:36 (D) 866 km	05/99	Functional. CHRPT

The next POES launch, NOAA-N, is slated for launch in September 2004. This spacecraft will be renamed NOAA-18 once it achieves orbit. Over the last four years, NOAA has successfully converged the operations of the five Defense Meteorological Satellite Program (DMSP) satellites with that of the NOAA POES. The current DMSP constellation consists of two primary, two secondary, and one back-up operational spacecraft. DMSP F-16 was successfully launched on 18 October 2003.

In the subsequent discussion, WMO recommended that satellite operators continue to process the data from older non-prime satellites for as long as possible, as they can still contribute valuable data to the Global Observing System.

China confirmed that it intended to process and archive data from its FY-1C satellite.

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 Second Generation-1 (for routine operations to be renamed Meteosat-8), Meteosat-7, 6 and 5.

Currently the 0° Service is provided by Meteosat-7, with Meteosat-6 as an in-orbit spare, supporting the Rapid Scan Service, at around 10°E. Meteosat-5 is located over the Indian Ocean at 63°E and provides the Indian Ocean Data Coverage (IODC) Service.

The inclination of Meteosat-7 at the end of October 2003 was 0.29° and decreasing. The remaining hydrazine fuel on board is estimated to be 9.60 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 orbital inclination of Meteosat-5 at the end of October 2003 was 6.01° and increasing. The remaining hydrazine fuel on board is estimated to be 4.95 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.

MSG-1 is currently located at 10.5°W. Phase A of the commissioning, comprising the Spinning Enhanced Visible and Infrared Imager (SEVIRI) switch on, instrument check-out and imaging with Image Quality Ground Support Equipment (IQGSE) performance monitoring, was completed in June 2003. Phase B of the commissioning is expected to be completed by the end of 2003. MSG-1 is expected to commence routine operations by the end of January 2004, when it will be relocated to 3.3°W.

As a result of the failure of an on-board solid state power amplifier, there could be no direct broadcast of MSG-1 HRIT and LRIT Services to users. On 30 April 2003 the dissemination of MSG-1 imagery was started to European “trial” users via EUMETCast, using the Hotbird 6 satellite as a carrier (Ku.band), with data being uplinked from the Usingen Ground Station, in Germany. This trial will continue until the start of routine operations at the end of January 2004, with dissemination products being progressively added.

CGMS was provided with a demonstration of a locally received EUMETCast broadcast on 12 and 13 November 2003. Details of the EUMETCast system are also presented in EUM-WP-12.

CGMS noted that there was no capability for providing return channels on EUMETCast.

CGMS further noted that when Meteosat-8 becomes fully operational, it will be relocated to around 3.3°W, Meteosat-7 will remain at 0°, Meteosat-6 will continue its Rapid Scanning Service at 10°E and Meteosat-5 will remain positioned over the Indian Ocean. This service is foreseen until the end of 2005. After the launch of MSG-2 it is likely that Meteosat-5 will be re-orbited.

WMO expressed its appreciation for the EUMETCast service, which would prove especially valuable to African users. WMO encouraged other satellite operators to provide similar broadcast services and work towards establishing a global service.

India reported on the status of INSAT and the METSAT (KALPANA-I) satellites in IND-WP-02.

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 74oE 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 from May, 2003.

Additionally, IND-WP-02 provided a description of the Meteorological Data Dissemination (MDD) using the INSAT-3C satellite, a summary of the DCP Service operated from METSAT and INSAT-3A and IMD's Cyclone Warning Dissemination System (CWDS). Furthermore, it gave a brief account of activities related to training in satellite meteorology and the bilateral collaboration programme with the NOAA for the exchange of INSAT data.

Action 31.01 Following a request expressed at a EUMETSAT workshop with Arab countries in February 2003, EUMETSAT made a request that India make KALPANA-I data available to Arab region

countries. India indicated that this might be possible through the planned use of a World Space Broadcast Satellite. More details would be provided in due course. Deadline: CGMS XXXII

Japan reported on the status of GMS-5 in JPN-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 the back-up operation using GOES-9 was started. A detailed report on the back-up operation of GMS-5 with GOES-9 is given in JPN-WP-03. Since 22 May 2003 GOES-9 has been operated at 155ºE. 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. Except for the VISSR all other instruments on board GMS-5 are operating satisfactorily. 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. Japan added that, as a result of recent solar activity, there had been a reduction in satellite power of about 4 Watts.

JMA expressed its deep appreciation to NOAA/NESDIS for the back-up arrangement with GOES-9 covering the position previously covered by GMS-5.

On behalf of its user community, WMO thanked NOAA/NESDIS for providing the GOES-9 satellite to ensure coverage of observations over the Western Pacific. CGMS welcomed the back-up operation, as a good example of regional contingency cooperation between JMA and NOAA/NESDIS.

In PRC-WP-04, 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. FY-2A, positioned at 86.5°E operates as a stand-by satellite. CMA indicated that the role of FY-2B was very important as it was being used to improve the quality of software used to control the satellite and process the data. This is encouraging in view of the launch of FY-2C in 2004.

In USA-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.

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. GOES-8 is stationed nearby as a back-up to GOES-9. 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 (once 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. The SXI has been turned off recently due to temperature power supply problems during the time of peak solar activity. SXI is now back on.

WMO asked whether NOAA might consider maintaining the geostationary satellite coverage (including the supply of sounder data) in the Pacific region and not de-orbit the GOES-8 satellite that could serve as a potential back-up to GOES-9. NOAA responded that a request for data coverage, including sounder data, in the Southern Hemisphere from GOES-9 would be studied. Current operational requirements came from the National Weather Service.

Action 31.02 NOAA to consider maintaining the GEO coverage (including sounder data) in the Pacific region and not de-orbit the GOES-8 satellite that could serve as a potential back-up to GOES-9.

Action 31.03 NOAA to study the request for data coverage sounder in the Southern Hemisphere from GOES-9. Current requirements came from N.W.S. Deadline: CGMS XXXII

EUMETSAT recalled that satellite operators subscribing to the relevant UN convention have to de-orbit no longer usable satellites, so the eventual decision was clear. However such a decision might be difficult bearing in mind the request to continue the supply of data.

China responded that the FY-2C satellite would be launched in 2004 to maintain the coverage in the region.

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. 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). Since August 2003 the CHRIS instrument has provided high spatial and spectral resolution directional data for atmospheric, land and coastal studies. ESA added that currently, there were around 550 Principle Investigators working with ENVISAT data. WMO thanked ESA for its efforts to provide ERS scatterometer wind data.

The Chairman encouraged new members of CGMS to provide information on their R&D satellites at future CGMS meetings.

Action 31.04 New members of CGMS to provide information on their R&D satellites. Deadline: CGMS XXXII

B.4 Anomalies from solar and other events

ESA reported in ESA-WP-10 that the European Space Operations Centre (ESOC) offered a free-of-charge solar and geomagnetic activity data service to registered users through "FTP" file copies. This is meant as atmosphere model inputs for orbit predictions.

USA-WP-04 reminded CGMS that Solar Cycle 23 is now more than three years past its maximum, and well into its declining phase. Sunspot numbers, 10.7 cm solar flux, and other indicators are reinforcing the opinion that Cycle 23's maximum era is over. This calming behaviour should continue to mid 2007, projected to be the next solar minimum. Although the more explosive types of activity – solar flares and coronal mass ejection – are now less frequent and impressive, the Sun still affects the Earth's magnetosphere with yet another type of stimulus – the high-speed solar wind. During the decline of the cycle, the solar magnetic field organises itself in a way that supports long-lived coronal holes, density voids with open magnetic field topology in the outer solar atmosphere, that allow for the unimpeded escape of the solar wind from the Sun. This fast solar wind, with its embedded magnetic field, energises Earth's magnetosphere. A consequence of the prolonged episodes of fast solar wind is large quantities of energetic (>2 MeV) electrons now occurring at geosynchronous orbit. These electrons can have a serious, deleterious impact, on satellites in orbit there. Energetic electrons cause deep dielectric charging of satellites, and can ultimately end the service life of a spacecraft. Serious satellite problems in 1994 at the same point in the solar cycle were diagnosed to be due to the cumulative impact of energetic electrons. SXI high voltage power supply anomaly caused the instrument to be shut down from 5 September to 27 October 2003. After engineering tests leading to modified operations, the SXI has once again become functional.

Table 2: Current Geostationary Satellites Coordinated within CGMS

(as of 13 November 2003)

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	At 155°E now providing data to Japan.
	GMS-5 (Op)	JAPAN	140° E	03/ 95	The back-up of GMS-5 with GOES-9 was started on 22 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
	GOES-8 (L)	USA/NOAA	147.6°W	04/ 94	Drifting West at 1.06° per day, back-up to GOES-9
WEST-ATLANTIC (108°W-36°W)	GOES-11 (B)	USA/NOAA	105°W	05/00	In-orbit back-up, 48 hours availability
	GOES-12 (Op)	USA/NOAA	75°W	07/01	Fully functional.
	Meteosat-7 (Op)	EUMETSAT	0°	02/97	Functional
EAST ATLANTIC (36°W-36°E)	Meteosat-6 (B)	EUMETSAT	10°E	11/93	Rapid Scanning Service minor gain anomaly on IR imager
	MSG-1 (P) (Meteosat-8 when OP)	EUMETSAT	10.5°W	28/08/02	Commissioning phase.

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)	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	105°E	06/2000	Hemispheric scanning only since 6/03. Image transmission stops in eclipse periods.
	FY-2A (B, L)	CHINA	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.
	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.

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 October to December 2005 with a nominal launch date on 1 October 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 system Wrap-up Preliminary Design Review took place in March 2002. The review was considered successful, leading to the closure of the programme-level Phase B. The system Critical Design Review (CDR) was successfully concluded in early summer 2003. The second part of the CDR-2 is foreseen for November 2003 focusing on the definition and planning of the Integration, Verification and Validation (IV&V) activities to be conducted pre-launch and during in-orbit commissioning, including Calibration and Validation.

In PRC-WP-05, China informed CGMS on the development of the FY-3 series of satellites, its second generation of polar-orbiting meteorological satellites. The FY-3 series include seven satellites to be operated during the period 2006-2020. The first two satellites FY-3A and FY-3B, and the on-board instruments, are currently being designed and manufactured. FY-3A is planned to be launched in 2006. The mission objectives of FY-3 include:

- To provide global three-dimensional atmospheric thermal and moisture structures, cloud and precipitation parameters, in order to support global numerical weather prediction.

- To provide global imagery for monitoring large-scale meteorological and hydrological disasters and biosphere and environment anomalies.

- To derive geophysical parameters to support research activities in the study of global and regional climate change.

Russia informed CGMS in RUS-WP-03 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 world's oceans. 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.

USA-WP-05 discussed NOAA's future polar-orbiting meteorological satellite systems. NOAA addressed the current operational system and the planned launch schedule for NOAA-N and N'. NOAA N', scheduled for launch in 2008, suffered major damage in a mishap on 6 September 2003 when it fell during test. NOAA is currently reviewing options to recover from this incident.

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.

NOAA discussed the development and implementation plans for NPOESS. Beginning later this decade, NPOESS spacecraft will be launched into three orbital planes to provide significantly improved operational capabilities and benefits to satisfy the critical civil and national security requirements for space-based, remotely sensed environmental data. The advanced technology visible, infrared, and microwave imagers and sounders that are being developed for NPOESS will deliver higher spatial and temporal resolution atmospheric, oceanic, terrestrial, and solar-geophysical data 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 at less cost, and provide sustained, space-based measurements as a cornerstone of an Integrated Global Observing System. These activities represent a sound beginning for achieving the planned national and international operational satellite programmes that will ensure continuous support to a variety of users well into the 21st century. It was also mentioned that NPP is planned to be launched in late 2006. The earliest possible launch date for NPOESS was 2009 for the mid-morning orbit satellite and in early 2010 for the afternoon orbit satellite.

WMO queried whether NOAA-N could be used in either the mid morning or afternoon orbits. NOAA stated that whilst this was possible, it was unlikely that NOAA-N would be used as a mid morning satellite.

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.

USA-WP-06 &-25 discussed the development of Direct Broadcast Services for the National Polar-orbiting Operational Environmental Satellite System (NPOESS), including High Rate Data (HRD) and Low Rate Data (LRD) broadcasts. Later this decade, NPOESS spacecraft will begin in-orbit operations and transmit Stored Mission Data to globally distributed ground stations. NPOESS will simultaneously broadcast real-time HRD (X-band) and LRD (L-band) data streams to suitably equipped field terminal systems. The NPOESS LRD service will be closely compatible with, but not identical to, the broadcast parameters for the Advanced High Resolution Picture Transmission (AHRPT) format that have been accepted and approved by CGMS. The NPOESS prime contractor is developing scalable software for the Interface Data Processing Segment (IDPS) that will run at U.S. Centrals and on HRD/LRD field terminals. During the next three to five years, the IPO will be working with the Department of Defense (DoD) and NOAA programme offices responsible for field terminals to develop and begin the testing of prototype terminals for the HRD/LRD broadcasts. Full details on the technical specifications for these HRD and LRD field terminal systems will not be available until mid-2005. The IPO will continue to investigate developments in antenna/receiver technologies and computer systems capable of running scalable IDPS software to identify “lower-cost” solutions for the mobile, lower capability LRD field terminals.

Table 3: Future Polar-Orbiting Satellites Coordinated Within CGMS

(as of 13 November 2003)

Orbit type (equatorial crossing times)	Future additional Satellites R = R & D	Operator	Planned launch date	Other information
Sun-synchr. "Morning" (6:00 – 12:00) (18:00 – 24:00)	Metop-1	EUMETSAT	09/2005	(827 km) (9:30) AHRPT
	Metop-2	EUMETSAT	01/2010	(827 km) (9:30) AHRPT
	Metop-3	EUMETSAT	07/2014	(827 km) (9:30) AHRPT
	FY-3A	China	2006	(9:30) series of seven satellites
	FY-3B	China	2006	(9:30)
	Meteor 3M-N2	Russia	2005	(9:15) or (10:30) AHRPT
	Meteor 3M-N3	Russia	2008	(10:30) or (16:30) AHRPT
	DMSP S-16	USA/NOAA	09/2003	(19:54 A) (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
	Monitor-E	Russia	2004	(550 km) (10:30) Land Observing Satellite
	GOCE (R)	ESA	02/2006	250 km (dawn-dusk)
	SMOS (R)	ESA	02/2007	755 km (6:00 A)
	ADM (R)	ESA	10/2007	405 km (18:00 A)
Sun-synchr. "Afternoon" (12:00 – 16:00) (00:00 – 04:00)	NOAA-N	USA/NOAA	6/2004	(14:00)
	NOAA-N'	USA/NOAA	03/2008	(14:00)
	NPOESS-2	USA/NOAA	06/2011	(833 km) (13:30 A) LRD (AHRPT)
	NPOESS-5	USA/NOAA	01/2018	(833 km) (13:30 A) LRD (AHRPT)
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	04/2013	(833 km) (5:30 D) LRD (AHRPT)
	NPOESS-6	USA/NOAA	~2019	(833 km) (5:30 D) LRD (AHRPT)
Non Sun-synchr.	Sich-1M	Russia/Ukraine	2004	(650 km) Oceanographic Satellite
	Resource-DK	Russia	2005	(350 km) Land Observing Satellite
	CRYOSAT	ESA	09/2004	717 km

Action 31.05 NOAA to regularly inform CGMS of the technical specifications for the L-band and X-band direct readout broadcast services on NPOESS. Deadline: CGMS XXXII

NOAA added that whilst direct broadcast from NPP was an option, there were no plans to implement such a broadcast at present.

C.2 Future Geostationary Meteorological Satellite Systems

India informed CGMS of its future plans for INSAT satellites with meteorological applications in IND-WP-03. 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.

Japan provided a report on its future plans for the Multifunctional Transport Satellites in JPN-WP-04. MTSAT-1R and MTSAT-2 will be launched in the first quarters of 2004 and 2005, respectively. MTSAT-2 is planned to remain in stand-by mode for four years and enter operational service in 2009. Information on the image data dissemination plan of both satellites was provided in the working paper.

In JPN-WP-05, the observation and dissemination schedule for MTSAT-1R SDUS/MDUS was provided.

As a general recommendation, CGMS urged all of its satellite operators to do their utmost to ensure that their parts of the world were fully covered. The need for robust systems, possibly involving 'hot' stand-by satellites or, at least, redundancy in satellite systems, was stressed.

China informed the meeting in PRC-WP-06 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 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.

Russia informed CGMS, in RUS-WP-04, on its continued development of the new geostationary meteorological satellite GOMS/Electro N2. 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, with the basic payload consisting of an imager, called MSU-G, retransmitters and a Data Collection System (DCS). In addition, it will be equipped with a Cospas-Sarsat geostationary transponder.

USA-WP-07 reported on the future GOES system. The follow-on GOES-N series has its first two spacecraft, GOES-N and -O, in preparation for thermal-vacuum testing. The completed GOES-N spacecraft is scheduled to be available for launch by December 2004 and GOES-O by December 2005. The new GOES-N series ground system was delivered to the Satellite Operations Control Center in June 2001. Contractual options for GOES-P were exercised in the spring of 2003.

Instrumentation will continue with the present five channel imagers and filter wheel sounders. At least two SXI instruments will fly on the GOES-N series. Horizontal resolution of these imagers will be improved to 4 km in all IR channels, including the 13.3 micrometer channel.

The GOES-R series satellites will each carry a new Advanced Baseline Imager (ABI). The ABI will have approximately 16 channels. Channels 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).

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 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 as understanding of weight and power issues. Twelve (12) systems architecture studies were awarded in November 2004. Spacecraft formulation phase will be initiated in 2004. GOES-R is planned to be ready for launch in 2012.

NOAA concluded by adding that the next GOES User Conference will take place in May 2004 and focus on GOES-R.

Responding to a question from India, NOAA indicated that there was currently no firm decision to fly the GIFTS instrument.

Table 4: Future Geostationary Satellites Coordinated Within CGMS

(as of 13 November 2003)

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	12/2004	135°W or 75°W
	GOES-O	USA/NOAA	2007	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	01/2005	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	2004	Improved FY-2 series, 5 channel VISSR, LRIT
	FY-2D	China	2006	Improved FY-2 series, 5 channel VISSR, LRIT
	FY-2E	China	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.

C.3 Future Research and Development Satellite Systems

ESA-WP-09 informed CGMS of the status of the future European Space Agency Earth Observation missions. Two of them, already mentioned, MSG and Metop are in cooperation with EUMETSAT. The Living Planet Programme has three lines of implementation: Earth Explorer satellites, Earth Watch satellites plus services and

applications demonstration. Since January 2002, the Earth Watch includes the Global Monitoring for Environment and Security (GMES) services element. IOC appreciated ESA missions on Ocean & Salinity, which will help in better understanding ocean circulation models.

Russia informed CGMS in RUS-WP-05 that three new Russian R&D satellites Monitor-E, Sich-1M and Resurs-DK are planned to be launched in 2004 to meet requirements of up-to-date technologies. Various imagers and sounders for remote sensing of the Earth surface, oceans and atmosphere will be placed on these satellites. The satellites will be used in ecology, disaster monitoring, hydrology, meteorology, mapping and other applied areas.

Rosaviakosmos is also planning to launch an experimental micro-satellite in 2004, investigating upper atmosphere magnetic fields responsible for tectonical activities.

Rosaviakosmos indicated that hydro-meteorological data from the SICH-1M satellite would be made available to scientists world-wide, as a contribution to the WMO Global Observing System (GOS), through ground stations in the Russian Federation and Ukraine.

WMO indicated that it had the intention to ask all R&D agencies at the WMO Consultative Meetings on High-level Policy on Satellite Matters to declare which data would be made available to the WMO GOS and how it could be accessed.

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

Concluding the presentations on current and future plans of meteorological and R&D satellites, WMO remarked that CGMS Members were moving in the right direction 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 also improve the utilisation of satellite data.

Action 31.06 WMO to propose a template to contain detailed information on CGMS satellite systems (including R&D satellites), noting data available in the CEOS database. Deadline: 31 December 2003

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

D. OPERATIONAL CONTINUITY AND RELIABILITY

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

In response to CGMS action 30.03, EUMETSAT gave a summary in EUM-WP-07 on the data content of the Advanced High Resolution Picture Transmission (AHRPT) and the Low Resolution Picture Transmission (LRPT) services, provided by the Metop satellites within the framework of the EUMETSAT Polar System. CGMS Members were informed that whilst this would apply to Metop-1 and -2 satellites, there might be change for Metop-3.

Also in response to this action, CMA reported in PRC-WP-10 on its S-Band DB Service of the Polar-orbiting Satellite FY-1 and FY-3, adding information on equator crossing times.

USA-WP-08 provided a summary of the NOAA S-band direct readout broadcast services from its current and future polar-orbiting satellites. The paper discussed the data content and processing levels for the broadcast services and made available the projected equatorial crossing times for current and future polar-orbiting satellites. NOAA plans to continue to support a global direct readout broadcast service in L-band frequencies with its next generation of National Polar-orbiting Operational Environmental Satellite System (NPOESS) spacecraft. The NPOESS Low Rate Data (LRD) service will be closely compatible with the broadcast parameters for the Advanced High Resolution Picture Transmission (AHRPT) format that have been accepted and approved by CGMS. The NPOESS L-band service will be transmitted within the accepted 1698-1710 MHz frequency band using a bandwidth of 8.0 MHz. The data content from the NPOESS spacecraft will be mission specific to satisfy U.S. military and civilian user requirements, but will be comparable to and complement the data content of the L-band direct readout broadcast service that will be used on the EUMETSAT Metop spacecraft. NOAA will continue to inform and coordinate with CGMS and WMO on the technical specifications for the L-band direct readout broadcast service on NPOESS.

WMO thanked NOAA for its continuous effort to accommodate AHRPT formats in its programmes.

D.2 Inter-regional contingency measures

This matter was discussed in Working Group IV on Global Contingency Planning and can be found under the relevant section in this report.

D.3 Long-term global contingency planning

This matter was discussed in Working Group IV on Global Contigency 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

Referring to the WMO's Tropical Cyclone programme, ESA informed CGMS on its plans for low Earth orbiting satellites in support of the WMO World Weather Watch programme in ESA-WP-04. ESA has three missions in preparation or under consideration, which will provide essential observational data for ocean salinity, wind profiles and precipitation, namely Soil Moisture and Ocean Salinity (SMOS), Atmospheric Dynamics Mission (ADM-Aelus) and the European contribution to GPM (EGPM).

Also referring to WMO's Tropical Cyclone programme, EUMETSAT reported in EUM-WP-08 that its Council has agreed that the service supported by Meteosat-5, the Indian Ocean Data Coverage (IODC) Service, will be continued to be provided until the end of 2005. EUMETSAT has studied contingency plans to provide another satellite to support the IODC Service in the event of a failure of Meteosat-5 or beyond 2005, should the requirement for the IODC Service remain. The eventual operations scenario depends upon the status of the new Meteosat Second Generation (MSG) satellites. Since it is now expected that MSG-1 will enter routine operations in January 2004, the possibility to utilise Meteosat-6 as a back-up to Meteosat-5 becomes more realistic, and has been agreed by the EUMETSAT Council. Plans for future covering of the Indian Ocean after 2005 will be discussed by the EUMETSAT Council in June 2004.

NOAA and WMO thanked EUMETSAT for the continuous coverage over the Indian Ocean.

CGMS also recalled that this EUMETSAT Council approved service is operated on the understanding that there is currently no other similar service provided in this region by another satellite operator. However, this situation could change in the coming years and, at that time, the requirement for EUMETSAT to provide an IODC or similar service will be reviewed.

In USA-WP-09, NOAA described its support for the WMO Tropical Cyclone Programme. NOAA uses its geostationary and polar-orbiting satellites to monitor tropical cyclone activities. The current series of GOES provides satellite data generated from full resolution, and imager and sounder data. Imagery at 1, 4, and 8 km resolution is available for daytime and night-time applications. The increased resolution of the satellite imagery is a vast improvement from previous satellites. The GOES spacecraft provides higher resolution and additional spectral channels than its predecessor, affording the hydro-meteorological community improvements in detection, monitoring, and analysis of developing tropical cyclones. From 135°W and 75°W, routine GOES satellite data coverage is extensive, stretching from the central Pacific through the Americas to the eastern Atlantic, including the vital breeding grounds for tropical cyclones. Visible data are available at 1 km, "near infrared" (channel 2 data), as well as the infrared channels 4 and 5 are available at 4 km resolution, and water vapour (channel 3) is available at 8 km resolution on GOES-10 and 4 km resolution on GOES-12. Channel 2 data are valuable for the detection of low clouds, fog, stratus, and surface hot spots; channel 5 data, available on GOES-10, in combination with data from channels 2 and/or 4 are useful for detecting volcanic ash in the atmosphere. On GOES-12, channel 5

is replaced by a new 13.3 micron channel 6 that detects the presence of CO_2. Channel 6 improves the measurement of the height of clouds and volcanic ash, thus improving computer model forecasts and ash warnings to the aviation community. The GOES-N series will continue with the present five channel imagers and filter wheel sounders.

The GOES-R system will transition from and begin replacing the GOES N series in approximately 2012. Based on new architecture concepts and system designs, the GOES R series will continue to meet and exceed GOES mission goals. Sensor improvements will enable more timely land, atmospheric and ocean forecasts, including vast improvements in hurricane track and intensity predictions. GOES R will operate during eclipses, and provide simultaneous mesoscale and full hemispheric coverage. The increase in GOES R latency will improve forecasts and climate/hydrology monitoring. The inclusion of a GLM will provide continuous lightning detection over land and water. Storm severity, maturity and advanced warning will be improved by the ability to track lightning intensity, frequency and location from space.

Although geostationary satellites provide the temporal resolution that is sometime required, considerable information can also be obtained from polar-orbiting satellites. Polar-orbiting satellite data usually have higher spatial resolution than corresponding data from geostationary platforms. Polar satellites also include instrumentation such as microwave sensors that are not available from geostationary orbit. In addition, NOAA's two operational geostationary satellites are primarily restricted to the Western Hemisphere. NOAA's polar-orbiting satellites can be used for global tropical cyclone analysis. The USA maintains a constellation of two Polar Environmental Operational Satellites (POES): NOAA-16 in a PM orbit and NOAA-17 in an AM orbit with one back-up, NOAA-15 in an AM orbit. POES provides almost complete coverage of the global tropics and subtropics four times per day.

Over the next decade, the NOAA POES programme is being merged with the Defense Meteorological Satellite Program (DMSP) to produce the National Polar-orbiting Operational Environmental Satellite System (NPOESS). The first launch is planned for early in the next decade. To prepare for these new capabilities, a subset of the planned instruments will be available in the 2005-2006 time frame in the NPOESS Preparatory Project (NPP). The Visible Infrared Imaging Radiometer Suite (VIIRS) can be used for tropical cyclone position and intensity estimation, and high spatial resolution sea surface temperature analysis. VIIRS will provide observations at higher spatial resolution that the POES/AVHRR. The USA mentioned that the Advanced Technology Microwave Sounder (ATMS) can be used for tropical cyclone warm core identification, temperature and moisture soundings in storm environment, identification of convective organisation below IR cloud top, and precipitation estimation. The ATMS will provide some advancement relative to the current Advanced Microwave Sounder Unit (AMSU) instrument. Also, the Cross-Track Infrared Sounder (CrIS) will provide temperature and moisture soundings in the storm environment, and will likely be used in combination with ATMS.

EUMETSAT noted with appreciation the measures taken by the USA to avoid data losses during critical weather events and recommends other satellite operators to consider similar mechanisms.

WMO-WP-12 advised CGMS Members of WMO's Tropical Cyclone Programme requirements. CGMS noted that the sixteenth session of the Regional Association I Tropical Cyclone Committee for the South-West Indian Ocean in Maputo, Mozambique from 8 to 12 September 2003 had been informed of a CGMS XXX action item. That action item requested India, China and the Russian Federation to take into account the Committee's request to consider the possibility of continuing and implementing, on a permanent basis, geostationary coverage of the Indian Ocean, in order to provide the necessary data in support of the national mandates of the WMO Members in the region and to report to CGMS-XXXI. The Committee thanked EUMETSAT for agreeing to maintain its coverage over the Indian Ocean at least until 2005. However, it reiterated its concern about the absence of any permanent geostationary satellite coverage over the Indian Ocean and requested WMO to inform CGMS with a goal of finding a solution ensuring geostationary coverage of the Indian Ocean beyond 2005.

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

WMO-WP-07 summarised efforts of the WMO/CBS/OPAG IOS Expert Team on Observational Data Requirements and Redesign of the Global Observing System (ET-ODRRGOS) towards continuing the Rolling Requirements Review (RRR). Under the RRR the requirements for observations to meet the needs of all WMO programmes are compared with the capabilities of present and planned observing systems provided and recommendations to the Commission for Basic Systems (CBS) of WMO on the "re-design" of the Global Observing System (GOS) are refined.

At their December meeting the CBS noted the ET-ODRRGOS vision for the redesign of the GOS and agreed that four operational LEOs and six operational GEOs were required, and agreed that this should be reflected in the update to the manual on the GOS. In addition CBS requested that the ET-ODRRGOS start drafting an implementation plan that evolves the GOS and assures full WMO utilisation, and considering strategies that would lead to comprehensive studies of observing system design.

At the recent ET-ODRRGOS meeting in Geneva, Switzerland, 3 to 7 November 2003, good progress was realised in all four areas. The WMO/CEOS database was updated and Statements of Guidance were reviewed. Plans were finalised for a Third WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction to be held in Alpbach, Austria from 9 to 12 March 2004. The 42 recommendations for evolution of the GOS were revisited in attempts to make suggestions for implementation. With regard to the recommendations for the space based component of the GOS, many of the next actions for implementation will rely on the WMO Space Programme to take them up with space agencies, via CGMS and WMO Consultative Meetings on High-level Policy on Satellite Matters. For the ground-based portion of the GOS, different strategies of implementation were suggested for the different components. The implementation plan will be iterated monthly, with the goal that a final version can be drafted at the next ET meeting (prior to the OPAG IOS ICT meeting in 2004).

WMO confirmed that the Atmospheric Chemistry User Requirements were included in the 2015 vision of the Global Observing System. These requirements will be continuously refined, e.g. by reflecting the work of the IGOS Theme Team for Integrated Global Atmospheric Chemistry Observations (IGACO).

WMO recommended to CGMS: that (a) the processing of data from functioning satellite instruments be maintained for as long as possible, and (b) that R&D satellite operators be encouraged to make their data available for routine near real-time use.

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

WMO requests, as a matter of urgency, that the Windsat evaluation should be performed in a manner similar to the Advanced Infrared Sounder (AIRS) (with distribution of data sets for outside evaluation).

Action 31.10 R&D satellite operators are encouraged to make their data available for routine near real-time use. Deadline: CGMS XXXII

E.2 Other WMO Programmes

USA-WP-11 provided an up-to-date-record of the US satellite missions for the update of the CEOS/WMO database, instruments and frequencies. The information presented in the document is accurate for the period ending 9 September 2003.

In WMO-WP-06, CGMS was informed of the decisions by the Fourteenth WMO Congress with regard to satellites. In particular, it was briefed on the establishment of the new cross-cutting major WMO Space Programme and the associated portions contained in the WMO Sixth Long-term Plan. CGMS also noted that CBS now has lead responsibility for two major programmes, the World Weather Watch Programme and the WMO Space Programme. The approved WMO Space Programme Long-term Strategy is:

"To make an increasing contribution to the development of the WWW GOS, as well as to the other WMO-supported Programmes and associated observing systems (such as AREP's GAW, GCOS, WCRP, HWR's WHYCOS and JCOMM's implementation of GOOS) through the provision of continuously improved data, products and services, from both operational and R&D satellites, and to facilitate and promote their wider availability and meaningful utilisation around the globe."

The main elements of the WMO Space Programme Long-term Strategy include: increased involvement of space agencies; promotion of a wider awareness of the availability and utilisation of data, products; considerably more attention to be paid to the crucial problems connected with the assimilation of R&D and new operational data streams in nowcasting, numerical weather prediction systems, re-analysis projects, monitoring climate change, chemical composition of the atmosphere, as well as the dominance of satellite data in some cases; closer and more effective cooperation with relevant international bodies; additional and continuing emphasis on education and

training; facilitation of the transition from research to operational systems; improved integration of the space component of the various observing systems throughout WMO Programmes and WMO-supported Programmes; and increased cooperation amongst WMO Members to develop common basic tools for utilisation of research, development and operational remote sensing systems.

CGMS also noted that the Fourteenth WMO Congress had established by resolution, sessions of the WMO Consultative Meetings on High-level Policy on Satellite Matters in order to establish more formally the dialogue and participation of environmental satellite agencies in WMO matters. The Consultative Meetings will continue to provide advice and guidance on policy-related matters, as well as maintain a high level overview of the WMO Space Programme.

WMO thanked EUMETSAT for its contribution to the WMO Space Programme Trust Funds, which was being used to prepare the Space Programme Implementation Plan. EUMETSAT indicated that satellite operators should support WMO in the implementation of its space programme, including potential financial contributions.

WMO-WP-16 provided 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 satellite rapporteur participating in CGMS XXX had submitted a report to the second session of the Management Committee (MAN-II) (Paris, February 2003) on the status of the JCOMM, including its interactions with satellite operators and CBS, concerning oceanographic satellite. The Expert Team on Wind Wave and Storm Surges in the JCOMM Services Programme Area held its first session in Halifax, Canada, June 2003. The session noted that during the last decade, the number of reliable wave/wind observations had improved drastically with the advent of earth-observing satellites including ERS-1, ERS-2, ENVISAT, TOPEX and JASON. The JCOMM Ship Observations Team (SOT), which is composed of the VOS Panel, SOOP Implementation Panel and the ASAP Panel, held its second session in London in July 2003, where the participation of and input from a representative of EUMETSAT was very valuable. The official JCOMM website can now be found at http://www.jcommweb.net.

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.

IOC requested that CGMS satellite operators consider the IOC satellite requirements, especially the data dissemination methods, bearing in mind the ongoing formation of GOOS Regional Alliances GRAs.

Action 31.11 CGMS satellite operators to consider the IOC satellite requirements, especially the data dissemination methods, bearing in mind the ongoing formation of GOOS Regional Alliances (GRAs). Deadline: CGMS XXXII

F. OTHER ITEMS OF INTEREST

F.1 Applications of Meteorological Satellite Data for Environment Monitoring

EUM-WP-04 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 2002 in March and July, respectively. For the SAF on "Nowcasting and Very Short Range Forecasting" the Operations Readiness Review for the MSG-based products is planned in early 2004. 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 have started in summer 2003. It is planned to achieve operational readiness for MSG-based products in April 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.

Russia gave an overview in RUS-WP-07 on Roshydromet/SRC Planeta's ground segment developed for the acquisition, processing and distribution of satellite data and products. The objective of operational and research activity in Roshydromet is to use satellite data and derived products in various application areas, including operational meteorology, NWP, hydrology, agrometeorology, hazards (fires, floods) and pollution monitoring, climate research. Examples of some derived by SRC Planeta products are presented in the working paper.

F.2 Search and Rescue (S&R)

There were no presentations under this agenda item.

F.3 Meteorological Data Distribution via satellite

IND-WP-04 reported on the installation of 100 digital cyclone warning dissemination system (DCWDS) stations in India under the World Bank aided "A.P. Hazard Mitigation

& Emergency Cyclone Recovery Project", managed by IMD. Information was given on the DCWDS ground segment and transmitting system.

CGMS Members also took note of the planned installation of 40 digital Meteorological Data Dissemination stations in India, reported on in IND-WP-05. Particularly in the cyclone prone coastal areas of India, availability of such data will give rise to better monitoring of cyclonic storms. The improved quality of MDD data will also benefit research in operational weather forecasting.

Finally, India presented its meteorological data and INSAT image broadcast service delivered through World Space satellites that started recently (see presentation on the CD-ROM). WMO noted that, presently, the Indian satellites were not included in the space-based component of the Global Observing System and that the coverage of the Indian Ocean is the responsibility of the Russian Federation. With the further development of data dissemination services described by India to WMO Members in the Indian Ocean region, WMO anticipated that India could become an operational partner, contributing to the space-based component of the GOS, adding that the projected service to be provided by India would need to be explicitly compared to WMO requirements for conformance.

CGMS Members welcomed the presentation by India and noted with appreciation the progress made towards Alternative Dissemination Methods (ADM). They urged India to officially communicate to WMO its offer to take a formal role in the WMO space-based component of GOS and while seeking to meet WMO observational data and service requirements to the maximum extent possible.

F.4 Training

EUM-WP-23 reported on training activities carried out by EUMETSAT over the last year. WMO noted with appreciation the efforts made by EUMETSAT to provide training to the Arabic countries, adding that there were plans to establish a WMO Training Centre in that part of the World.

Japan informed CGMS in JPN-WP-09 of the activities of its Virtual Resource Library (VRL) which provides a Computer Aided Learning (CAL) tool for the use of satellite data called Satellite Animation and Interactive Diagnosis (SATAID), accessory tools for the use of SATAID, related documents and learning materials. In addition, JMA reported on its cooperation with the Commonwealth Bureau of Meteorology, Australia (CBoM), a VL partner, in setting up a server to provide near real-time satellite data. The server will be operated by CBoM. In September 2003 CBoM established a prototype near real-time imagery server, which it is currently operating for evaluation. The server provides the last seven days of satellite imagery from GOES-9 in SATAID format. It is expected to be launched at the time of CGMS XXXI.

WMO thanked JMA for making near real-time data available for training purposes.

USA-WP-10 informed CGMS on activities and the status of the implementation plan of the Virtual Training Laboratory. Schedule and funding constraints required the Virtual Laboratory (VL) Focus Group meeting to be postponed until December 2003, which coincided with the WMO satellite training programme scheduled to take place in

Barbados from 2 to 12 December 2003. Thus the second session will take place in Barbados during the week immediately following the WMO training event.

As instructed by CGMS, the second session of the Focus Group will conduct an initial assessment of the VL, report back to CGMS-XXXII on activities and status of the implementation plan. The following items will be discussed: the resource library, its role, how it is structured, how it is "peer-reviewed," and other pertinent matters; VISITview, its role in the Virtual Laboratory structure, etc.; 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. Virtual Laboratory participant roles and responsibilities; archiving of training class presentations as a future training resource; 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". The third session should occur in five years and conduct a comprehensive review of the VL.

In WMO-WP-17, CGMS was informed of WMO discussions concerning a Virtual Laboratory (VL) for Education and Training in Satellite Meteorology. CGMS noted that a number of important activities and milestones that were established by the VL Focus Group were being addressed and met. All "centres of excellence" had completed a survey covering how they were using the VL and importantly, details on connection speeds. The survey showed all centres were using the VL but some a lot more than others due to lack of Internet bandwidth. All centres were using the VL, mainly for lecturer information rather than class room, this was at least partially due to poor line speed. All satellite operators have a server online and connected to the VL. There were VL servers online at BoM (Australia) and EAMAC (Niamey) centres of excellence. Resource libraries were available online for the VL at NESDIS (CIRA), EUMETSAT, JMA, NSMC and WMO. VISITview has been made available via the VL website at CIRA to all participants. Courses on MSG were organised at the "centres of excellence" at EAMAC in Niamey and the RMTC in Nairobi where VISITView was successfully used. EUMETSAT's new five year training programme has integrated the Virtual Laboratory into its planning and implementation. In addition, the VL was directly accessible to all WMO Members through the main WMO's Satellite Activities Home Page under the heading "CGMS Virtual Laboratory for Education and Training in Satellite Matters."

CGMS was informed that the Fourteenth WMO Congress (Cg-XVI) had noted the positive impact of the Virtual Laboratory for Education and Training in Satellite Meteorology and that it had made a tremendous impact throughout WMO Regions through its six "centres of excellence". Congress was pleased to see the integration of the new R&D constellation into education and training activities. It also noted that the WMO Space Programme Long-term Strategy and associated Implementation Plan provided for increased utilisation of the Virtual Laboratory to the benefit of WMO Members especially for fuller exploitation of R&D data, products and services as well as those from new and existing operational meteorological satellite systems.

CGMS Members took note of the reports given on the VL and further noted that they, together with the space agencies, were invited to participate in the WMO Satellite training event scheduled for Barbados from 2 to 12 December 2003, and prepare for the

second session of the CGMS VL Focus Group to be held in Barbados from 15 to 16 December 2003. In this context WMO was pleased to note that both ESA and NASA had expressed their intentions to participate in the second session of the VL Focus Group.

Action 31.12 CGMS Members to indicate their activities aimed towards 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. Deadline: CGMS XXXII

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

F.5 Information

EUM-WP-05 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-06 EUMETSAT invited CGMS to approve the CGMS Consolidated Report, Edition 10 with the updates sent by Members to the CGMS Secretariat since CGMS XXX. CGMS approved Edition 10 of the Consolidated Report.

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.

Action 31.14 CGMS Members 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. Deadline: 31 December 2003.

Action 31.15 The CGMS Secretariat to develop a new structure for the CGMS Consolidated Report. Deadline: CGMS XXXII.

PRC-WP-11 informed CGMS about the International Symposium on Sand and Dust Storm, to be held in Beijing from 6 to 10 September 2004. The conference aims at presenting the latest scientific understanding of the nature of dust storms through the observation of dust storm particles and other related aerosol species, modelling results and satellite observations, climatology of sand and dust storms and their origination zones, the phenomenology of these storms and associated regional scale conditions. It is sponsored and organised by WWRP/WMO and CMA.

USA-WP-12 provided a summary of US providers of satellite receiving equipment. NOAA maintains a partial list of satellite equipment manufacturers on its NOAASIS website at: http://noaasis.noaa.gov/NOAASIS/ml/manulst.html.

The list contains HRPT, APT, GVAR and WEFAX equipment manufacturers and dealers of complete meteorological satellite receiving systems, system components, and system integrators. In the future, this list will also include LRIT, HRD and LRD equipment manufacturers. The list is compiled and maintained by the NOAA/NESDIS Direct Services Division, and was last revised in August 2003. The intent of its compilation is to provide an informational tool to users and is not an endorsement by NOAA of any specific manufacturer or product. Inclusion of manufacturers on this list is strictly voluntary. Additions or corrections to this list should be forwarded to the NOAA/NESDIS contact through the NOAASIS website listed above.

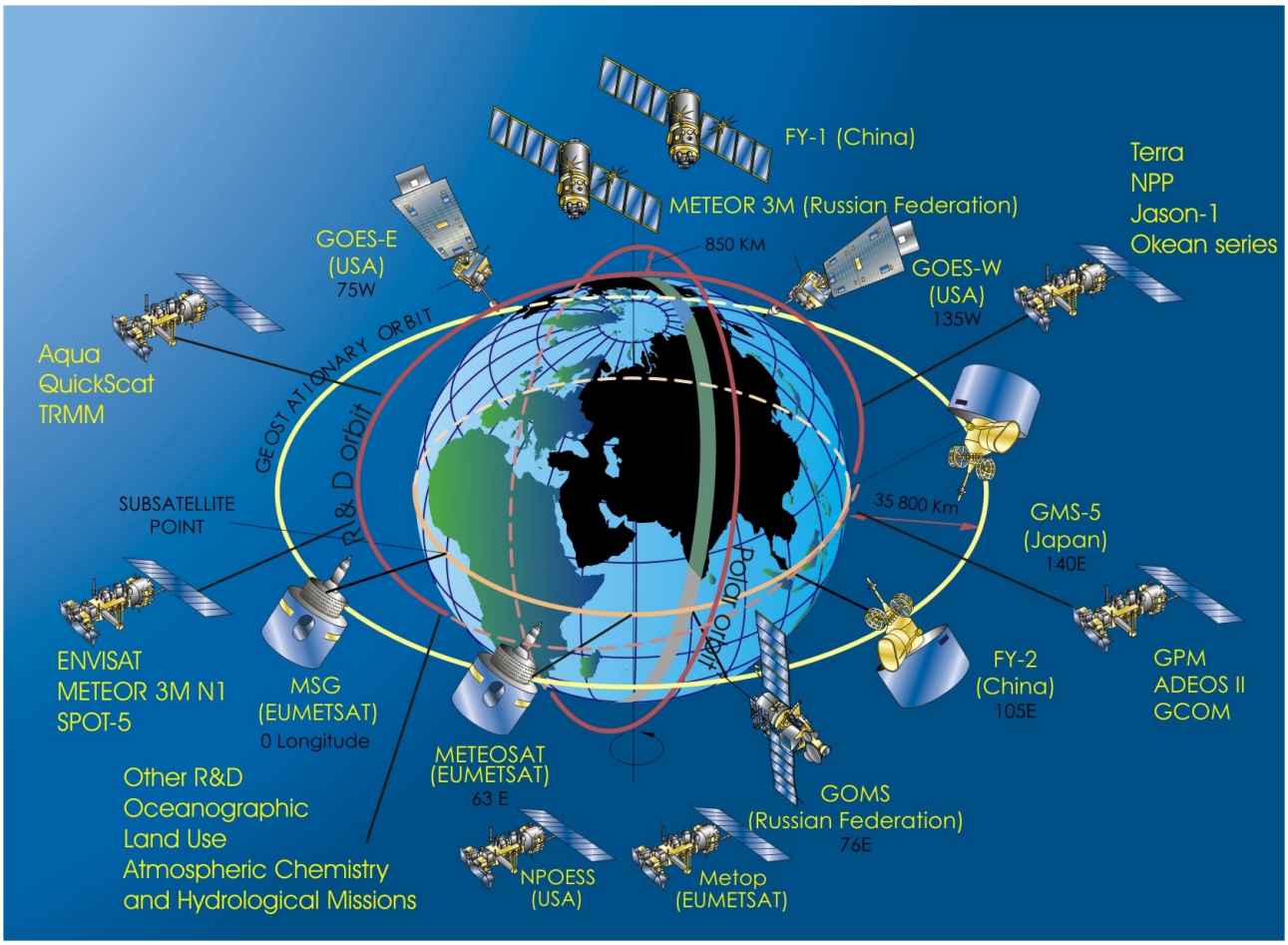
WMO described the latest status of the database for satellite receiving equipment in WMO-WP-01. Since CGMS XXX, WMO has added a few new records to the database. WMO noted that the next request to WMO Members for updates to the database would occur in early 2004 and a new diskette version of the database would be distributed at CGMS XXXII. CGMS Members were requested to provide information for the database as contained in the relevant CGMS permanent action.

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 noted that the technical document entitled *Utility of Existing R&D Satellite Data (WMO TD No. 1141, SAT-31)* had been published and was available on CD-ROM. CGMS also noted that the new technical document entitled *The Role of Satellites in WMO programmes in the 2010s* had been finalised and was being printed and translated into official WMO languages.

In WMO-WP-15, CGMS was informed of items of relevance arising from the third session of the Consultative Meetings on High-level Policy on Satellite Matters (CM-3) held in February 2003. Those items included a description of the expanded space-based component of the World Weather Watch's Global Observing System (GOS), expansion of CGMS membership, redesign of the GOS and the WMO Space Programme. CGMS noted that the present session included four new CGMS Members (NASA, ESA, JAXA and Rosaviakosmos) and their associated satellite missions contributing to the space-based component of the GOS as shown in Figure 1, as well as the new contributions made by CNES for Jason-1 and SPOT-5.

Figure 1: The space-based component of the World Weather Watch's Global Observing System



WMO-WP-24 proposed to establish an exciting, world-wide, 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, math and technology education for all of the world's children and (b) a focus on establishing a world-wide 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 XXXII. Since the GESN relies on the Virtual Lab, it would be beneficial for a member of the GESN focus group to attend the Virtual Lab focus group meeting in Barbados in December 2003 to solicit support from the Centers of Excellence.

Action 31. 16 CGMS Members to form a focus group to further examine the Global Education and Science Network Focus Group, which should meet before CGMS XXXII and present a way forward at CGMS XXXII.

WMO-WP-25 presented a brief summary of some recent developments in the Global Climate Observing System (GCOS) programme relevant to CGMS. CGMS-XXX had considered the Climate Monitoring Principles developed by GCOS and developed a drafting committee to reword of some of the principles. The revised 'GCOS Climate Monitoring Principles' were adopted by the Fourteenth session of the WMO Congress in May 2003. CGMS also noted that the Principles would be included in the next update of the United Nations Framework Convention on Climate Change (UNFCCC) Reporting Guidelines on Global Climate Observing Systems, as well as presented to the other GCOS Sponsors for endorsement. GCOS welcomed the cooperation with CGMS in finalising these guidelines for climate monitoring and the efforts being undertaken by the space agencies to adhere to them. The 'Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC' had been completed in April and presented to the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA) at its Eighteenth Session (June 2003), for subsequent submission to the Conference of the Parties (COP) in December. A Summary of Conclusions was presented to CGMS XXXI, and of particular note for CGMS was Recommendation 2 in the Summary concerning the need to develop integrated global climate products, including those largely dependent on satellite observations:

"Parties with responsibility for space agencies should support the long-term operation of Earth observation satellites; ensure that homogeneous climate data and integrated products are produced; and strive to make them available to all Parties" and

"Such Parties should support an internationally-coordinated approach to the development of an initial set of integrated global climate products" related to the variables in item 2 of the summary.

CGMS also noted that the Ninth Session of the Atmospheric Observations Panel for Climate (AOPC) was held in Asheville, USA, 23 to 27 June 2003. Developments related to CGMS included the request from CGMS-XXX (Action 30.28) to consider the consolidated list of metadata for satellite observations with respect to its adequacy for AOPC applications. AOPC had concurred with this list. AOPC also noted the specific efforts by EUMETSAT to develop additional climate products through its support for the Satellite Applications Facility on Climate Monitoring (CM-SAF) and looked forward to cooperating in a workshop planned toward this end.

GCOS had welcomed the increasing cooperation with CGMS and its members in defining and establishing the satellite component of the GCOS baseline networks, including the observational infrastructure and the development of the integrated global climate products needed by its users. GCOS looked forward to continuing and expanding this cooperation.

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, EUMETSAT, was elected Chairman of Working Group I (WG I) on Telecommunications, with Mr. Gordon Bridge, EUMETSAT, appointed as Rapporteur. WG I comprised representatives of the satellite operators from China, Japan, ESA, Russia, NOAA, Korea and EUMETSAT together with a representative of WMO (see Annex 4 for list of participants).

I/1 Coordination of Frequency Allocations

Results of the World Radio Conference (WRC) 2003

Five Working Papers summarising the results of the World Radio Conference 2003 were submitted, i.e. ESA-WP-02, JPN-WP-07, USA-WP-13, WMO-WP-11, and EUM-WP-09.

The World Radio Conference (WRC 2003) took place in Geneva from 9 June to 4 July 2003. More than 2300 delegates attended the conference, representing about 150 national administrations and several so-called sector members.

The issues of interest to CGMS Members at WRC 2003 can be broadly split into the following areas:

- Meteorological Satellite Service
- Earth Observation
- Space Science

The following acronyms as defined by the International Telecommunication Union (ITU) are used in the next section of the document:

MetSat	= Meteorological Satellite Service
MSS	= Mobile Satellite Service
EESS	= Earth Exploration Satellite Service
GSO	= Geo-Synchronous Orbit
Non-GSO	= Non Geo-Synchronous Orbit

WRC Results related to the Meteorological Satellite Service

There were two agenda items involving the Meteorological Satellite Service, i.e. agenda items 1.20 and 1.31. The results were as follows:

Agenda Item 1.20 (Non-GSO MSS service links in bands below 1GHz)

This issue has been on WRC agendas since 1992. The MSS seeks spectrum below 1 GHz for so-called “Little LEOs”, i.e. low earth orbiting satellites performing mobile services such as paging, data collection etc. Several candidate bands have been identified

including parts of the band 401 - 406 MHz. This band is used for radiosonde operations (MetAids) and part of the band for Data Collection Systems of meteorological satellites (LEO and GEO). WMO has conducted studies on the future requirements for the band and has submitted documents to ITU and WRC. A dedicated resolution pointing to the band 401 - 406 MHz was deleted during WRC-2000.

In discussions in the ITU as well as CEPT there has been no support for new MSS allocations. For the band 401 - 406 MHz there has been strong opposition to the MSS request.

Outcome of WRC 2003: No new MSS allocations were made and Resolution 214 on this issue was finally suppressed. This issue will not be allowed for future WRC agendas. The MetSat allocations in the band 401 - 403 MHz are therefore safe.

Agenda Item 1.31 (MSS in the 1 - 3 GHz band)

This agenda item targeted specifically the bands 1518 - 1525 MHz (downlink) and 1683 - 1690 MHz (uplink), but was open to examining other frequency bands between 1 and 3 GHz.

The band 1675 - 1700 MHz is allocated to both the Met-Aids and MetSat services with the MetSat allocation extending up to 1710 MHz, and is vital to the operations of the WMO as well as other meteorological services in many administrations. The band is essential for EUMETSAT programmes MTP, MSG and EPS (Metop).

Studies in the ITU-R, including several submissions by EUMETSAT, have shown that MSS (Earth-to-space) cannot share with the MetSat or Met-Aids services without undue constraints. For example, three independent studies have shown that sharing between the MSS and MetSat in the 1683 - 1690 MHz band would be very difficult due to the hundreds of GVAR/S-VISSR stations, including a number of mobile GVAR earth stations. Earlier studies have proven that sharing is not feasible in the bands 1690 – 1698 MHz due to thousands of user stations for geostationary meteorological satellite systems as well as 1698 - 1710 MHz due to downlinks of polar-orbiting meteorological satellites to user terminals and main Earth stations. Therefore, any MSS allocation in the 1675 - 1710 MHz band was considered practically unusable and consequently opposed.

Outcome of WRC 2003: A primary allocation to the MSS was made in the band 1668 - 1675 MHz for all ITU regions. Footnotes to protect existing services were added to the allocation. This outcome of the WRC 2003 was the desired one and is totally acceptable to the meteorological community in view of the very limited use of this band and the protection afforded to existing meteorological stations. On a global scale, the band 1670 - 1675 MHz is only used by very few data downlinks, which can be protected. There are no EUMETSAT downlinks in this band.

Existing MSS allocations in region 2 within the band 1675 - 1700 MHz were deleted. Resolution 227 was also deleted which implies that this issue will not be included on future WRC agendas.

The new allocation and the consequent deletion of other allocations terminate now an ongoing activity from MSS to obtain additional spectrum. This activity has been on all agendas of WRCs since 1992.

WMO-WP-11 notes that as a consequence of the new MSS allocation, administrations (i.e. countries) are invited to notify before 1 January 2004 MetSat Earth stations which were operating in the band 1670 - 1675 MHz on 4 July 2003. They are also urged not to implement new MetAids systems in the band 1668.4 - 1675 MHz and are encouraged to migrate operations to other bands as soon as practicable. It should be noted in this regard that the target is to concentrate radiosonde operations in the sub-band 1675 - 1683 MHz.

Action 31.18[1] 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. Deadline: 31 December 2003

WRC Results related to Earth Observation (EESS)

Several items at WRC 2003 were of interest for Earth Observation (EESS in ITU terminology):

(a) New allocation in the 432 - 438 MHz for P-band SAR applications
(b) Protection of the band 31.3 - 31.5 GHz (used by AMSU on METOP) from unwanted emissions by HAPS (High Altitude Platform System) in the adjacent band
(c) Protection of the 1.4 GHz band (to be used by SMOS) from unwanted emissions by new Mobile Satellite feeder links in nearby bands
(d) Protection of the band 50.2 - 50.4 GHz (used by AMSU on Metop) from unwanted emissions by High Density Fixed Satellite Systems (HDFSS) operating uplinks in the lower adjacent band
(e) Protection of the EESS active sensors operating in the band 5250 - 5350 MHz (e.g. SAR on ERS-1 and ENVISAT) from new wireless LANs to be deployed in this band
(f) Extension of the allocation to EESS active sensors in the 5 GHz range from the current 210 MHz bandwidth to 330 MHz (Main application: future high resolution altimeters or SARs in C-band)
(g) Elimination of some legal uncertainty on the use of the 35.5 - 36 GHz band by rain radars
(h) Definition of regulatory limits for unwanted emissions into bands reserved for EESS passive sensors only
(i) Protection from proposed allocations to mobile satellite systems in various bands used by meteorological satellites.

Agenda item 1.38: New allocation in the 432 - 438 MHz for P-band SAR applications

This long-standing issue, already discussed unsuccessfully at WRC-97, has finally been positively resolved with a 6 MHz secondary allocation at this Conference. The

[1] Please note that Action 31.17 is under G. Final Session on page 88.

operational limitations to be applied to the SARs operating in this band (ITU-R Recommendation SA.1260-1) will still allow them to cover forest biomass and Antarctic ice measurements, the two main observation targets identified for this type of instrument, with a spatial resolution of 100 meters. This result has been possible on the basis of an agreement that all future operators of these satellites will publish in advance on the Space Frequency Coordination Group (SFCG) website the observation areas and schedule of their campaigns, so that the other users of the band can be aware of the planned use beforehand.

Agenda item 1.13: Issues related to HAPS

This agenda item is of interest to CGMS in order to protect the sensor band 31.3 – 31.5 GHz used by AMSU on Metop and NOAA satellites from unwanted emissions by High Altitude Platform Systems (HAPS) in the adjacent band.

Outcome of WRC 2003: Very stringent limits on the unwanted (out-of-band and spurious) emissions (-100dBW/m²) by HAPS uplink stations have been put in the ITU Radio Regulations. This will guarantee the protection of the "window" for the meteorological vertical sounders and at the same time will allow the development of HAPS systems around 31 GHz in a number of interested countries, mainly in Asia, but including also Russia. This regulation represents also the very important first case of having a hard limit specified for unwanted emission levels in the Radio Regulations; this should open the door for similar protection levels needed for other bands used for satellite passive sensing.

Agenda Item 1.16 (Non-GSO MSS feeder links in bands around 1.4 GHz)

This item deals with the protection of the 1.4 GHz band (to be used by SMOS) from unwanted emissions by new Mobile Satellite feeder links in nearby bands. The US industry made a strong attempt to get an allocation for MSS feeder link despite the unfavourable conclusions of compatibility studies conducted by the relevant ITU-R Working Parties and the incompleteness of these studies. The CEPT had submitted a European Common Proposal (ECP) for no allocations to MSS feeder links to WRC 2003, which was signed by 35 European administrations. Moreover, around 60 other administrations submitted proposals for no allocations to MSS feeder links. Despite this very strong position expressed by almost 100 countries, the USA, supported only by three other administrations, pushed its desire for an allocation by using all available means.

Outcome of WRC 2003: After lengthy and heavy debates, it was finally possible to limit the allocation for MSS to a secondary status restricted to the bands 1390 - 1392 MHz for uplinks and 1430 - 1432 MHz for downlinks. Furthermore, and very importantly, the allocations are only provisional and tied to a Resolution which does not allow the use of these bands for MSS feeder links before completion of all ITU-R studies to be reviewed by WRC-07.

Agenda Item 1.5 (Use of the frequency range 5 150 - 5 725 MHz)

Protection of the EESS active sensors operating in the band 5250 - 5350 MHz (e.g. SAR on ERS-1 and ENVISAT) from new wireless LANs (RLAN) to be deployed in this band.

This has been one of the most difficult issues at WRC 2003. The ITU studies conducted on this issue in preparation of WRC 2003 had concluded that a proper protection of the EESS active sensors could only be achieved by limiting the RLAN to indoor use only and by imposing some additional technical constraints. This conclusion was supported by the European RLAN industry, which confirmed that these constraints were acceptable to them. Compatible European regulations in this area have been put in place already since 3 years. Unfortunately, the US and Canadian national regulations allowed outdoor usage of this equipment as well as higher power and therefore these administrations, supported by the North American wi-fi industry, objected to the results of the ITU studies. While the Canadian problem has been solved with a compromise that will allow limited outdoor usage only with antennas with strong attenuation above the horizontal plane, it has been very difficult to deal with the US objections.

Outcome of WRC 2003: The solution has been to introduce regulatory text that invites Administrations to encourage "predominantly indoor" systems, but at the same time allows Administrations to use alternative methods to protect the EESS systems. What these alternative methods may be is unclear, since all the technically meaningful methods have been analysed.

A new footnote has been introduced in the Radio Regulation for this band, stating that no harmful interference shall be generated by the RLAN devices towards the EESS sensors. This implies that demonstrated interference shall lead to the obligation of switching off the RLANs.

Extension of the size of the allocation to EESS active sensors in the 5 GHz range from the current 210 MHz bandwidth to 320 MHz.

This frequency extension was requested to allow future high-resolution altimeters or SARs in C-band (eventual JASON-2 follow-on).

Outcome of WRC 2003: The extension of the band allocated from 5250 - 5460 MHz to 5250 - 5570 MHz has been achieved at this WRC. The allocation has been given in the same band also to Space Research active systems (to be used for planetary exploration).

Agenda Item 1.8 (Unwanted emissions)

This agenda item dealt with unwanted emissions from adjacent bands into passive sensor bands. Several bands were identified were regulations are required to protect passive sensors. Active services were very reluctant to establish mechanisms for such protection and there was no conclusive output from 2003. The agenda point will be put on the agenda of the next competent WRC (most probably WRC 2007).

One of the problems discussed was related to the protection of the band 50.2 - 50.4 GHz (used by AMSU on Metop) from unwanted emissions by High Density Fixed Satellite

Systems (HDFSS) operating uplinks in the lower adjacent band. It has been possible to insert in the associated Resolution some text inviting Administrations to limit HDFSS uplink deployments in the frequencies next to 50.2 GHz until proper ITU studies will have identified mechanisms to protect the sensors in the 50.2 - 50.4 GHz band. Although the threat is not imminent (some even question if these high frequency bands are really suitable for HDFSS applications), studies are needed in this area in the future.

Outcome of WRC 2003: Despite strong resistance by some important Administrations, the WRC decided that the problem of unwanted emissions into passive bands will have to be studied and technical regulations should be put in place. This will constitute one of the most complex issues to be covered in the next ITU study cycle.

Agenda for the future WRCs (WRC-07 and WRC 2010)

As usual the agenda for the next WRC-07 contains quite a mix of different subjects. 21 Agenda Items have been included. There are two agenda items, which are very important to CGMS Members. These two items are:

Expansion of MetSat Allocation

EUMETSAT (see EUM-WP-25), supported by other CGMS Members, has forwarded to WRC 2003 the request to include a new agenda item concerning the expansion of the present footnote allocation for the Meteorological Satellite Service in the band 18.1-18.3 GHz by 100 MHz. The new allocation either in the band 18.1 – 18.4 GHz or 18.0 – 18.3 GHz should be on a primary status and could be used for geostationary meteorological satellite downlinks (for example METEOSAT Third Generation). The agenda item was accepted and was put on the agenda for WRC 2007. It was combined with other EESS activities as follows:

"AI 1.2, related to sharing studies in the bands 10.6 - 10.68 GHz and 36 - 37 GHz between passive EESS sensors and terrestrial services, as well as to the extension by 100 MHz of the current Meteorological Satellite downlink band 18.1 - 18.3 GHz (to cover the higher data rates required by the next generation of Geostationary Meteorological Satellites)."

Consideration of the use of frequencies between 275 and 3000 GHz

It is necessary to provide suitable frequency allocations for passive sensor atmospheric measurements in the EESS (passive) and SRS (passive). There are already spaceborne passive sensors utilising frequency bands above 275 GHz. Planned and existing instruments include MLS (USA), SMILES (Japan) as well as other sensors which use spectra above 275 GHz.

Protection is presently only given by footnote S.5.565 that was revised by WRC-2000. This footnote is quoting that the band 275 – 1000 GHz may be used for experimentation and development of various active and passive services. A list of frequencies is contained in the footnote but this list is not complete. Operations of sensors in such frequency bands are not adequately protected. It is therefore necessary to open the table of frequencies to include frequencies up to 1000 GHz.

An agenda item was put on WRC 2010 to consider the expansion of the table of frequencies up to 3000 GHz. A corresponding resolution (COM7/1) was adopted.

Another very important topic on the agenda of WRC 2007 is:

Agenda item 1.20 "to consider the results of studies, and proposals for regulatory measures regarding the protection of the Earth exploration-satellite service (passive) from unwanted emissions of active services in accordance with Resolution 738 (WRC 2003)"

Resolution 738 (WRC 2003) calls for studies on the compatibility analyses between EESS (passive) and the corresponding active services in certain bands listed below with a view to updating Recommendation ITU-R SM.1633 or developing additional Recommendations.

EESS (passive) band	Active service band	Active service
1 400-1 427 MHz	1 350-1 400 MHz	Fixed service (FS) Mobile service (MS) Radiolocation service
1 400-1 427 MHz	1 427-1 429 MHz	FS, MS (except aeronautical mobile service) and space research service (Earth-to-space)
1 400-1 427 MHz	1 429-1 452 MHz	FS and MS
23.6-24 GHz	22.55-23.55 GHz	Inter-satellite service
31.3-31.5 GHz	30-31 GHz	FSS (Earth-to-space)
50.2-50.4 GHz[1]	50.4-51.4 GHz[1]	FSS (Earth-to-space)[1]
50.2-50.4 GHz[1]	47.2 -50.2 GHz (Regions 2 and 3) 49.44-50.2 GHz[1] (Region 1)	FSS[1]

[1]Studies in this band must take into account No. 5.340.1 of the Radio Regulations which states "The allocation to the earth exploration-satellite service (passive) and the space research service (passive) in the band 50.2-50.4 GHz should not impose undue constraints on the use of the adjacent bands by the primary allocated services in those bands.

Summary of WRC 2003 Results

The results of WRC 2003 were very good for CGMS Members and the meteorological user community. The main positive results were:

- The termination of activities to allocate spectrum to MSS in bands presently used by Meteorological Satellite Service. The only allocation MSS achieved (1668 – 1675 MHz) is in a band not used by EUMETSAT. Other CGMS Members operate a few downlinks in this band. These links will be protected by the footnotes attached to the new MSS allocation.
- The inclusion of hard limits on HAPS operations neighbouring to the band 31.3 – 31.8 GHz. This was based on results of EUMETSAT studies successfully forwarded through ITU working parties and study groups.

- The expansion of EESS (active) allocation from 210 MHz to 320 MHz bandwidth for altimeters in the band 5250 – 5570 MHz.
- The inclusion of the new agenda item related to the expansion of the Meteorological Satellite Service footnote allocation in the band 18.1 - 18.3 GHz by 100 MHz to the WRC 2007 agenda.
- The inclusion of the opening of the table of frequencies from 275 GHz to 3000 GHz as an agenda item to WRC 2010.

Other Frequency Management Issues

WMO-WP-11 informs on the results of the Fourteenth Congress related to Radio Frequency matters. The Congress re-affirmed the prime importance of radio frequency matters for meteorological and related environmental operations and research, and adopted Resolution 3 (Cg-XIV). It particularly emphasised that the utmost importance should be attached to ensuring absolute protection of the special bands allocated to space-borne passive sensing (e.g. the exclusive 23.6 - 24 GHz passive band for measurement of atmospheric water vapour), which were a unique natural resource for atmospheric measurements and had an increasing importance in meteorology (e.g. observation, NWP, climatology). Resolution 3 (Cg-XIV) was brought to the attention of the Secretary-General of ITU as well as submitted to the World Radiocommunication Conference 2003, emphasising on "APPEALS to the International Telecommunication Union and its Member Administrations, (1) and (2) "

The 14th Congress strongly urged Members to actively participate in radio frequency activities, especially the preparation of World Radiocommunication Conferences (WRC) issues, conducted by their national telecommunication administrations, by regional radiocommunication organisations (CEPT for Europe, APT for Asia-Pacific, CITEL for the Americas, PATU and the Arab League for Africa and the Middle East), and by the ITU. It also requested CBS to pursue the continuous review of regulatory and technical radio frequency matters, and the Secretary-General to continue the active role of the Secretariat in coordinating and supporting radio frequency activities.

CGMS Members were informed that the “Handbook on use of radio frequency spectrum for meteorology”, which was developed in cooperation between WMO and ITU, was published as a joint WMO/ITU publication in paper and CD format and was distributed to all NMHSs.

USA-WP-14 provides a summary of radio frequency topics involving meteorological satellites discussed at recent meetings of the Space Frequency Coordination Group and the International Telecommunication Union’s Working Party 7C. The SFCG members discussed objectives relative to the space science services on the agenda of the 2007 World Radio Communication Conference (WRC-07). SFCG promotes the use of space-based passive sensors to provide vital ecological and environmental data that is unobtainable by any other means. Such passive sensors depend for their successful operation on frequency bands that are defined by the physical laws of the atmosphere.

However, in frequency bands allocated to the Earth exploration-satellite (passive) service, where sharing with active systems has been shown to be not feasible, the SFCG holds the view that such active systems should not be implemented, and would support

any review by administrations that might lead to a reduction in the number of such infeasible sharing situations in the Table of Frequency Allocations.

During the first plenary session of CGMS XXXI the Korean Aerospace Research Institute (KARI) presented their plans for a geostationary satellite containing a meteorological payload. It was stated that there would be downlinks in the band 1670 – 1710 MHz. WG I recalled that there is a CGMS agreement on the separation of this band into various subsections to be used for main stations, user stations, and broadcasts from polar-orbiting satellites. This CGMS agreement was also implemented into ITU Recommendation SA 1158. KARI was requested to take into account this recommendation when finalising its downlink frequency plan.

Action 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. Deadline: CGMS XXXII

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

This topic has been introduced in detail at CGMS XXX. Three working papers on this topic were presented to CGMS XXXI, namely ESA-WP-03, EUM-WP-13 and USA-WP-14.

ESA-WP-03 provided a report on the status of the discussions in Europe about the potential use of UWB (Ultra Wide Band) technology for car collision avoidance Short Range Radars (SRRs) in the band around 24 GHz.

The most important evolution of the SRR discussion in Europe has been the fact that CEPT concluded on the non-feasibility of the sharing between SRRs and most of the other services operating in the 24 GHz area including in particular the EESS (passive) service operating in the band 23.6-24 GHz. This was the case even in the presence of a change in the SRR characteristics indicated by the SARA (Short-range Automotive Radiofrequency Allocations) group, which aligned these technical specifications to the FCC (Federal Communications Committee) ones, both in terms of e.i.r.p. and in term of reductions of the non-horizontal emission limits in time-steps.

For the EESS part, this conclusion was based on studies conducted by ESA, EUMETSAT, and CNES. A deficit of 10.8 dB was calculated in the sharing scenarios that considered the final market penetration figures, implying that compatibility could only exist in the case of a market penetration capped to 10%.

Frequencies in the 77 GHz range have been identified as the only possible long-term solution to allow the SRR deployment.

The discussion has therefore concentrated on the possibility (or not) of developing a short-term solution allowing a temporary deployment of SRRs at 24 GHz up to a TBD date, under the hypothesis that the market penetration of these devices will remain below the 10% threshold. Three positions are presently under discussion.

The Short Range Automotive Radar (SARA) position asking for the possibility to market 24 GHz devices up to 2014, with the justification that 77 GHz devices cannot be commercialised before and that anyhow the market penetration will be below 10% until that date.

The EESS community position stating that this temporary solution is unacceptable, also because it would violate footnote 5.340 (no emission are allowed in this band). A possible compromise solution of limiting the production of 24 GHz Short Range Radars (SSRs) to the year 2008, when the market penetration will be still low enough to take care of some of the uncertainties in the sharing analysis.

The compromise solution is not really supported by any of the two "groups". SARA state that it could not work from a commercial point of view and in any case they will not be ready by 2008 with the 77 GHz technology (!). The EESS community is very worried by any acceptance of the principle that you can waive the application of 5.340 and by the consequences this may have also in other areas.

At the moment the situation is somehow blocked, with most of the European administration objecting to any use at 24 GHz (mostly to protect the FS - Fixed Service - systems in that band) and the European Commission heavily pushing in support of the SARA position.

EUM-WP-13 also summarises the developments of introduction of SRRs in Europe and provides information on activities of EESS organisations.

The Directors of the European organisations ESA, ECMWF, EUMETNET, and EUMETSAT have sent letters to the European Commission to stress concerns on the planned SRR implementation. A similar letter was also sent by WMO.

In his reply to the organisations the responsible EU Commissioner has stressed that the requirements of the EESS community will be taken into account in any regulation concerning the SRR implementation. He stressed that an "explicit and credible commitment" on the issue of a temporary SRR implementation around 24 GHz needs to be developed within the CEPT framework.

USA-WP-15 provides a summary of the USA position on the use of the 21 - 27 GHz band and its use for car radars. The USA reviewed its position on the use of car radars systems operating in the 21 - 27 GHz band. The 24 GHz band is an exclusive and unique band for sensing characteristics of the atmosphere needed to forecast weather and climate throughout the world. Accordingly this band has been granted additional protection from Radio Frequency Interference (RFI) as stated in international ITU-R Regulation Number 5.340 ("all emissions are prohibited in the following bands :..."). The critical importance of this band for accurate and early weather forecasting has resulted in NOAA studies of the proposed use of this band for Ultra Wide Band (UWB) devices and services, especially automotive radars. These studies resulted in a NOAA determination that the extensive proliferation of automotive radars in high density areas (e.g., metropolitan or urban areas) could seriously and permanently compromise the availability of weather data from this critical band. Most meteorological agencies, including NOAA, have also noted that the automotive radar functions could be performed in the 77 MHz band instead of the 24 GHz band, thereby ensuring that this

unique 24 GHz resource would not be irreparably contaminated and remain available for its natural weather forecasting potential.

Considering the criticality of this issue to the space-component of the GOS and to its all-weather sounding capability, CGMS Members are invited to express their concerns to their national frequency administrations.

Action 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. Deadline: 31 January 2004

In USA-WP-14, in conclusion, the USA discussed contributions expected from CEOS. At its 23rd meeting in September 2003, the SFCG membership considered the preliminary agenda for the WRC-10 as found in ITU Resolution 803 (WRC 2003). Not all of the items in that agenda are of interest to the SFCG. However item 2.2 "to consider frequency allocations between 275 GHz and 3000 GHz taking into account the result of ITU-R studies in accordance with Resolution 950 (WRC 2003)" is one of interest not only to the SFCG but also to the CEOS Plenary. It provides the opportunity for CEOS to have the future planned CEOS sensor frequency needs considered for placement in the ITU's Table of Frequency Allocations. Such needs can be realised by having the SFCG act as the advocate for CEOS and have such frequencies added to the SFCG's list of WRC objectives. It is incumbent on the CEOS Plenary and its members to not waste such an opportunity and provide to the SFCG the necessary input document for consideration at the 24th SFCG meeting in September 2004. The SFCG web master must receive the contribution electronically no later than August 19, 2004. The email address is: john.e.zuzek@nasa.gov.

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

Frequency Plans for missions in the Indian Ocean Region

CGMS Action 30.4 requested CGMS Members to provide relevant information on frequencies used or planned for use in support of CGMS missions in the Indian Ocean region.

Two documents were received and discussed in WG I.

In USA-WP-20, NOAA provided a summary of possible support over the Indian Ocean using a GOES spacecraft. GOES-8, the first in current series of GOES satellites (GOES-8 through –12) began operation in 1994. The last in the series, GOES-12, was launched in 2001. Currently all five of the spacecraft are functional, though GOES-9 has limited capacity. GOES-10 and –12 are the operational satellites, located nominally at 135°W and 75°W, respectively. GOES-9 was moved earlier this year to near 155°E to assist the Japanese whose GMS spacecraft is nearing its end of life. The presence of a GOES satellite will avoid a possible gap in Japanese geostationary meteorological satellite coverage should this spacecraft fail before the launch of the next satellite, MTSAT. Knowing the limited function of GOES-9 and its possible failure in the near future,

NOAA recently positioned GOES-8, a much healthier satellite, at 165°E as a back-up to GOES-9. GOES-8, however, has no fuel remaining for orbital manoeuvres. With two GOES being used as the U.S. operational spacecraft and with the two oldest providing support to Japan, the only remaining satellite, GOES-11, must remain in storage at 105°W to be readily available as a back-up to the two operational satellites should one fail.

EUM-WP-14 provided information on frequencies used by the Meteosat spacecraft presently operated at 63°E.

After the presentation of the documents there was a discussion on potential conflicts between the various operations. The operations positions are as follows:

Meteosat	63° East
Kalpana-1	74° East
INSAT-2E	83° East
FY-2A	86° East
INSAT-3A	93.5° East
FY-2C	105° East
COM5	116° East
FY-2D	123.5° East
MTSAT	140° East

It was concluded that most spacecraft positions allow simultaneous interference free operations. There is one exception, i.e. the FY-2 spacecraft and the planned geostationary spacecraft of the Korea Aerospace Research Institute (KARI) are only separated by 7 degrees. This does not allow discriminating broadcasts to user stations. The FY-2 satellite is notified with the ITU. KARI needs to coordinate with CMA to avoid problems during the notification process and operational conflicts.

I/2 Telecommunication techniques

No working papers were presented under this agenda item.

I/3 Coordination of International Data Collection & Distribution

I/3.1 Status and Problems of IDCS

EUM-WP-15 reported on the Status and Problems of the International Data Collection System (IDCS). The Working Group noted that at the beginning of September 2003, there were 377 International DCP (IDCP) registered worldwide for use with the IDCS, using 19 of the 33 available channels (see below). This is 23 IDCPs more, when compared to one year ago. By special agreement with CGMS, 32 IDCPs are operated by Aeronet using channels I23-I24, 20 IDCPs are operated by Roshydromet using I25, with I26 available for a further expansion of the Russian network, and 174 are "Regional" DCP belonging to WMO's agro-meteorological and hydro-meteorological networks, operating over channels I27-I33.

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

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

JPN-WP-06 reported that as of 31 August 2003, the total number of IDCPs registered on the GMS-5 IDCS was 66 i.e. 57 for ships including ASAP ships and 9 for airborne ASDAR units. Japan further noted that it had experienced severe interference, affecting the successful relay of IDCP messages, on some of its IDCS channels in the Pacific region, however, the level of interference was similar to that experienced in 2002. EUMETSAT commented that such serious interference currently did not appear to be a problem in the Meteosat telecommunications field of view, although there was only limited monitoring of channels because of the ongoing MSG-1 commissioning activities.

RUS-WP-06 informed CGMS that a first batch of 20 experimental DCPs had been installed at hydrometeorological stations in the European and Ural regions of Russia. DCP tests started at the end of the summer 2002 and DCPs messages were transmitted via Meteosat-7, mainly using channel I25. Channel I26 had been used temporarily for the relay of messages from DCP located in the far north of Russia, where reception difficulties had been experienced due to the fact that the DCP were probably located on the extreme fringe of the reception field of view of the satellite and because there had been some periodic movement in the orbital position of the satellite. For all the Russian DCP direct data collection was carried out by the SRC Planeta ground receiving station near Moscow. In response to a query from EUMETSAT, Russia confirmed the operational DCP, developed to be used with the GOMS/Electro N2 DCS which will provide the operation of 300 regional channels and 33 international channels, will relay message information formatted according to standards established by CGMS and described in the IDCS Users Guide.

EUMETSAT whilst noting that it would be difficult for Russia to retrofit the experimental DCPs, stressed that as it was responsible for monitoring the IDCS system in its area of responsibility (Meteosat) it was unable to decode messages from the experimental Russian DCP and, as a consequence, would not be able to support any investigation of any anomalies that might be encountered by the Russian network. All future allocations of IDCP on channels I25 and I26 should involve DCP units transmitting messages in the agreed IDCS format.

In response to a query from WMO concerning future operation of data collection and relay systems by China and Korea, China reported that whilst its current FY-2 satellite had such a capability, it was not being used. However, the data collection and relay facility of future satellites in the FY-2 series would be operated. Korea reported that it had no plans to operate such a mission in the foreseeable future.

USA-WP-16 reported that, pending delivery and installation of the DCS Automated Processing (DAPS) II System, the current USA monitoring procedures had been interrupted several times throughout the 2003. In early September, the monitoring activities were terminated for the actual installation of the GOES DAPS II equipment. Continuous real-time monitoring of the IDCS operation was expected to resume in January 2004. NOAA acknowledged that a conflict in the generation of new platform

identifications made it difficult for NOAA to include new addresses generated by EUMETSAT in its database, as some of these addresses already existed in the original USA database, as these platform identifications, assigned to US domestic platforms, had been operating for decades. This conflict had not recognised by NOAA at the time this scheme was agreed upon, however, it plans to address this discrepancy after the completion and phase-in of DAPS II.

In USA-WP-18, CGMS was informed about a NOAA request for the temporary use of International Channels for High Data Rate (HDR) (300/1200bps) DCP. NOAA has begun the deployment of HDR transmitters and currently NOAA has almost 3000 transmitters assigned at the two higher data rates. In order to ease this transition, NOAA requested that CGMS grant permission to temporarily utilise unused international channel capacity for the staging of 100 bps transmitters. NOAA proposed to use these channels for a ten-year period, i.e. until 1 June 2013. If all NOAA 100 bps channels were converted to high data rate before that time, then the international channels would be freed up sooner.

Whilst noting that there was currently significant under use of the IDCS channels, WG I expressed some concern over the potential commitment of up to 5 IDCS channels for a 10 year period. NOAA confirmed that whilst a block of five consecutive channels was the preferred option, the use of five individual channels was also acceptable. The following action was agreed:

Action 31.22 NOAA 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. Deadline: CGMS XXXII

I/3.2 Ships, including ASAP

In WMO-WP-13, CGMS was informed about the number of radiosondes performed in 2002 within the framework of the Automated Shipboard Aerological Programme (ASAP). The total number of radiosondes had decreased (–5%) due mainly to INMARSAT transmission problems encountered by Spain, and also to a slight decrease in the number of radiosondes performed by France and the United Kingdom. CGMS noted that two important contributors to the ASAP Programme (Russian Federation and NOAA) had temporarily suspended their ASAP activities and that the ASAP Panel was encouraging those countries to implement new ASAP ships, especially on routes where upper-air data were sparse.

CGMS noted the important role expected from ASAP observations in the redesign of the World Weather Watch's Global Observing System (GOS) and strongly supported the efforts by the ASAP Panel to increase such observations. For its part, CGMS remained committed to provide the system support for ASAP observations.

I/3.3 ASDAR

In WMO-WP-09, CGMS was informed about the latest status of the operational Aircraft to Satellite Data Relay (ASDAR) Programme. CGMS noted that although the number of ASDAR reports continued to decline, a small number of aircraft still provided valuable

data in data sparse areas of the world. Of the eight installed ASDAR units, only five had reported during the previous 6 months. ASDAR aircraft were still reporting over Africa, central, southern and northern Atlantic Ocean, western, northern and southern Indian Ocean, Asia and Eastern Europe. CGMS was informed that ASDAR equipped airlines were actively working to replace older ASDAR equipped aircraft with larger fleets of AMDAR equipped aircraft. It was expected that coverage of the data sparse areas would be improved over the next two years as more AMDAR aircraft became operational. CGMS would be advised if there were any substantial changes to the ASDAR Programme.

Noting the current level of utilisation of IDCS channels and the earlier request from NOAA for the temporary but long-term use of IDCS channels, the Chairman suggested that there should, bearing in mind evolving technology, perhaps be a requirement for CGMS Members to review future requirements for IDCS capacity in both the short- and longer-term (e.g. up to 15 years time). Such requirements could only realistically come from the user community.

Action 31.23 WMO and IOC to review requirements for the IDCS in the near and long-term future (up to 15 years). Deadline: CGMS XXXII

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

No working papers were submitted under this item.

WORKING GROUP II: SATELLITE PRODUCTS

II/0 Introduction

Working Group II on Satellite Products (WG II) was chaired by Dr. Ramesh Bhatia, IMD, and Dr. Paul Menzel, WMO, assisted as secretary. 28 working papers were discussed. Several of these papers were in response to actions from CGMS XXX: regarding monitoring practices for satellite radiance data, post launch calibration experiences, establishing data broadcast processing packages for future sensors, establishing faster access to data and products from polar-orbiting systems. In addition the reports from the International TOVS Working Group and the International Precipitation Working Group were presented and discussed. All past actions were addressed. Nine new actions were suggested.

II/1 Image Processing Techniques

There were no papers on image processing techniques. However, WG II noted again that the challenges of 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) warrants further discussion at a future CGMS. Papers on these subjects are encouraged for CGMS XXXII.

II/2 Satellite Data Calibration

ESA-WP-05 reports on the status of the instrument calibration of Medium Resolution Imaging Spectrometer (MERIS), which is on board ENVISAT. The radiometric calibration of the instrument has yielded results of very high accuracy using Spectralon^{TM} diffusers viewing the Sun as a reference. The highly stable design of the instrument, coupled with the system described above, guarantees users data of the highest quality for the complete lifetime of MERIS. The CEOS working group Cal/Val (WGCV) subgroup on Infrared and Visible Optical System Calibration (IVOS) is currently reviewing different solar radiometric calibration concepts and plans to hold a workshop in the 2004 timeframe on the inter-comparison of solar radiometric calibration of the large scale optical sensors.

EUM-WP-16, written in response to CGMS action 30.19, describes the operational method for the routine calibration of the solar channels of SEVIRI on MSG. The method relies on calculated radiances from clear ocean and bright desert targets that are associated with observed raw radiances. The accuracy of the simulated radiances is about 3% and has been validated by using well calibrated space-borne observations acquired over the target areas. First SEVIRI images have been calibrated with an estimated error of 4 - 6%.

JPN-WP-08 describes the intercalibration results between the GOES-9 Imager and GMS-5 VISSR infrared channel data collected just before switch over. Simulated brightness temperatures for given atmospheric conditions were calculated; observed brightness temperatures showed some differences from simulated ones. GOES-9 and GMS-5 residuals of simulated minus observed brightness temperatures average 0.70 K, 0.28 K and 2.4 K for the infrared window channels 1 and 2 and the water vapour channel respectively. Potential sources of the differences include inaccurate calibration,

degradation of the sensors, and systematic error in the simulated brightness temperatures. In order to understand the discrepancy between observed and calculated brightness temperature differences between GOES-9 and GMS-5, further research is necessary.

In USA-WP-23 submitted in response to CGMS action 30.19, the in-flight calibration of the Moderate Resolution Imaging Spectro-radiometer (MODIS) reflective solar bands (RSB) is described. MODIS visible and near infrared bands are calibrated on-orbit by a solar diffuser (SD) and a solar diffuser stability monitor (SDSM) system. The paper provides examples of RSB long-term response trending and discusses the methodology of inter-calibration of different sensors via lunar observations. The MODIS RSB radiance product uncertainty is +5% including the solar irradiance error contributions. In the lunar calibration, the percent differences between the model and measured values are nearly identical for both Terra and Aqua MODIS (less than 1%), a clear demonstration of their consistent calibration. An approach is presented for using satellite orbital intersections for inter-comparison and/or calibration and the application of this technique to the Terra and Aqua MODIS (bands 1 and 2) and the latest Advanced Very High Resolution Radiometer (AVHRR) on board the NOAA-17 (channels 1 and 2). Using NOAA-17 AVHRR as a common reference, it is found that the difference between Terra and Aqua MODIS calibration is about 0.3% and 0.7% for bands 1 and 2. MODIS is a good inter-comparison candidate because of its broad spectral coverage and the two nearly identical copies currently operating on the EOS Terra and Aqua satellites. The use of MODIS with the Visible/Infrared Imaging Radiometer Suite (VIIRS) in the National Polar-Orbiting Operational Environment Satellite System (NPOESS) will be even more attractive in providing high quality inter-comparisons because of their similar design characteristics including some of the same on-board calibrators and many similar spectral bands.

USA-WP-29 reports that NESDIS/CIMSS has been intercalibrating geostationary satellites (GOES-8, -9, -10, -12 Imagers, Meteosat-5, -7, GMS-5) with a polar-orbiting satellite (NOAA-14, -15, -16 HIRS and AVHRR) on a routine, automated basis using temporally and spatially co-located measurements in 11-µm infrared window (IRW) and 6.7-µm water vapor (WV) channels. Using NOAA-15 and -16 as references, the GOES-GMS compare within 1K and the Meteosat satellites compare within 1K; but the two groups compare only within 3K. WV comparisons are within 4K, possibly indicative of calibration problems in some of these instruments. Additional results can be found at http://cimss.ssec.wisc.edu/goes/intercal. GEO comparisons with well calibrated Advanced Infrared Sounders (AIRS) and MODIS are being started, as well as 13.3 µm LEO comparisons with GOES-12.

USA-WP-30 reports on the efforts at NESDIS to calibrate the AVHRR and GOES solar channels post launch; these channels do not have on-board calibration devices so post-launch calibration can only be attempted via vicarious techniques (i.e., using external references). There are four broad categories of external references that are commonly used: stable Earth targets, celestial targets, calibrated radiometers, and modeled radiances. The first three approaches are employed at NESDIS to calibrate the solar channels of the AVHRR and the GOES Imager. Current status and results of applications with the first three types of external references are summarised. Eight years of observations from the visible channel of the GOES-8 Imager over the Sonoran Desert suggest a degradation rate of 5.8% per year.

EUM-WP-18 recalls past discussions regarding a workshop on calibration of satellite sensors and proposes the initiation of a workshop wherein an inventory of the calibration of IR and VIS sensors on operational meteorological satellites is established. As the scope of the original proposal appears to be too broad the paper (i) proposes to confine the initial work to operational meteorological satellites and (ii) outlines a workshop confined in scope. WG II welcomed the idea of a calibration workshop but felt that the focus of the workshop should be sharpened. WG II suggested that a preparatory group should be nominated to organise a calibration workshop.

Thus CGMS noted that considerable progress has been made to improve calibration of operational and research sensors, that considerable discrepancies in calibration accuracy evaluations remain, and that the following actions should be undertaken.

Action 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. Deadline: 31 January 2004

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

Action 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: CGMS XXXII

II/3 Vertical sounding and ITWG matters

ESA-WP-06 describes the potential use of ESA EO satellite data for climate purposes. The paper notes the first EO satellite launched by ESA, in 1977, was Meteosat. This was followed by six of the same series, now being fully operated by EUMETSAT. The Meteosat database constitutes a very good record of climate data, that EUMETSAT is recovering both physically (from the original tapes to a long-term archive) and by re-processing. Data from ERS (ESA Remote Sensing) satellites, launched in 1991 and 1995 respectively, have also been archived. The main sensors on board ERS-1 were Synthetic Aperture Radar (SAR), Scatterometer, Radar Altimeter & Microwave radiometer (MWR), and Along Track Scan Radiometer (ATSR). ERS-2 added the Global Ozone Monitoring Experiment (GOME) and a modified ATSR. The Metop series, with initial launch in 2005, embarks advanced continuations of the ERS-1/2 scatterometers and the ERS-2 GOME, thus assuring long-term records of ocean wind fields and ozone data.

ESA-WP-08 summarises the use of Numerical Weather Prediction (NWP) systems for monitoring of Earth Observation data produced by ESA satellites. The ERS and ENVISAT data products are validated by comparison with the collocated ECMWF atmospheric and ocean-wave model data. By studying the differences between satellite and model data one can make conclusions about the quality of the satellite data, and by studying time series of the differences one can draw conclusions on the stability of the performance of the instruments. Based on more than a decade of these ESA and

ECMWF collaborations, it is now known that this comparison method is sound, because of the high quality of the ECMWF model products (which incorporate observational data from many other sources) and because the comparisons are done on a global scale. As an extra check, ECMWF compares also satellite products against in-situ observations whenever and wherever possible. It is planned that these monitoring activities will be extended to future ESA missions also.

EUM-WP-17 provides a review of the radio occultation experiment flown on the German satellite CHAMP. This experiment has produced up to now the longest and most comprehensive occultation data set. With the limb sounding by occultation from the GRACE twin satellites more than 500 globally distributed temperature and water vapour profiles are expected per day. Good agreement has been obtained with ECMWF analyses. Prof. Reigber of GFZ Potsdam provided the paper in response to CGMS Action 30.20 that states 'EUMETSAT to invite scientists participating in CHAMP to submit a report on sounding experiences at the next CGMS'. WG II was also informed that the UK Met Office had demonstrated positive NWP impact from assimilation of CHAMP bending angle measurements in a two week test.

EUM-WP-20 was written in response to CGMS action 30.23. It reports that EUMETSAT is taking steps to provide ingest and pre-processing code for future advanced instruments, and integrate this code into (existing) processing packages for international distribution in a timely manner, such that those packages are available prior to the launch of the new sensors. Sensor information, navigation and calibration information will be made available. Activities are planned to upgrade the Advanced ATOVS Processing Package (AAPP) for the European Polar System (EPS)/Metop/NOAA-N, N' era. The current AAPP must be adapted to support the MHS instrument for which NOAA-N will provide the first real data in summer 2004. The upgrade of AAPP for the use with Metop data is anticipated in summer 2005. This will accommodate the A(dvanced)HRPT on Metop that will contain all instrument data including the new infrared high spectral resolution sounder IASI (Infrared Atmospheric Sounding Interferometer) and the Advanced Scatterometer (ASCAT).

EUM-WP-21 details the cooperation between EUMETSAT and several European NWP centres to generate instantaneous feedback on product quality and also to provide long-term monitoring of the products. Currently EUMETSAT monitors data from Meteosat-5, -6 and -7 and ATOVS data available through EUMETSAT ATOVS Retransmission System (EARS). The EUMETSAT Polar System and the EUMETSAT contribution to the Ocean Surface Topography Mission (OSTM) with JASON-2 will also be added when these data become available.

EUM-WP-26 reports on the recent improvement in timely access to ATOVS data through the EUMETSAT ATOVS Retransmission Service (EARS). In June 2001, the EUMETSAT Council decided to establish a satellite data service that provides the meteorological community with satellite data sets from the US NOAA polar-orbiting satellites covering data-sparse sea areas around Europe. The aim is to provide ATOVS level 1a and 1c data with a timeliness of 30 minutes to cover the needs of EUMETSAT Member State Regional NWP operators for NOAA sounder data. Initial implementation has been most successful and future plans are to expand the areal coverage, to achieve operational product quality control through the NWP SAF, and to support dissemination of EPS sounder and ASCAT data sets.

IND-WP-06 presents the results of recent studies carried out at IMD, New Delhi, regarding improvements in the quality of temperature and humidity profile derived from NOAA ATOVS data. Assimilation of humidity profile derived from this data into the Limited Area Model forecasts being run operationally at IMD shows positive impact. CGMS Members are invited to take note.

USA-WP-24 states that currently NOAA/NESDIS has no formal method of using NWP data for monitoring data quality. However, NESDIS is embarking on a project to develop a user-friendly, one-stop, searchable web-based system for compiling, monitoring, and archiving polar and geostationary satellite instrument performance data. This system will make use of existing systems where possible through the use of web links. The system shall 1) provide the ability for managers to access high-level data on instrument status so as to assist in making decisions, e.g., whether to discontinue operational use of data from that instrument, 2) maintain a history of metadata, e.g., to help climate scientists interpret features in time series of satellite-based geophysical data, and 3) provide engineering and radiometric performance information for monitoring instrument performance and data quality. All of the data and metadata used in the system shall be permanently archived and documented with the ability for easy retrieval. The system shall include links to NWP radiance monitoring sites for quality assurance.

USA-WP-25 discusses the development of Direct Broadcast Services for the National Polar-orbiting Operational Environmental Satellite System (NPOESS), including High Rate Data (HRD) and Low Rate Data (LRD) broadcasts. Later this decade, NPOESS spacecraft will begin on-orbit operations and transmit Stored Mission Data to globally distributed ground stations. NPOESS will simultaneously broadcast real-time HRD (X-band) and LRD (L-band) data streams to suitably equipped field terminal systems. The NPOESS LRD service will be closely compatible with, but not identical to, the broadcast parameters for the Advanced High Resolution Picture Transmission (AHRPT) format that have been accepted and approved by CGMS. The NPOESS prime contractor is developing scalable software for the Interface Data Processing Segment (IDPS) that will run at U.S Centrals and on HRD/LRD field terminals. During the next 3-5 years, the IPO will be working with the DoD/NOAA program offices responsible for field terminals to develop and begin testing prototype terminals for the HRD/LRD broadcasts. Full details on the technical specifications for these HRD and LRD field terminal systems will not be available until mid-2005. The Integrated Program Office (IPO) will continue to investigate developments in antenna/receiver technologies and computer systems capable of running scalable IDPS software to identify "lower-cost" solutions for the mobile, lower capability LRD field terminals. NOAA will continue to inform and coordinate with CGMS and WMO on the technical specifications for the L-band and X-band direct readout broadcast services on NPOESS.

USA-WP-32 provides a brief near real-time summary of the thirteenth International TOVS Study Conference, ITSC-XIII, held in Sainte Adéle, Quebec, Canada from 29 October to 4 November 2003. ITSC-XIII marked the milestone of 25 years of TOVS data starting with the launch of TIROS-N in October 1978. Around 130 participants attended representing twenty countries. Some of the major conclusions from the workshop are provided by the co-chairs Roger Saunders (UK Met Office) and Tom Achtor (CIMSS). They are:

(1) Recent observing system experiments have shown that the impact on medium range weather forecasts of using ATOVS data in NWP now exceeds that from the radiosonde network. The microwave radiances contribute most of the impact. The impact of 3 ATOVS platforms with different equator crossing times was shown to improve on the current baseline 2 polar orbiter system. As a result ITWG reaffirms the requirement for both the 0530LT and 1330LT NPOESS platforms to include both CrIS and ATMS measurements.

(2) The timeliness requirements for global ATOVS datasets needs to be reviewed as NWP models are now reducing their data cut-off times to well below three hours. The EUMETSAT ATOVS Retransmission Services (EARS) now covers a significant part of the Northern Hemisphere and provides ATOVS level 1c radiances within 30 minutes of measurement time. Plans are well advanced to use these data for both regional and global NWP. Satellite agencies should consider this option for future polar orbiters particularly if delays are likely to be greater than 60 minutes for the global datasets.

(3) Community software for processing Aqua AIRS, AMSU-A, HSB and MODIS locally received data is now available. AMSR-E processing capability will be added soon. The AIRS advanced sounder data has proven to be stable and accurately calibrated and so is an excellent dataset for validating radiative transfer model simulations.

(4) Several presentations demonstrated the feasibility of including the effects of both cloud and precipitation in radiative transfer models, preparing the way for assimilation of cloud and rain affected radiances.

(5) Access to documents describing NPOESS/NPP ground processing and raw data and sensor data records (content and format) needs to be established to allow review by members of the group.

CGMS thanked the ITWG co-chairs for their prompt summary of ITSC-XIII and noted the particular significance of positive NWP impacts from three polar satellites that suggest further NWP benefit is likely when the WMO requirement for four LEO satellites in the space-based component of the GOS is realised.

USA-WP-33 reports that the NOAA/NESDIS operational GOES East and West soundings continue to be produced nearly every hour at approximately 50 km resolution 5X5 Fields of View (FOV) in clear skies. Additionally, following the replacement of GMS-5 with GOES-9 over the western Pacific 155°E in May 2003, experimental sounder data and products including Total Precipitable Water (TPW) and cloud-top information. can be found at
http://cimss.ssec.wisc.edu/goes/realtime/grtmain.html#gsall.

Research retrievals are routinely generated at single FOV resolution (approximately 10 km) and operations are evolving to single FOV retrievals. Derived Product Images (DPI) of Total column Precipitable Water vapor (TPW) and atmospheric stability (Lifted Index, LI) are being used by the National Weather Service forecast offices. Three layers of moisture derived from the GOES soundings are used operationally by regional forecast models over land. Cloud Top Pressure and Effective Cloud Amount at single

field of view (FOV) resolution (approximately 10 km) are being generated and used in several numerical weather prediction models with positive impact. Research has shown that radio occultations data can improve the temperature profiles from infrared sounders similar to GOES. Additionally, GOES-12 replaced GOES-8 as the operational GOES-East over the Western Atlantic on April 2003 and GOES-9 started support of GMS-5 at 155°E in May 2003.

II/4 Other parameters and products

EUM-WP-19 summarises the derivation of global surface albedo maps from geostationary weather satellites. The paper had been presented to the CGMS XXXI plenary. The purpose of the presentation and the associated paper EUM-WP-19 is to demonstrate the utility of geostationary satellite observations for the production of a consistent climate product, eventually spanning the complete period of available data from all geostationary satellites. Such a data set would be very valuable for studies on inter-annual variability of surface albedo and associated processes, as well as for climate model validation. The surface albedo is considered a "prototype climate product" from geostationary meteorological satellites. The project also provides unique opportunity to learn lessons concerning the difficulties in reprocessing archived data for climate applications in a consistent manner.

The advantages of geostationary radiance observations for inferring surface albedo were pointed out to be the observations throughout the day that can be used to estimate the anisotropy of the surface reflection. The generation of a consistent global surface albedo map needs to address the following points for all spacecraft and instruments being utilised in the retrieval: (i) radiometric noise, (ii) spectral response characterisation, (iii) calibration, (iv) temporal sampling, (v) spatial resolution. Example surface albedo maps derived from both Meteosat-7 and Meteosat-5 demonstrate good performance of the retrieval algorithm; the product from two satellites shows a seamless transition from one satellite to the other. It has also been possible to derive an albedo map from the very first archived Meteosat-2 data (September 1981). This indicates that EUMETSAT has developed the necessary expertise to accurately and precisely calibrate the Meteosat VIS band and to derive reliable surface albedo maps from geostationary observations. In order to move toward the goal of creating a "global" surface albedo data set, EUMETSAT would like to share the acquired expertise with other CGMS Members. Therefore it is proposed to process some 10-day periods (i.e. the averaging period of the product) for either 2001 or 2002. Those years are particularly appropriate as Meteosat-7 and Meteosat-5, GMS-5, GOES-11 and GOES-12 observations are available simultaneously to Terra/MODIS and MISR surface albedo products. As a result CGMS endorsed the following actions:

Action 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. Deadline: 30 November 2003

Action 31.28 All geostationary satellite operators to provide the VIS data requested according to Action 31.27 to EUMETSAT. Deadline: 31 January 2004

JPN-WP-12 reports on the status of data processing for climate monitoring applications at the Meteorological Satellite Center (MSC) of the Japan Meteorological Agency (JMA) in response to CGMS Action 30.09. MSC has been producing and providing basic data sets for the International Satellite Cloud Climatology Project (ISCCP) and Global Precipitation Climatology Project (GPCP), which are promoted under the framework of WCRP; this has continued after the switch over from GMS-5 to GOES-9. Additionally, the re-processing of the Atmospheric Motion Vectors (AMVs) and the re-analysis of the quality control for TOVS data have been performed for the use of the long-term reanalysis project of JMA, Japanese Re-Analysis 25 years (JRA-25).

PRC-WP-12 describes recent progress at NSMC/CMA in developing methods using FY2 data for cloud analyses, precipitation estimation, sea surface temperature, outgoing long wave radiation; and using FY-1 data for aerosol optical depth over ocean. In cloud analysis, NSMC tried to combine a segment approach and a pixel approach to get a uniform cloud analysis over the full disk. Precipitation estimation considered IR gradients as well as the distance from the convective core; a statistical convective rainfall estimation technique was developed that has been installed in 60 Medium Scale Data Utilization Stations (MDUSs) in China. Sea surface temperature and outgoing long wave radiation use multi-IR window channel information from FY-2C. Global aerosol over ocean is derived with sun reflectance channels on FY-1C/D.

RUS-WP-07 presents an overview of Roshydromet/SRC Planeta ground segment developed for the acquisition, processing and distribution of satellite data and products. The objective of operational and research activity in Roshydromet is to use satellite data and derived products in various application areas, including operational meteorology, NWP, hydrology, agrometeorology, hazards (fires, floods) and pollutions monitoring, climate researches. Examples of some products derived by SRC Planeta are presented.

WMO-WP-14 informs CGMS Members on the status of activity related to the International Precipitation Working Group (IPWG). A central data and document database was organised and maintained on the IPWG World Wide Web (WWW) site:
- http://www.isac.cnr.it/~ipwg (main IPWG site)
- http://www.isac.cnr.it/~ipwg/algorithms/algorithms-invent.html (algorithm site).

As of late September 2003 the IPWG algorithm site contained algorithm descriptions from seven infrared (IR)-only algorithms, two IR-based (with ancillary data) algorithms, four passive microwave (PMW)-only algorithms, and four blended PMW-IR algorithms. CGMS-XXXI noted the successful development of the IPWG web page and the positive activity with regard to action 30.27, which led to the development of an inventory of routinely produced precipitation estimates; either operational or experimental/research. Action 30.27 remains open since some CGMS Members needed to address the portion of the template "including available web and FTP sites for imagery and data download." CGMS Members that have provided algorithm information should check and update their input on a routine basis. Nearly all of the algorithms or techniques do not yet have any training materials posted. The training materials should be posted at the IPWG website under “Training” which is available at:
http://www.isac.cnr.it/~ipwg/training.html.

The Virtual Laboratory for Satellite Data Utilization (VL) located at http://www.cira.colostate.edu/WMOVL also has a link back to the IPWG website for

training. CGMS was informed of the plans for the second International Precipitation Working Group Science meeting and workshop to be held in Monterey, California, from 24 to 28 October 2004 and that a call for papers would be forthcoming. CGMS also noted with appreciation the activities within the three IPWG working groups: Operational Applications, Research Activities, and Validation Activities and looked forward to their continuing activities. There was particular interest and support for plans for validation activities.

CGMS noted the excellent progress made by the IPWG since its inception two years ago and thanked the co-chairs Arnold Gruber and Vincenzo Levizzani for their efforts. In addition the following action in three parts was endorsed:

Action 31.29 (1) CGMS Members to note and support the upcoming IPWG science meeting. (2) CGMS Members to provide and update the inventory of routinely produced precipitation estimates, either operational or experimental/research, along with training information to the IPWG co-chairs via the IPWG web page. (3) CGMS Members to provide information to the IPWG Rapporteur on areas for future consideration by the IPWG. Deadline: 31 May 2004

WMO-WP-20 informs CGMS of the latest WCRP activities related to satellite systems and provides an update of WCRP space mission requirements based in part on a WCRP initiated study to update the space mission requirements for climate research. Conclusions and recommendations on priorities for space missions, on data management issues and interactions between space agencies and WCRP were endorsed by the WCRP Joint Scientific Committee (JSC) in Reading in March 2003. The WCRP initiative was strongly encouraged by the CEOS Chair present at that meeting and pursued with the support of an informal working group composed of representatives of the main space agencies and the various WCRP core projects, and other interested scientists which met on 20 to 22 October 2003 in Geneva. Among the points emphasised: for climate research, the value of space missions came mostly from the capability to produce globally integrated, high quality and reliable data products requiring the merged analysis of measurements from the whole constellation of operational and research / demonstration Earth observation satellites complemented by data from in situ observing networks. Specifically addressed were space requirements for continuity of existing missions, both operational and research, as well as the important parameters to be extracted from various planned missions. For several existing missions it was emphasised that continuation of measurements were essential until the NPOESS era when that system would assume the measurement responsibility, including extensions of useful lifetimes and launching of replicate missions and sensors. In addition to investigating planned missions, the paper also pointed to the need for new research/measurement missions that would build on current missions and focus on clouds, aerosols, tropospheric composition and high resolution gravity, snow water equivalent and all weather surface temperature. The working paper also pointed to the need and the importance of sensor calibration and product validation and concluded that further major efforts and resources should be devoted to these activities. Specifically: "Space agencies should consider an international effort in order to meet the GCOS and WCRP needs for cross-calibration, overlap, and continuity for operational satellites. Meeting these objectives within budgetary constraints would likely require innovative

approaches. Such approaches could consider a cooperative mission using a subset of the common passive frequencies in the visible, infrared, and microwave spectrum and optimal orbital configuration to serve as a common radiance transfer standard." A close interaction between WCRP and space agencies at all levels (strategic, programme management and day to day work) was recognised as a key factor of progress in the domain of climate research. The recently approved WMO Space Programme was a new channel to take into account WCRP priorities.

II/5 Coordination of Code forms for Satellite Data

WMO-WP-10 describes the latest additions to the satellite data BUFR descriptors recommended by the CBS/Expert Team on Data Representation and Codes Meeting in Arusha, Tanzania from 17 to 21 February 2003. At that meeting, the Expert Team also examined the requirements for additions to binary code tables for encoding satellite data and recommended changes to the Tables of the BUFR WMO Code Form for experimental pre-operational use with a view to their full operational implementation in November 2005. The WMO Chair of the CBS/OPAG on Information Systems and Services and the CBS President endorsed the proposed additions to binary codes. CGMS understood that use of the new descriptors in pre-operational mode could be performed prior to November 2005 since these new code additions had been tested and validated. It also contains a proposed set of additions for AIRS and ENVISAT data that are still awaiting full validation.

Action 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 Space Programme for communication to the CBS Chair OPAG ISS. Deadline: CGMS XXXII

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

In response to a CGMS XXX action to provide information about Earth Observation (EO) Science data stewardship, ESA-WP-07 summarizes ongoing discussions about an EO strategy called the Oxygen Project (O2 for Open and Operational). This strategy has the long-term goal of building the necessary rationale and resources for the definition, deployment, and operation of the next generation of operational European satellites. In the short term, the strategy calls for the introduction of advanced technologies for distribution of EO data from existing spacecraft and a complete overhaul of current policies. The proposed approach is also intended to provide opportunities for turning Explorer missions into operational systems and to respond to requirements for long-term scientific observations.

EUM-WP-22 reports in response to CGMS actions 30.22 and 30.28 on EUMETSAT approaches to establish data sets from operational meteorological satellites suitable for climate applications and to suggest a consolidated list of metadata. The Climate Data Set (CDS) is described; this includes a condensed radiance data set that associates radiances with observed targets, i.e. surface and level of cloud, and provides relevant statistics. It

has been an operational product in the Meteosat era for two decades and is now being continued with Meteosat Second Generation (MSG). EUMETSAT contributes operationally to the International Satellite Cloud Climatology Project (ISCCP) and the Global Precipitation Climatology Project (GPCP). EUMETSAT has also embarked on the production of a novel data set, i.e. surface albedo, from Meteosat satellites; this requires going through a painstaking effort of re-analysing archived image data and performing a re-calibration (see EUM-WP-19). Relevant to this is the re-calibration effort at EUMETSAT conducted in the context of re-analysis of Atmospheric Motion Vectors (AMVs). Concerning the metadata action, EUM-WP-10 notes that the following metadata list has been endorsed by the GCOS Atmospheric Observation Panel for Climate (AOPC):

- **Time**: The definition of the acquisition time of each pixel is quite straightforward for geostationary satellites because of the data acquisition mechanism.
- **Position**: The definition of the location of each pixel requires the accurate characterisation of the spacecraft position and attitude at the time of the data acquisition. The accuracy of the rectification can be assessed by means of ground control points.
- **Observation angles**: The definition of the observation angles requires in addition the characterisation of the instrument optics.
- **Sensor spectral response**: This quantity should be observed before launch. Its temporal degradation is difficult to assess, however means to estimate the degradation should be established.
- **Calibration coefficient and offset**: The evaluation of calibration coefficient, associated error and temporal drift are the most critical information. In the absence of on-board calibration device, vicarious calibration is required. On-board calibration systems should be fully characterised.
- **Field of size (view)**: The area at the earth surface wherein the encircled energy is greater than 99% or the half power points of the received energy. (WG II suggested this be amended to indicate the encircled energy within one field of view).

An action was placed upon satellite operators to indicate their plans for including metadata to their archives.

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

EUM-WP-10 provides a first analysis of the how well the current practice of data handling at EUMETSAT adheres to the GCOS climate monitoring principles. The paper responds to CGMS Action 30.09, which states "In view of the increasing use and importance of operational meteorological satellite data for climate research and monitoring, CGMS is invited (i) to consider a review of current practice of satellite operators with regard to the climate monitoring principles from satellites, and (ii) to provide pertinent reports at CGMS XXXI meeting". EUM-WP-10 presented an item-by-item response to the climate monitoring principles.

Action 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. Deadline: CGMS XXXII

II/7 Conclusion and preparation of the WG Report

WG II concluded a very full agenda noting considerable progress on CGMS actions (performing GEO-LEO intercalibrations, continuing dialogue with ITWG, defining metadata, establishing IPWG, preparing direct broadcast packages for new sensors, planning science data stewardship) but also noting the need for more activity in others (calibration workshop, inventory of past sensors). WG II further introduced actions in some new areas (demonstrating a global surface albedo product from geostationary sensors, inventory and description of operational precipitation algorithms, planning for adhering to the climate monitoring principles) and supported ITWG and IPWG work plans.

WORKING GROUP III: SATELLITE-DERIVED WINDS

III/0 Introduction

The Working Group on Satellite-Derived Winds (WG III) was chaired by Mr. Xu Jianmin and Dr. Johannes Schmetz assisted as secretary. In total eight papers were presented at and discussed by the Working Group. Papers were grouped under the following headings: i) Preparation of the 7th International Winds Workshop, ii) Wind statistics, iii) Procedures for the exchange of inter-comparison data, iv) derivation of wind vectors v) Conclusion.

III/1 Preparation of the 7th International Winds Workshop

EUM-WP-24 provides an update on the preparation of the 7th International Winds Workshop (IWW7). This workshop, originally planned for October 2003, had to be postponed and will be held in June 2004 in Helsinki, Finland. The paper recalls actions and recommendations from CGMS XXX to IWW7 and invites WG III to amend and re-formulate recommendations and actions for IWW7 as required. In the discussions WG III regretted the postponement of IWW7, originally planned for Beijing, due to SARS.

For convenience the relevant actions from CGMS XXX for IWW7 are repeated below (in italic):

Action 30.31
The co-chairs of IWW7 are requested to invite representatives of the regional scale modelling community to the next IWW.

Action 30.32
IWW7 is invited to establish an inventory of all height assignment methods used for low-, medium- and high-level AMVs.

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

Following an item-by-item discussion of topics that should be addressed by IWW7, Working Group III formulated the following action (in addition to the actions from CGMS XXX) on IWW7:

Action 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)**
  Deadline: 14 June 2004

Finally, CGMS thanked the co-chairs of the IWW, Drs. K. Holmlund and C. Velden, for their sustained dedication to leading and guiding the international winds community assembled under the umbrella of the IWW.

USA-WP-26 is in response to action 30.30 reading "NOAA/NESDIS is invited to report on the 'auto-nowcaster' at CGMS XXXI". The paper reports on work done at the Cooperative Institute of Meteorological Satellite Studies (CIMSS) in autocasting in three main areas: (1) processing real-time meteorological satellite imagery toward the assessment of convective initiation (CI) on scales of 1-4 km, (2) performing basic research in the use of data from the MODerate resolution Infrared Spectrometer (MODIS) for estimating convective cloud growth toward CI, and (3) performing a first assessment of the value that hyperspectral data has toward studying convective clouds and the CI process. For this work, CI is defined as the first occurrence of rainfall reaching the Earth's surface from convective (i.e. cumulus) clouds. When processing for CI, (a) a Cumulus cloud mask is combined with NEXRAD radar data in real-time, (b) the various IR channel differences are investigated, (c) the 10.7 μm temperature drop below freezing is timed, (d) cumulus cloud motion and jet stream-level wind speed is tracked, and (e) a scoring procedure that tabulates CI likelihood is tested. It is a goal to be able to nowcast the occurrence of CI, based on tests against NEXRAD information, from 30 to 60 minutes into the future with reasonable accuracy (~70 %) with little additional processing effort. Exploration into multispectral opportunities offered by MODIS has also started. WG III welcomed the novel information and suggested that a paper on this topic should be submitted to IWW7.

III/2 Wind Statistics

USA-WP-27 summarises NOAA/NESDIS and the Cooperative Institute for Meteorological Satellite Studies (CIMSS) collaborations aimed at improving the quality of Atmospheric Motion Vectors (AMVs) derived from the GOES-I/M series of satellites. Active areas of winds research include improved height assignment through use of the 13.3 μm channel aboard GOES-12 (NOAA's newest geostationary satellite) and the derivation of motion vectors from rapid scan GOES imagery, and from future IR sounding instruments with high spectral resolution, e.g. from the Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS). Steady improvements in the GOES cloud-drift wind algorithms, processing schemes, and quality control algorithms continue to be made. Since early 2003, routine production of cloud-drift winds and water vapour motion winds every 6 hours from GOES-9 has ensued and these are made available on a NOAA/NESDIS anonymous FTP server (gp12.wwb.noaa.gov) in BUFR format. Research in tracking features in hyperspectral moisture retrieval fields using simulated data has proved that coherent vector fields at multiple levels (more than 5) can be achieved. WG III expressed a keen interest in the research activities pursued by NOAA/NESDIS. The preparatory work on GIFTS derived winds attained particular attention and WG III recommended that NESDIS submit a pertinent paper to IWW7.

Action 31.34 CGMS XXXI requests NESDIS to consider submission of a paper to IWW7 on preparatory work on the derivation of AMVs from high-spectral resolution IR sounding instruments (e.g. GIFTS). Deadline June 2004

WG III concluded the discussion on USA-WP-27 by pointing at the opportunity to derive AMVs over polar regions from water vapour profile retrievals derived from the Advanced Infrared Sounder (AIRS) high spectral radiance measurements. Those measurements would be a good surrogate for high spectral water vapour measurements for wind derivation from geostationary orbit.

USA-WP-28 reports on the status of a project for deriving tropospheric wind information at high latitudes from polar-orbiting satellites. The methodology employed is based on the algorithms currently used with geostationary satellites, modified for use with the Moderate Resolution Imaging Spectroradiometer (MODIS). The project presents some unique challenges, including the irregularity of temporal sampling, different viewing geometries in successive orbits, uncertainties in wind vector height assignment as a result of low atmospheric water vapour amounts and thin clouds typical of the Arctic and Antarctic, and the complexity of surface features. MODIS winds are now generated experimentally in near real-time from both Terra and Aqua satellites. Model impact studies have shown that when the MODIS winds are assimilated in the European Centre for Medium Range Weather Forecast (ECMWF) and the NASA Data Assimilation Office systems, forecasts of the geopotential height for the Arctic, Northern Hemisphere extratropics, and Antarctica are improved significantly. As a result, ECMWF now uses the MODIS winds in their operational forecast system. WG III commended NOAA/NESDIS on the excellent work on MODIS winds and recalled that positive impact of the observed magnitude is rarely observed for a single new data set. It was also pointed out that the MODIS instruments are on NASA research satellites and that NASA deserves credit for making data available in near-real-time through additional effort.

III/3 Procedures for the exchange of inter-comparison data

No paper was presented under this topic.

III/4 Derivation of Wind Vectors

EUM-WP-27 reports on preliminary work on the cloud height assignment using multi-channel SEVIRI radiance observations from of Meteosat Second Generation (MSG). SEVIRI provides an opportunity to study current and novel multi-spectral cloud height assignment techniques simultaneously. The paper compares height assignment techniques using SEVIRI observation during the early phase of commissioning. Comparisons have been made between height assignment based on the following methods:

- EBBT method using the channel at 10.8 μm,
- Semi-transparency correction (STC) or water vapour intercept method using the channels at 10.8 and 6.2 μm,
- Semi-transparency correction (STC) or water vapour intercept method using the channels at 10.8 and 7.3 μm,

- CO_2 slicing method using the channels at 10.8 and 13.4 μm,
- CO_2 slicing method using the channels at 12.0 and 13.4 μm,
- CO_2 slicing method using the channels at 10.8, 12 and 13.4 μm.

The results show that all CO_2 slicing configurations are well correlated, with linear correlations well above 0.9, with each other and give the same results within a range of 30 hPa. The correlation between the two different STC techniques is poor as the mean cloud top pressure difference between these two configurations is close to 70 hPa. The poor performance of the STC method using the 6.2 μm channel could due to dynamic range currently being limited to seven bits rather than 10 bits. These first results will be further verified and analysed through more extensive investigations in the future. A paper is foreseen for the IWW7. WG III welcomed the excellent opportunity that the new SEVIRI data provide for testing different height assignment methods for tenuous clouds in a consistent manner. NESDIS pointed out that similar work is now being pursued with GOES-12 imager data as the GOES-12 imager has a water vapour and CO_2 channel. JMA informed WG III that the work conducted with SEVIRI data provides relevant information concerning the selection of spectral channels of future imaging instruments in geostationary orbit. WG III concluded with the suggestion to further segregate the height allocation into classes of cloud phase (ice or water) as the inherent assumptions of the CO_2 slicing on cloud emissivity are not equally well fulfilled for water and ice clouds.

JPN-WP-10 outlined the new AMV extraction method that was developed in response to previous discussions at CGMS and at the International Winds Workshops encouraging further standardisation of AMV extraction methods. The Meteorological Satellite Center (MSC) of JMA commenced operational high-density AMV extraction in May 2003. Almost all goals of the new high-density AMV extraction have been realised including a significant increase in the number of wind vectors. The accuracy of the high-density AMVs is almost the same as that of the former product which were manually quality checked. WG III thanked JMA for the dedicated work in line with the spirit of creating more commonality in the processing at different operational centres. It also commended JMA on the very good results obtained with the new high-density AMV extraction method.

PRC-WP-12/3 summarised AMV derivation scheme for the FY-2 satellite, which had been developed on the basis of NSMC's AMV derivation scheme for GMS-5. It also described the current work on improvements including i) a new height assignment for semi-transparent clouds, ii) an additional improvement making adjustments to the radiative forward calculations for the semi-transparency correction and iii) a new BUFR encoding of AMVs. The first improvement addresses the height assignment of optically thin using simultaneous radiance observations within the IR and WV channels, i.e. the pre-calculated WV-versus-IR curve for opaque clouds is now based on radiative forward calculations using Modtran and NWP model output. As the water vapour in the upper troposphere is often not realistically decsribed by NWP models the new CMA method adjusts the pre-calculated curve on the basis of observed clear-sky WV radiances in the vicinity of the semi-transparent clouds. Both changes to the operational AMV software led to significant improvements in the quality of AMVs. WG III applauded the work at CMA recognising that CMA has made a good step forward by revisiting and improving 'established' concepts for the height assignment of semi-transparent clouds. CMA concluded the discussion with the interesting remark that the problems with FY-2 data

created good opportunities to learn and to draw important conclusions relevant to future planning.

WG III discussed the importance of verifying the performance of WindSat Coriolis for determining sea surface winds and the utility of NWP assimilation tests to verify the performance. Thus the following action:

Action 31.35 CGMS to request that the 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 CGMS XXXII.

III/5 Conclusion

WG III concluded with the chairman thanking all participants for good and open discussions. It was also noted (in the plenary discussion) that the IWW7 would not take place before the next meeting of CGMS; therefore it is anticipated to confine discussions within WG III at CGMS XXXII to new additional items relevant to IWW7.

WORKING GROUP IV: CGMS GLOBAL CONTINGENCY PLANNING

Working Group IV on Global Contingency Planning (WG IV) met during CGMS XXXI and discussed activities since CGMS XXX as summarised in WMO-WP-05. The Working Group also discussed WMO-WP-18 that presented several recommendations that guided the deliberations of the Working Group with regard to equator crossing time coordination for sun-synchronous satellites, geostationary satellite positions and satellite instrumentation.

In WMO-WP-05, WG IV reviewed activities related to global contingency planning. It noted that the WMO baseline space-based component of the GOS had changed. In particular, with regard to the geostationary orbit, there was a new WMO requirement for at least six geostationary satellites. With regard to the polar orbit, there was a new WMO requirement for at least four polar-orbiting satellites, two in the AM and two in the PM orbit. Additionally, the Working Group recognised that while R&D satellite missions did not require contingency planning themselves, they could provide back-up to operational meteorological satellite missions. The Working Group also recalled that it had reviewed Climate Monitoring Principles (CMPs) submitted by the Global Climate Observing System at CGMS XXX and that updated CMPs had been approved by the Fourteenth WMO Congress. The Working Group was also informed of CNES' formal commitment to WMO for the altimetric mission on Jason-1 and that it now formed part of the space-based component of the GOS within the R&D constellation. In anticipation that the now approved Jason-2 Ocean Surface Topography Mission (OSTM) – a four way joint mission with participation by CNES, NASA, NOAA and EUMETSAT – would also become part of the space-based component of the GOS, the Working Group agreed to discuss the need for contingency planning for operational oceanographic satellites within the space-based component of the GOS.

WG IV agreed to use the following as an agenda in its discussions on global contingency planning:

- the revised GOS baseline for six geostationary satellites;
- a revised CGMS Global Contingency Plan for geostationary orbit;
- the revised GOS baseline for four polar-orbiting satellites;
- the need for a CGMS contingency plan for operational oceanographic satellites;
- the recently adopted GCOS Climate Monitoring Principles; and
- the use of Alternative Dissemination Methods (ADM) in contingency planning.

WMO-WP-18 summarised current plans for both polar-orbiting satellite equator crossing times as well as planned geostationary satellite coverage for the next two decades. The Working Group was informed of instrument characteristics for those systems as well as the approved WMO CBS vision for the space-based component of the GOS (Cairns, 2002) that included: a constellation of at least four sun-synchronous satellites states that should be optimally spaced in time with multispectral imager (MW/IR/VIS/UV), all with sounder (MW), three with hyperspectral sounders (IR), all with radio occultation (RO), two with altimeters and three with conical scanning MW or scatterometer; and, at least six equally spaced geostationary satellites that include imagery, data collection, data dissemination and sounding (for some). WMO-WP-18

presented several recommendations that guided a further discussion by the Working Group in following its agreed-upon agenda with regard to equator crossing time coordination, geostationary satellite positions and satellite instrumentation.

WMO-WP-18 pointed out that the space-based component of the World Weather Watch's Global Observing System (GOS) for meteorological satellites currently included approximately 15 satellites in geostationary orbit and approximately 16 in sun-synchronous orbit, including operational and back-up satellites. Because many of those satellites were spaced closely together, the WMO system requirement with respect to aerial coverage or sampling time between observations was not fully satisfied, i.e.

- geostationary positions (for GEO) and LST (Local Solar Time) for LEO should be regularly spaced;
- each satellite in the geostationary or polar orbit should have comparable instrument suites or should be able to provide comparable data content;

Table 5: Polar-orbiting satellite equator crossing times

(as of 13 November 2003)

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
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

Satellite	Service	Start	EOL	Eq. Cross-time	Freq (MHz)	BW MHz	Data rate (Mb/s)
NOAA-16	GAC/LAC	2000	2004	1400	1698/1702.5/1707 failed	5.32	2.66
NOAA-17	APT	2002	2005	1000	137.50 – 137.62	0.34	.017
NOAA-17	HRPT	2002	2005	1000	1698	2.66	.665
NOAA-17	GAC/LAC	2002	2005	1400	1698/1702.5/1707	5.32	2.66
NOAA-N	APT	2004	2008	1330	137.50 – 137.62	.034	.072
NOAA-N	HRPT	2004	2008	1330	1698/1707	2.66	.665
NOAA-N	GAC/LAC	2004	2008	1330	1698/1702.5	5.32	2.66
NOAA-N'	APT	2008	2012	1330	137.50 – 137.62	.034	.017
NOAA-N'	HRPT	2008	2012	1330	1698/1707	2.66	.665
NOAA-N'	GAC/LAC	2008	2012	1330	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

WG IV then discussed in detail items related to the agenda and as highlighted below.

Military satellite systems

The Working Group discussed the issue of the use of military satellite systems and their associated data and products in contingency planning. It agreed that it would only be appropriate to include systems such as the Defense Meteorological Satellite Program (DMSP) satellites if there were a formal commitment to WMO to include them in the space-based component of the GOS. NESDIS noted however, that depending on the outcome of NOAA N' recovery efforts, both R&D satellite missions as well as military missions could be included in its national contingency planning. Thus, the Working Group indicated that the DMSP systems could be included in its future contingency planning activities if they became part of US contingency plans. The Working Group noted the potential benefits from the use of R&D data and products by operational entities in anticipation of contingency plan implementation as well as the benefits from such data streams as a precursor of future operational satellite systems.

Geostationary satellite contingency planning

The Working Group noted that several satellite operators had already formalised contingency planning for their geostationary satellites in following the CGMS principle to "help your neighbour". EUMETSAT, NESDIS, JMA and the Russian Federation had already agreed-upon plans to assure continuity of data, products and services with their neighbouring satellite operator. At the present, three such plans existed and two were being implemented due to difficulties experienced with satellite systems that were providing less-than-optimal performance. CGMS was informed by WMO of the deep appreciation expressed by WMO Members at the recent WMO Congress for this strong willingness by satellite operators to voluntarily meet WMO contingency requirements. CGMS satellite operators were also appreciative of the satellite neighbours' commitment to ensure continuity.

Comparable data content from geostationary satellites

The Working Group discussed the recommendations 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 spectrometers within the same timeframe. The Working Group unanimously endorsed those two recommendations in noting the goal to have comparable data content from comparable instrumentation with common spectral bands from all geostationary satellites. It agreed that as an action each CGMS satellite operators should inform CGMS XXXII on its plans to achieve that goal within the 2015 timeframe.

Action 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. Deadline: CGMS XXXII

International Geostationary Laboratory

The Working Group briefly discussed the concept of an International Geostationary Laboratory (IGL). IGL would be a joint undertaking to provide a platform for demonstrations from geostationary orbit of new sensors and capabilities. While the Working Group agreed that the IGL concept was not an issue for contingency planning, it could prove to be of high value to CGMS Members. Thus, EUMETSAT, NESDIS and WMO accepted a request to prepare a paper on IGL for consideration at CGMS XXXII with a goal towards agreement by all CGMS satellite operators. Within the same discussion, ESA accepted a request to report on its activities about a MW sounder from geostationary orbit. EUMETSAT noted that a MW sounder in geostationary orbit had been studied within MSG follow-on activities and found to contain sufficient uncertainties to warrant further research and development such as being considered by ESA.

Action 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. Deadline: CGMS XXXII

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

Low Earth Orbit satellite contingency planning

The Working Group noted the less-than-optimum equator crossing time plan by CGMS satellite operators. As expressed in previous CGMS meetings, both Roshydromet and CMA reconfirmed their willingness to consider placing their satellite missions in the afternoon orbit with a view of optimising temporal coverage of the globe. In particular, CMA noted that if FY-3A (tentatively scheduled for launch in late 2006) was successful, it would consider launching FY-3B into an afternoon orbit, tentatively scheduled for 2008. Roshydromet indicated with the difficulties being experienced with the meteorological payload on Meteor 3M N1, Meteor 3M N2 could be launched in 2005 into a morning orbit. With a launch date in 2008, Roshydromet expressed a willingness to consider placing Meteor 3M N3 into an afternoon orbit. The Working Group noted that with these possible shifts from AM to PM orbit near the end of the decade, the equator crossing time plan would approach more optimal spacing. WG IV noted the large gap in the early morning orbit contained in the existing satellite operators plans and that NESDIS was the only satellite operator at present seeking to reduce the gap. Given the existing plans, the large gap would only be reduced in 2013.

Altimetric satellite mission contingency planning

The Working Group was of the opinion that the present plans for altimetric missions were sufficiently uncertain to warrant the development of contingency planning. However, it did agree in principle with the need for contingency planning once there were sufficiently mature plans.

GCOS Climate Monitoring Principles

WG IV agreed that the GCOS Climate Monitoring Principles were valuable from the perspective of expected satellite system performances. With regard to calibration, the Working Group noted the recommendation from WMO that:

"A major issue for effective use of satellite data, especially for climate applications, is calibration. There should be more common spectral bands on GEO and LEO sensors to facilitate inter-comparison and calibration adjustments; globally distributed GEO sensors can be intercalibrated using a given LEO sensor and a succession of LEO sensors in a given orbit (even without the benefit of overlap) can be intercalibrated with a given GEO sensor. The advent of high spectral resolution infrared sensors will enhance accurate intercalibration."

The Working Group was of the opinion that the paper to be prepared by EUMETSAT, NESDIS and WMO (see action 31.37) could address the value of the IGL with regard to calibration requirements as expressed above.

Alternative Dissemination Methods (ADM)

WG IV recalled that a new CGMS Working Group on ADM, Working Group V on Integrated Strategy for Data Dissemination from Meteorological Satellites, had been established. The use of ADM was already being implemented by some satellite operators and the capabilities were developing rapidly. The Working Group unanimously agreed in principle that ADM should be an integral part of all contingency planning. WG IV encouraged all satellite operators to develop the capability to deliver satellite data and products by ADM. Such systems allowed for the exchange of satellite information and in this way helped to facilitate contingency planning. NESDIS noted that it was already investigating means to further exploit ADM that could benefit WMO Members in Regions III and IV.

CGMS Global Contingency Plan

The Working Group noted that while considerable progress had been made, both at this and previous CGMS meetings, there was no consolidated description of the CGMS Global Contingency Plan. It agreed that such a description should be prepared and maintained. Thus, it proposed an action to consolidate CGMS discussions and agreements into a CGMS Global Contingency Plan that would reside as part of the CGMS Consolidated Report. The Working Group also noted the valuable information contained in the tables found in WMO-WP-18 and requested that the tables be updated as a new CGMS Permanent Action.

Action 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.

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

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

V/1 Coordination of Data Dissemination

The Chairman, Mr. Mikael Rattenborg, EUMETSAT, explained to the participants that the aim of this new working group was to discuss the future strategy for data dissemination for meteorological satellites.

In USA-WP-21 NOAA discussed the data content and processing levels for the broadcast services for current and future polar-orbiting satellites. NOAA's plans to continue to support a global direct readout broadcast service in L-band frequencies with its next generation of National Polar-orbiting Operational Environmental Satellite System (NPOESS) spacecraft. The NPOESS Low Rate Data (LRD) service will be closely compatible with the broadcast parameters for the Advanced High Resolution Picture Transmission (AHRPT) format that have been accepted and approved by CGMS. The NPOESS L-band service will be transmitted within the accepted 1698-1710 MHz frequency band using a bandwidth of 8.0 MHz. NOAA stated that they would continue to inform and coordinate with CGMS and WMO on the technical specifications for the L-band direct readout broadcast service on NPOESS.

The increase of the dissemination channel bandwidth to 8 MHz should be no problem if the lower boundary of 1698 MHz is observed. However, due to broader bandwidth there could be a potential overlap of 4 MHz so that orbit separation would be more of an issue. However, this would only be relevant if the satellites were in the field of view of the same receiving stations.

Action 31.40 EUMETSAT and NOAA/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. Deadline: CGMS XXXII

USA explained the planned processing level of the direct broadcast services. The AHRPT format versus the NPOESS format is similar in nature but not explicitly that suggested by CGMS because it has some mission specific implementation features. As far as data content is concerned, NOAA N and N' will not differ from the current polar systems.

The group was informed that USA would look into the channels that will compose the Environment Data Records for the LRD data content.

EUMETSAT commented that if the outer structure of the data was not going to be changed, the same receivers can be used but different software might be needed to process the data. Once in the data layer the processing software can take care of any differences.

USA-WP-22 provided a summary of USA's review of the Future WMO Information Systems (FWIS) in consideration of the ISO Standard for geographic metadata. NOAA reviewed the document http://www.wmo.ch/web/www/metadata/WMO-core-

metadata.html, which is referred to as the proposal for a "WMO Core Metadata" profile within the context of the ISO Standard for Geographic Metadata (ISO 19115). USA recommended that WMO considered taking this decision one step further by adopting the ISO standard as the standard for WMO. Almost all of the fields in the WMO Core Standard (WCS) are also in the ISO Standard, and many important fields from the ISO Standard are included in the WCS. Unfortunately, many potentially important fields from the ISO standard are left out of the WCS proposal. USA considered that the FWIS would fall short of the ISO standard, so it recommended that it should stay with the ISO standard because it would be more complete.

WMO asked whether this was input to the FWIS task force. If not, USA was recommended to do so.

Action 31.41 NOAA/NESDIS to raise the issue of using the full ISO standard for geographic metadata in the framework of the FWIS inter-programme task team. Deadline: 30 September 2004

In USA-WP-31, NOAA/NESDIS presented its development of the technical specifications for an affordable user station that can receive and display environmental data from several meteorological satellites. NOAA is investigating technologies required to receive and display signals from both polar and geostationary satellites.

NOAA has 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 MCUT would employ state-of-the-art technology, including: 1) digital processing software, and 2) Application Specific Integrated Circuits (ASICs). The programme development investigated and demonstrated both technologies and logically left open the commercial issue as to which technology may prove more advantageous for various “markets” (e.g. high rate or low rate; high performance or low performance). Two MCUT systems are being developed: one for exploiting software hosted on common work stations (i.e. CPUs) and a second for exploiting ASICs technology. Both systems will share a common front-end receiver (i.e., tracking, acquisition, pre-selection, low-noise RF amplification and down conversion to a common intermediate frequency) to conserve project resources. This common front-end was based on a previously developed DMSP front-end that demonstrated a potentially more cost-effective or efficient aperture.

It was explained that the MCUT should be able to receive and process data from Metop, NPOESS, FY-1, Meteor, GOES and Meteosat satellite systems. As a constraint it was set that the station should be affordable and mostly based on off the shelf components. USA was pleased to inform the Group that this goal had been achieved.

EUMETSAT questioned whether the X-band dissemination was included in the requirement. NOAA responded that so far this had not been included. So far, only S-band and L-band dissemination had been considered. The inclusion of X-band would be a real challenge.

CGMS welcomed the information concerning the MCUT development because this would help users to more easily acquire data from numerous direct readout services. Otherwise, following the launch of Metop, users would have to use multiple receiving stations.

The MCUT would also address the need of the marine community for mobile reception platforms. The antenna diameters of the MCUT would be about 1 meter but further developments aim at achieving an antenna with 30 cm diameter.

Action 31.42 NOAA/NESDIS to provide CGMS with further details of its MCUT development. Deadline: CGMS XXXII

WMO-WP-03 discussed the latest status for LRIT/LRPT conversion for satellites in polar and geostationary orbit. An analysis of the plan for LRIT conversion indicated that in WMO Regions I (Africa) and VI (Europe) the operation of WEFAX service would be terminated in 2005 and the LRIT service (on EUMETCast) would start in 2003. WMO Regions II (Asia) and V (Southwest Pacific) would have a two-year overlap starting in 2004. For WMO Regions III and IV (South, Central and North America including the Caribbean) in November 2002, GOES-East was converted from WEFAX to LRIT transmission and ceased transmitting WEFAX data. The conversion of GOES-West to LRIT would be based on the needs of the users. The date for GOES-West conversion would be announced as soon as practical. The Indian Ocean area (RA II) appeared to have no overlap starting in 2003. An analysis for LRIT conversion also showed that the morning (AM) satellite would start LRPT in 2006 while the afternoon (PM) satellite would transmit two data streams (AHRPT and X-band) starting in 2010. The FY-3 series would only transmit AHRPT and X-Band starting in 2004. Meteor 3M-N2 would transmit LRPT starting in 2005.

NOAA mentioned that it had taken the action to investigate possibilities for the dissemination of MSG data to South America.

Action 31.43 WMO to propose a modification to the layout of the LRIT/LRPT transition tables taking ADM into account. Deadline: 31 December 2003

Action 31.44 CGMS Members to provide required information in Action 31.43 to WMO. Deadline: CGMS XXXII

WMO informed CGMS in WMO-WP-21 about the latest status and activities related to Alternative Dissemination Methods (ADM). It was stated that access to satellite data and products by WMO Members should be through a composite service comprised of both Direct Broadcast (DB) from satellite systems and ADM. ADM would be the baseline while DB reception would serve as back-up for those WMO Members unable to take advantage of ADM. This concept would allow a seamless inclusion of data/product sets from polar and geostationary operational satellites as well as from relevant R&D environmental satellites. ADM is likely to bring significant advantages to many regions. Several CGMS Members are implementing or are developing plans to implement ADM. WMO added that the ADM concept is also compatible with its FWIS concept.

The paper noted that the use of ADM would spread and become the baseline for dissemination of satellite data and products. Regional ADM implementations would have to be interoperable. It was identified that there was an urgent need for coordination and recommendations on common standards.

From WMO-WP-21 five actions were adopted for CGMS by the Working Group:

Action 31.45 CGMS Members to indicate actions enabling global networking of the Alternative Dissemination Method (ADM) implementation in view of a smooth exchange of specific ADM contents among differing ADM systems and report to CGMS XXXII. Deadline: CGMS XXXII

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

Action 31.47 CGMS Members to consider WMO Core Metadata profiles within the context of the ISO Standard for Geographic Metadata (ISO 19115) and report to CGMS XXXII. Deadline: CGMS XXXII

In addition the following further action was identified:

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

NOAA commented that it had carried out a study to develop a concept for an integrated data dissemination system. This would allow the combination of GEO and LEO satellite data together with data from research satellites.

NOAA informed WG V Group that a study as to whether DOMSAT could cover a wider area than at present had been initiated. The next step in the set-up of ADM would be the definition of a single data stream and to identify how to get this data stream out to the users (e.g. Internet, direct broadcast). A study on the associated cost was also foreseen. It has to be clarified how ADM will be used for current and future NOAA spacecraft data. However, NOAA supported the idea of ADM. Currently NOAA's activities on ADM were limited to satellite data. Other meteorological data are not yet included. This might come at a later stage.

The representative of IOC asked for clarification about what technical means would be used for ADM systems described in the WMO paper. WMO commented that the concept presented was, in effect, technology-free. ADMs have to use low cost, off-the-shelf means to disseminate satellite data (e.g. Internet or DVB satellite broadcast).

Another question from IOC addressed the issue of whether local or ADM reception would provide faster access for users.

NOAA replied that it had studied real-time versus non real-time reception. It was stated that once the data would be on the ground it could be sent out immediately. In so far ADM is considered to be also a real-time service. The calibration and rectification would only result in a small delay due to additional ground processing times involved.

NOAA added that it was trying to consolidate all data sets into a single dissemination concept. This included talking to the user communities. The current baseline is a 10.5 MB/s dissemination service. WG V commented that the various regions of WMO would have to consolidate their data requirements.

It was identified that in the ocean user communities both the regions and applications were different. The ocean community was in the process of setting up regional alliances to better manage coastal areas.

WMO-WP-23 discussed the development of the Future WMO Information System (FWIS), including the outcome of the recent meeting of the CBS/Inter-programme Task Team on FWIS (Kuala Lumpur, 20-24 October 2003). Taking into consideration the directives of WMO Congress, Executive Council and CBS, the FWIS vision was recently reviewed and consolidated by the Inter-Programme Task Team. Among other points consideration was given to the inclusion of the comprehensive requirements of all WMO Programmes as regards information types and volumes, timeliness, sources and users, security, etc. The team also developed a questionnaire to be distributed by the WMO Secretariat to WMO Technical Commissions. The team strongly felt that the success of FWIS would depend upon volunteering WMO Members actively supporting the FWIS implementation.

The WMO system considers NWP and satellite data as drivers for the capacity of the FWIS.

EUMETSAT commented that it was supporting the FWIS concept in Regional Association VI. The concept was, that with respect to ADM, it was set up as an integrated concept for both satellite and conventional meteorological data. The inclusion of a general-purpose channel for meteorological data on EUMETCast would ensure this.

It was agreed that CGMS partners should respond to the results of the WMO questionnaire, thus the following action on WMO was agreed.

Action 31.49 WMO to report on the output of the questionnaire to CGMS XXXII. Deadline: CGMS XXXII

PRC-WP-07 provided the S-VISSR image transmission format of the FY-2C geostationary satellite. The current version was issued in November 2003. CMA stated that the FY-2C format is compatible with that of FY-2B and FY-2A as well as with the format of the next Japanese MTSAT.

JPN-WP-11 reported on the Internet successful back-up dissemination of high-resolution image data for NMHSs as an alternative measure to the GMS-5 direct dissemination. This became necessary as the high inclination of GMS-5 is causing more and more problems for the general user to directly receive the S-VISSR data from GMS-5 at MDUSs.

JMA added that it started the S-VISSR data dissemination service with an Internet/FTP server for the NMHSs on 2 December 2002, in addition to the GMS-5 direct dissemination. On 22 May 2003, the back-up of GMS-5 with GOES-9 started, and S-VISSR data dissemination via GMS-5 was terminated. At the same time, the S-VISSR data on the server was switched to that generated from GVAR data from GOES-9. The Internet dissemination of S-VISSR data will be continued until the initiation of MTSAT-1R normal operations.

EUMETSAT asked how many NMHSs were registered as users. JMA responded that there were around 20 countries registered.

JMA clarified that due to bandwidth limitations not all GOES-9 data could be provided. As yet, no other options are available for JMA. Timeliness of the current data can be achieved however without problems.

V/1.1 Dissemination of satellite images

RUS-WP-08 contained information on the status and development plans of Roshydromet/SRC Planeta system for dissemination of operational satellite images and products. The present SRC Planeta receiving facilities provide, on a regular basis, data acquisition from geostationary satellites (Meteosat-7 and Meteosat-5, GOES-E, GOES-W, GMS via Meteosat-7) and polar-orbiting satellites (Meteor-3M N 1, NOAA series, EOS/Terra/Aqua).

In the near future the following primary factors will influence 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.

The Working Group encouraged the development of activities in the direction of ADM.

Russia added that, so far, the Internet was to be used as an ADM but no specific satellite based system for ADM had been identified yet. However, the chosen system would then cover the whole of Russia.

USA-WP-08 provided a summary of NOAA S-band direct readout broadcast services from its current and future polar-orbiting satellites. NOAA discussed the data content and processing levels for the broadcast services and made available the projected equatorial crossing times for current and future polar-orbiting satellites. The data content from the NPOESS spacecraft will be mission-specific to satisfy U.S. military and civilian user requirements. But it will be comparable to and complement the data content of the L-band direct readout broadcast service that will be used on EUMETSAT's Metop satellite.

In USA-WP-17, NOAA discussed a transition and implementation plan for the LRIT that will commence on a GOES I-M spacecraft. Using the GOES-M spacecraft, LRIT testing was conducted from October 2002 – October 2003. Test schemes included variations of alternate transmissions of simulated LRIT signals with WEFAX and/or Emergency Manager Weather Information Network (EMWIN) broadcasts.

It was reported that NOAA planned to implement timesharing between WEFAX and LRIT on individual spacecraft for a limited time period (e.g. 1 to 2 years) followed by a total transition. The transition from existing WEFAX services to the new LRIT services has considered the requirements and concerns of the existing user population as well as the availability of USA resources (e.g. satellites, ground communications and control systems, personnel). Currently, using the GOES-East (GOES-12) satellite, USA's LRIT data transmissions were scheduled and taking place daily from [HH:45 to HH+1:14] and WEFAX data from [HH:14 to HH:45].

A goal of the transition plan is to provide the capability for an extended transition period without imposing significant demands for additional space, ground, and personnel resources. Current assessments of NOAA's plan are encouraging in the ability of the GOES I-M series to simultaneously accommodate both WEFAX and LRIT data through timesharing techniques. The LRIT transition period is supposed to last from October 2003 to October 2005.

EUMETSAT questioned whether there has been any feedback from the WEFAX user community. NOAA replied that there had only been a few complaints so far. Manufacturers had some questions for clarification, but for the user community everything seemed to be fine. NOAA had about 1000 WEFAX users but assumed that the total was about three times that number.

NOAA added that the delay in the LRIT transition dissemination was caused by a request from the Weather Service to wait until the EMWIN data was ready.

Action 31.50 NOAA to inform WMO on its latest schedule for LRIT transition. Deadline 30 April 2004

EUMETSAT commented that the timeframe of 2005 was consistent with its plans for WEFAX termination.

NOAA recalled that the document was prepared in response to an action for operators to inform CGMS about their transition plans. In its view, this action continues for CGMS operators.

NOAA asked to what extent the Korean LRIT service would be coordinated with standard LRIT. KMA responded that it wished to disseminate the satellite data to the full disc area using the CGMS agreed standard for LRIT.

V/1.2 Dissemination of satellite products

There were no additional working papers under this agenda item.

V/1.3 Global exchange of satellite image data

There were no working papers under this agenda item.

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

EUM-WP-12 proposed an overall strategy for convergence of planned ADMs and an implementation plan. The paper presented:

- The status of EUMETSAT activities regarding Alternative Dissemination Methods
- Plans for the evolution of the EUMETCast system
- Elements for consideration in a strategy for convergence of ADMs

In the paper EUMETSAT presented the current status of its alternative dissemination system used for satellite and other meteorological data. At the time of writing the data was disseminated using a digital video broadcast (DVB) via Ku- and C-Band, making use of Hotbird-6 and Atlanticbird-3, respectively. The catalyst for the development of EUMETCast into a multi-sourced, multi-mission environmental data distribution system was the addition of MSG operational services to EUMETCast. This necessitated a significant increase in EUMETCast bandwidth and geographic coverage, which, in turn, triggered the development of a critical mass in terms of the potential take-up of EUMETCast in the meteorological user community.

When considering the future development of the EUMETCast system, additional EUMETSAT-sourced operational services that are candidates for dissemination via EUMETCast are:

- Meteosat-7 dissemination, as the spacecraft enters its end-of-life fuel optimisation phase;
- A second MSG operational service (e.g. rapid scanning);
- ASCAT retransmission service;
- JASON-2 operational service;
- Higher-frequency data from other geostationary satellites.

For non-EUMETSAT-sourced operational services, it is difficult to judge what the level of demand in this area is, and whether the level of demand experienced so far is 'the tip of the iceberg' or a fuller representation of the long-term level of demand. Certainly, the infrastructure offered so far seems to bring significant cost-benefit to the Meteorological Services concerned.

For developing a global "system" for alternative dissemination, a number of issues need to be addressed. These are proposed here as a starting point of discussion:

- Frequency bands
    - C-band versus Ku-band
- Communication standards
    - Standard DVB protocols for physical layer
    - TCP/IP as standard for transport layer
    - FTP as standard for application layer

- Data format standards
    - WMO formats versus HRIT/LRIT versus others
- Data policy aspects
    - Standard encryption mechanisms
- User station standards
    - Operating systems
- Acquisition of data
    - Provision of non-satellite data from WMO community
    - Retransmission services for locally acquired satellite data
- Global data exchange
    - Mechanisms for real-time data exchange between operators
    - DVB-turnaround or file-transfers
    - Data policy aspects of global exchange
- User requirements
    - Mechanisms for consolidation of data requirements within WMO regions
    - How are user communities outside meteorology addressed?
- Coverage
    - Reflection of global coverage of coordinated GEO satellites
    - Issue of continental-only coverage of Telecom satellites
    - Possible other solutions for oceans and islands

NOAA asked how EUMETSAT had ensured that user station standards would guarantee an affordable solution for the design of user stations. EUMETSAT explained that it had restricted its specification to high level aspects of the design, leaving open the possibility for the commercial market to respond competitively, using off-the-shelf hardware and software solutions.

NOAA informed WG V about its consideration of a potential concept for handling a data subscription service to allow users to select data streams of interest to them. The decision as to whether data will be freely available or on subscription was, however, still under discussion.

Action 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. Deadline: 30 April 2004

NOAA informed the Working Group that it was analysing the problem of how to get its data to other spacecraft operators for re-distribution within their areas of coverage.

WG V felt that the question of data property and effective protection of ownership would have to be discussed in due course when considering a global data redistribution systems. The technical means for data protection (e.g. encryption) already exist and are in use.

Action 31.52 CGMS to investigate further data protection techniques appropriate for a global "alternative distribution system". Deadline: CGMS XXXII

G. FINAL SESSION

G.1 Appointment of Chairman of Final Session

Dr. Donald Hinsman was elected as the Chairman of the Final Session.

G.2 Reports from the Working Groups

Reports from the five working groups were presented by Mr. Robert Wolf (WG I on Telecommunications), Dr. Paul Menzel (WG II on Satellite Products), Dr. Johannes Schmetz (WG III on Satellite-Derived Winds), Dr. Tillmann Mohr (WG IV on Global Contingency Planning) and Mr. Mikael Rattenborg (WG V on Integrated Data Dissemination).

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 five working groups for their comprehensive reports and for their achievements since the preceding meeting of CGMS. It was decided that at CGMS XXXII the two working groups WG II and WG III should be merged into a new WG II on Satellite Products including Satellite-Derived Winds.

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

In WMO-WP-19, CGMS was informed that the next WMO Consultative Meeting on High-level Policy on Satellite Matters would be held in Geneva, Switzerland, 26 to 27 January 2004. Dr. Mohr was designated to represent CGMS at this WMO Consultative Meeting.

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

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 co-chaired by Dr. Marie Colton and a Russian delegate (TBD) 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 Dr. Volker Gaertner as Rapporteur.

G.5 Any Other Business

The proposal for amended CGMS Terms of Reference, as presented in EUM-WP-11, was approved by CGMS Members with minor changes in the text proposed by ESA (see annex).

In WMO-WP-22, CGMS recalled the recent expansion of the space-based component of the Global Observing System (GOS) to include appropriate R&D satellite missions, in particular, the confirmed commitments by NASA, ESA, NASDA and Rosaviakosmos. CGMS noted that since CGMS-XXX, another space agency, CNES, had made a formal and firm commitment to include Jason-1 and SPOT-5 as part of the space-based component of the GOS. Thus, WMO recommended that CNES be considered for full membership in CGMS to which CGMS agreed.

Action 31.17 CGMS Secretariat to invite CNES to CGMS XXXII as a full member.

CGMS was also briefed by the China National Space Administration (CNSA) and the Republic of Korea as to their respective satellite plans with a goal towards their eventual inclusion in the space-based component of the GOS and to becoming full CGMS Members.

G.6 Summary List of Actions from CGMS XXXI

(i) Permanent Actions

1. All CGMS Members to inform the Secretariat of any change in the status or plans of their satellites (to allow updating of the CGMS Tables of Satellites).

2. 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. EUMETSAT, Japan and USA to provide the agreed set of reporting statistics on International Data Collection System (IDCS) performance and report to CGMS Secretariat and WMO on a regular basis.

4. CGMS Members to update the Committee on Earth Observation Satellites (CEOS)/WMO Consolidated Database as appropriate using the utility tools provided by WMO and to respond directly to WMO following the database update cycle process.

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

6. All CGMS satellite operators to review the tables in Appendix A of WMO-WP-03 and provide any updates to WMO, as appropriate, and 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 two months prior to every CGMS plenary meeting.

8. CGMS satellite operators to update 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.

New permanent action

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

(ii) Outstanding 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).

This action has been closed and reformulated in Action 31.46 and 31.47.

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

A paper will be presented at IWW7 in June 2004.

30.39 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.

This will be an agenda item at next session of OPAG IOS Expert Team on Satellite Systems Utilization 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 KALPANA-I data available to Arab region countries. India indicated that this might be possible through the planned use of a World Space broadcast satellite. More details would be provided in due course. Deadline: CGMS XXXII

31.02 NOAA to consider maintaining the GEO coverage (including sounder data) in the Pacific region and not de-orbit the GOES-8 satellite that could serve as a potential back-up to GOES-9.

31.03 NOAA to study the request for data coverage sounder in the Southern Hemisphere from GOES-9. Current requirements came from N.W.S. Deadline: CGMS XXXII

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

31.05 USA to regularly inform on the technical specifications for the L-band and X-band direct readout broadcast services on NPOESS. Deadline: CGMS XXXII

31.06 WMO to propose a template to contain detailed information on CGMS satellite systems (including R&D satellites), noting data available in the CEOS database. Deadline: 31 December 2003

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

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

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

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

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). Deadline: CGMS XXXII

31.12 CGMS Members to indicate their activities aimed towards 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. Deadline: CGMS XXXII

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

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. Deadline: 31 December 2003

31.15 The CGMS Secretariat to develop a new structure for the CGMS Consolidated Report. Deadline: CGMS XXXII

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

31.17 CGMS Secretariat to invite CNES to CGMS XXXII as a full member.

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. Deadline: 31 December 2003

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. Deadline: CGMS XXXII

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. Deadline: 31 January 2004

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

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. Deadline: CGMS XXXII

31.23 WMO and IOC to review requirements for the IDCS in the near and long term future (up to 15 years). Deadline: CGMS XXXII

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. Deadline: 31 January 2004

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

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: CGMS XXXII

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. Deadline: 30 November 2003

31.28 All geostationary satellite operators to provide the VIS data requested according to Action 31.27 to EUMETSAT. Deadline: 31 January 2004

31.29 CGMS Members to note and support the upcoming IPWG science meeting. (2) CGMS Members to provide and update the inventory of routinely produced precipitation estimates, either operational or experimental/research, along with training information to the IPWG co-chairs via the IPWG web page. (3) CGMS Members to provide information to the IPWG Rapporteur on areas for future consideration by the IPWG. Deadline: 31 May 2004

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 Space Programme for communication to the CBS Chair OPAG ISS. Deadline: CGMS XXXII

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

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. Deadline: CGMS XXXII

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)

Deadline: 14 June 2004

31.34 CGMS XXXI requests NESDIS to consider submission of a paper to IWW7 on preparatory work on the derivation of AMVs from high-spectral resolution IR sounding instruments (e.g. GIFTS). Deadline June 2004

31.35 CGMS to request that the 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 to report on pertinent steps at CGMS XXXII.

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. Deadline: CGMS XXXII

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. Deadline: CGMS XXXII

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

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.

31.40 EUMETSAT and NOAA/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. Deadline: CGMS XXXII

31.41 NOAA/NESDIS to raise the issue of using the full ISO standard for geographic metadata in the framework of the FWIS inter programme task team. Deadline: 30 September 2004

31.42 NOAA/NESDIS to provide CGMS with further details of its MCUT development. Deadline: CGMS XXXII

31.43 WMO to propose a modification to the layout of the LRIT/LRPT transition tables to taking ADM into account. Deadline: 31 December 2003

31.44 CGMS Members to provide the required information in action 31.43 to WMO. Deadline: CGMS XXXII

31.45 CGMS Members to indicate actions enabling global networking of the Alternative Dissemination Method (ADM) implementation in view of a smooth exchange of specific ADM contents among differing ADM systems and report to CGMS XXXII. Deadline: CGMS XXXII

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

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

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

31.49 WMO to report on the output of the questionnaire to CGMS XXXII. Deadline: CGMS XXXII

31.50 All CGMS operators to provide CGMS with information on their plans for the introduction of LRIT broadcasts on a regular basis.

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. Deadline: CGMS XXXII

31.52 CGMS to investigate further data protection techniques appropriate for a global "alternative distribution system".

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 XXXI Working Papers and presentations.

G.8 Date and Place of Next Meeting

CGMS was pleased to accept an offer from Russia to host CGMS XXXII tentatively in Soči, Russia, from 17 to 20 May 2004. Japan also offered to host CGMS XXXIII at a date and a place still to be decided.

The Chairman thanked all participants for their cooperation and fruitful participation in the Thirty-first meeting of the 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 WMO for a very efficient and productive meeting, and for hosting the meeting in such a wonderful environment. WMO thanked the local host, MeteoSvizzera, for organising the logistics of the meeting locally, as well as the technical visit and liasing with the CGMS Secretariat. The meeting adjourned at 12.00 hours on 13 November 2003.

ANNEXES:

Annex 1 **CGMS XXXI Agenda**

Annex 2 **List of Working Papers and Presentations**

Annex 3 **List of Participants**

Annex 4 **List of Participants in the Working Groups**

AGENDA OF CGMS XXXI
10 – 13 November 2003

---------- PRESENTATIONS ----------

"The operational meteorological satellite system in Korea", Korea Aerospace Research Institute

"The satellite system of the Chinese National Space Administration", Chinese National Space Administration

"Surface Albedo Retrieval from geostationary satellites: Reprocessing of Meteosat data", EUMETSAT/EC-JRC

---------- 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

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 Conclusion and preparation of the WG Report

WORKING GROUP III: SATELLITE-DERIVED WINDS

III/1 Preparation of the 7th International Workshop on Winds
III/2 Wind Statistics
III/3 Procedures for the exchange of inter-comparison data
III/4 Derivation of Wind Vectors
III/5 Conclusion and preparation of WG report

WORKING GROUP IV: CONTINGENCY PLANNING

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

V/1 Coordination of Data Dissemination
V/1.1 Dissemination of satellite images
V/1.2 Dissemination of satellite products
V/1.3 Global exchange of satellite image data
V/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

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

LIST OF CGMS-XXXI WORKING PAPERS

ESA

ESA-WP-01	Status of the current ESA Earth Observation Missions	B.3
ESA-WP-02	World Radio Conference (WRC-03)	I/1
ESA-WP-03	UWB Use of 24 GHz Band in Europe: Status Report	I/1
ESA-WP-04	Plans of the European Space Agency for geostationary and low Earth orbiting satellites in support of WMO's Tropical Cyclone programme	E.1
ESA-WP-05	Radiometric calibration of the Medium Resolution Imaging Spectrometer (MERIS) on board ENVISAT	II/2
ESA-WP-06	ESA EO Satellite data for climate purposes	II/3
ESA-WP-07	EO Science data stewardship at ESA	II/6/F.5
ESA-WP-08	Use of NWP in ESA EO data quality monitoring	II/3
ESA-WP-09	Status of the Future ESA Earth Observation Missions	C.3
ESA-WP-10	Solar/geomagnetic activity data supply	B.4
ESA-WP-11	Status of CGMS Actions	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 the EUMETSAT Satellite Applications Facilities	F.1
EUM-WP-05	EUMETSAT Conferences and Publications	F.5
EUM-WP-06	Update of CGMS Consolidated Report	F.5
EUM-WP-07	Data content of direct broadcasting services for METOP	D.1
EUM-WP-08	Report on planned geostationary and low earth orbiting satellite coverage to support WMO's Tropical Cyclone programme including distribution mechanisms for the data	E.1
EUM-WP-09	Report on WRC 2003	I/1
EUM-WP-10	Review of current practice of climate monitoring principles from satellites	F.6
EUM-WP-11	Amended CGMS Terms of Reference	G.5
EUM-WP-12	Proposal of an overall strategy for convergence of planned ADMs and implementation plan	V/2
EUM-WP-13	Automotive short-range radar operations around 24 GHz	I/1
EUM-WP-14	Frequency Plan for missions in the Indian Ocean region	I/4
EUM-WP-15	Status and Problems of the IDCS	I/3.1
EUM-WP-16	Operational Calibration of the MSG/SEVIRI Solar Channels	II/2
EUM-WP-17	The Radio Occultation Experiment Aboard the German Satellite CHAMP	II/3
EUM-WP-18	Proposal for a workshop on an inventory of the calibration of satellite sensors	II/3
EUM-WP-19	Deriving Global Surface Albedo maps from Geostationary Weather Satellites	II/4

EUM-WP-20	Report on pre-processing codes for future advanced instruments and activities for integrating the code in processing packages	II/3
EUM-WP-21	Report on current use of and plans on use NWP monitoring results in quality monitoring activities	II/3
EUM-WP-22	Considerations on satellite data for climate applications and a consolidated list of metadata	II/6
EUM-WP-23	Report on EUMETSAT Training Activities	F.4
EUM-WP-24	Preparations for IWW7	III/1
EUM-WP-25	Expansion of the Frequency Allocation to the meteorological Satellite Service around 18.2 GHZ	I
EUM-WP-26	Report on EARS	II/3
EUM-WP-27	Comparison of Cloud Height Assignment Techniques using SEVIRI Data	III/4

INDIA

IND-WP-01	Status of CGMS XXX Action Items	A.5
IND-WP-02	Current Status of INSAT and KALPANA-I (METSAT) Satellites for Meteorological Applications	B.2
IND-WP-03	Future Plans of INSAT Satellites for Meteorological Applications	C.2
IND-WP-04	Installation of 100-Digital Cyclone warning Dissemination System (DCWDS) stations in India	F.3
IND-WP-05	Installation of 40-Digital Meteorological data Dissemination stations in India	F.3
IND-WP-06	Impact of vertical profiles of temperature and moisture retrieved from ATOVS data of NOAA satellites on weather forecasting	II/3

IOC

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

JAPAN

JPN-WP-01	Review of Action Items from Previous CGMS Meetings	A.5
JPN-WP-02	Status of Geostationary Meteorological Satellite	B.2
JPN-WP-03	Status of Backup Operation of GMS-5 with GOES-9	B.2
JPN-WP-04	Plan on Multi-functional Transport Satellite	C.2
JPN-WP-05	MTSAT-1R Schedule of observation and dissemination	C.2
JPN-WP-06	Status of the GMS IDCS	I/3.1
JPN-WP-07	Report on WRC-2003	I/1
JPN-WP-08	Intercalibration between GMS-5 and GOES-9 (Action 30.19)	II/2
JPN-WP-09	Activities on Virtual Laboratory in JMA	F.4
JPN-WP-10	High-density Atmospheric Motion Vector	III/4
JPN-WP-11	Backup dissemination of high-resolution data for MDUSs	V/1.1
JPN-WP-12	Status of Data Processing for Climate Monitoring Applications	II/4

PEOPLE'S REPUBLIC OF CHINA

PRC-WP-01	Review of Action Items	A.5
PRC-WP-02	Current Status of FY-1D Meteorological Satellite	B.1
PRC-WP-03	Current Status of FY-1C	B.1
PRC-WP-04	Current status of FY-2B and FY-2A	B.2
PRC-WP-05	Development of FY-3A Meteorological Satellite	C.1
PRC-WP-06	Geostationary Meteorological Satellite FY-2C	C.2
PRC-WP-07	Transmission Characteristics of FY-2C S-VISSR Data	V/1
PRC-WP-08	China/CMA Update to the table: current geostationary satellites coordinated within CGMS	B.2
PRC-WP-09	China/CMA Update to the table: current polar-orbiting satellites coordinated within CGMS	B.1
PRC-WP-10	S-Band DB Service of FY-1 and FY-3	D.1
PRC-WP-11	The international symposium on Sand and Dust storms 2004, Beijing	F.5
PRC-WP-12	Product Reports	III/1
PRC-WP-12-01	Remote Sensing of Cloud Microphysical Properties with Satellite Data	II/4
PRC-WP-12-02	Satellite Precipitation estimate at CMA /NSMC	II/4
PRC-WP-12-03	AMV Derivation Scheme for FY2 Meteorological Satellite	III/4
PRC-WP-12-04	Development of SST Derivation Method for FY-2C	III/4

RUSSIAN FEDERATION

RUS-WP-01	Review of action items from previous CGMS meetings	A.5
RUS-WP-02	Status of Russian polar orbiting meteorological satellite system	B.1
RUS-WP-03	Future polar-orbiting meteorological satellites Meteor-3M	C.1
RUS-WP-04	Future geostationary meteorological satellite GOMS/Electro N2	C.2
RUS-WP-05	Future Russian research and development satellites	C.3
RUS-WP-06	Roshydromet DCS current status and development plans	I/3
RUS-WP-07	Applications of meteorological satellite data for environment monitoring and climate research in Roshydromet	II/4 F.1
RUS-WP-08	Roshydromet's system for dissemination of operational satellite images and products	V/1.1

USA

USA-WP-01	Review CGMS XXX Action Items	A.5
USA-WP-02	Polar Orbiting Operational Environmental Satellite (POES)	B.1
USA-WP-03	Geostationary Operational Environmental Satellite (GOES)	B.2
USA-WP-04	Anomalies from Solar Events	B.4

USA-WP-05	Future Polar Orbiting Meteorological Satellite System	C.1
USA-WP-06	Technical Specifications of the NPOESS Receiver Station (update)	C.1
USA-WP-07	Report on the status of future Geostationary Meteorological Satellite System	C.2
USA-WP-08	USA Direct Readout Service Information	V/1.1
USA-WP-09	USA Support the WMO Tropical Cyclone Program	E.1
USA-WP-10	Assessment of the Virtual Training Laboratory (Word, PDF)	F.4
USA-WP-11	Updates for the CEOS/WMO Database	E.2
USA-WP-12	Input to the WMO Database for Satellite Receiving Equipment	F.5
USA-WP-13	WRC 2003 Report	I/1
USA-WP-14	Technical Input to the Space Frequency Coordination Group and ITU-R	I/1
USA-WP-15	Problems Caused by Car Radars in the 21 - 27 GHz Range	I/1
USA-WP-16	Status and Problems of IDCS	I/3
USA-WP-17	LRIT System Transition and Test Plans	V/1.1
USA-WP-18	USA Request for the Temporary Use of International Channels for High Data Rate Transition	I/3
USA-WP-19	Updates for WMO Tables on Satellites Operations and Services	F.5
USA-WP-20	Report on the Planned Frequencies to support the Indian Ocean Region	V/1
USA-WP-21	NOAA Commitment to Use the CGMS Global Specifications of the AHRPT Format for Future Polar-Orbiting Meteorological Satellites	V/1
USA-WP-22	NOAA use of FWIS in the ISO Standard for Geographic Metadata	V/1
USA-WP-23	On-orbit Calibration and Characterization of MODIS Reflective Solar Bands)	II/2
USA-WP-24	NOAA's Current Use and Plans for NWP Quality Monitoring Report	II/3
USA-WP-25	NOAA Report on Specifications of Raw Data Records and Sensor Data Records	II/3
USA-WP-26	Report on "Auto-Nowcaster" Research	III/1
USA-WP-27	2002/2003 Report on NOAA/NESDIS Satellite Derived Winds	III/2
USA-WP-28	Cloud Drift and Water Vapor Winds in the Polar Regions	III/2
USA-WP-29	New Analysis with the Intercalibration of Geostationary and Polar Orbiting Radiance Measurements	II/2
USA-WP-30	Post-launch Calibration of AVHRR and GOES Solar Channels	II/2
USA-WP-31	Multi-Constellation User Terminal (MCUT) Development	V/1
USA-WP-32	Report on International TOVS Working Group	II/3
USA-WP-33	2002 / 2003 Report on NOAA/NESDIS GOES Soundings	II/3

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	V/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/IV
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-10	WMO code form changes	II/5
WMO-WP-11	Radio Frequency matters	I/1
WMO-WP-12	Tropical Cyclone Programme requirements	E.1
WMO-WP-13	ASAP status report	I/3.2
WMO-WP-14	International Precipitation Working Group	II/4
WMO-WP-15	WMO Consultative Meetings on High-level Policy on Satellite Matters	F.5
WMO-WP-16	Other programmes, Joint WMO/IOC Technical Commission	E.2
WMO-WP-17	Virtual Laboratory Focus Group	F.4
WMO-WP-18	Equator Crossing Times	IV/1
WMO-WP-19	Nomination of CGMS representatives at WMO and other meetings	G.3
WMO-WP-20	ISCCP Products	II/4
WMO-WP-21	Alternative Dissemination methods	V/1
WMO-WP-22	CGMS Membership expansion and expanded space-based component of the Global Observing System	G.5
WMO-WP-23	FWIS	V/1
WMO-WP-24	WMO Globe Project	F.5
WMO-WP-25	Global Climate Observing System (GCOS)	F.5

ADDITIONAL PRESENTATIONS GIVEN AT CGMS XXXI:

"The Communication Ocean and Meteorological Satellite (COMS) Programme in Korea", Korea Aerospace Research Institute

"The satellite system of the Chinese National Space Administration", Chinese National Space Administration

"Global Surface Albedo Product from Geostationary Observations, Scientific Issues and Feasibility Assessment", EUMETSAT/EC-JRC

"Meteorological Data and INSAT images broadcast through the World Space Satellite Broadcast System", IMD.

All working papers and presentations are included on the CD-ROM accompanying the printed report.

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APPENDIX: GENERAL CGMS INFORMATION

1. **Charter for CGMS**
2. **CGMS Membership**
3. **Addresses for Procuring Data**
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Appendix 1

CHARTER FOR THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES (CGMS)[2]

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,

RECOGNIZING the expansion of the space-based component of the WMO's World Weather Watch Global Observing System to include Research & Development missions and

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

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 8

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
ADC	Atlantic Data Coverage
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
AMDAR	Aircraft Meteorological Data Relay
AMS	American Meteorological Society
AMSU	Advanced Microwave Sounding Unit
AMV	Atmospheric Motion Vectors
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)
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
CboM	Commonwealth Bureau of Meteorology Australia
CBS	Commission for Basic Systems
CCD	Charged Couple Device (INSAT-2E)
CCIR	Consultative Committee on International Radio
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
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)
CLS	Collecte Localisation Satellites (Toulouse)
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
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
DRS	DCP Retransmission System (Meteosat)
DRT	Data Relay Transponder (INSAT)
DSB	Direct Soundings Broadcast
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
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
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
GCOM	Global Change Observation Mission (NASDA)
GCOS	Global Climate Observing System
GDPT	Chinese Delayed Picture Transmission Format (Global Data) (FY-1C)
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)
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
GSLMP	Global Sea Level Monitoring Programme
GPCP	Global Precipitation Climatology Project
GPM	GRAs GOOS Regional Alliances
GPS	Global Positioning System
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)
ICI	Inversion Coupled Imager (India)
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
JAXA	Japan Aeronautic Exploration Agency (name change of NASDA)
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)
LAN	Local Area Networks (Telecommunication)
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)
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
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
OLR	Outgoing Longwave Radiation
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)
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)
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)
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)
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
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
SEVIRI	Spinning Enhanced Visible and Infrared Imager (MSG)
S-FAX	S-band facsimile broadcast of FY-2 (PRC)
SFCG	Space Frequency Coordination Group
SMA	State Meteorological Administration (PRC)
SMD	Stored Mission Data (NPOESS)
SMOS	Soil Moisture and Ocean Salinity (ESA)
SOT	Ship Observation Team (JCOMM)
SRF	Spectral Response Function
SRR	Short Range Radar (frequency management)
SRS	Space Research Service (frequency regulation)
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
TD	Technical Document
TIROS	Television Infrared Observation Satellite
TOMS	Total Ozone Mapping Spectrometer
TOR	Terms of Reference
TOVS	TIROS Operational Vertical Sounder
TPW	Total Precipitable Water (NOAA)
TTC	Telemetry Tracking Control
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
VISSR	Visible and Infrared Spin Scan Radiometer
VL	Virtual Laboratory (USA training concept)
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
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)