REPORT OF THE TWENTY-NINTH MEETING OF THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES

CGMS XXIX

Capri, Italy, 22 - 25 October 2001

Cover page illustration:
EUMETSAT
November 2001.

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

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TABLE OF CONTENTS

Page

TWENTY-NINTH MEETING OF CGMS FINAL REPORT OF THE PLENARY SESSION

A. INTRODUCTION

A.1 Welcome

CGMS-XXIX was convened by EUMETSAT at 8:00 a.m. on 24 October 2001 in Capri, Italy. Dr. Tillmann Mohr, Director-General of EUMETSAT, opened the meeting and warmly welcomed participants in the ancient monastery Certosa di San Giacomo in Capri.

A.2 Election of Chairman

Dr. Tillmann Mohr was unanimously elected as Chairman of CGMS XXIX.

A.3 Adoption of Agenda

The agenda (see Annex 1) was adopted. The meeting recalled that the four Working Groups had met during the previous two days, on 22 and 23 October 2001.

The Secretariat provided a list of working papers submitted to CGMS XXIX (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 in advance of the meeting, based upon summaries of the working papers and the Reports of the Working Groups.

A.5 Review of Action Items from Previous Meetings

The Secretariat reviewed the outstanding actions from previous meetings, taking into account inputs provided in EUM-WP-01, IND-WP-05, JPN-WP-01, PRC-WP-00, RUS-WP-00, USA-WP-01 and WMO-WP-02:

(i) Permanent actions

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

   Ongoing. *Tables were distributed and updated during the meeting.*

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. *Tables will be distributed by the Secretariat once all inputs have been consolidated.*

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

Closed for CGMS XXIX. *For USA see http://www.dcs.noaa.gov. For Japan see JPN-WP-04.*

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

Closed for CGMS XXIX.

5. USA to keep CGMS Members regularly informed about anomalies from solar events at CGMS meetings.

Closed for CGMS XXIX*. See USA-WP-06.*

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.

Closed for CGMS XXIX.

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

Closed for JMA and USA by CGMS XXIX*. Japan updates received on 7 September 2001 and USA on 16 October 2001.*

(ii) Actions from CGMS XXVIII

ACTION 28.01 Satellite operators to provide information to CMA on avoiding stray light in the radiometer.

Closed. *China received information from EUMETSAT and USA (see USA-WP-04). See also IND-WP-06. No further action required at this time.*

ACTION 28.02 CMA to inform WMO when the FY-2B broadcast becomes operational and WMO to assist with the distribution of this information by 15 December 2000.

Closed. *Dissemination schedule has been placed on CGMS web site.*

ACTION 28.03 USA to consider options to meet the WMO requirements for satellite images in the Southern hemisphere (half-hourly, full disc, multi-spectral) and inform CGMS Members at CGMS XXIX.

Closed. *See USA-WP-05.*

ACTION 28.04 WMO to place USA Future Polar Orbiting Meteorological Satellite System and NPOESS presentations on the CGMS web site by **15 November 2000**.

Closed. *Presentations available on CGMS web site.*

ACTION 28.05 USA to investigate whether global or a selection of NPOESS level 1B data can be made available to end-users in near real-time and report to CGMS XXIX.

Closed. *See USA-WP-09.*

ACTION 28.06 China and Japan to exchange detailed information on their planned LRIT broadcasts and to inform the CGMS Members in parallel by **31 May 2001.**

Closed for Japan. *Japan sent info on LRIT and HRIT to China on 22 November and 28 December 2000. China's detailed plan for LRIT is being finalised and will be sent to Japan soon.*

ACTION 28.07 USA-WP-08 to be submitted to the Expert Team on Redesign of the Global Observing System as input for consideration and the draft Terms of References to be finalised by the Chairman of the Expert Team in preparation for its workshop.

Closed. *The workshop was held at WMO in Geneva on 23-24 April 2001.*

ACTION 28.08 WMO to place the MTSAT-1R observation and dissemination schedule on the CGMS server by **15 November 2000.**

Closed. *Dissemination schedule is located on the WMO Satellite Activities web site.*

ACTION 28.09 Japan to regularly keep the CGMS Secretariat informed of potential changes in the MTSAT-1R observation and dissemination schedules.

Closed. *There is no change to the MTSAT-1R observation and dissemination schedules as of 1 September 2001 (see JPN-WP-05).*

ACTION 28.10 WMO and USA to coordinate their efforts to inform WMO Members on the transition period from analogue WEFAX to LRIT dissemination schemes for GOES satellites and inform CGMS Members at CGMS XXIX.

Closed. *Updated transition schedules have been placed on the WMO Satellite Activities web site (see USA-WP-18).*

ACTION 28.11 CGMS Members to review the Draft CGMS Consolidated Report and send comments to the CGMS Secretariat by **30 November 2000.**

***Closed**. The draft CGMS Consolidated Report was made available on-line on 27 March 2001 (see EUM-WP-12).*

ACTION 28.12 CGMS Members to review the content of WMO Publication No. 411 and to provide comments and/or updates to WMO by **30 November 2000.**

***Closed**. Updates have been received from all CGMS Members.*

ACTION 28.13 The CGMS Secretariat to initiate the establishment of a Working Group on Precipitation, with co-sponsorship of WMO and CGMS, and to report to CGMS XXIX on progress.

***Closed.** The Working Group met from 20 - 22 June 2001 in Fort Collins, USA (see WMO-WP-14).*

ACTION 28.14 WMO to work with the CGMS Secretariat to initiate the establishment of a focus group on satellite data utilisation and training within the Virtual Laboratory Framework and report back to CGMS XXIX on its findings and need for future activities in this area.

***Closed.** The first meeting of the Focus Group took place from 16-18 May 2001 in Darmstadt, Germany. A report was sent to CGMS Members on 29 May 2001 (see WMO-WP-17).*

ACTION 28.15 CGMS Members, through their national representatives, shall provide to ITU (ITU-R WP 7C) all relevant information on the current status and future plans of GVAR and S-VISSR stations.

***Closed.** USA (NOAA), Japan (JMA) and Australia have provided inputs, which were submitted to the ITU by EUMETSAT, as a WMO contribution, on 4 May 2001 (see USA-WP-22 and JPN-WP-10).*

ACTION 28.16 WMO to dispatch a questionnaire to its Members, updating the database of receiving stations, including GVAR and S-VISSR stations, and to forward the updated information to the ITU.

***Closed.** The database has been updated (see WMO-WP-01).*

ACTION 28.17 Japan and USA to prepare technical inputs to the Space Frequency Coordination Group and ITU-R indicating the revision of the CGMS partition agreement and providing technical justification for this change.

***Closed.** However, there is a new action: to request the monitoring of ITU activities related to the WP7C document (see USA-WP-23 and JPN-WP-10).*

ACTION 28.18 WMO to host a task force meeting to discuss the coordination of data formats and frequency planning for all polar-orbiting satellites, and including their equator crossing times, **by early 2001**.

Closed. *A meeting took place in Geneva on 24 January 2001. The Task Force recommended that CGMS further consider a four-time slot scenario (see WMO-WP-06).*

ACTION 28.19 CGMS Members located within the telecommunication coverage of MTSAT satellites to inform their responsible Telecommunication Administrations (with copy to Japan (JMA)) a few months before MTSAT is launched, that they are convinced that there would be no unacceptable interference between their systems and MTSAT satellites.

Closed. *See USA-WP-24. A meeting between Russia and Japan on coordination of satellite networks took place in Moscow from 10-16 October 2001. Furthermore, China has advised the Radio Regulation Department, Ministry of Information Industry about the MTSAT frequency plan and there is no obvious interference of MTSAT with China's satellite system. Appropriate action by India remains to be taken.*

ACTION 28.20 NOAA to inform CGMS Members on the response of ITU regarding NOAA's request to exempt meteorological satellites from the ITU cost recovery for satellite network filing.

Closed. *See USA-WP-25.*

ACTION 28.21 NOAA to inform CGMS Members on the progress of development and implementation of the Interference Location System for the DCS.

Closed. *See USA-WP-26.*

ACTION 28.22 NOAA to distribute information on the CDMA-based DCP System to CGMS Members by e-mail by **30 November 2000**.

Closed. *Information was sent on 24 October 2000.*

ACTION 28.23 Each satellite operator to post on the CGMS homepage available relevant papers and results on satellite radiance (VIS, IR, WV) inter-comparisons in convenient format and to update them periodically throughout the period until CGMS XXIX.

Closed *for USA, Japan, Russia, EUMETSAT.* ***See*** *EUM-WP-14, JPN-WP-11 and USA-WP-27.*

ACTION 28.24 NOAA/NESDIS and EUMETSAT to report at CGMS XXIX on their monitoring procedures and practices for satellite data and products placed on the GTS.

Closed. *See EUM-WP-15 and USA-WP-31.*

ACTION 28.25 WMO to report at CGMS XXIX on the future monitoring policy for the IPS.

Closed. *See WMO-WP-20.*

ACTION 28.26 NOAA/NESDIS to report at CGMS XXIX on the availability of SSMI/S data.

Closed*. See USA-WP-30.*

ACTION 28.27 Satellite wind producers to report at CGMS XXIX on their implementation of BUFR encoding of satellite-tracked wind products.

Closed *for USA, Japan, Russia and EUMETSAT (see JPN-WP-12 and EUM-WP-16). China will provide information when development of its wind product is finalised.*

ACTION 28.28 CGMS Members to provide working papers to CGMS XXIX on operational multi-spectral methods used for the height assignment of cloud-tracked winds. The analysis should also include accuracy estimates for the heights of semi-transparent clouds.

Closed *for USA, Japan and EUMETSAT (see USA-WP-33, JPN-WP-13 and EUM-WP-16, respectively).*

ACTION 28.29 In view of the imminent development toward high spectral resolution measurements from geostationary orbit, CGMS XXVIII invites USA to provide a paper on wind retrievals from advanced sounding instruments to the Workshop on "Long-term future of the basic sounding and imagery missions" to be organised by WMO in conjunction with the Expert Team on Redesign of the Global Observing Systems. A report should be provided to CGMS XXIX.

Closed. *The workshop on long-term future of basic sounding and imagery missions took place on 23-24 April 2001 (see USA-WP-32).*

ACTION 28.30 CGMS XXVIII requests EUMETSAT to invite ESA to provide a working paper on wind retrievals from advanced sounding instruments to the Workshop on "Long-term future of the basic sounding and imagery missions" to be organised by WMO in conjunction with the Expert Team on Redesign of the Global Observing Systems. A report should be provided to CGMS XXIX.

Closed. *EUMETSAT sent letter to ESA on 31 October 2001.*

ACTION 28.31 CGMS Members to report at CGMS XXIX on plans and progress of the reprocessing of satellite-tracked winds from archived image data with state-of-the-art algorithms.

Closed *for Japan, EUMETSAT and Russia (see EUM-WP-18, JPN-WP-14). USA provided a report to WG III.*

ACTION 28.32 CGMS Members to report on experiments on targeted observations using rapid scans and to explore the impact on NWP.

***Closed**. See EUM-WP-20 and JPN-WP-15. USA provided a report in WG III. Russia, India and China have no reports at this stage.*

ACTION 28.33 CGMS Members performing rapid scans to provide, at CGMS XXIX, an update on rapid scan schedules and applications of rapid scans including an impact assessment. This should include an NWP experiment with and without the improved winds. The analysis should also address the dependence of wind retrieval on the accuracy of the operational image navigation.

***Closed.** See EUM-WP-21, JPN-WP-15 and USA-WP-31. Russia, India and PRC have no inputs at this stage.*

ACTION 28.34 All satellite wind producers to provide comments to the CGMS Secretariat on the satellite wind monitoring results provided on the Web page of the EUMETSAT NWP Satellite Application Facility (SAF) by 31 March 2001.
http://www.met-office.gov.uk/sec5/NWP/NWPSAF

***Closed** for USA, Japan, EUMETSAT and Russia (see EUM-WP-25). Russia has no input at this stage.*

B. REPORT ON THE STATUS OF CURRENT SATELLITE SYSTEMS

B.1 Polar-Orbiting Meteorological Satellite Systems

China reported in PRC-WP-01 on the status of FY-1C, launched on 10 May 1999. Although the satellite is operating well beyond its designed lifetime, all on-board subsystems, i.e. the attitude control, power supply, thermal control, broadcasts and remote sensing are in good working order. However, the MVISR Channel 2 output signal is considerably attenuated compared to 2 years ago. As there is no on-board calibration for the visible channel, visible and near infrared data must be corrected either with reference to in-situ measurements from a calibration site or by using cross-calibration schemes before any quantitative applications can be carried out. The real-time CHRPT broadcast can be accessed by users worldwide. In addition, efforts are now underway to make FY-1C products accessible through the Internet. As a result of the good performance of FY-1C the launch of FY-1D has been postponed to the second quarter of 2002.

Russia informed CGMS in RUS-WP-01 that two satellites of the Meteor-2 and -3 series are being operated in circular orbit, inclined at approximately 82°. They are both operated well beyond their lifetime and have limited capabilities. TV image data from the MR-900 scanning instrument is available through direct broadcast in APT mode (137 MHz), as well as from the RESURS-01 N4 satellite, which is equipped with a similar imager. The RESURS-01 N4 satellite is temporarily out of service, but it is expected to be in operation again soon. The OKEAN-O satellite provides additional satellite information, which is used in various meteorological and hydrological applications. Its core payload includes a MSU-SK multi-zonal scanning device with medium resolution (150 m at 600 km swath band).

USA reported on its polar-orbiting meteorological satellite systems in USA-WP-02. The Polar Operational Environmental Satellite (POES) constellation includes two primary, one secondary and two stand-by spacecraft. These spacecraft are in polar orbits inclined at approximately 98 degrees (retrograde). The primary operational spacecraft, NOAA-16 and NOAA-15, are in sun-synchronous afternoon and morning orbits, respectively. NOAA-15 is the primary morning satellite and operates in an orbit with a 7:30 a.m. descending node. NOAA-16 is the primary afternoon satellite and operates in an orbit with a 2:00 p.m. ascending node. One secondary spacecraft, NOAA-14 operated as primary afternoon satellite until it was replaced by NOAA-16 in January 2001. As a secondary satellite it provides additional payload operational data. NOAA-12 and NOAA-11 are stand-by spacecraft supporting additional user data requirements. NOAA-M is currently scheduled for launch in March 2002. It will be renamed NOAA-17 once it achieves orbit and replaces NOAA-15 as the operational morning spacecraft. Its equator crossing time will be moved from 7:30 am to 9:30 am. NOAA-10 was deactivated on 13 September 2001.

WMO noted the significant impact of AMSU data from the two NOAA satellites on the forecasting skills at major numerical weather prediction (NWP) centres.

USA also reported that over the last three years NOAA and the US Air Force had successfully completed the convergence of the five Defense Meteorological Satellite Program (DMSP) military satellites into the NOAA meteorological constellation. The transfer of operations was an interim step towards the development of a single, integrated, environmental satellite system designed to meet civilian and military needs. The current DMSP constellation consists of two

TABLE 1 : CURRENT POLAR-ORBITING SATELLITES COORDINATED WITHIN CGMS
(as of 25 October 2001)

Orbit type **(equatorial crossing times)**	**Satellites in orbit** (+operation mode) P=Pre-operational Op=operational B=back-up L=limited availability	**Operator**	**Crossing Time** A=Northw D=Southw +Altitude	**Launch date**	**Status**
Sun-synchr. "Morning" (6:00 – 12:00) (18:00 – 24:00)	NOAA-15 (Op)	USA/NOAA	7:30 (D)	05/98	Functional (problems with AVHRR +HIRS)
	NOAA-12 (B)	USA/NOAA	06:40 (D) 850 km	05/91	Functional (except sounding)
	NOAA-10 (L)	USA/NOAA	10:00 (D) 840 km	12/86	Deactivated on 13/09/01
	DMSP-F15 (Op)	USA/NOAA	21:45 (A) 850 km	12/99	Defense satellite. Data Available to civilian users through NOAA
	DMSP-F14 (B)	USA/NOAA	20:42 (A) 852 km	04/97	Defense satellite. Data available to civilian users Through NOAA.
	DMSP-F12 (B)	USA/NOAA	21:13 (A)	8/94	Defense Satellite. Data available to civilian users Through NOAA.
	RESURS-01-N4 (P)	Russia	09:30 (A) 835 km	7/98	Temporarily out of operations
Sun-synchr. "Afternoon" (12:00 –16:00) (00:00 – 04:00)	NOAA-16 (Op)	USA/NOAA	14:00 (A) 870 km	09/00	Problems with APT
	NOAA-14 (Op)	USA/NOAA	14:00 (A) 850 km	12/94	Functional, one OBP is unusable SBUV instrument data ltd
	NOAA-11 (B)	USA/NOAA	14:00 (D)	09/88	
Sun-synchr. "Early morning" (4:00 - 6:00) (16:00 – 18:00)	DMSP-F13 (Op)	USA/NOAA	17:40 (A) 850 km	03/97	Defense satellite. Data available to civilian users
	DMSP-F11 (B)	USA/NOAA	19:32 (A) 850 km	11/91	Through NOAA.
Sun-synchr. "morning"	FY-1C (Op)	China	7:50 (A) 862 km	5/99	Functional
Non Sun-synchronous or unspecified orbits	METEOR 2-N21 (Op)	Russia	950 km	08/91	Functional (APT transmissions of visible images)
	METEOR 3-N5 (Op)	Russia	1200 km	08/91	Functional (APT transmissions of visible images)

primary, two secondary and one back-up operational spacecraft. The first satellite of the new converged system, designed to meet both military and civilian needs, is planned to be available for launch in July 2007.

B.2 Geostationary Meteorological Satellite Systems

EUMETSAT reported in EUM-WP-02 that Meteosat-7 was fully operational at 0°, Meteosat-6 was in stand-by mode at around 9.5°W and Meteosat-5 was located over 63°E providing the Indian Ocean Data Coverage (IODC) Service. The orbital inclination of Meteosat-5 on 1st August 2001 was 4.39° and increasing and the remaining on-board hydrazine fuel was estimated to be 5.46 kg of which a 4 kg reserve is required to de-orbit the spacecraft at the end of its useful life. It is planned to re-evaluate the on-board fuel reserve towards the end of 2004.

In addition to operating as the stand-by satellite, Meteosat-6 has provided an operational Rapid Scanning Service (RSS) since mid-September 2001. This involves continuous rapid scan imaging operations for periods of up to three days, with no loss of geometric accuracy in the rectified images when compared to that normally achieved for full Earth scan images. Rapid scanning is performed 7 days a week with 12-hour interruption every 3 days to perform full Earth scanning (see EUM-WP-21).

India, USA, WMO and the Observer from IOC thanked EUMETSAT for the continuation of the IODC Service. In response to questions on the future duration of the IODC Service, EUMETSAT commented that it was currently committed until the end of 2003. However, the situation would be reassessed, bearing in mind the available supply of on-board fuel and the successful start of operation of the first Meteosat Second Generation satellite (MSG-1). Preliminary discussions to continue the service until 2005 were taking place following several requests from users.

India reported on the status of its Indian National Satellite (INSAT) System in IND-WP-01. The INSAT satellites are three-axis stabilised operational multi-purpose spacecraft and include a meteorological payload, as well as telecommunications and broadcast services. The operational INSAT system includes the first generation INSAT-1D (launched in 1990) positioned at 74°E and the second generation INSAT-2E satellite (launched in 1999) located at 83°E. INSAT-2B is in stand-by mode located at 93.5°E, with an inclined orbit of about 0.8 degrees and with the imager IR channel no longer functioning.

INSAT-2E has a new payload, a Charged Coupled Device camera, capable of taking 1km resolution images in VIS, near IR and short-wave IR bands. The meteorological imaging capability has also been upgraded on this satellite by providing a Water-Vapour channel with 8km resolution, in the VHRR in addition to VIS and IR channels. However, due to an anomaly in the scan mechanism, the VHRR on-board INSAT-2E is not currently available for operational use.

Data from the USA polar-orbiting satellites, as well as from the Meteosat-5 satellite were also received and used operationally by the India Meteorological Department.

Japan reported on the status of GMS-5 in JPN-WP-02. GMS-5, which is well beyond its design lifetime of 5 years, will be kept as an operational satellite until summer 2003 when the Multi-functional Transport Satellite (MTSAT-1R) will take over the meteorological mission. As result

of a lubricant build-up in the GMS-5 mirror scan mechanism, the VISSR observation area was reduced on 4 July 2001. The southern boundary of the full-disc observation was moved upwards to around latitude 49°S and the frequency of the revised full-disc format was reduced from 28 times to 16 times a day. Other formats, made 12 times a day, were changed from full-disc to northern hemisphere up to the southern limit of latitude 10°S. Additionally, the range of mirror scanning has been slightly changed in all formats to avoid further increase of lubricant build-up. Due to a shortage of on-board fuel, the last N-S manoeuvre was carried out on 23 October 2001. The orbit inclination of GMS-5 is expected to exceed 1° around April 2002 and 2° by the summer of 2003.

Referring to the scan problems experienced by Japan with GMS-5, the USA commented that the problems were very similar to those it had experienced in earlier years with GOES. As a consequence, the USA stated that it was more than willing to offer Japan related expertise or technical support, should it be required. Japan expressed its appreciation to USA for this offer of assistance.

In PRC-WP-02 China informed the meeting that since January 2001 FY-2B, launched in June 2000, was operating as the primary operational satellite at 105°E. FY-2A was located in stand-by mode at 86.5° E. It remained in good condition except for the S-band antenna which was unable to point towards the earth for long periods of time because of a defect in its de-spin mechanism. The local oscillator of the FY-2B down-link subsystem ceased working in February 2001, during the spring eclipse period and interrupted raw image transmission. Though the S-band broadcast and acquisition have re-commenced afterwards, there is concern that the unsteady local oscillator of the transponder may still be an interrupting element for transmission during future eclipse periods. China added that it was currently upgrading the image navigation and calibration database elements of the FY-2 ground segment.

Concerning the problem of stray light affecting FY-2B VIS and IR images, and in response to Action 28.01 from CGMS XXVIII, India reported in IND-WP-06 on its experience with stray light affecting the Charge Coupled Device (CCD) imager on-board the INSAT-2E satellite. The impact of stray light had been reduced on the next satellite of the series (INSAT-3A) to less than 3% through the use of additional baffling to the rear of the secondary mirror to eliminate the direct entry of light. India offered to provide China with further assistance if there was a request for more specific technical details.

USA explained in USA-WP-04 that it had experienced a stray light problem with the GOES-8 Imager and Sounder. This was corrected on GOES-10, and possibly in GOES-9, by slightly modifying the telescope design. A degradation in the VIS band of GOES-8, 9 and 10 had also been analysed and was thought to have been caused by scan mirror degradation. It was also suggested that a hole in the secondary mirror of FY-2B might be allowing stray light to enter. The USA was also very willing to assist China with its investigation of the stray light problem, however, it would need technical details, including a full description of the stray light and any information China might have on the degradation of the FY-2B scan mirror coating.

China thanked CGMS for all the information provided and offers of assistance with stray light reduction.

In USA-WP-03, the USA reported on the status of its geosynchronous meteorological satellites. The current Geostationary Operational Environmental Satellites (GOES) are three-axis stabilised spacecraft. The primary satellites, GOES-8 and GOES-10, were stationed over

75°W and 135°W, respectively. GOES-12 was launched in July of 2001 and will complete its post-launch checkout in December 2001. It carries the first Solar X-Ray Imager (SXI) instrument. Samples of data are available on the NOAA Web site at http://www.noaa.sec.gov. Other instrumentation is similar to that flown on GOES-10. One important change is the imager channels: one channel at 12.0µm has been replaced by a 13.3µm channel to improve the assessment of height of winds used for the prediction of tropical storm and for more accurate cloud optical properties. Furthermore, the horizontal resolution of the 6.7µm water vapour channel has been improved from 8 km to 4 km. GOES-12 will be stored in orbit near GOES-11 and GOES-9, ready for replacement of the older operational spacecraft, as required.

With regard to the GOES-12 radiometer channel changes, WMO noted some concerns that had been expressed by ICAO and related to a possible loss of data used successfully in the past for the detection of volcanic ash clouds. The USA agreed to provide more information on the performance of the new channel in relation to the detection of volcanic ash clouds.

Action 29.01 **USA to provide WMO with a copy of the Principal Components Analysis (PCA) report for the new GOES-12 imager channels, in order to evaluate the possibility of detecting volcanic ash clouds. Deadline: November 2001.**

CGMS was further informed that GOES-11 had been placed in a passive spin-stabilised storage mode at 105°W in August 2000. GOES-9 was in storage near 105°W, in a Z-axis Precession (ZAP) mode, a spin-stabilised storage mode that minimises use of life-limited spacecraft components and requires little operator intervention. It has limited capability due to attitude limitations and imager VIS channel noise. GOES-7 and GOES-3 continue to support data relay requirements of the University of Hawaii's Pan-Pacific Educational and Cultural Satellite Program and South Pole Station for the National Science Foundation, respectively. GOES-2 was placed into a super-synchronous orbit (de-orbit) in May 2001 and is no longer operating.

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 will provide real-time images (one per minute of the sun in the X-Ray band). A data collection system on the GOES spacecraft receives and relays environmental data sensed by widely dispersed surface platforms such as river and rain gauges, seismometers, tide gauges, buoys, ships and automatic weather stations. Platforms transmit sensor data to the satellite at regular or self-timed intervals, upon interrogation by the satellite, or in an emergency alarm mode whenever a sensor receives information exceeding a present level.

With regard to Action 28.03 concerning GOES image coverage in the southern hemisphere, USA-WP-05 presented options, which would meet WMO imagery requirements, i.e. ½ hourly full-disc multi-spectral scans. The WMO requirement for ½ hourly southern hemisphere coverage would be met during routine operations by the combined coverage provided by GOES-East and GOES-West. CGMS noted that during Rapid Scan Operations (RSO) periods a full disc scan would be performed every 3 hours. Thus during severe weather outbreaks, in which RSO is used, the WMO requirement for ½ hourly southern hemisphere coverage would

TABLE 2 : CURRENT GEOSTATIONARY SATELLITES COORDINATED WITHIN CGMS
(as of 25 October 2001)

Sector	**Satellites currently in orbit (+type)** P: Pre-operational Op: Operational B: Back-up L: Limited availability	**Operator**	**Loca-Tion**	**Launch date**	**Status**
EAST-PACIFIC (180°W-108°W)	GOES-10 (Op)	USA/NOAA	135°W	04/97	Inverted, solar array anomaly, DCP interrogator on back-up
WEST-ATLANTIC (108°W-36°W)	GOES-8 (Op)	USA/NOAA	75°W	04/ 94	Minor sounder anomalies, loss of redundancies on some sub-systems
	GOES-11 (B)	USA/NOAA	105°W	05/00	in orbit back-up, 48 hours availability
	GOES-9 (L)	USA/NOAA	106°W	05/95	ZAP mode, attitude control problems
	GOES-12 (P)	USA/NOAA	105°W	07/01	Deplaced in storage mode in Dec. 2001
EAST ATLANTIC (36°W-36°E)	METEOSAT-6 (B)	EUMETSAT	9.5°	11/93	Rapid Scanning Service minor gain anomaly on IR imager
	METEOSAT-7 (Op)	EUMETSAT	0°	02/97	Functional
INDIAN OCEAN (36°E-108°E)	METEOSAT-5 (Op)	EUMETSAT	63°E	03/91	IODC, functional but inclination
	GOMS-N1 (B)	RUSSIA	76°E	11/94	Since 9/98 in stand-by
	FY-2B (Op)	CHINA	105°E	06/2000	Image transmission interrupted in eclipse periods
	FY-2A (B, L)	CHINA	86.5°E	06/97	
	INSAT II-B (B)	INDIA	93.5°E	07/93	Experimental Satellite (defect of de-spin
	INSAT II-E (Op)	INDIA	83°E	04/99	subsystem – problems w. S-band antenna) inclined orbit mode of operation. IR channel not available.
	INSAT I-D (Op)	INDIA	74°E	06/90	Imagery data from 3 channel CCD payload (1km res.) available for operational use. 3 channel VHRR not available for use. Cloud imagery data obtained for routine operational use. Derived CMVs disseminated on GTS.
WEST-PACIFIC (108°E- 180°E)	GMS-5 (Op)	JAPAN	140° E	03/ 95	Operational, 1° inclination becoming 3° by 2004

not be met. The USA cautioned that, currently, there were insufficient resources to support the use of a third GOES satellite for RSO sessions, or more frequent southern hemisphere scans.

WMO stated that, from the perspective of NMHSs in WMO Regions III (South America) and IV (Central and North America and the Caribbean), the GOES image coverage over the southern hemisphere was insufficient during periods of RSO. Thus, WMO asked the USA to continue to look at alternatives to increase image coverage over the southern hemisphere in these situations. WMO recognized and supported the high priority given to RSO operations and thus further suggested that any alternative should not impact RSO operations.

Concerning the value of RSO sessions, EUMETSAT commented that their importance had been amply demonstrated and then had helped considerably in convincing its Member States of the need for a Rapid Scanning Service.

B.3 Anomalies from solar and other events

In USA-WP-06, USA informed CGMS that NOAA's Space Environment Centre (SEC) had announced that the maximum of Solar Cycle 23 had probably occurred in April 2000. To date, the smoothed sunspot number recorded had been 120.8, which implied that cycle 23 was an average solar cycle. SEC warned satellite operators that the maximum of the geomagnetic storm season was still to come and lagged the solar maximum by approximately two years. With regard to radiation storms the paper discussed that although cycle 23 had a relatively moderate sunspot count, activity that posed problems for spacecraft had occurred. In this respect events from 10-19 July 2000 and from 16-18 August 2001 were highlighted. The former had led to the degradation of data quality below useful levels in instruments used by SEC and the latter had caused star tracker anomalies on at least three widely-spaced satellites. Regarding geomagnetic storms, it was stated that we were still in a period when major geomagnetic storms could be expected. Satellites could be affected through magnetopause boundary crossings and problems with magnetic torqueing at geosynchronous altitude, increased satellite drag at lower altitudes and surface and deep dielectric charging. Adding to its report on its activities in the area of space environment monitoring, USA also mentioned its involvement in a Space Weather Initiative.

WMO raised the question whether CGMS operators should, in the future, include space environment monitoring instruments on their satellites, stating, however, that there were currently no WMO requirements for such observations.

CGMS noted the increased importance of monitoring space environment and space weather and the Chairman invited CGMS Members to report back on this subject at future meetings.

Action 29.02 **CGMS Members to report to CGMS XXX on discussions amongst their organizations on the possibility of flying space environment monitoring instruments on their next generation of geostationary satellites.**

C. REPORT ON FUTURE SATELLITE SYSTEMS

C.1 Future Polar-Orbiting Meteorological Satellite Systems

ESA informed CGMS in ESA-WP-01 of the status of ESA's Earth Observation missions. Two of them, MSG and Metop were in cooperation with EUMETSAT. ERS-1 ceased operations in March 2000. ERS-2, launched in 1995, continued to provide its services, except for the scatterometer, following correction of attitude control difficulties caused by gyroscope problems in January 2001.

ESA reported that ENVISAT was now ready for launch. It should have been launched in October 2001, however, following the recent Ariane-5 upper stage failure on 12 July 2001, the ENVISAT launch date had been delayed. In the meantime, a date for the next Ariane 5 launch, together with ENVISAT, had been fixed by Arianespace for the end of January 2002.

The meeting was reminded that the Earth Explorer and Earth Watch missions were undertaken under the so-called Envelope Program, a rolling program designed to underpin European efforts in Earth Observation from space. For the full implementation of Earth Watch missions, a new Earth Watch programme has been proposed. Central to the definition of Earth Watch missions are the interest of EUMETSAT and the initiative for Global Monitoring for Environment and Security (GMES), which is at the heart of the European Strategy for Space and defined by the European Commission. Four missions within the Earth Explorer Programme were to be launched: GOCE (Gravity Field and Steady State Ocean Circulation Explorer), ADM (Atmospheric Dynamics Mission) for lidar winds, CRYOSAT (Polar Ice Monitoring) and SMOS (Soil Moisture and Ocean Salinity). Further Explorer missions were in the selection process.

The Chairman, supported by the Observer from IOC, asked ESA whether there was a possibility to receive data from the demonstrator mission earlier. In response ESA considered that the published dates were realistic, given ongoing technical developments.

Responding to a request from WMO concerning the supply of ERS data, ESA commented that although there were some technical problems, it intended to supply ERS-2 data for as long as possible.

The status of the EUMETSAT Polar System (EPS), as of August 2001, was presented in EUM-WP-03. The first Metop satellite (Metop-1) was being developed within the framework of the Metop-1 Programme of the European Space Agency (ESA) in cooperation with EUMETSAT.

The Metop satellite will be a 4.3-ton class satellite carrying a payload of about 900 kg. Its orbit is sun-synchronous with an inclination of 98.7^{o} and an equator local crossing time at 09.30 hrs. It will communicate to ground in S-, L- and X-bands for command and control, local (direct broadcast) dissemination and global acquisition. The Metop-1 industrial activities started in 1998 and have been proceeding normally since then. The Metop satellite Critical Design Review took place between 11 September and 22 October 2001.

Due to the advanced and complex technologies used in the IASI instrument to be flown on Metop, some technical problems have been encountered during IASI development and a delay

in the delivery of instruments to April 2003 was now expected. It was further reported that the Core Ground Segment contract had been kicked-off in January 2001. The launch of the first Metop satellite was currently planned for 2005 using a Soyuz launcher. ESA added to this report that the Critical Design Review of Metop had now been completed and that the satellite was making good progress.

Recalling the launches of NOAA-M in 2002 and Metop-1 in 2005, USA remarked that there was a need to extend the life of the USA morning orbit satellite until Metop became available for operational use. It suggested that EUMETSAT try to expedite the Metop-1 commissioning period to minimise the risk of loss of morning orbit coverage. EUMETSAT confirmed that the development of Metop remained on schedule for a launch in July 2005. EUMETSAT added that it, too, shared USA concerns of the need to assure continuity of the global observing system.

Also sharing these concerns, WMO stressed the need to minimise the risk of a potential gap in morning orbit observations. Responding to a request for information on the payload for Metop-3, EUMETSAT mentioned that the choice of imager was still an open issue and discussions on a European imager were still in progress. There was a possibility that AVHRR could be flown on Metop-3. In the meantime, the USA NPP mission would provide imaging capability in the morning orbit with a VIIRS instrument on board.

CGMS was informed in PRC-WP-04 that FY-1D had completed its on-ground test programme in June 2001 and should have been transported to Taiyuan Launch Centre for launch in the autumn of 2001. However, in view of the good performance of the FY-1C satellite currently in orbit, it had been decided to postpone the launch of FY-1D until the first half of 2002. CGMS were informed that FY-1D would have orbital and mission characteristics similar to FY-1C and would provide a global CHRPT broadcast.

In PRC-WP-05, China informed CGMS about the development of the FY-3 series of satellites, its second generation polar-orbiting meteorological satellites. It was planned that this satellite series would operate between 2004 and 2018. The FY-3 mission objectives, the imaging mission payload and sounding mission payload were all described in the document. China added that all FY-3 satellite subsystems had passed examination and evaluation phase. The FY-3A mock-up had been completed and the FY-3A dynamic load satellite was being manufactured. Furthermore, a test of the electrical interface between satellite subsystems would be completed by the end of 2001. The launch of FY-3A was currently planned for 2004.

WMO informed CGMS that details of the FY-3 series of satellites were published in the WMO/CEOS database. Commenting on the use of X-band broadcast frequencies, WMO noted that since most WMO Members would not normally be able to afford access to such broadcast frequencies, China should consider alternatives to make all FY-3 satellite data available to WMO Members.

Action 29.03 **China to provide details of its future X-band broadcast and to inform CGMS XXX how WMO Members could access FY-3 satellite data, using either low-cost user stations or alternative dissemination methods.**

China also briefly reported on the use of V-SAT technology to ensure a wider distribution of

large amounts of data to its regional weather forecast centres.

Russia reported on the status of the polar-orbiting meteorological satellite Meteor-3M series in RUS-WP-02. Meteor-3M N1 has been shipped to the Baikonur Kosmodrom at the end of August 2001 from where it will be launched in December 2001. Meteor-3M N2 has been designed to include global climate monitoring in addition to providing hydrometeorological and heliogeophysical information on the atmosphere, Earth surface and the global oceans. The launch of Meteor-3M N2 is planned for 2004-2005.

The Meteor-3M N1 satellite will operate with an inclination of 99.6° at an altitude of 1024 km and a period of 105.3 minutes. The ascending node of the equator crossing time will be at 09:15 a.m. The exact orbital parameters for Meteor-3M N2 will be coordinated with CGMS at a later date.

The payload of Meteor-3M N1 includes the scanning (0.5-0.8 μm) instrument MR-2000M (similar to that flown on Meteor-3) and KLIMAT (improved KLIMAT scanning IR radiometer installed on board Meteor-3). Meteor-3M N1 will carry the MIVZA microwave scanning radiometer (5 channels in the range 20–94 GHz) and the MTVZA radiometer (26 channels in the range of 18.7–183.3 GHz). The latter instrument will provide data for atmospheric temperature and humidity soundings, as well as for oceanographic research into diagnostics of the active ocean layer processes. Scanning instruments of medium (MSU-S) and high (MSU-E) resolution are also installed on board of Meteor-3M N1 satellite, as well as UV-band instrument (SFM-2) for ozone and small atmospheric gases measurements, and heliogeophysical instrument complex (KGI-4, MSGI-5EI). The following new sensors for imaging and sounding missions will be installed on board Meteor-3M N2:

- multichannel scanning radiometer (MSR) (six channels in visible and IR, similar to AVHRR/3, spatial resolution is close to 1 km);
- advanced IR atmospheric sounder (IKFS-2) based on Fourier transform spectrometer (spectral range of 5.0–15 μm; spectral resolution is equal or better than 0.5 cm^{-1}). The IKFS primary mission is to provide temperature and humidity soundings and to meet WMO requirements on vertical resolution and accuracy of sounding in the troposphere.

The SAGE-III (USA, NASA) sensor is installed on board the Meteor-3M N1 satellite (in the framework of the agreement between NASA and Rosaviakosmos).

Data from Meteor-3M N1 will be down-linked in 0.466, 1.7 and 8.2 GHz bands. An HRPT (1.7 GHz) and LRPT (137 MHz) standard broadcast mode and data transmission in 8.2 GHz band are foreseen on Meteor-3M N2.

WMO remarked on the number of satellites using similar morning equator crossing times (e.c.t.). Whilst WMO understood the need to meet national requirements, it questioned the need for so many satellites with similar e.c.t. The Chairman added that for ocean colour monitoring the situation was similar, since there was also considerable duplication of information. However, since it was not appropriate for CGMS to discuss issues of a political nature, such issues could be addressed in the WMO High Level Consultative Meetings.

China commented that whilst it was very willing to contribute to a Global Observing System, it first needed a stable satellite system; only then would China be in a position to consider alternative operating scenarios, such as a change in e.c.t.

Recalling earlier discussions under this agenda item where the risk of gaps in future morning orbits had been raised, the Chairman commented that it was, perhaps, important to have at least two systems in similar morning orbit to ensure adequate system redundancy. There was, however, also the need to address potential conflict between down-link frequencies, caused by satellites flying in formation.

CGMS proposed that a discussion paper be initiated by EUMETSAT, in cooperation with USA, China and WMO, for presentation at the High Level Consultative Meeting in February 2002. WMO also requested all CGMS Members to update Table 3 in order that it could be used as a basis for the discussion paper.

Action 29.04 **CGMS Members to update Table 3 – "Coordination of Data Formats and Frequency Planning for Polar-Orbiting Satellites", with a view to using this table as a reference in the preparation of discussions on mission planning in the polar orbit and contingency during the WMO Consultative Meeting on High Level Policy planned in Geneva in February 2002. Deadline: December 2001.**

Action 29.05 **EUMETSAT to provide CGMS Members with an outline of a discussion paper on mission planning in the polar orbit and contingency by the beginning of December 2001.**

Action 29.06 **CGMS Members to respond and provide inputs to this document by mid-January 2002 in view of using this paper as an input to the discussions on mission planning in the polar orbit and contingency planned during the WMO Consultative Meeting on High Level Policy planned in Geneva in February 2002.**

The USA discussed its future polar-orbiting meteorological satellite system in USA-WP-08. NOAA now has a follow-on polar satellite programme to replace current satellites as they reach the end of their operational life. The new fifth-generation POES ATN follow-on satellites are designated NOAA-K, -L, -M, -N, and -N'. NOAA-K, -L, and -M have been upgraded with new primary environmental instruments, with NOAA-N and -N' updated to a later instrument baseline. The major changes to the environmental instrument baseline for the NOAA-K, -L, and -M satellites include the AVHRR/3, the HIRS/3, and the AMSU-A and -B. Instrument changes for NOAA-N and -N' include the HIRS/4 which will provide 10 km field of view as opposed to 20 km on the previous model, and the Microwave Humidity Sounder, provided by EUMETSAT, which will replace the AMSU-B.

NOAA-K, now designated NOAA-15, was launched into a morning orbit on 13 May 1998. NOAA-L, now designated NOAA-16, was successfully launched in September 2000 into an afternoon orbit and replaced the ageing NOAA-14. The planned launch dates for the remaining ATN follow-on satellites are as follows:

- NOAA-M March 2002
- NOAA-N June 2004
- NOAA-N' March 2008

TABLE 3 : COORDINATION OF DATA FORMATS AND FREQUENCY PLANNING FOR POLAR-ORBITING SATELLITES

(as of 5 December 2001)

Satellite	Service	Start	EOL	Eq. Cross-time	Freq (MHz)	BW MHz	Data rate (Mb/s)
Metop-1	LRPT	2006	2011	0930	137.9	.150	.072
Metop-2	LRPT	2010	2015	0930	137.9	.150	.072
Metop-3	LRPT	2015	2020	0930	137.9	.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	2005	2009	1030	7750-7850	30.8	20
NPP	SMD	2005	2009	1030	8025-8400	232	300
NPOESS-1	LRD	2010	2015	0930	1706.5	3.5	3.5
NPOESS-2	LRD	2011	2016	1330	1706.5	3.5	3.5
NPOESS-3	LRD	2013	2018	0530	1706.5	3.5	3.5
NPOESS-4	LRD	2015	2020	0930	1706.5	3.5	3.5
NPOESS-5	LRD	2017	2022	1330	1706.5	3.5	3.5
NPOESS-6	LRD	2018	2023	0530	1706.5	3.5	3.5
NPOESS-1	HRD	2010	2015	0930	7750-7850	30.8	20
NPOESS-2	HRD	2011	2016	1330	7750-7850	30.8	20
NPOESS-3	HRD	2013	2018	0530	7750-7850	30.8	20
NPOESS-4	HRD	2015	2020	0930	7750-7850	30.8	20
NPOESS-5	HRD	2017	2022	1330	7750-7850	30.8	20
NPOESS-6	HRD	2018	2023	0530	7750-7850	30.8	20
NPOESS-1	SMD	2010	2015	0930	25500-27000	384	400
NPOESS-2	SMD	2011	2016	1330	25500-27000	384	400
NPOESS-3	SMD	2013	2018	0530	25500-27000	384	400
NPOESS-4	SMD	2015	2020	0930	25500-27000	384	400
NPOESS-5	SMD	2017	2022	1330	25500-27000	384	400
NPOESS-6	SMD	2018	2023	0530	25500-27000	384	400
NOAA-15	APT	1998	2001	0730	137		,072
NOAA-15	HRPT	1998	2001	0730	/1702..5		.688
NOAA-15	GAC	1998	2001	0730	2247.5		
NOAA-16	APT	2000	2004	1400	Failed		.072
NOAA-16	HRPT	2000	2004	1400	1698		.688
NOAA-16	GAC/LAC	2000	2004	1400	1698//1702.5/1707		
NOAA-M	APT	2002	2005	1000	137		.072
NOAA-M	HRPT	2002	2005	1000	1698		.688
NOAA-M	GAC/LAC	2002	2005	1400	1698//1702.5/1707		
NOAA-N	APT	2004	2008	1330	137		.072
NOAA-N	HRPT	2004	2008	1330	1698		.688
NOAA-N	GAC/LAC	2004	2008	1330	1698//1702.5		
NOAA-N’	APT	2008	2012	1330	137		.072
NOAA-N’	HRPT	2008	2012	1330	1698		.688
NOAA-N’	GAC/LAC	2008	2012	1330	1698//1702.5/1707		
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

Satellite	Service	Start	EOL	Eq. Cross-time	Freq (MHz)	BW MHz	Data rate (Mb/s)
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 N1*	Raw	2001	2004	0915	466.5	3	0.080
Meteor 3M N1*	Raw	2001	2004	0915	1700	2	0.665
Meteor 3M N1*	Raw	2001	2004	0915	8192	32	15.36
Meteor 3M N2	LRPT	2004	2011	1030	137.89 / 137.1	0.15	0.064
Meteor 3M N2	HRPT	2004	2011	1030	1700	2	0.665
Meteor 3M N2	Raw	2004	2011	1030	8192	32	15.36

To support these new satellites, elements of the ground segment have also been updated to accommodate new and updated satellite data formats, generate S-band commands, ingest new satellite environmental data, product processing, and product distribution and archiving. To provide the latest information on the specifics of these changes, NOAA has prepared a user guide for the new POES satellites. This information is available on the polar satellite homepage on the Internet at the following URL: http://www2.ncdc.noaa.gov/POD/intro.html .

The NPOESS development and acquisition plan is designed to make best use of production and existing POES and DMSP assets, to reduce risk on critical sensor payloads and algorithms, and to leverage civil, governmental, and international payload and spacecraft developments. In 1997, the Integrated Program Office (IPO) initiated a robust sensor risk reduction effort that is focused on early development of the critical sensor suites and algorithms necessary to support NPOESS. In August 2001, preliminary design efforts were completed for the last of five critical imaging/sounding instruments for NPOESS. Final design, prototype development, and fabrication of these instruments have begun, with delivery of the first flight units for three sensors scheduled for late 2004. In 2000, the IPO initiated a program definition and risk reduction program to define the requirements for the NPOESS total system architecture, including space, ground processing, and command, control, and communications components, as well as to develop specifications for sensor/spacecraft integration. This phase of the early development program will be concluded in late 2002, with the award of a single contract for the Engineering and Manufacturing Development of NPOESS.

NPOESS will provide significantly improved operational capabilities and benefits to satisfy the critical civil and national security requirements for space-based, remotely-sensed environmental data. These activities represent a sound beginning for achieving the planned national and international programs in the new millennium and ensuring continuous support to a variety of users.
The first converged NPOESS satellite is expected to be available for launch by 2008 to back-up the last launches of the current DMSP and POES satellites.

In USA-WP-09 USA provided an overview of the near real-time availability of global Stored Mission Data (SMD) and real-time High Rate Data and Low Rate Data from NPOESS. NPOESS global SMD will be routed to four U.S. Operational Processing Centres for processing into Raw Data Records (RDR), Sensor Data Records (SDR), and Environmental Data Records (EDR). The RDR will be full resolution, unprocessed digital sensor data, time-referenced and earth-located (or orbit-located for in-situ measurements), with radiometric and

geometric calibration coefficients appended to the data. SDRs will be full resolution sensor data that are time-referenced, earth-located and calibrated by applying the ancillary information, including radiometric and geometric calibration coefficients and geo-referencing parameters. EDRs are fully processed sensor data containing the environmental parameters or imagery that must be generated as user products. NESDIS will provide the world-wide user community access to near real-time processed NPOESS data and higher-level products via the NESDIS Central Environmental Satellite Computer System (CEMSCS) servers, as well as access to archived NPOESS data via other distributed servers at the NESDIS Data Centres. USA reported that HRD X-band data (at 20 mbs) would be available from NPOESS together with LRD (at 3.5 mbs) and with a frequency of 1702 MHz.

Referring to the development of new operational satellite instruments and systems, WMO stressed that CGMS should be aware of the severe problems, which would be faced by global users when dramatic changes were made to imagers, dissemination formats, broadcast frequencies etc. unless such changes were planned and implemented in a coordinated manner.

EUMETSAT commented that, to avoid confusion over nomenclature, it might be more appropriate for CGMS Members to adopt one name for the so-called "AHRPT" broadcast. USA agreed to consider the implications of such a change and report at CGMS XXX. USA added that whilst the NPP satellite would have an X-band broadcast, it was currently not clear whether there would be a Low Rate broadcast.

Action 29.07 **USA to provide information on the broadcasts available from its NPP satellite to CGMS XXX.**

WMO thanked USA for the information on the Low Rate broadcast and supported the concept of a common nomenclature for AHRPT. WMO noted that a WMO Expert Team would discuss satellite direct broadcast schemes at a meeting planned in December 2001 and prepare the way for a more detailed discussion of the subject the following April. WMO suggested that CGMS satellite operators should consider discussing alternative broadcasting schemes at the next CGMS meeting.

In response to a request for further information on alternative broadcast mechanisms, EUMETSAT agreed to provide information on its planned ATOVS Retransmission Service (EARS) and China agreed to provide details of its internal data retransmission to CGMS Members by the end of December 2001.

Action 29.08 **EUMETSAT to provide details of its ATOVS Retransmission Service to CGMS Members by December 2001.**

Action 29.09 **China to provide details of its internal data retransmission to CGMS Members by the end of December 2001.**

TABLE 4: FUTURE POLAR-ORBITING SATELLITES COORDINATED WITHIN CGMS
(as of 25 October 2001)

Orbit type (equatorial crossing times)	Future Additional Satellites	Operator	Planned launch date	Other information
Sun-synchr. "Morning" (6:00 – 12:00) (18:00 – 24:00)	METOP-1	EUMETSAT	12/2005	(827 km) (9:30) AHRPT
	METOP-2	EUMETSAT	06/2010	(827 km) (9:30) AHRPT
	METOP-3	EUMETSAT	12/2014	(827 km) (9:30) AHRPT
	FY-1D	China	2002	(8:40) CHRPT
	FY-3A	China	2004	(9:30)
	FY-3B	China	2006	(9:30)
	METEOR 3M-1	Russia	12/2001	(9:15)
	METEOR 3M-2	Russia	2004	(10:30) or (16:30) HRPT
	NOAA-M	USA/NOAA	09/2001	
	NPOESS-1	USA/NOAA	2010	(9:30)
	NPOESS-4	USA/NOAA	2015	(9:30)
Sun-synchr. "Afternoon" (12:00 – 16:00) (00:00 – 04:00)	NOAA-N	USA/NOAA	6/2004	(13.30)
	NOAA-N'	USA/NOAA	03/2008	(13.30)
	NPOESS-2	USA/NOAA	2011	(13.30)
	NPOESS-5	USA/NOAA	2017	(13.30)
Sun-synchr. "Early morning" (4:00 - 6:00) (16:00 – 18:00)	DMSP-S16	USA/NOAA	2001	
	DMSP-S17	USA/NOAA	2002	
	DMSP-S18	USA/NOAA	2003	
	DMSP-S19	USA/NOAA	2005	
	DMSP-S20	USA/NOAA	2007	
	NPOESS-3	USA/NOAA	2013	(5:30)
	NPOESS-6	USA/NOAA	2018	(5:30)

C.2 Future Geostationary Meteorological Satellite Systems

EUM-WP-04 reported that manufacture of the MSG satellites was progressing according to schedule and following the satellite Critical Design Review in the last quarter of 1998, the Qualification Result Review was held in the first half of 2000. The Flight Acceptance Review has been divided into two phases with phase 1 completed early in 2001 and phase 2, which will include a satellite storage period, de-storage and execution of remaining tests to be performed before shipment to the launch site. Phase 2 will be concluded by a Readiness to Ship Review in the first quarter of 2002. The satellite Engineering Model has ended its test programme and the first part of compatibility tests with the MSG Ground Segment has also been completed.

MSG-1 will be launched on an Ariane-4 launcher in July 2002. MSG-2 and MSG-3 will, however, be launched on Ariane-5 launchers in 2010 and 2014, respectively. Additional shock test campaigns are being carried out on the Engineering Model of MSG 2/3 to check compatibility with Ariane-5.

Currently, the transition period with parallel operations of Meteosat-7 and MSG-1, starting after the commissioning of MSG-1 in 2002, will extend until the end of 2003. It is technically possible

to further extend the overlap until 2005, assuming continued nominal operations of Meteosat-7. Possibilities for extending the overlap are currently being discussed with the EUMETSAT Council.

EUM-WP-05 presented the status of the network of approved Satellite Application Facilities (SAF) currently under development in the EUMETSAT Member States. The Pilot SAFs on "Nowcasting and Very Short Range Forecasting" and "Ocean and Sea Ice" are expected to start their Initial Operations Phases in 2002. The paper also described the status of the remaining five SAF projects and provided an updated list of planned products.

SAFs will use data from Meteosat, MSG and EPS and, in some cases, data from non-EUMETSAT missions. Until such data become available, information from current satellites is being used for development of algorithms, software packages and products.

It is expected that the Initial Operational Phase will give a major opportunity for users to start activities based on the use of SAF Products and Services. Lessons learnt will assist the validation of all other SAF Projects using real satellite data and will optimise the Operational Phases.

EUMETSAT added that one further SAF, addressing hydrological issues, was currently being considered.

Finally, CGMS was reminded that further information on the objectives and the status of the SAF Network is available at http://www.eumetsat.de/SAF

In IND-WP-01 India informed CGMS of its plans for future geostationary satellites, namely INSAT-3A (similar in capability to INSAT-2E), METSAT (with similar VHRR to INSAT-2E) and INSAT-3D.

INSAT-3A and METSAT are scheduled for launch around mid 2002. INSAT-3D will have an advanced imager with six channels and a nineteen-channel sounder for derivation of atmospheric temperature and moisture profiles, and is scheduled for launch in the year 2004. India added that METSAT will be the first in a series of satellites dedicated solely to meteorology (unlike earlier INSAT series) and will have a broadcast capability, initially in extended C-band, but consideration will be given to L-band in due course. India added that if the first METSAT is successful, it hoped that there would be others in the series, to serve the needs of the meteorological and climate communities.

CGMS congratulated India on its development of the METSAT series and hoped that the satellite system would, eventually, become part of the WWW's Global Observing System.

JPN-WP-03 provided a report on the future plans for the Multi-functional Transport Satellites. MTSAT-1R and MTSAT-2 will be launched early 2003 and 2004, respectively. MTSAT-2 is planned to remain in stand-by mode for 3 years and enter into operational service in 2008. MTSAT-1R will have the capability to support LRIT and HRIT broadcasts, together with WEFAX (for reception by SDUS) and HiRID (for reception by MDUS). During the transition period WEFAX to LRIT and HiRID to HRIT, image data will be disseminated using a time-sharing method on each broadcast centre frequency. It is planned to terminate the WEFAX service in March 2005 and the HiRID service in 2008.

TABLE 5 : FUTURE GEOSTATIONARY SATELLITES COORDINATED WITHIN CGMS
(as of 25 October 2001)

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 GOES-O GOES-P GOES-R	USA/NOAA USA/NOAA USA/NOAA USA/NOAA	4/2003 2005 2007 2011	135° W or 75° W
EAST – ATLANTIC (36°W-36°E)	MSG-1 MSG-2 MSG-3	EUMETSAT EUMETSAT EUMETSAT	7/2002 2004 2008	0° 0° 0°
INDIAN OCEAN (36°E-108°E)	GOMS-N2 INSAT III-A INSAT III-D METSAT FY-2C FY-2D FY-2E	Russia India India India China China China	2005 2002 2004 2002 2004 2006 2009	76° E dedicated meteorological mission Improved FY-2 series, 5 channel VISSR, LRIT
WEST-PACIFIC (108°E- 180°E)	MTSAT-1R MTSAT-2	Japan Japan	2003 2004	Multi-functional Transport Satellite 140°E

China informed the meeting, in PRC-WP-06, that the FY-2 satellite series will be continued with FY-2C, to replace FY-2B (at 105°E) in 2004. 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 3 to 5. Further changes include an enhancement of the satellite power supply, the cancellation of the S-Fax broadcast, replacement of the WEFAX service with LRIT and a change in the specification of the VISSR instrument. China added that it planned to launch FY-2D and E satellites in 2006, 2009, respectively, if all went well with FY-2C.
WMO was pleased to note that several satellite systems would already be supporting LRIT broadcasts starting from 2003 and that this would be a major CGMS milestone.

Russia indicated, in RUS-WP-03, that the GOMS/ELECTRO N2 is being developed and taking advantage of up-to-date technology. The spacecraft will be a three-axis stabilised platform and besides the standard meteorological communication package (the DCS and re-transmission) the key payload will consist of a MSU-G imager with 12 channels in VIS and IR, similar to the MSG SEVIRI. The spatial resolution at the sub-satellite point will be about 1 km (VIS) and 4 km (IR). The details of this instrument design and construction are currently under consideration. The

basic design of the satellite is completed and the development of technical documentation commenced during 2001. The satellite is planned to be launched in 2005 and will be placed into geostationary orbit at 76°E.

USA-WP-10 discussed NOAA's future geostationary meteorological satellite system. The GOES-N series will have five channel imagers and filter wheel sounders. At least two SXI instruments will also fly on the GOES-N series. Horizontal resolution of these imagers will be improved to 4 km in all IR channels, including the 13.3µm channel. GOES-N and O are currently in the systems testing phase and the imager and sounder for GOES-N have been delivered for integration. The GOES-N series ground system was delivered to the Satellite Operations Control Centre in June 2001. GOES-N is scheduled to be launched in January 2003 and GOES-O in April 2004.

The GOES-R series will carry a new Advanced Baseline Imager (ABI), which will be an eight to twelve channel imager with channel selection based in part on EUMETSAT'S SEVIRI instrument, and an Advanced Baseline Sounder (ABS), and an interferometer-class instrument based on NASA's Geosynchronous Imaging Fourier Transform Interferometer (GIFTS) (see USA-WP-07).

The GIFTS instrument will be a new hyper-spectral imaging spectrometer designed for atmospheric sounding and which will become the basis for future GOES sounding instruments. GIFTS will be launched in 2005 as NASA's third New Millenium Program (NMP) Earth Observing (EO-3) satellite mission. It is a joint program of NASA with the Navy, Air Force and NOAA. NOAA will provide the ground processing system. GIFTS will view areas of the Earth with a linear dimension of about 500-km, anywhere on the visible disc for a period between 0.125 and 10.0 seconds. It will use two detector arrays within a Michelson interferometer to cover the spectral bands, 685 to 1130 cm^{-1} and 1650 to 2250 cm^{-1}. USA added that consideration was being given to use of X-band broadcast.

India expressed some concern over possible radio frequency interference in the Indian Ocean region. In response, the USA commented that it had already started procedures for frequency coordination with the ITU.

C.3 Reconfiguration of future combinations of LEO and GEO missions

In EUM-WP-06, presented under item E1 for convenience of discussion by all parties, Dr. Bizzarri, (at the invitation of EUMETSAT) provided a presentation covering discussions initiated at CGMS XXVII in October 1999 and continued at CGMS XXVIII in October 2000. These discussions had been further advanced as a result of a CGMS Workshop on Long-term Future of the Basic Sounding and Imagery Missions held in Geneva from 23-24 April 2001.
The working paper addressed areas where gaps between user requirements and space capabilities could be identified. These gaps were categorised by geophysical parameters and thematic areas (e.g. atmospheric thermodynamics, atmospheric dynamics, atmospheric chemistry, clouds and precipitation, clouds and radiation, ocean surface and sea-ice, land surface and vegetation). As a result of this analysis, 42 recommendations were drawn up on how to fill or reduce the gaps by the 2015 time frame.

The recommendations were subsequently categorised according to approaches taken for their implementation, i.e. by:

- advanced geostationary satellites

- updating the payload of medium-large meteorological operational satellites
- small satellites, generally in low orbit (but also in GEO, in the case of MW/Sub-mm sounding)
- constellations of mini-satellites
- a new R&D mission
- acquiring data from R&D or commercial satellites.

The results of the analysis carried out by Dr. Bizzarri were collected in two tables (or "manifests"). Table 1 presents the recommendations for development/demonstration missions and Table 2 contains recommendations for measurements from R&D or commercial programmes, which should be considered for operational use. The tables can be found in appendix A.1.

Recalling the increasing importance of geostationary satellite observations supporting Global Climate Monitoring, CGMS agreed to the following future agenda item for Working Group II – Satellite Products:

Action 29.10 **The CGMS Secretariat to make sure that a discussion on a response to GCOS requirements for Global Climate Monitoring products from geostationary satellites is included in the discussions of Working Group II – Satellite Products at CGMS XXX.**

CGMS thanked Dr. Bizzarri for his valuable contribution to the discussion relating to an updated/upgraded Global Observing System. It was agreed that the WMO Expert Team on Observational Data Requirements and Redesign of the Global Observing System would further discuss the issues presented in the paper with the understanding that the Expert Team will report to CBS.

D. OPERATIONAL CONTINUITY AND RELIABILITY

The report from Working Group IV, on Global Contingency Planning, was presented under this agenda item. The Working Group was convened and chaired by Dr. Tillmann Mohr, Director-General, EUMETSAT, and Dr. Donald Hinsman, WMO, served as Rapporteur. Representatives from all CGMS satellite operators participated.

The Working Group (WG) reviewed the status of the current contingency plans existing amongst the satellite operators. It noted that a formal contingency agreement existed between EUMETSAT and NOAA/NESDIS that could be activated when both satellite operators were in a defined nominal configuration. The WG noted that other plans, similar to contingency plans, existed between some other CGMS satellite operators. The WG also recalled that in 1991, the forty-fourth Executive Council of WMO recommended the development of contingency plans by satellite operators to increase the reliability of the space-based global observation system. WMO considered that space segment contingency planning was the core of the statement of WMO requirements for system continuity. It was anticipated that CGMS would continue its role of coordination and standardisation, such that ground receiving equipment would be able to receive and process services from any contingency satellite provided by another operator, e.g. by accessing standardised down-link broadcasts and data formats.

In 1992, the statement of WMO requirements for continuity was, subsequently, endorsed by the satellite operators who then established a CGMS Working Group on Global Contingency Planning. The satellite operators also noted that they were presently processing and disseminating other satellite operators' imagery and products and thus they relied on each other to maintain a global satellite system. A main strength in such a system was through contingency and reliability. It also acknowledged that the concept of "help your neighbour" also implied that a satellite operator would be willing to be "helped by its neighbour". The duality of the concept, i.e. to help and be helped, would allow sets of regional contingency plans to be the foundation for a global contingency plan for both the geostationary and polar-orbits.

Each satellite operator indicated a willingness to discuss regional contingency plans with its neighbours and within CGMS. With regard to the polar-orbiting satellites, a global plan should be developed with respect to the morning and afternoon orbits. It also agreed that a nominal configuration should be a basis for the activation of any regional contingency plan.

Thus, the WG suggested that it reconvene for regular discussion at future CGMS meetings. Furthermore, in preparation for CGMS XXX, a WG meeting should be held to discuss the structure and content for regional contingency plans in more detail. WMO offered to host the first meeting of the WG immediately following the second session of the WMO Executive Council Consultative Meetings on High Level Policy on Satellite Matters. The tentative dates and venue for the session are 18-19 February 2002 in Geneva. Additionally, satellite operators agreed to continue discussions on regional contingency plans, as appropriate, after the February 2002 WG meeting.

Action 29.11 **WMO to host a meeting of the CGMS Working Group on Global Contingency Planning, in February 2002 following the Consultative Meeting on High Level Policy, in preparation for further discussions at CGMS XXX.**

E. SATELLITE REQUIREMENTS OF WMO PROGRAMMES

E.1 World Weather Watch

In WMO-WP-12, WMO informed CGMS that during the 28th session of the WMO/ESCAP Panel on Tropical Cyclones for the Bay of Bengal and the Arabian Sea held in Bangkok, Thailand from 14-20 March 2001, the Panel had noted, with appreciation, that EUMETSAT had moved Meteosat-5 to provide coverage over the Indian Ocean Region. The Panel had requested, via WMO, a continuation of coverage over this region and information on contingency plans for the coverage.

It was agreed that CGMS satellite operators consider what measures were necessary to respond to the request of the WMO/ESCAP Panel on Tropical Cyclones for the continuation, on a permanent basis, of coverage over the Indian Ocean region in order to provide data supporting the national mandates of WMO Members.

In WMO-WP-07 and WMO-WP-21 WMO reported on the activities related to the redesign of the WWW Global Observing System (GOS). It briefly recalled the discussions that had taken place on the reconfiguration of future combinations of LEO and GEO missions at CGMS

XXVIII. As a result of these discussions, a CGMS workshop on the evolution of LEO-GEO remote-sensing post 2015, was organised in Geneva on 23-24 April 2001, concurrent with the meeting of the WMO Expert Team on Observational Data Requirements and Redesign of the Global Observing System. During the CGMS workshop, concepts were discussed for evolving geostationary (GEO) satellites with high spectral resolution Infra-Red data for improved soundings and winds and microwave data for precipitation and cloud studies. With regard to low earth-orbit (LEO) satellites, it was proposed to provide these with active microwave for ocean surface determinations and high spatial resolution multi-spectral capabilities for sea/land/ice surface feature discrimination. Furthermore, it was proposed at the workshop to supplement LEO and GEO with mini- and small-satellites for Lidar winds and the definition of the tropopause and stratosphere. A vision suggested for the GOS of 2020 was for all citizens of the planet to have "weather in the palm of their hands". LEOs and GEOs as well as *in situ* sensors, advanced computers, twenty-first century communications to provide timely and detailed weather information and forecasts to individuals in a "Palm Pilot" sized instrument were foreseen. LEO observations would provide global coverage, high spatial resolution, microwave sounding, Global Positioning System (GPS) density profiles, Doppler LIDAR winds, and water vapour while GEO observations would provide high temporal resolution (weather dynamics), tracer wind velocities, synergism with ground-based observations, lightning measurements, and microwave precipitation determinations. Considerable economic benefits for extending forecasts could be realised (e.g. by 2020 a 7-day forecast that would be as accurate as today's one day forecast would change the way the world functioned).

The Working Paper also reported on the discussion of the Expert Team on Observational Data Requirements and Redesign of the GOS (ET-ODRRGOS) on the changes in the GOS that have occurred during the past decade and their positive impact on the skills of NWP centres. Furthermore, the ET-ODRRGOS discussed a coordinated development and utilisation of a comprehensive software tool for carrying out Observing System Simulation Experiments (OSSEs) as well as preparation, maintenance, and evolution of a realistic OSSE database with user-friendly access. It was, however, felt that the required resources for OSSEs were still so large that the limited resources for evaluating changes to the GOS would probably be better focused on well-defined Operational System Experiments (OSEs). The ET-ODRRGOS agreed to study the following OSEs for consideration by NWP centres:

- Impact of hourly SYNOPs;
- Impact of denial of radiosonde data globally above the tropopause;
- Information content of the Siberian radiosonde network and its changes during last decades;
- Impact of AMDAR data over Africa through data denial in a 4D-Var analysis and forecasting system;
- Impact of tropical radiosonde data;
- Impact of three LEO AMSU-like sounders;
- Impact of AIRS data.

WMO-WP-21 reported on the work of a team of experts within the Expert Team on Observational Data Requirements and Redesign of the GOS (ET ODRRGOS) led by Dr. Paul Menzel (NOAA) that was studying the future GOS. The ET ODRRGOS would prepare recommendations for consideration by CBS 2002. A total systems approach was taken by comparing user requirements with total observing system capabilities, both present and future. In

late April 2001, ET ODRRGOS benefited from the CGMS Workshop on long-term future of the basic satellite sounding and imaging missions that was held concurrent with a meeting of the ET-ODRRGOS. Other activities mentioned included the OPAG Chairman's report to CBS 2000 that identified a potential role for Research Satellites as contributors to the GOS and the First Consultative Meeting on High-Level Policy on Satellite Matters in January 2001. Further it was reported that at the fifty-third WMO Executive Council in June 2001 CBS had been requested to review the space-based component of the GOS with a goal of defining an overall system that included appropriately identified R&D satellite missions and provide this as input for discussion at the fourteenth WMO Congress.

In WMO-WP-15, CGMS was informed of recent WMO activities in the Consultative Meetings on High-Level Policy on Satellite Matters and the WMO Executive Council. The fifty-third Executive Council had reviewed recommendations from the first session of the Consultative Meeting on High-Level Policy on Satellite Matters and in particular those related to: support by R&D satellite missions to WMO Programmes; guidelines for requirements for observational data from operational and R&D satellite missions; and a review of the configuration for the space-based component of the Global Observing System (GOS).

With regard to a review of the configuration for the space-based (GOS), the WMO Executive Council had requested the Commission for Basic Systems to review, as a matter of urgency in order to provide the fourteenth WMO Congress appropriate input, the space-based component of the Global Observing System with a goal of defining an overall system that included appropriately identified R&D satellite missions.

The Executive Council suggested that CBS review and make appropriate changes to the definitions as contained in the Guide and Manual for the GOS for the present polar-orbiting and geostationary satellites. The changes should be flexible enough to: (1) accommodate proven and existing operational meteorological and other related environmental observations and services; (2) enhance these capabilities based on the evolution of scientific understanding and technological innovations; and (3) adopt new and mature capabilities and provide the associated services mandated by emerging requirements such as, but not limited to:

- Improved understanding of the structure and dynamics of the atmosphere through, for example, soundings of temperature and humidity, improved wind profiles and better rainfall estimates;

- Improved knowledge of the ocean structure and circulation through, for example, operational surface wind vectors and ocean surface topography;

- Better knowledge of the chemistry of the atmosphere, for example, through measurement of ozone, carbon dioxide, and other trace gases;

- Better understanding of the changes in the terrestrial and marine ecosystems and their role in the carbon cycle;

- Improved knowledge of the cycling of water and energy through the earth system to enable better management of global fresh water resources;

- Increased emphasis on calibrated instruments with a view to a better understanding of climate change;

- Improved global coverage from geostationary orbit using at least six operational spacecraft;

- Improved detection and monitoring of hazardous atmospheric phenomena such as fog and volcanic ash.

E.2 Other Programmes

In WMO-WP-16, WMO and the Observer from IOC reported on the first session of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) held in Akureyri, Iceland, from 19 to 29 June 2001. The importance of data, products and services from the present geostationary and polar-orbiting satellites operated by CGMS Members for analyses of ocean surface variables such as sea-surface temperature, sea state, sea-ice and ocean surface wind had been stressed at this meeting. Future contributions from satellites such as Metop with its Advanced Scatterometer (ASCAT), NPOESS with its Conical Microwave Imager Sounder (CMIS) and altimeter, the Jason series with their altimeters, ICESat and ADEOS-2 would significantly increase the quantity of valuable data and products for operational oceanography. EUMETSAT's Satellite Application Facilities (SAFs) would also further contribute to the goals of JCOMM in future.

The Joint Commission emphasised the importance of the dialogue with satellite operators with regard to observational requirements. In this sense, it mentioned the extensive consultation that took place in the development of the Oceans Theme of the Integrated Global Observing Strategy (IGOS) and requested JCOMM to be involved in the WMO Rolling Requirements Review. It also expressed interest in being represented at the WMO Consultative Meetings on High-Level Policy on Satellite Matters with satellite operators and R&D space agencies. A strong partnership with WMO in representing the user communities at CGMS and in the IGOS Partnership was very important.

It was decided that in future there would also be a satellite expert in the JCOMM Observations Programme Coordination Group. Finally, JCOMM noted the importance of assessing the value of satellite observations of ocean variables to end-users, such as offshore oil and gas industry, fishing industry, aquaculture, ship routing, environmental agencies etc. This had been done during the EuroGOOS conference, hosted at EUMETSAT in October 2000, where a wide range of users had presented detailed technical analysis of their requirements with a summary of economic factors. A recommendation for EUMETSAT to participate in the JASON-2 mission had been one result from this conference, and JCOMM very much welcomed the recent decision of the EUMETSAT Council to make a 25% contribution to JASON-2.

F. COORDINATION OF INTERNATIONAL DATA COLLECTION & DISTRIBUTION

This item was discussed under Agenda item I/3 in Working Group I on Telecommunications, and relevant discussions on the topic are included in the report of that Working Group.

G. COORDINATION OF DATA DISSEMINATION

This item was discussed under Agenda item I/4 in Working Group I on Telecommunications, and relevant discussions on the topic are included in the report of that Working Group.

H. OTHER ITEMS OF INTEREST

H.1 Applications of Meteorological Satellite Data for Environment Monitoring

No working papers were presented under this Agenda Item.

H.2 Search and Rescue (S&R)

USA-WP-19 described the COSPAS-SARSAT system consisting of a network of satellites, local users terminals (LUTs), mission control centers (MCCs) and rescue coordination centers (RCCs). The space segment of the SARSAT system is formed by the three Russian COSPAS spacecraft, five U.S. SARSAT low earth orbiting (LEO) weather satellites, two U.S. geostationary satellites, GOES 8 and 10, and the Indian GEO spacecraft, INSAT-2B. The USA noted the effectiveness of GEO coverage using the 406 MHz at improving emergency response time. It also looked forward to the additional coverage which will be provided by EUMETSAT's MSG satellites. Finally, USA asked other CGMS satellite operators to consider including compatible search and rescue capabilities in their future missions.

H.3 Meteorological Data Distribution via satellite

No working papers were presented under this Agenda Item.

H.4 Training

This item was discussed under Agenda item II/7 in Working Group II on Satellite Products, and relevant discussions on the topic are included in the report of that Working Group.

H.5 Information

CGMS was informed in EUM-WP-10 of the progress of the PUMA project, which is an initiative of the PUMA Task Team made up of representatives of Africa's Regional Intergovernmental Organisations (IGAD, ECOWAS, SADC, IOC and CEMAC) and 53 African National Meteorological and Hydrological Services (NMHS), WMO and EUMETSAT. The objective of the PUMA project is to develop and implement a strategy to prepare the African user community for the transition from MTP to MSG and to support resource mobilization efforts necessary to fund the replacement of ground receiving equipment and data processing software required before use can be made of MSG data.

The PUMA Project is funded by the European Commission through the European Development Fund. It consists of five components. The first component covers the installation of combined HRIT/LRIT receiving stations including antennas, MSG User Station Base-band Modules (MBUM), PCs, LAN connections etc., in 53 African NMHS. Additionally, HRIT/LRIT receiving stations will be installed in five selected regional centres in Africa.

The second component includes training in the use of software and maintenance of hardware in the 53 African NMHS. Component three covers training for the African NMHS to allow them to maintain, as a minimum, continuity of services currently offered, as well as additional demand-driven training events on advanced applications. Component four, covering so-called "outlook" activities, will lay the ground for NMHS in Africa to develop pro-active partnerships with end-users. The fifth component consists of the Project Management Unit (PMU), responsible for implementing the project on behalf of the final beneficiaries. The PMU will supervise the installation of the receiving stations, user training and outlook activities in all African countries. It set up its office at the site of the Kenya Meteorological Department in October 2001.

EUM-WP-11 presented a summary of EUMETSAT conferences, which have taken place since CGMS XXVIII. It also reported on the Fourth Central and Eastern European Forum, held in Bratislava, Slovak Republic, in August 2001 and the EUMETSAT Satellite Data Users' Conference, held in Antalya, Turkey, in October 2001. CGMS was informed that the next EUMETSAT Scientific Data Users' Conference will be held in Dublin from 2-6 September 2002.

A list of EUMETSAT's latest publications was included in the document, all of which can be downloaded from the EUMETSAT web site at http://www.eumetsat.de.

EUM-WP-12 recalled that since 27 March 2001 a CGMS Consolidated Report has been available on-line at http://www.eumetsat.de/en/area2/cgms.html. A CD-ROM containing the draft Consolidated Report had already been sent to CGMS Members at the end of March 2001 with a proposal for a permanent update action, the objective being to approve and issue an updated version of the Consolidated Report around the time of each CGMS meeting.

Action 29.12 **CGMS Members to amend, as necessary, contact information for the CGMS Consolidated Report Drafting Committee, and inform the CGMS Secretariat accordingly. Deadline: November 2001.**

Action 29.13 **CGMS Members to submit updated sections of the CGMS Consolidated Report relating to their organisations/programmes to the CGMS Secretariat, and the CGMS Secretariat to issue a Revised Version of the document on-line. Deadline: December 2001.**

WMO described the latest status of its database for satellite receiving equipment in WMO-WP-01. The present database contained 11,444 unique receiving stations for APT, HRPT, WEFAX and High-Resolution broadcasts, which represented an increase of 121 stations since the last meeting of CGMS. All CGMS Members were provided with a copy of the database, which contained the latest "combined" table including all station data and all queries necessary to view statistics for the above table. WMO indicated that it had developed a tool to authenticate each record in order to reduce duplicates in the database.

In WMO-WP-04, CGMS Members were informed of the various list servers used by CGMS Groups, i.e. the Plenary, Wind Sub-group and Frequency Matters. CGMS Members were requested to review their contact details on the list servers and update them as necessary.

In WMO-WP-08 WMO recalled that the latest update to WMO Publication No. 411 was nearing completion. Inputs from all CGMS Satellite Operators had been received. The

Publication will be made available in both hard copy and on the WMO Satellite Activities Web pages. CGMS was also informed that the Application of Satellite Technology Progress Report for the period 1999/2000 was under preparation and it was planned to publish it in autumn 2001. Furthermore, an updated version of WMO/TD No. 824(SAT-17) has been prepared and would be distributed before the end of 2001, entitled "Applications with Meteorological Satellites".

WMO-WP-17 reported on the proposed structure, goals and implementation plan of the CGMS Virtual Laboratory Focus Group. It also presented the structure and Draft Terms of Reference for the Group which were the result of discussions which took place at the first session of the CGMS International Satellite Data Utilisation and Training Focus Group, hosted by EUMETSAT in May 2001.

CGMS noted with appreciation the work of the Virtual Laboratory Focus Group and approved the structure, goals and implementation plan for the Virtual Laboratory, as contained in Appendix A-3. CGMS requested that it be kept informed about the progress and activities of the Focus Group.

Action 29.14 **CGMS requests the CGMS Virtual Laboratory Focus Group to report on the development of its activities at CGMS XXX.**

H.6 ANY OTHER BUSINESS

Following discussions at CGMS XXVIII, WMO nominated IOC to become a full Member of CGMS. CGMS Members fully supported the nomination from WMO and unanimously invited IOC to become a full Member of CGMS.

The representative of IOC, Dr.Colin Summerhayes, warmly thanked CGMS for its kind invitation, adding that the IOC was pleased to accept since the IOC Assembly, held in July 2001, had already authorised acceptance of membership of CGMS, in the event that CGMS Members approve the proposal. IOC looked forward to a long and fruitful cooperation with the other Members of CGMS.

PARALLEL WORKING GROUP SESSIONS

WORKING GROUP I : TELECOMMUNICATIONS

I/0 INTRODUCTION

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

I/1 COORDINATION OF FREQUENCY ALLOCATIONS

Preparation of the World Radio Conference (WRC-2003)

The World Radio Conference 2003 (WRC-2003) is scheduled to take place in May and June of the year 2003. The location of the Conference is confirmed to be Caracas (Venezuela).

The World Radio Conference 2000 (WRC 2000) established the agenda for WRC 2003 and drafted a provisional agenda for WRC 2006. Several items of interest to the meteorological user community have been included into the agenda.

Preparations for the WRC 2003 are underway on many different levels including national, regional and global working groups (including CEPT, WMO, SFCG). Furthermore there are many activities in the framework of the International Telecommunication Union (ITU) to establish the technical baseline for the Conference. The main working parties of interest to the meteorological user community are working parties WP 7C, 7D, 7E and WP 8D.

The technical baseline for WRC 2003 will be discussed and agreed at the Conference Preparatory Meeting (CPM) of the ITU, which is scheduled for November 2002. This meeting will take place in Geneva. It is therefore very important to submit technical inputs into the ITU working parties before summer 2002.

Several input documents related to the preparation of the World Radio Conference 2003 were discussed during CGMS XXIX, i.e. documents EUM-WP-13, JPN-WP-10, RUS-WP-05, USA-WP-23 and WMO-WP-11.

After discussions in WG I the present status of preparatory activities in accordance with the relevant WRC agenda items can be summarized as follows:

<u>Agenda Item 1.20 – Additional MSS Allocations below 1 GHz :</u>

Possible additional allocations for the non-GSO Mobile Satellite Service (MSS) below 1 GHz may affect several MetSat (as well as MetAids) applications. Although WRC-2000 suppressed Resolution 219 (WRC-97) on the band 401–406 MHz, Resolution 214 (Rev.WRC-2000) makes it possible to address any band below 1 GHz in this respect. There has not been so far any ITU-R contribution addressing MetSat

bands, but developments on this matter should be carefully monitored. It shall be noted that ITU-R/Working Party 8D is the responsible group for this agenda item.

Agenda Item 1.31 – Additional MSS Allocations in the Range 1–3 GHz:

This agenda item is of particular concern with WRC Resolution 227 (WRC-2000) that addresses possible MSS allocations in the band 1683–1690 MHz as well as alternative frequency bands in the 1-3 GHz range. It shall be noted that ITU-R/Working Party 8D (MSS) is also the responsible group for this agenda item.

Resolution 227 requests that the technical and operational studies on the feasibility of sharing between MSS and MetSat in the band 1683–1690 MHz be completed. GVAR and S-VISSR stations are critical in this respect. This request is an opportunity to revisit criteria for sharing and coordination (likely to the benefit of MetSat) as well as the MetSat partitioning of the frequency band 1670–1710 MHz as stated in the current recommendation ITU-R SA.1158 (Sharing of the 1670-1710 MHz band between MSS and MetSat), that did not fully reflected GVAR and S-VISSR applications. It should be noted that the band 1670-1675 MHz is also considered as an alternative frequency band for MSS (Earth-to-space) in the 1-3 GHz range

Resolution 227 also requests ITU-R to assess, with the participation of WMO, the current and future spectrum requirements of the MetSat service and of the MetAids service in the band 1683-1690 MHz, with a view to a possible allocation to the MSS (Earth-to-space).

The current developments are as follows:

The CBS/Steering Group on Radio Frequency Coordination held a meeting from 3-8 May 2001 (WMO Headquarters), just prior to the ITU-R/Working Party 7C session (9-18 May 2001, ITU). Particular attention was given to Resolution 227 (WRC-2000) and the SG-RFC developed contributions to ITU-R/WP 7C in this respect. In accordance with CGMS AI 28.15 and AI 28.16 several contributions related to GVAR and S-VISSR stations were received. The contributions included a list of existing and planned stations as well as sharing studies between those stations and the MSS. A preliminary draft revision of Recommendation ITU-R SA.1158 was drafted and forwarded to the ITU. The purpose of the document was to revise the MetSat partitioning of the frequency band 1670–1710 MHz, taking into account the outcome of CGMS-XXVIII in this respect, and to review conclusions on possible sharing between MSS and MetSat. The Steering Group also drafted a document on the "Assessment of frequency requirements for meteorological services in the 1670-1675 and 1683-1690 MHz bands". The document was the WMO response to Resolution 227 (WRC-2000) requesting the current and future spectrum requirements of the MetSat and MetAids service. Both documents were also submitted to WP 8D.

The ITU-R/Working-Party 7C developed a preliminary draft revised Recommendation ITU-R SA.1158, based on the above-mentioned WMO contribution, on contributions from EUMETSAT and Australia revising the criteria for MSS/MetSat sharing and coordination, including separation distances and a USA contribution listing operational GVAR stations.

WP 7C fully endorsed the "Assessment of Frequency Requirements for Meteorological Services in the 1670-1675 MHz and 1683-1690 MHz Bands", and agreed on an estimation of number and locations of GVAR/S-VISSR ground stations. The group also developed the Conference Preparatory Meeting (CPM) text on agenda item 1.31 with respect to the meteorological services and a preliminary draft revised Recommendation ITU-R SA.1264 (Sharing between MetAids and MSS). The WP 7C outcome on this issue was consolidated into a liaison statement to WP 7E and WP 8D. Furthermore it should also be noted further that WP 7C endorsed the "Handbook on use of radio frequency spectrum for meteorology", which had been consolidated by the CBS/SG-RFC, and the process for its publication has been initiated.

ITU/R Working Party 8D (Mobile Satellite Service) reviewed the contributions from WP 7C. A number of detailed comments on the preliminary draft revised Recommendations ITU-R SA.1158 and SA.1264 were sent back to WP 7C for consideration. Very long and tough discussions took place during the review of the CPM text on agenda item 1.31. It should be noted in this respect that the number of participants to the WP 8D from the meteorological community was rather limited (USA, EUMETSAT and WMO), although they were quite active. WP 8D in its capacity as the ITU-R group responsible for this agenda item, significantly revised the text, which nevertheless still reflects the MetSat and MetAids concerns. During CGMS XXIX it was pointed out that it would be necessary to have a stronger representation of CGMS Members at the next WP-8D meeting which will take place in May 2002.

Action 29.15 **CGMS Satellite operators and WMO to coordinate with their responsible Frequency Administrations to ensure that meteorological experts participate at the meetings of ITU WP 8D (8-14 May 2002, Geneva) and ITU WP 7C (11-15 February 2002, Geneva) to support and defend meteorological applications. Deadline: January 2002.**

Agenda Item 1.13 - HAPS (High Altitude Platform Systems) Uplink Emissions around 31.3 GHz

This agenda item considers regulatory provisions and possible identification of existing frequency allocations for services, which may be used by high altitude platform stations, taking into account S5.5RRR and the results of ITU-R studies in accordance with Resolutions 122 and 734 (COM5/14). Frequency bands between 18 and 32 GHz have already been of great interest to other services for several years.

The band 31.3 – 31.8 GHz and, in particular, the sub-band 31.3 – 31.5 GHz are used for passive sensor applications. A new fixed service system application, referred to as HAPS (High Altitude Platform System), plans an expansion of services to the band just below 31.3 GHz. A modification to Resolution 122 was adopted at WRC-2000 which requests the ITU-R to urgently conduct studies on the feasibility of identifying suitable frequencies focussing particularly on the band 31.0-31.3 GHz. In addition, a footnote S5.5RRR was adopted which allows already now the use of the band 31.0-31.3 GHz for HAPS in a number of Region 3 countries. However, this footnote states that HAPS systems shall not cause harmful interference to passive services in the band 31.3-31.8 GHz based on Recommendation SA.1029. It is also emphasised that

the deployment of HAPS shall be limited to the subband 31.0-31.15 GHz until WRC-2003 reviews this item.

EUMETSAT and Japan wishing to identify potential restrictions for the operation of HAPS systems have conducted a first series of studies on out-of-band interference impact on passive sensing. The study results need to be promoted in ITU-R and updates based on information from other working parties need to be carried out. In view of the sensitivity of this exclusively passive band, out-of-band emissions from potential HAPS stations are likely to exceed required protection levels. It is necessary to address the interference impact on current and future EESS passive sensing applications and establish protection measures to be forwarded via appropriate mechanisms to the ITU-R.

A careful maintenance of the studies submitted to Working Party 7C and Working Party 4-9S will be required, as assumptions have been made which indicate that actual operation of such systems will not be in compliance with the currently assumed system characteristics. This has also happened in the past with other services, where operational systems caused orders of magnitude more interference than established through ITU-R studies. It may be necessary to oppose the use of this band by HAPS or at least restrict the operating conditions. Contributions to Working Party 7C, 9D and 4-9S, which has been assigned the lead for preparation of CPM text regarding agenda item 1.13 for WRC-2003, need to be prepared as well as monitored.

Status of Activity: On behalf of EUMETSAT, several study contributions were submitted to ITU-R Working Parties 7C and 4-9S. These contributions demonstrated that restrictions on HAPS operations would be required in order to protect passive sensor operations. Japan submitted also studies which showed that the required protection levels can be met by careful design of RF equipment and some limitations on HAPS operations. Draft CPM text has been agreed at WP7C and WP4-9S levels which proposes currently a stringent out-of-band power density limitation on HAPS transmitters in compliance with passive sensor protection requirements.

Agenda items for future World Radio Conferences

WRC 2000 has adopted a preliminary agenda for the WRC 2006. This includes several items of interest to the meteorological user community.

<u>Allocations to EESS above 275 GHz:</u>

Recent WRCs have improved EESS allocations in the bands 50 – 71 GHz and 71 - 275 GHz. A first attempt to put allocations above 275 GHz on the agenda of WRC 2003 failed. It was argued that active services are presently not able to identify bands for their operations and don't want to be restricted by allocations for EESS (passive) at a later time. A provisional item was put on the inputs for future WRCs. So far EESS bands are identified in FN S5.565 of the RR which was updated at WRC 2000. Studies are required to identify bands for future measurements of EESS passive. The studies have to identify bandwidth and protection requirements, and should give an indication on the possibility to share the band. It is necessary to indicate which type of measurements is planned in the future.

EUMETSAT informed CGMS that it is in process of preparing a study on this topic. The output is expected to be available early 2002. After completion of studies it will be necessary to promote the study results.

Action 29.16 **CGMS Members to provide information on planned passive sensors using frequency bands above 275 GHz on future meteorological satellite systems. Deadline: January 2002.**

Action 29.17 **EUMETSAT to distribute the final report of the study on "Passive sensor requirements above 275 GHz" to CGMS Members. Deadline: February 2002.**

Sharing conditions of EESS (passive) below 40 GHz

Several important frequency bands used for operational measurements below 40 GHz are not sufficiently protected. The bands are 4.2 – 4.4 GHz, 10.6 – 10.68 GHz and 31.5 – 31.8 GHz. Studies will be required to determine coordination and sharing conditions for these bands. EUMETSAT will support such a study in the year 2002 and will report results to CGMS XXX.

Status and plans for Future GVAR and S-VISSR Stations

In reply to AI 28/15, several input documents (from Australia, Japan, the USA, and EUMETSAT) were forwarded to the WMO-CBS Steering Group on Frequency Coordination and to the ITU. The information was used to update ITU Recommendation SA. 1158. It is now recognised that there are hundreds of such stations operated in ITU Regions 2 and 3 and that sharing with other services such as the Mobile Satellite Service (MSS) would require large coordination distances up to several hundreds of kilometres. It was also recognised that due to the use of transportable GVAR/S-VISSR stations sharing would be not feasible. This conclusion is contained in the present version of SA 1158 but is so far not accepted by ITU Working Party 8D (Mobile Satellite Serviced).

WMO dispatched a questionnaire to its members to update the database of receiving stations including GVAR and S-VISSR stations and forwarded the updated information to the ITU (see also chapter above).

Technical Information on potential Interference between MTSAT and GOES

In reply to AI 28/19 the US presented document USA-WP24. It was concluded that analysis of the sharing situation in frequency bands to be used by MTSAT and GOES has led to the conclusion that due to the large orbital separation of the satellite systems no interference is expected.

ITU Cost Recovery for Satellite Network Filing

Action 28.20 requested NOAA to inform CGMS on details related to ITU cost recovery for satellite network filing. Document USA-WP-25 explains that costs for

filing are expected to be very low compared to the overall costs of the satellite series. The National Telecommunications and Information Administration (NTIA) in the USA therefore decided not to forward a request for exemption to ITU.

CGMS Members concurred that corresponding activities would presently not be required.

Other Frequency Management Issues

The report of the 20th Space Frequency Coordination Group meeting was submitted for information (USA-WP-27). Up to date information on SFCG activities can be achieved through the SFCG Web page: www.sfcgonline.org.

Document USA-WP-23, in responding to Action 28.17, provides a status of the efforts in the Space Frequency Coordination Group and the International Telecommunication Union's Radiocommunication Bureau (ITU-R) to update the partitioning of the 1670-1710 MHz band for METSAT use. SFCG Recommendation 11-1 (now 11-1R1) was revised in 2000 to align with the CGMS partition agreement. This same updated CGMS partitioning was reflected in a preliminary draft revision to the ITU-R Recommendation SA.1158.

EUMETSAT reported on problems in the notification process of the Meteosat Second Generation system. After the advanced notification there were several coordination requests issued. All but one were successfully closed. The remaining request is from the Frequency Administration of Russia and it is related to the PROGNOS system. Problems indicated are related to the use of TC and TM in the 2 GHz band. EUMETSAT requested the delegation of Russia to contact the Russian Frequency administration to inquire whether the coordination process could be advanced to allow the finalisation of the MSG notification process.

Action 29.18 **EUMETSAT to send a letter to ROSHYDROMET explaining the technical details related to the MSG frequency coordination problems. Deadline: November 2001.**

Action 29.19 **ROSHYDROMET to contact the responsible frequency administration in Russia to address CGMS concerns related to the notification process of MSG. Deadline: December 2001.**

I/2 TELECOMMUNICATION TECHNIQUES

There were no papers presented in this section.

I/3 STATUS AND PROBLEMS OF THE IDCS (FORMERLY IN AGENDA ITEM F)

Russia informed CGMS in RUS-WP-04 about the introduction of the first phase of its IDCS implementation consisting of a network of 20 IDCPs, and utilising (by prior

agreement of CGMS) International Channels I25 and I26 and supported by Meteosat-7. The Russian designed DCP very recently achieved certification from EUMETSAT for use with the current Meteosat system. The Russian IDCS system will be operated by SRC Planeta, on behalf of Roshydromet, using its ground reception facilities and is expected to come into operation by the end of 2001 or early 2002. The eventual use of Russian telecommunications satellites, to broaden the network, is currently under consideration. By the time of launch of GOMS/Electro N2 in 2005, it is expected that some 600 – 800 DCPs could be added to the network.

EUM-WP-07/08 reported on the status and use of the International DCP channels. At the present time around 636 International DCPs (IDCPs) are registered world-wide for use with the IDCS, using 19 of the 33 available channels. Of these, 20 are Aeronet DCPs operating on channels I23-I24 and 170 are "Regional" DCPs belonging to WMO agro-meteorological and hydro-meteorological networks and operating on channels I27-I33.

Channels I23-I24 and I27-I33 are currently being used within the Meteosat IDCS on a temporary basis with the special agreement of CGMS until such time that those DCPs can be transferred to the MSG Data Collection System (now expected early 2003).

Once again there have been a relatively small number of new DCPs added to the IDCS over the last year (IDCS allocation details can be found at www.eumetsat.de/idcs/). At the present time the following Members have read/write access: EUMETSAT, Japan and USA. WMO has read-only access for system monitoring purposes. CGMS Members may access this database at any time and the CGMS Secretariat (EUMETSAT) is responsible for keeping the database up-to-date.

The EUMETSAT Mission Data Reception System (MDRS), which allows certain DCP users to access their data via the World Wide Web, has continued to operate during the last year. Various system performance parameters are also provided through this system. Access to the system is via a link on the web site and operators first have to register with EUMETSAT so that they can be provided with a user name and password.

Concerning interference, EUMETSAT reported that during the last twelve months there appeared to have been negligible interference affecting users of IDCS channels within the Meteosat telecommunications field of view. Only one user (ASAP) had to change operations from I12 to I10 because of interference to data relay.

Concerning the IDCS Users Guide (available online at www.eumetsat.de), EUMETSAT informed the Group about changes to its DCP certification procedures to bring them into line with requirements resulting from the eventual transition of the Data Collection and Retransmission Service to the MSG satellite system. The Group recalled that EUMETSAT brought two changes to DCP performance parameters to the attention of CGMS, via email, on 11 July 2001, namely:

- A closer tolerance on transmit carrier frequency stability, from 1.75 parts per million down to 0.75 parts per million;
- A closer tolerance on the drift from allocated frequency window, from 600 Hz down to 300 Hz.

Furthermore, the Secretariat also proposed that allocation/de-allocation messages make use of email rather than telex.

All the above modifications have been included within a draft revised document (to eventually become Issue 9) which was distributed to CGMS for comment/correction/update with the above email in July 2001, with a deadline for comments given as 2 September 2001. To date only one reply has been received, from Japan, indicating general support for the proposed changes to the document. Japan also commented that it was also considering an expansion of the IDCS, especially following a planned upgrade of its ground segment between April 2004 and March 2005. In this regard, Japan agreed to provide further information on its plans to upgrade the IDCS at CGMS XXX. Japan also informed the Group that it was currently increasing the operating speed (to 300bps) of regional DCP located on some Ships and remote stations, and supported by GMS satellites. As there were no other comments on the EUMETSAT proposal to change the IDCS User Guide, the Group agreed that the proposed modification would be adopted, and published in a new Issue 9 of the document.

In JPN-WP-04 CGMS were informed that 347 IDCPs were registered with the GMS system, the same number as in 2000. It was noted that over the last 12 months around 18 IDCS channels had been affected by severe interference.

Japan also informed the Group of the successful conclusion of the GOES-6 DCP support activity, where the DCP data were relayed via GMS. The agreement between JMA and NOAA has been in place since 1992.

USA-WP-11 provided an update on the GOES Channel Interference Monitoring System, CIMS. The CIMS provides continuous automatic testing and reporting for the IDCS channels. Its expanded capabilities include scheduled testing of all channels, international and domestic. Along with statistical reporting of radio frequency interference, the CIMS is able to capture, archive and analyse spectrum plots for all test signals. A monthly report is produced showing the percentage of time when a channel is experiencing interference.

USA also informed the Group that it has awarded a contract for the design and implementation of the next GOES DCS Automatic Processing System, DAPS II, which will fully integrate the CIMS functionality and provide real-time data and interference "snapshots" through the Internet as well as archiving the data for long term statistical analysis.

USA-WP-26 provides a status report of US activities in developing an interference location system (TLS) for the IDCS. The technical details of this system have been presented during CGMS XXVIII and information was distributed to CGMS Members in reply to AI 28.21. NOAA awarded a development contract. The development will be in three phases, which will be separately funded. A nine months period is anticipated for the performance of the first two phases. A proof of concept demonstration for locating interference to the GOES DCS is scheduled for January 2002.

Action 29.20 **USA to inform CGMS Members on the results of the demonstration of its interference location system (TLS). Deadline: March 2002.**

USA-WP-12 described the various means currently being developed for the dissemination of DCP messages via the Internet. The current DAPS will be replaced with a new system which will be tested in 2002. More Internet interfaces will be provided, together with better GUIs, the expanded use of email notification to users, better use of push and pull techniques to move data, and use of FTP. The new system will also have improved security and configuration management.

JPN-WP-04 reported on the status and use of the IDCS. Japan also commented on the modifications to the IDCS Users Guide.

I/3.2 Ships, including ASAP

WMO-WP-13 discussed the Automated Shipboard Aerological Programme (ASAP). The number of soundings taken in the frame of the ASAP had averaged around 5300 annually over recent years. Even so there were fairly large fluctuations from year to year, mainly through the influence of enhanced activities in specific observational programmes and the routing and availability of vessels.

The total number of ASAP or similar shipboard sounding units operated in 2000 was 21; the same number as in 1999. The operators were: Denmark (2 units), EUMETNET (1 unit), France (4 units), Germany (2 units), Japan (7 units), Russia (1 unit), Spain (1 unit), Sweden-Iceland (1 unit), United Kingdom (1 unit) and the United States (1 unit). The total number of ASAP soundings in 2000 corresponded approximately to the number of soundings which could be performed annually by a little more than 6 ocean weather ships.

EUMETNET, which is a network grouping of 18 European National Meteorological Services, has started a programme called E-ASAP. One ASAP is operated on a route within the Mediterranean whilst another will start soon on a route between the English Channel and the South-eastern seaboard of the United States.

I/3.3 ASDAR

WMO-WP-09 informed the Working Group that although the ASDAR programme peaked early in 1998 with 21 operational systems, there had been a substantial reduction in the size of the ASDAR programme since January 2000.

KLM decommissioned the first of its 3 high quality operational units in April 2001 leaving only 11 units operating out of the original 23 units operated within the framework of the programme. Current level of funding suggests that the operational ASDAR programme would continue until December 2002. The ASDAR programme will continue to use up to 15 of the 30 currently available time slots in IDCS channel I18. The remaining 15 have been released for other users of the IDCS.

I/4 COORDINATION OF DATA DISSEMINATION (FORMERLY IN AGENDA ITEM G)

I/4.1 Dissemination of satellite images via satellite

JPN-WP-05 provided an update on the schedule of MTSAT-1R observations and image data dissemination. The Working Group was informed that there were no changes from the information presented one year ago at CGMS XXVIII.

USA-WPs-13 to -18 presented the current USA plans for implementing the Low-Rate Information Transmission (LRIT) system and the new LRIT user stations. The implementation effort will begin with the testing and validation of specific LRIT system engineering issues.

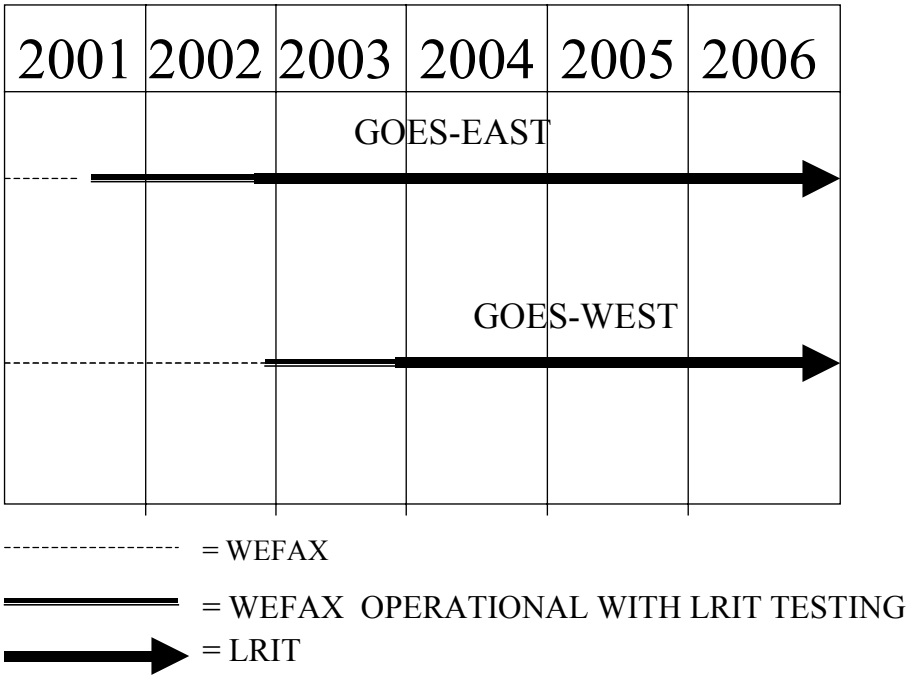
The follow-on GOES-N series, will replace WEFAX with LRIT. NOAA's LRIT will have an initial (IOC) and a final operating capability (FOC). The IOC will include all of the current WEFAX capabilities at 64 Kbps. The information data rate for FOC will be 128Kbps. NOAA further presented its LRIT receiver and transmitter specifications. NOAA noted that the modulation on the transmitter would be PCM/NRZ-L BPSK, not NRZ-M as presented in the paper. This makes NOAA's scheme compatible with that of EUMETSAT.

In USA-WP-18, NOAA presented its transition and test plans stating that the current in-orbit series (GOES I-M when tested in April 2001 could not support the 128Kbps data stream with its existing EMWIN transmissions. The following update was provided at CGMS-XXIX:

The current GOES-I/M spacecraft series will support the new digital LRIT signal through the WEFAX transponder at either 64Kbps or 128Kbps, while maintaining the present EMWIN service. This performance is achieved with a worst case 3-db margin. The recently completed PLT characterisation of the GOES-12 transponder shows an additional 1-db may be available using a different measurement method. It was noted that the current WEFAX link distributes the equivalent of less than 20Kbps of data; hence even at 64Kbps, users will be getting significantly more information. The LRIT signal is expected to eventually grow to 256Kbps during the GOES-N series.

NOAA plans to implement LRIT have not changed since the last meeting of CGMS. NOAA will begin LRIT transmissions at 64Kbps on GOES-East later in 2002 and GOES-WEST in late 2003, at which time WEFAX will be discontinued. The US implementation plan is shown in the figure below.

WEFAX/LRIT TRANSITION PLAN
(calendar year)



JPN-WP-03, JPN-WP-05 described the future data dissemination schedule. There were no changes to the schedules presented at CGMS XXVIII.

WMO-WP-03 described the status of activities related to the conversion of the APT/WEFAX services from analogue to digital scheduled to occur during the next decade. Tables were included in the document indicating the schedules of conversion for all CGMS satellite operators, for both GEO and LEO satellite systems. WMO-WP-03 also announced a new technical document on the migration of satellite receiving stations. The document is available from WMO in hard copy and from the WMO Web pages. Table XX contains the latest status related to the conversion of the APT/WEFAX analogue services to LRPT/LRIT digital services scheduled to occur during the next decade.

Present CGMS satellite operator plans for the transition indicated that in WMO Regions I (Africa) and VI (Europe) there would be at least a nine month overlap starting in March 2003 when MSG-1 is scheduled to become operational. WMO Regions II (Asia) and V (Southwest Pacific) will have a two-year overlap starting in 2003. The Indian Ocean area (RA II) appears to have no overlap starting in 2002.

For WMO Regions III and IV (South, Central and North America including the Caribbean) and as confirmed by NOAA/NESDIS during the Working Group discussions, there would be an approximately one-year transition to LRIT starting in November 2002. At that time, GOES-East will be converted from WEFAX to LRIT transmission and will cease transmitting WEFAX data. The conversion of GOES-West to LRIT will start in late 2003.

With regard to the analogue APT to digital LRPT transition, the morning (AM) satellite (METOP) will start LRPT (at 137 MHz) and AHRPT (at 1698 MHz) in 2006 while the afternoon (PM) satellite will transmit two data streams (AHRPT at 1702 MHz and X-band) starting in 2010. The FY-3 series will transmit AHRPT (in S-band) and X-band starting in 2004. Meteor 3M N2 will transmit LRPT and AHRPT starting in 2003. There will be no transition period for the AM orbit or PM orbit separately and the present combined CGMS satellite operators' plans indicate that it may be necessary to have at least three different receiving stations to receive all AM and PM satellite data.

Thus, the Working Group strongly recommended that the CGMS satellite operators, as a matter of urgency, develop an integrated strategy for data dissemination from AM and PM polar-orbiting satellites in order that the user communities could benefit from all available data without the need to purchase and maintain multiple receiving stations. The strategy should also address the use of alternative dissemination methods and the recommendations for commonality of user stations. Additionally, the Working Group suggested that CGMS continue to keep the transition tables for LRIT and LRPT up-to-date.

The Working Group noted that WMO had hosted a CGMS Task Force meeting to discuss co-ordination of data formats and frequency planning for all polar-orbiting satellites including their equator crossing times, at the World Meteorological Organization (WMO) Headquarters in Geneva, Switzerland on 24 January 2001. The CGMS Task Force had recommended that: a) CGMS satellite operators investigate the possibility to establish a global data dissemination service with common frequency, common bandwidth, CGMS global specifications for AHRPT and comparable data content; b) WMO provide input as to which data and products would be appropriate to maintain comparable data content; and c) CGMS satellite operators investigate alternative dissemination means.

With regard to equator crossing times, the Task Force identified several important factors to consider together, namely:

- For 3 satellite systems, the idealised spacing between satellites should be 4 hours;
- For 4 satellite systems, the idealised spacing between satellites should be 3 hours;
- Meteorologically, the satellite should be evenly distributed in terms of equator crossing-time;
- The AM orbit would provide an advantage for less cloud imagery and therefore more cloud-free sounding retrievals;
- Evenly distributed equator crossing-times provide for reduced probabilities of interference (although interference at high latitudes was unavoidable);
- Station keeping capabilities for individual satellites should be part of the system design;
- Maintain satellite phasing (in terms of the right ascension of the apogee) is important;
- The instrument payload should be considered for a particular equator crossing time;
- The noon equator crossing time was not attractive for technical and meteorological reasons.

TABLE 6 : STATUS FOR LRIT CONVERSION, SATELLITES IN GEOSTATIONARY ORBIT
(updated 5 December 2001)

Operator	Satellite	Launch (M/Y)	Service	Start	Stop
EUMETSAT	Meteosat 5	03/1991	WEFAX	03/91	
	Meteosat 6	11/1993	WEFAX	11/93	
	Meteosat 7	02/1997	WEFAX	07/97	12/03
	MSG 1	1/2002	LRIT	10/02	2007
	MSG 2	2003	LRIT	2004	2010
	MSG 3	2008	LRIT	2008	2013
India	INSAT I-d	06/1990	None		
	INSAT II-a	07/1992	None		
	INSAT II-b	07/1993	None		
	INSAT II-e	---	None		
Japan	GMS-5	03/1995	WEFAX	06/95	2003
	MTSAT-1R	2003	WEFAX LRIT	2003 2003	2005 2008
	MTSAT-2	2004	LRIT	2008	2013
USA	GOES - 8	04/1994	WEFAX	11/94	
	GOES - 9	05/1995	WEFAX	01/96	
	GOES - 10	04/1997	WEFAX	06/97	
	GOES - 11	05/2000	WEFAX	09/00	
	GOES - M	08/2002	WEFAX	10/02	
	GOES - N	2002	WEFAX/LRIT	See footnote	
	GOES - O	2005	WEFAX/LRIT		
Russian Federation	Elektro-1	11/94	WEFAX		
	Elektro-2	2003	WEFAX		
	Elektro-3	TBD	LRIT		
China	FY-2B	06/00	WEFAX	01/01	
	FY-2C	2004	LRIT	2004	
	FY-2D	2006	LRIT	2006	
	FY-2E	2009	LRIT	2009	

Footnote: In the January 2002 time frame, a LRIT test signal will be provided for a few weeks through a GOES spacecraft other than the operational GOES-East and GOES-West. During that period, GOES-East and GOES-West will continue to provide routine WEFAX data. This LRIT test signal will allow users to test new or modified receiver equipment without disrupting normal WEFAX transmissions. Around November 2002, GOES-East will be converted from WEFAX to LRIT transmission and will cease transmitting WEFAX data. The conversion of GOES-West to LRIT will be based on the needs of the users. The date for GOES-West conversion will be announced as soon as practical.

Thus, the Task Force had recommended that CGMS further consider a four time-slot scenario and that WMO provide advice on the need for sounding instruments in the 05:30 a.m. and 05:30 p.m. orbits.

Action 29.21 **CGMS further consider a four time-slot scenario and WMO provide advice on the need for sounding instruments in the 05:30 a.m. and 05:30 p.m. orbits. Deadline: CGMS XXX.**

The Task Force summarised the meeting results in noting that: (1) agreement had been confirmed on the data format for LRPT and AHRPT; (2) a global data dissemination service should be investigated based on the AHRPT format with common frequency and bandwidth and comparable data content; (3) the LRPT service may be more appropriately accompanied through alternative dissemination means; and (4) a four time-slot scenario for equator crossing times should be considered.

During the Task Force meeting, the USA submitted information on the development of a low cost antenna system for L-band reception stations. It was agreed to make technical information relating to these developments available to CGMS Members.

Action 29.22 **USA to distribute technical information on low cost L-band antenna systems to CGMS Members. Deadline: February 2002.**

The Working Group noted and agreed with the recommendations from the CGMS Task Force and encouraged CGMS to undertake, as a matter of urgency, activities needed to address the recommendations.

To this end, CGMS proposed the setting up of an *ad hoc* Task Force on Integrated Strategy for Data Dissemination from Meteorological Satellites, which should meet in Geneva prior to the next meeting of the Expert Team on Satellite System Utilization and Products scheduled for April 2002. It was proposed that the Task Force would also look at alternate dissemination methods (ADM). A preliminary set of Terms of Reference, drafted at the meeting, can be found in Appendix A.2. Additionally, CGMS satellite operators were invited to submit proposals for discussion at the above mentioned *ad-hoc* Task Force meeting.

Action 29.23 **CGMS to establish Terms of Reference for an *ad-hoc* Task Force on Integrated Strategy for Data Dissemination from Meteorological Satellites which will meet in Geneva prior to the next meeting of the Expert Team on Satellite System Utilization and Products. Deadline: April 2002.**

Action 29.24 **CGMS satellite operators to submit proposals for discussion at the *ad-hoc* Task Force on Integrated Strategy for Data Dissemination from Meteorological Satellites. Deadline: February 2002.**

Action 29.25 **WMO to inform R & D satellite operators about alternative dissemination methods, at the 2nd WMO Consultative Meeting, being held in Geneva in February 2002.**

TABLE 7 : STATUS FOR LRPT CONVERSION, SATELLITES IN POLAR ORBIT
(updated 5 December 2001)

Operator	Satellite	Launch (M/Y)	Service	Start	Stop
EUMETSAT	Metop-1	12/2005	LRPT	2006	
	Metop-2	12/2009	LRPT	2010	
	Metop-3	06/2015	LRPT	2015	
USA	NOAA-9	12/1984	APT	12/84	08/95
	NOAA-12	05/1991	APT	05/91	
	NOAA-14	12/1994	APT	12/94	
	NOAA-15	08/1997	APT	08/97	
	NOAA-16	09/2000	APT	09/00	
	NOAA-M	04/2001	APT	04/01	
	NOAA-N	12/2003	APT	12/03	
	NOAA-N'	07/2007	APT	07/07	
	NPOESS-1	2010	Tentative: AHRPT and X-band		
	NPOESS-2	2011	Tentative: AHRPT and X-band		
	NPOESS-3	2013	Tentative: AHRPT and X-band		
	NPOESS-4	2015	Tentative: AHRPT and X-band		
	NPOESS-5	2017	Tentative: AHRPT and X-band		
	NPOESS-6	2018	Tentative: AHRPT and X-band		
China	FY-1C	05/1999	No APT or LRPT. CHRPT only		
	FY-1D	05/2002	No APT or LRPT. CHRPT only		
	FY-3A	2004	AHRPT and X-band only		
	FY-3B	2006	AHRPT and X-band only		
Russian Federation	Meteor 2-21	08/1991	APT	08/91	
	Meteor 3-5	08/1991	APT	08/91	
	Resourse-01-N4	---	APT		
	Meteor 3M-1	2001	APT		
	Meteor 3M-2	2003	LRPT	2003	

CGMS also suggested that the table of equator crossing times be updated on a regular basis to provide a clear overview of all satellites, frequencies, equator crossing times and other information, as required (See CGMS Action Item 29.04).

JPN-WP-06 described the meetings of the Asia-Pacific Satellite Data Exchange and Utilisation (APSDEU) which were established to promote the use of satellite data within the Pacific region. The meeting was a forum for satellite operators, data producers and users and telecommunications experts. The main purpose of the meeting was to share information among experts, to expedite the process of satellite data exchange and to promote more advanced and effective use of satellite data by the NMHS in the region. The next meeting of APSDEU will be held in February 2002.

WORKING GROUP II : SATELLITE PRODUCTS

II/0 INTRODUCTION

Working Group II on Satellite Products was chaired by Dr. Paul Menzel of NOAA/NESDIS and Dr. Johannes Schmetz of EUMETSAT assisted as secretary. 27 working papers were discussed. Several of these papers were in response to actions from CGMS XXVIII (regarding data availability from new systems, web site reporting of cross calibration efforts, monitoring satellite data and products distributed on GTS, coordination of data formats including meta-data needed for reprocessing, and establishing a working group on precipitation); all past actions were addressed. Eight new actions were suggested.

II/1 IMAGE PROCESSING TECHNIQUES

There were no papers on image processing techniques. However, the WG II noted that there remains a need to communicate progress on preparing measurements from multiple detectors into coherent images (e.g. destriping) and the discrimination of features within (e.g. clouds over snow or ice covered regions). Papers on these subjects are encouraged for CGMS XXX.

II/2 SATELLITE DATA CALIBRATION

EUM-WP-14 reported on a routine cross calibration established to compare the IR-window and WV-channels of Meteosat-7 (at 0° E) and Meteosat-5 (at 63° E) with similar channels of the HIRS instrument on NOAA-14. They note that IR window cross-calibration gives biases (Meteosat-HIRS) of about –1 K and WV cross-calibration gives biases (Meteosat-HIRS) of about +3 K. Biases are similar for both Meteosat-7 and –5. Sources of the biases are not clear; potential explanations include errors in the operational calibrations, uncertainties in the instrument characterisation, especially in the spectral response functions.

EUM-WP-23 reported that since 29 May 2000 Meteosat-7 imagery has been calibrated using the on-board radiometer black body calibration. This requires a correction model that takes account of the different geometry of Earth and black body scanning and the optical transmission through the radiometer front optics. The correction model was updated in January 2001 to remove part of a cold bias of the Meteosat IR channel. In EUM-WP-24, it was noted that since 31st May 2001, Meteosat-5 imagery has been calibrated using a satellite cross calibration technique using the Meteosat-7 black body calibration as reference. The cross calibration technique seems to stabilise the Meteosat-5 WV calibration, which varied by several degrees K over short periods when using forward calculations based on radiosonde ascents. The quality of raobs and cloudy atmospheric conditions had caused considerable variability.

JPN-WP-11 reviewed the intercalibration activities in MSC/JMA reported at an earlier CGMS. MSC will establish a homepage together with a plan to increase the network capacity for Internet by the end of 2001. The results of inter-calibration, to be started on a routine basis sometime after March 2002, will be posted in the MSC homepage after it

is established.

USA-WP-28 reviewed the algorithm for LEO-GEO inter-calibration and presents results from inter-calibrating five geostationary satellites (GOES-8, -10, Meteosat-5, -7, GMS-5) with a single polar-orbiting satellite (NOAA-14 HIRS and AVHRR) on a routine, automated basis for over a year using temporally and spatially co-located measurements. Comparisons of 11-µm infrared window (IRW) channels and 6.7-µm water vapour (WV) channels have been tabulated in a large data set (more than 100 LEO comparisons for every GEO). All five geostationary instruments on average are measuring colder temperatures than HIRS (0.3 to 1.1 C) and AVHRR (0.0 to 0.8 C) in the IRW channel; they measure warmer temperatures on average than HIRS in the WV channel (1.4 to 4.2 C). These results are in good agreement with the inter-comparisons of EUMETSAT and JMA. NESDIS now intends to track inter-calibration by the seasons.

It was concluded that the various intercalibration approaches had matured and that results should be posted routinely (at least quarterly). WG II thus suggested the following action.

Action 29.26 **Satellite operators to post on the CGMS homepage available relevant papers on satellite radiance (VIS, IR, WV) inter-comparisons and to start routine inter-comparisons of LEO and GEO calibrations as soon as possible, striving to post results every quarter on their own web pages. Deadline: June 2002.**

II/3 VERTICAL SOUNDING AND ITWG MATTERS

EUM-WP-26 describes the EUMETSAT ATOVS Retransmission Service that has been established to collect data from a pre-selected set of HRPT stations and to retransmit the data to users via a satellite broadcast system. The service is expected to evolve in response to operational experience, availability of NOAA satellites/instruments, user feedback and developments in meteorological processing. Initial limited trials of the Service are expected to begin late 2001 and it is currently expected that the service will continue to be provided until at least the end of 2004.

RUS-WP-07 reported on the SRC Planeta processing package called Integrated System for the ATOVS Data Processing (ISADP) developed to retrieve atmospheric temperature and humidity profiles from the ATOVS NOAA-16 measurements of local area coverage. A description of the basic algorithms of ATOVS data inversion is followed by a presentation of the accuracy characteristics of the derived profiles. RMS error of the averaged atmospheric layer between 1000 and 10 hPa is in the range 1.6° C while the mean RMS error for the surface temperature is 1.9° C.

USA-WP-30 reported on the anticipated availability of Special Sensor Microwave Imager and Sounder (SSM/IS) data. NESDIS plans to provide standard FTP access to files containing SSM/IS Temperature Data Records (TDRs), Environmental Data Records (EDRs) and Sensor Data Records (SDRs) through the Shared Processing distribution system to the participating Centrals approximately one year after the scheduled November 2001 launch of the Defense Meteorological Satellite Program's

(DMSP) F-16 spacecraft (provided successful calibration and validation is completed). Currently, the data are selected to be in native format (Aerojet Binary) from the Air Force Weather Agency (AFWA). NESDIS will not serve SSM/IS Upper and Lower Air Sounding data through Shared Processing unless a request for these data is received and approved. The most current set of products will be kept on the NESDIS server. All archived sources shall be through the NESDIS Satellite Active Archive.

WMO-WP-20 responded to the concerns (raised by the International TOVS Working Group) about the monitoring of the current products distributed on the GTS and the coordination plans for future product distribution from the IJPS. WMO found that a requirement for monitoring of the products had been recorded; policy and procedure issues were first adopted by Recommendation 8 at the Ninth Session of the Commission for Basic Systems (CBS-IX) in 1988. A lead centre for monitoring satellite and aircraft data quality had been appointed. As international contributions to the global observing system had increased, the monitoring of product distribution was becoming more complex. In the near future, many new satellite operators would be producing and distributing satellite data and products especially over the GTS but a future monitoring policy had not yet been developed. Such a future monitoring policy could require that co-centres (or several centres) for the monitoring of satellite data and products be established.

Thus, WG II felt it would be appropriate for a CBS Expert Meeting, comprising relevant lead centres, to be established and where procedures and responsibilities could be discussed. The focus of the meeting would include satellite data and address the issues and recommend procedures for monitoring the quality of these types of observations. The participation of satellite product generating institutions would also facilitate implementation.

The following action was proposed:

Action 29.27 **The Chairman OPAG IOS is asked to bring to the attention of the CBS Management Group, as a matter of urgency, the need for a designated CBS Open Programme Area Group with responsibility for the monitoring of satellite data as well as the need for an expert meeting to discuss associated issues. CGMS Members are asked to indicate their willingness, as appropriate, to participate in such a WMO planning meeting. Deadline: March 2002.**

USA-WP-32 gave an update on the GOES sounding activities. The NESDIS operational GOES-8/10 soundings continue to be produced every hour at 50 km resolution in clear skies; RMS differences with respect to radiosondes remain about 3 mm for total precipitable water (TPW). Derived Product Images (DPI) of TPW and atmospheric stability continue to be used by the National Weather Service forecast offices with positive impact. GOES definition of three layers of moisture remains an operational input to the regional forecast; using cloud properties at single field of view resolution (approximately 10 km) is being investigated. Current sounding research includes achieving model independence in the first guess, resolving single field of view soundings, and estimating the short and long-wave infrared surface emissivity in the

sounding retrieval. The GOES-11 sounder performance had been checked out and the GOES-12 sounder check-out was taking place during autumn 2001.

The use of GOES Sounder in the NWS forecast offices prompted discussion on Nowcasting user requirements, WMO determination of remote sensing system capabilities for meeting these requirements, and processes for evolving current remote sensing assets to more capable configurations. WG II suggested the following action for CGMS consideration.

Action 29.28 **WMO to report on Nowcasting user requirements and observing system capabilities and the statements of guidance resulting from a critical review of these; NOAA/NESDIS is requested to report on their experiences using the GOES sounders for Nowcasting applications; and EUMETSAT to report on its process for setting Nowcasting requirements to be met by their Meteosat Third Generation. Deadline: CGMS XXX.**

Dr. Paul Menzel, rapporteur to the International TOVS Working Group (ITWG) presented USA-WP-29 reporting on activities of the International TOVS Working Group. The paper summarised the significant conclusions from the last ITWG meeting that were reported at CGMS XXVIII and notes that their next meeting will take place in Lorne, Victoria, Australia from 27 February to 5 March 2002. The co-chairs, Dr. Guy Rochard from CMS, Lannion, France and Dr. John LeMarshall from BMRC, Melbourne, Australia, are proposing that key issues for the meeting should be:

- Use of ATOVS, SSM/T and SSM/IS data;
- Applications of ATOVS data to numerical weather prediction; generation of geophysical parameters (profiles, clouds, surface characteristics) and to Nowcasting;
- Application of ATOVS data in climate monitoring and research and in global change research;
- Preparation for advanced infrared and microwave sounders. Examples include those carried on AQUA, EO-3, NPP, METOP, NPOESS and FY3.

USA-WP-29 also summarised items brought to CGMS XXVIII and the response (including importance of direct broadcast as well as GTS product distribution, monitoring of IJPS product uniformity, coordination of national remote sensing assets into an international global observing system, advanced preparation of processing packages for high spectral resolution infrared sounders). WG II noted that the communications with the ITWG remain most useful (the alert on monitoring issues had come from ITWG). In conclusion, WG II encourages CGMS to consider the following action as well as ITWG to take up the following:

Action 29.29 **EUMETSAT and USA report on their plans for developing and supporting Direct Broadcast processing packages for IASI/AVHRR/AMSU and CrIS/VIIRS/**

ATMS, respectively, at ITWG (March 2002) and CGMS XXX (October 2002).

Action 29.30 **ITWG, at its March 2002 meeting, to (a) summarize the successful characterisation of problems with AMSU-A & B direct broadcast (DB) data (e.g. humidity profiles derived with AMSU-B) and post these on a web site for DB users, (b) characterise the DB profile retrieval packages (three are known to CGMS – AAPP, IAPP, ISDAP), (c) provide an update on the status of using satellite data over land for retrievals and other products, (d) explore the quantitative use of cloud products, (e) discuss the necessity for CO_2 profile measurements for improving atmospheric temperature profile retrieval, and (f) investigate multi-satellite utilization for profile retrieval, specifically radio occultation with high spectral resolution infrared radiometers.**

II/4 OTHER PARAMETERS AND PRODUCTS

EUM-WP-15 reported on plans for product quality assessment (each product alone) and monitoring (product trends over a longer time-scale). EUMETSAT has implemented a procedure to monitor the variability of products over time. The goal of this monitoring procedure is the detection of changes in the products (and hence potentially in the product quality) within a maximum period of one working day. Typically, product information covering the last 30 days is taken into account. WG II noted the importance of this activity and encouraged other satellite operators to report on their plans for product assessment and monitoring; it recommended that action 28.24 remain open.

Action 29.31 **Satellite operators to report at CGMS XXX on their monitoring procedures and practices for satellite data and products placed on the GTS using EUM-WP-15 as an example.**

IND-WP-03 described the capabilities of the first Indian satellite for ocean applications (Oceansat-1) launched in May 1999 on-board the IRS-P4 mission. Various data products (total water vapour, sea surface temperature, ocean surface wind speed, and cloud liquid water) derived from the Multi-channel Scanning Microwave Radiometer (MSMR) and the results of the last two years validation studies are presented. MSMR is found to be providing data of good quality and reliability; large scale features of all the observed parameters and their inter linkages have been well brought out by the data. Derived products are also found to be useful for some meteorological applications. Research work regarding rainfall rate, sea ice extent, and soil moisture are also making good progress with promising results.

IND-WP-04 summarised results of a limited study conducted over the Indian sub-continent for the period 1997-2000 with a view to improve the Quantitative Precipitation Estimates (QPEs) being derived operationally with INSAT data using

Arkin's technique. Based on a detailed study, best possible combination of temperature threshold and rain–rate constants have been found for various sub-divisions. By using these revised parameters improved quality of QPEs has been derived.

RUS-WP-08 described the monitoring of ice conditions in the Arctic Region carried out by SRC Planeta with their long-term archive of OKEAN satellite radar data. Maps of multi-year and first year distribution of ice in the winter periods of 1983-2000 have been generated and validated using aviation observations and ship measurements. Mean square deviation of ice boundary estimation is 8-12 km. The analysis of the data has shown a 10% increase of the area of multiyear ice in the 1990s compared to the 1980s. WG II applauded the SRC Planeta for this demonstration of careful processing of long term data sets for climate trend studies.

WMO-WP-14 reported on activities toward the establishment of an International Precipitation Working Group in response to Action 28.13. There was an organising meeting of the IPWG that met in Fort Collins in 20-22 June 2001. Terms of reference were drafted; they were guided by the terms of reference for the ITWG and CGMS Winds Working Group. Issues were identified in a lengthy review of the current status of precipitation estimation from satellite-based observing systems and their utilisation. A summary of both is found in WMO-WP-14. The first session suggested that the IPWG be served by two Co-Chairmen, Dr.Arnold Gruber (USA) and Dr.Vincenzo Levizzani (Italy), and a Rapporteur to CGMS, Dr.Purdom (USA). Noting the key role of the Nowcasting SAF regarding rainfall issues, the IPWG further suggested that it be invited to consider hosting a summer 2002 meeting of the IPWG. CGMS reviewed the structure and terms of reference for the IPWG and approved them.

Action 29.32 **CGMS to invite the EUMETSAT Nowcasting SAF to host the next IPWG meeting in 2002. Deadline: December 2001.**

II/5 COORDINATION OF CODE FORMS FOR SATELLITE DATA

WMO-WP-10 presented the additions to WMO Binary Code Tables (BUFR) and CREX Tables, which have been approved by the President of WMO and will come into force on 7 November 2001. WG II took note of the information contained in this document and encouraged CGMS Members to convey any comments or suggestions in the field of WMO Codes Forms used for exchange of satellite data.

II/6 COORDINATION OF DATA FORMATS FOR ARCHIVE AND RETRIEVAL OF SATELLITE DATA

EUM-WP-18 summarised the progress on the Archive Data Reprocessing Project. It has been divided into several phases: (a) establishment of a reprocessing system environment that was completed in early 1999, (b) pilot reprocessing of Meteosat Surface Albedo for 1996 (Meteosat-5) that was completed in August 1999 and the product made available to beta-testers, (c) operational reprocessing of wind products from 1981-1989 (Meteosat-2) that is ongoing in support of the ECMWF 40-year re-analysis (ERA-40) project, (d) upgrade of hardware (July to November 2001) and

production of albedo products for Meteosat-5 Indian Ocean Data Coverage (IODC) for ERA-40 that will run from December 2001 till April 2002, and (e) a feasibility study concerning the possibilities for reprocessing surface albedo products from the pre-operational series of Meteosat spacecraft (Meteosat-2 and Meteosat-3) foreseen for 2002.

EUM-WP-19 presented the status of the development of the first version (V1) of the U-MARF, phased with the MSG development programme, that will provide services related to Meteosat and MSG data and products. The second version of the U-MARF (V2) is to be developed in parallel with the EPS programme, so that U-MARF services will be further extended to the EUMETSAT Polar System (EPS). These services will also support some connectivity with the Satellite Application Facilities (SAFs) that will form the distributed elements of the EUMETSAT Ground Segment.

EUM-WP-22 discussed the importance of ancillary information for reprocessing geostationary data in support of climate applications. It presents a short list of possible meta-data (such as time, position, observation angles, sensor spectral response, and calibration coefficient and offset). The working paper noted that reprocessing is greatly enhanced by attaching these meta-data to the archive, and lamented that an agreed upon list of meta-data does not exist. In view of the importance of meta-data for the reprocessing of satellite data from an archive and the general lack of this type of information, the WG II suggests the action:

Action 29.33 **CGMS Members to propose lists of parameters and data which should be contained in "meta-data" to accompany reprocessed data, at CGMS XXX.**

PRC-WP-03 discussed an automatic image navigation algorithm for FY-2 geosynchronous meteorological satellites that was realised in NSMC. Parameters and coordinates used in FY-2 spin geosynchronous meteorological satellite image navigation are derived, with emphasis on attitude parameters. The solution to the navigation model does not depend on any landmark matching, instead it tracks the centre of the Earth over time. This produces a stable FY-2 image navigation of good quality over five days. WG II applauded China for its innovative approach to navigation and encouraged it to publish details.

RUS-WP-06 summarised the unique archive, maintained by SRC Planeta, of all data received from Russian meteorological, oceanographic and earth observation satellites (KOSMOS, Meteor, OKEAN, RESURS, GOMS series) since the first Russian satellite mission in 1979 as well as from a number of foreign satellites (e.g. Meteosat, NOAA, GMS, SPOT) received in Russia in direct readout mode. The 3.5 terabyte of digital data since 1991 as well as the photographic data prior to 1991, represents a valuable resource for case study research and climate studies. On-line digital data catalogue is available at the following SRC Planeta web sites: http://sputnik1.infospace.ru and http://planet.iitp.ru.

II/7 TRAINING

EUM-WP-10 described training activities carried out over the past year and presented an outline plan of training activities for the coming year. MSG/EPS training courses,

organised to prepare both English and French speaking African NMS for changes arising with the new EUMETSAT satellite systems, were held in Niamey in October 2000 and in Nairobi in November 2000. MSG/EPS training courses were also held in Belgium for EUMETSAT Member States and Cooperating States in November 2000, as well as a course in Lisbon, Portugal in November 2000, benefiting organisations from Portuguese-speaking countries. Further MSG courses for Cooperating States were held in Budapest in December 2000, Bratislava in March 2001 (including also the work of the SAFs), Krakow, Poland in June 2001.

Satellite data application training courses were held for German-speaking users in Langen in May/June 2001, hosted by the DWD and in Nairobi in August 2001 benefiting the African NMHS. User training workshops for SAFs were also organised, i.e. for the Climate Monitoring SAFs in Dresden in November 2000 and for the Ozone SAF in Thessaloniki in May 2001.

At a MSG Computer Aided Learning (CAL) workshop at the Deutscher Wetterdienst training school in Langen from 22–24 August 2000 valuable contributions on the development of MSG training material had been received. These are to be used in the development of an initial set of MSG CAL modules currently underway. A very full schedule of training activities will continue in 2002, with training activities already foreseen in Niger, Spain, Kenya, Croatia, Portugal, Germany, Denmark, Czech Republic and France.

India reported on its training programme in satellite meteorology in IND-WP-01. A new centre was set up in 1998 at Ahmedabad, India, to teach Satellite Meteorology and other related subjects to national and foreign personnel. This institution is part of the "Centre for Space Science and Technology Education for Asia and the Pacific (CSSTE-AP)" and is affiliated to the United Nations. India Met. Department experts are delivering lectures on satellite meteorology in post-graduate training courses conducted periodically by this Institute.

Japan reported in JPN-WP-07 on the MSC/JMA efforts in developing and improving Computer Aided Learning (CAL) packages since 1994. These CAL packages are aimed at providing the environment for practical and interactive training with a personal computer in satellite meteorology and its applications. The CAL comprises hardware and software systems and include resources for training and development. The software system provides the various functions and materials for satellite image analyses, e.g. displaying and animating satellite images, overlaying the surface and upper-air observation data and the products of Numerical Weather Prediction (NWP), display and voice explanations of case studies. The paper also described improvements to Satellite Animation and Interactive Diagnosis (SATAID), electronic publications, plans for operational use, and participation in the activities of the WMO/CGMS Virtual Laboratory.

JPN-WP-08 noted that the first session of the CGMS Virtual Laboratory Focus Group held at the EUMETSAT Headquarters in Darmstadt, Germany, from 16 to 18 May 2001 drafted a proposed structure and developed the goals and the implementation plan for the CGMS Virtual Laboratory Focus Group in response to Action 28.14. The strategic goals of the Virtual Laboratory are to provide high quality and up-to-date training resources on current and future meteorological and other environmental

satellite systems, data, products and applications; and to enable the "centers of excellence" to facilitate and foster research and the development of socio-economic applications at the local level by the NMHS through the provision of effective training and links to relevant science groups. This document describes the activities in the Japan Meteorological Agency (JMA) for the preparation of the Virtual Resource Library (VRL) and the Asia Pacific Satellite Application Training Seminar (APSATS) 2002 workshop.

JPN-WP-09 reported on the plans to launch the Multi-functional Transport Satellite-1R (MTSAT-1R) as a successor to GMS-5 in early 2003 and on efforts to hold a series of seminar/workshops in 2000-2002 to encourage National Meteorological and Hydrological Services (NMHSs) to highly utilise the MTSAT/LRIT data especially in Southeast Asia. The project consists of (a) a survey of LRIT data utilisation plan of NMHSs and user requirements for the functions of LRIT browser software, (b) a seminar on LRIT data utilisation and consultations on the implementation of LRIT reception systems, (c) training workshops on the integrated utilisation of cloud imagery and meteorological data. A first seminar was held in Tokyo from 14 to 16 February 2001; schedule and contents of LRIT data and browsing software for disseminated data were explained, and the information on latest LRIT receiving system was provided. In addition, a survey of LRIT data utilisation plan of NMHSs and user requirements was conducted. JMA will hold "The Second International Seminar on MTSAT/LRIT Data Utilisation" in Tokyo from 27 to 29 November 2001; the enhanced utilisation of newly distributed data will be discussed, i.e. digital satellite cloud image data and various meteorological data including numerical weather prediction products. Lectures will also be given on the review of the transition plan to LRIT and the new equipment for receiving LRIT data.

PRC-WP-07 reported on work being done at NSMC to develop a system that enables on line access to data and product service of NSMC. In conjunction with implementation of the Virtual Laboratory, the development of the system is also aimed at providing a way for students to acquire training courses in satellite meteorology, and for meteorological specialists to exchange views and ideas in an interactive method. The ultimate goal of the system is to become a platform distributing the meteorological satellite information and products, as well as an on-line training centre.

WG II applauded all of these valuable contributions designed to strengthen the international Virtual Laboratory; and contributors were encouraged to stay aware of the activities of the WMO OPAG/IOS Expert Team on Satellite System Utilisation.

II/8 CONCLUSION

WG II concluded a full agenda and noted considerable progress on some CGMS actions (e.g. GEO/LEO inter-calibration, establishment of the IPWG) but also noted the need for more activity in other areas (e.g. product monitoring, status of archive reprocessing). WG II introduced actions in some new areas (e.g. plans for Direct Broadcast data processing packages, definition of archive meta-data) and made suggestions for consideration by ITWG.

WORKING GROUP III : SATELLITE TRACKED (DERIVED) WINDS

III/0 INTRODUCTION

Working Group III, on Satellite Derived Winds, was chaired by Dr. Xu Jianmin of CMA, and Dr. Johannes Schmetz of EUMETSAT assisted as Rapporteur. In total fourteen papers were presented and discussed by the Group. Following a suggestion by the Chairman the order of presentation was changed and papers were grouped under the following headings: i) targeted observations, ii) height assignment, iii) quality control, iv) status and applications and v) re-analysis and report of the Working Group. This allowed discussion of similar papers by CGMS Members in a logical sequence.

i) Targeted Observations

The first paper presented to WG III was EUM-WP-20, which responded to an action from the previous CGMS meeting where the success of recent experiments on targeted observations and the complementary role of satellite tracked winds was acknowledged. Targeted observations serve the purpose to provide better and/or more measurements of an area in the atmosphere that has a very high probability to benefit the forecast at a downstream location. Extra observations in those areas will result in a relatively large decrease in the forecast error in a given downstream area at a given point in time. Targeted observations need to be adaptive; i.e. the position of the 'sensitive' areas needs to be determined in near-real time on the basis of a numerical forecast model. Then in-situ measurements within this area could be improved through dedicated observations, for instance dropsondes from aircraft. An alternative, or a complementary effort, is to better utilise satellite observations in the sensitive area. This can be achieved through more frequent observations, a denser spatial coverage or improved retrieval techniques in general. WG III discussed the notion that satellite-tracked winds are not targeted observations as such. Satellite-tracked winds should rather have an optimal coverage and frequency (and of course quality) per se; then the targeted area is always part of the operational data set (provided the retrieval in the relevant area is possible at all). In that respect the targeting experiments noted the highly variable coverage with AMVs as drawback. WG III reiterated that efforts should be made to better compensate for the lack of AMVs in cloud free areas with AMVs from tracking WV features. In parallel the way of assimilating the satellite data needs to be improved; here a distinction between the tracking of cloud targets and water vapour targets might be beneficial.

EUM-WP-21 provided an update on rapid scans performed at EUMETSAT with Meteosat-6 and also presented applications. Following the success of the rapid scanning support provided to the Mesoscale Alpine Programme in Autumn 1999, and after extensive discussions with potential users, a proposal for an operational Rapid Scanning Service (RSS) had been developed. Rapid Scanning trials began in August 2000 and resulted in the start of the operational RSS in September 2001 with routine 10-minute rapid scans from Meteosat-6. Preparations for the RSS addressed four main areas i) Rapid scan image taking and processing, ii) Fast dissemination of rapid scan

images via the Internet, iii) Extraction of meteorological products from rapid scan images, and iv) Operational and administrative aspects of the RSS. Access to rapid scan data is given via the EUMETSAT Operations Internet Server using either FTP pull or push. The WG noted the EUMETSAT achievements with appreciation and requested an update on the utilisation at the next CGMS meeting.

Action 29.34 **EUMETSAT to report at CGMS XXX on the progress concerning the production of winds from rapid scans and the relevant feedback from users.**

JPN-WP-15, also in response to actions from CGMS XXVIII, reported on an experiment on the derivation of Cloud Motion Winds (CMW) from 15-minute rapid scan observations. Whilst the operational CMW derivation at 15-minute intervals is targeted to an area within 20 x20 degrees around a typhoon, the observations are performed over most of the Northern hemisphere. The high-level IR and WV winds are derived in the area as well as VIS low-level winds. The rapid scan winds are experimentally assimilated into the 6-hourly wind data of two operational models, i.e. the Global Spectral Model and the Typhoon Model of JMA. The assimilated model output is compared with the control runs with no assimilation of the rapid scan winds in order to assess their impact. In this study, the position, maximum speed and central pressure of the typhoons are compared, and two values of 0.6 and 0.8 of the EUMETSAT Quality Indicator (QI) are used for the automatic quality control. At present, the comparison is made only for two typhoon cases at two different initial times and a check of the accuracy of rapid scan CMW is not fully completed. JMA will continue further study of the CMW derivation at 15-minute interval rapid scan observations including an impact assessment for Numerical Weather Prediction (NWP). The results of the study will be presented at the 6th International Winds Workshop. WG III commended JMA on the study and invited JMA to provide an update at the next CGMS meeting.

Action 29.35 **JMA to report on the progress of the experiment using targeted CMW observations around Typhoons and related model impact studies at CGMS XXX.**

The presentations on targeted observations and rapid scans sparked off a lively discussion embracing a range of related scientific and technical issues. They are summarised in the following actions to the 6th International Winds Workshop:

Action 29.36 **The 6th International Winds Workshop to discuss the compatibility of spatial resolution and image repeat cycle for winds tracking and to provide pertinent recommendations to CGMS satellite operators. Deadline: May 2002.**

Action 29.37 **The 6th International Winds Workshop to discuss the template size for tracking features in relation to the question whether the displacement vector represents a local wind vector. A pertinent recommendation should be**

provided to CGMS satellite operators. Deadline: May 2002.

ii) Height Assignment

At CGMS XXVIII, WG III discussed the height assignment of semi-transparent clouds as a possible cause of the speed bias. This had led to the action: CGMS Members to provide working papers to CGMS XXIX on operational multi-spectral methods used for the height assignment of cloud-tracked winds. The analysis should also include accuracy estimates for the heights of semi-transparent clouds. The following four papers were submitted in response to this action.

EUM-WP-17 introduced the current operational height assignment, which is based on the so-called water vapour intercept method. This scheme utilises the radiances measured in the water vapour absorption and the infrared window channel to derive the temperature at the top of semi-transparent clouds. Another possibility to estimate the cloud-top pressure is the carbon dioxide (CO_2) absorption method that has already been successfully used with the imager data from the previous GOES satellites. The current Meteosat imager does not have a CO_2 channel, however such a channel will be on Meteosat Second Generation (MSG). In preparation for the new generation, the current operational height assignment techniques, as well as techniques utilising the CO_2-channel together with new improved concepts for the existing techniques have been developed. The described height assignment methodologies have been implemented at EUMETSAT in the MSG Meteorological Products Extraction Facility (MPEF) prototyping environment and have been applied to both GOES imager and sounder data as well as Meteosat data. This has enabled an evaluation of the reliability of the different methods as well as validation against current operational height assignment schemes. The paper also reported on experimental stereo height assignment. The WG noted that the accuracy of the stereo heights was not better that those of the multi-spectral IR methods, presumably due to the fact the accuracy for image navigation is very demanding.

PRC-WP-08 described the NSMC scheme for the height assignment. For opaque clouds it is based on the IR cloud brightness temperature. For semi-transparent clouds, the height assignment method follows the physical principle first introduced by Szejwach (1982) by using both IR and WV channels. Very thin cirrus clouds appear in the IR-WV scatter diagram at almost the same place as the low-level clouds and the surface. The separation of thin clouds from low clouds is therefore essential. In order to separate high level clouds from the low-level clouds, the correlation between the IR and WV matching template is calculated before the height assignment. For tracers with high clouds, the correlation between the IR and WV measurements will be high, whereas for tracers with low clouds it will be low. This information is of major importance to the height assignment, because for low correlation cases the height adjustment procedure is not performed. The correct allocation of cloud types (high or low) greatly reduces error of AMVs.

JPN-WP-13 introduced the multi-spectral method for the height assignment in the operational IR wind extraction in use at JMA. The VISSR channels used for the method are the IR-1 channel in 11 micron band and the WV channel in 6.7 micron

band. The multi-spectral method for semi-transparent clouds also uses the relation between the brightness temperatures of IR and WV channels. It is calculated using atmospheric temperature and water vapour amount of the Numerical Weather Prediction of the JMA Global Spectral Model (GSM). In the processing for the height assignment, the relation is actually provided as a Look-Up Table (LUT). The cloud top heights are assigned to the satellite-derived wind vectors with the corrected IR brightness temperature histogram using the minimum temperature.

USA-WP-33 recalled that its heights are assigned by any of three techniques when the appropriate spectral radiance measurements are available. In opaque clouds, infrared window (IRW) brightness temperatures are compared to forecast temperature profiles to infer the level of best agreement which is taken to be the level of the cloud. In semi-transparent clouds or sub-pixel clouds, since the observed radiance contains contributions from below the cloud, this IRW technique assigns the cloud to too low a level. Corrections for the semi-transparency of the cloud are possible with the carbon dioxide (CO_2) slicing technique where radiances from different layers of the atmosphere are ratioed to infer the correct height. A similar concept is used in the water vapour (H_2O) intercept technique, where the fact that radiances influenced by upper tropospheric moisture (H_2O) and IRW radiances exhibit a linear relationship as a function of cloud amount is used to extrapolate the correct height.

WG III noted the advent of new multi-spectral imagers (e.g. MSG, GOES-12) with IRW, WV and CO_2 channels, which renew the interest in inter-comparisons of the several height assignment techniques. It concluded the discussions with the following actions:

Action 29.38 **The 6th International Winds Workshop to discuss and encourage the use of geometric (and other) height allocation methods for comparison with and validation of multi-spectral infrared height assignment methods of wind vectors which are used operationally. Deadline: May 2002.**

Action 29.39 **The 6th International Winds Workshop to revisit the current concepts of height allocation techniques (e.g. IR-W EBBT, WV intercept, CO2 slicing and WV EBBT) for assigning atmospheric motion vectors to a single level height and to provide relevant results to CGMS satellite operators. Deadline: May 2002.**

iii) Quality Control

EUM-WP-16, in response to an action from the last CGMS meeting, summarised the current BUFR encoding of products at EUMETSAT. Currently four distinct satellite wind products are produced and disseminated on an operational basis. In each case the data are encoded in BUFR together with associated quality control information. All wind vectors whose quality control score exceeds a threshold value (currently 0.3, or 30%) are disseminated. The encoding uses the so-called unified template, which was designed for this purpose. The products are also archived in the MARF in the same BUFR format. Since 5 June 2001, each wind has two associated sets of quality control

information, one calculated using first guess data and one without. For the time being, the high resolution visible winds (HRV) are disseminated in parallel in a simplified BUFR format. The paper provided additional information on the BUFR encoding of other Meteosat products (e.g. Clear Sky Radiances) and announced that All products generated by the MSG Meteorological Product Extraction Facility (MPEF) and disseminated on the GTS will be encoded in BUFR.

JPN-WP-12 explained that the standardised BUFR format is required to include quality indices. A summary report of IWW-5 had noted that all data providers should strive to implement quality control procedures equivalent to the combined Recursive Filter Flag (RFF) of the University of Wisconsin Cooperative Institute for Meteorological Satellite Studies (UW-CIMSS) and the EUMETSAT Quality Indicator (QI) scheme. In this regard, MSC intends to introduce the combined UW-CIMSS RFF and EUMETSAT QI scheme to the GMS CMWs for the BUFR format. The paper described the preliminary result of evaluation with EUMETSAT QI toward the introduction of the combined scheme for the BUFR format of the GMS wind products. Japan thanked EUMETSAT and NOAA/NESDIS/UW-CIMSS for providing the software and sample data.

Discussions on the two papers recalled some initial experience with quality indicators (QI) at the NWP centres. While they are overall promising it was also stated that data thinning experiments on the basis of QIs led to inconclusive results. The WG thanked JMA for the effort to adapt the QI methods developed at NESDIS/CIMSS and EUMETSAT. China also announced that they intend use the QI approach in the future. In conclusion WG III placed the following action:

Action 29.40 **The 6th International Winds Workshop to analyse the status of the implementation of quality indicators assigned to wind vectors and to report back to CGMS on current benefit to NWP. Deadline: May 2002.**

iv) Status and Applications

IND-WP-02 summarised the results of improvements incorporated during last two years in the operational scheme for derivation of CMVs from INSAT data. Changes were introduced in three phases after which the quality of operational CMVs improved significantly over the last two years. As a result of persistent efforts over the last two years for improving the quality of operational CMVs derived from INSAT, sufficiently good quality of CMVs are now being derived with INSAT for operational use by a number of users. The discussions recalled that the Numerical Forecasting Centres of India confirm the improvements in terms of a small but positive impact. Comparisons with Meteosat-5 winds show good agreement too. Other monitoring centres (e.g. at the UK Met Office, as part of its NWP SAF activities) have also confirmed improved quality of INSAT CMVs. WG III applauded India's efforts to improve the quality of operational winds.

USA-WP-31 provided a comprehensive overview of the NOAA/NESDIS operational wind product suite that includes the high density cloud-drift and water vapour winds from the GOES imager, water vapour motion winds derived from the GOES sounder.

Improvements in wind products are being researched in areas, such as the 4 μm channel, improved motion vectors from rapid scan imagery, and the derivation of polar winds from a MODIS water vapour channel. In this preliminary work the feasibility of deriving tropospheric wind information at high latitudes from polar-orbiting satellites has been proven. WG III applauded these efforts and also recognised the great potential of winds from hyper-spectral imagery, which could provide multi-level winds in cloud free areas.

EUM-WP-25, prepared by the Satellite Application Facility (SAF) for NWP, gave an introduction to the 'SAF Integrated Satellite Wind Monitoring Report (ISWMR) which displays differences between satellite wind observations and short-range NWP model forecasts. Both the satellite wind observation and the model forecast contribute to these differences; neither can be assumed to be "true", and therefore the differences are model dependent. Currently this report compiles differences found from two NWP models (ECMWF and UK Met Office) in order to try to separate the contributions from satellite winds and the models. The ISWMR is available at: http://www.metoffice.com/sec5/NWP/NWPSAF/satwind_report

The First ISWMR Analysis Report is available at:
http://www.metoffice.com/sec5/NWP/NWPSAF/satwind_report/SAF_2000.html.

The NWP SAF home page is at:
http://www.metoffice.com/sec5/NWP/NWPSAF/.

In order to instigate discussions on the monitoring in the future, WG III proposed the following action:

Action 29.41 **All CGMS Members to provide feedback on the 'Integrated Satellite Wind Monitoring Report' to Pauline Butterworth (pauline.butterworth@metoffice.com), with copy to the Secretariat by 31 March 2002. Comments of general interest should be provided through the CGMS Wind List-Server at WMO.**

v) Re-analysis and Report to WG III

JPN-WP-14 responded to Action 28.31 (reprocessing of satellite-tracked winds from archived image data with state-of-the-art algorithms). It reported on the plan of the re-processing of CMW from the GMS archived data as a part of a research project, the "Japanese Re-Analysis 25 years (JRA-25)". JMA started to conduct a research project of long-range re-analysis of global atmosphere, called the "Japanese Re-Analysis 25 years (JRA-25)", in cooperation with the Central Research Institute of Electric Power Industry (CRIEPI) foundation in order to provide an essential data set. The JRA-25 project is to be implemented for 5 years from April 2001 to March 2006. The re-analysis will be performed using JMA operational numerical weather prediction and assimilation system, and the initial data for re-analysis considerably depends on the satellite data. The period of re-analysis is for 26 years from 1979 to 2004 taking into account the availability of the satellite data. Further information on the JRA-25 project is given at the homepage: http://www.jreap.org. MSC is planning to derive the high-density winds with high accuracy in re-processing from the archived GMS

VISSR data during the period from April 1987 for IR and April 1991 for VIS through December 2004 in which the archived GMS VISSR data are available. JMA is also asking other satellite operators and the European Centre for Medium-Range Weather Forecasts (ECMWF) to provide the re-processed CMW data of Meteosat.

WG III congratulated JMA on its effort and achievement and expressed the need for other satellite operators with large archives to consider a reprocessing of the winds. WG III noted that EUMETSAT was actively engaged in reprocessing of Meteosat wind vectors from archived data. With regard to the potential in the GOES archived data, WG III proposed the following recommendation and action:

Recommendation: USA to consider a reprocessing of their GOES winds in support of the reanalyses conducted at NWP Centres.

Action 29.42 USA to report on potential plans for the reprocessing of winds at CGMS XXX

EUM-WP-27 provided a report from the Rapporteur of the CGMS Working Group on Cloud Motion Winds. It addresses the following topics:

a) Report from the 5th International Winds Workshop held at Lorne, Australia
b) Announcement of the 6th International Winds Workshop, to be held at Madison, USA, 7 – 10 May 2002
c) The use of Atmospheric Motion Vectors at NWP centres, which has been put on the EUMETSAT web page using the information provided by Japan Meteorological Agency in a paper to CGMS 28 entitled 'Summary of comments from NWP Centers represented in WGNE on the large differences in satellite wind observation errors assigned at NWP Centers'
d) Winds monitoring by the NWP Satellite Application Facility of EUMETSAT
e) A revised version of the 'Terms of Reference of the CGMS Working Group on Cloud Motion Winds'.

It is also suggested renaming that working group 'CGMS Working Group on Satellite Derived Winds'.

WG III welcomed the presentation; specifically it encouraged all satellite operators to approve the attendance of their relevant staff at the next International Winds Workshop. It also endorsed the proposed change of the Terms of Reference of the WG as well as a corresponding change of name to WG on 'Satellite Derived Winds'. CGMS plenary was requested to approve these changes.

CONCLUSION

WG III concluded with a summary of the recommendation and actions, most of which should be pursued at the 6th International Winds Workshop. The Chairman thanked all participants for the excellent discussions. Good progress was evident in the area of rapid scans, improvements of operational satellite tracked winds, uniform quality indicators of wind vectors, multi-spectral height assignment and in the reanalyses of archived data for the production of winds with state-of-the-art algorithms.

WORKING GROUP IV : GLOBAL CONTINGENCY PLANNING

The report is presented in section D (page 30-31).

SENIOR OFFICIALS MEETING

J.1 APPOINTMENT OF CHAIRMAN

The CGMS XXIX Senior Officials meeting was convened at 9.00 a.m. on 25 October 2001. Opening the session, Mr. Roberto Sorani, Director of the Italian Meteorological Service and Head of the Italian Delegation to the EUMETSAT Council, welcomed the participants and expressed the appreciation of his service for the many important achievements of CGMS over the years. He was pleased to note that CGMS was now addressing some very important issues affecting the continuation, the coordination and effectiveness of future satellite systems and the Global Observing System and he wished CGMS every success with its future endeavours. On behalf of CGMS, Dr. Tillmann Mohr thanked Mr. Sorani for his kind words and the generous support of the Italian Meteorological Service, which had made the organisation of this CGMS meeting so successful.

Dr. Tillmann Mohr was then unanimously elected Chairman of the Senior Officials Meeting.

J.2 REPORTS FROM THE WORKING GROUPS

Reports from the three Working Groups were presented by their Chairmen: Mr. R. Wolf (WG I on Telecommunications), Dr. P. Menzel (WG II on Satellite Products), and Dr. Xu (WG III on Satellite-Derived Winds). The meeting recalled that the report of WG IV on Global Contingency Planning had been presented by Dr.Mohr under Agenda Item D.

The Senior Officials took note of the reports and thanked the participants, Chairmen and Rapporteurs for their active and fruitful discussions. They endorsed the proposed actions and recommendations formulated by each Working Group. The Senior Officials congratulated the four Working Groups for their comprehensive reports and for their achievements since the preceding meeting of CGMS.

J.3 NOMINATION OF CGMS REPRESENTATIVES AT WMO AND OTHER MEETINGS

The Senior Officials agreed that:

- The CGMS Secretariat will represent CGMS at the CEOS Plenary, November 2001, in Kyoto.
- The CGMS Secretariat will represent CGMS at the WMO Fifty-fourth Executive Council (EC-LIV) from 11-21 June 2002.
- Dr. Johannes Schmetz will represent CGMS at the WMO GSN GUAN meeting in Geneva in the second half of 2002.

Concerning the meetings of the Working Groups at CGMS XXX it was agreed that:

- Mr. Robert Wolf will chair Working Group I on Telecommunications.

- Dr. Bhatia will chair Working Group II on Satellite Products, with Dr. Paul Menzel acting as Rapporteur.
- Dr. Xu will chair Working Group III on Satellite Derived Winds, with Dr. Johannes Schmetz acting as Rapporteur.
- Dr.Tillmann Mohr will chair Working Group IV on Global Contingency Planning, with Dr. Donald Hinsman acting as Rapporteur.

J.4 ANY OTHER BUSINESS

It was noted that whilst the posting of working papers on the CGMS web site prior to the CGMS meetings had generally worked well over recent years, for this meeting, however, several working papers had only been made available during the week prior to the meeting. As a consequence, for some topics, CGMS Members had insufficient time to discuss papers internally and adequately prepare for the meeting. CGMS Members were reminded that their working papers should be made available at least *three weeks prior* to meetings.

Commenting on the shortening of the schedule of the CGMS meeting to three and a half days, WMO expressed concerns over the completeness of the Final Report and completeness of the actions. These concerns were noted by the other Members. Whilst EUMETSAT and USA supported a shortening of meetings to three and a half days, it was generally agreed that it was important for CGMS to agree on a List of Actions at the meeting. USA suggested that, in future, the technical visit could take place just prior to the Senior Official's Meeting, to allow more time for Members to study the draft Final Report.

J.5 SUMMARY LIST OF ACTIONS

(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. The Secretariat to review the tables of current and planned polar and geostationary satellites, and to distribute this updated information, via the WWW Operational Newsletter, via Electronic Bulletin Board, or other means as appropriate.

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

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

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

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

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

(ii) Actions from CGMS XXIX

Action 29.01	USA to provide WMO with a copy of the Principal Components Analysis (PCA) report for the new GOES-12 imager channels, in order to evaluate the possibility of detecting volcanic ash clouds. Deadline: **November 2001.**
Action 29.02	CGMS Members to report at CGMS XXX on discussions within their organisations on the possibility of flying space environment monitoring instruments on next generation geostationary satellites.
Action 29.03	China to provide details of its future X-band broadcast and to inform CGMS XXX how WMO Members could access FY-3 satellite data, using either low-cost user stations or alternative dissemination methods.
Action 29.04	CGMS Members to update Table XX– "Coordination of Data Formats and Frequency Planning for Polar-Orbiting Satellites", with a view to using this table as a reference in the preparation of discussions on mission planning in the polar orbit and contingency during the WMO Consultative Meeting on High Level Policy planned in Geneva in February 2002. Deadline: December 2001.
Action 29.05	EUMETSAT to provide CGMS Members with an outline of a discussion paper on mission planning in the polar orbit and contingency **by the beginning of December 2001.**
Action 29.06	CGMS Members to respond and provide inputs to this document **by mid-January 2002** in view of using this paper as an input to the discussions on mission planning in the polar-orbit and contingency planned during the WMO Consultative Meeting on High Level Policy planned in Geneva in February 2002.
Action 29.07	USA to provide information on the broadcasts available from its NPP satellite to CGMS XXX.
Action 29.08	EUMETSAT to provide details of its ATOVS Retransmission Service to CGMS Members by **December 2001.**
Action 29.09	China to provide details of its internal data retransmission system to CGMS Members by the **end of December 2001.**

Action 29.10 The CGMS Secretariat to make sure that a discussion on a response to GCOS requirements for Global Climate Monitoring products from geostationary satellites is included in the discussions of Working Group II – Satellite Products at CGMS XXX.

Action 29.11 WMO to host a meeting of the CGMS Working Group on Global Contingency Planning, in February 2002 following the Consultative Meeting on High Level Policy, in preparation for further discussions at CGMS XXX.

Action 29.12 CGMS Members to amend, as necessary, contact information for the CGMS Consolidated Report Drafting Committee, and inform the CGMS Secretariat accordingly. **Deadline: November 2001.**

Action 29.13 CGMS Members to submit updated sections of the CGMS Consolidated Report relating to their organisations/ programmes to the CGMS Secretariat, and the CGMS Secretariat to issue a Revised Version of the document on-line. **Deadline: December 2001.**

Action 29.14 CGMS requests the CGMS Virtual Laboratory Focus Group to report on the development of its activities at CGMS XXX.

Working Group I

Action 29.15 CGMS Satellite operators and WMO to coordinate with their responsible Frequency Administrations to ensure that meteorological experts participate at the meetings of ITU WP 8D (8-14 May 2002, Geneva) and ITU WP 7C (11-15 February 2002, Geneva) to support and defend meteorological applications. **Deadline: January 2002.**

Action 29.16 CGMS Members to provide information on planned passive sensors using frequency bands above 275 GHz on future meteorological satellite systems. **Deadline: January 2002.**

Action 29.17 EUMETSAT to distribute the final report of the study on "Passive sensor requirements above 275 GHz" to CGMS Members. **Deadline: February 2002.**

Action 29.18 EUMETSAT to send a letter to ROSHYDROMET explaining the technical details related to the MSG frequency co-ordination problems. **Deadline: November 2001.**

Action 29.19 ROSHYDROMET to contact the responsible frequency administration in Russia to address CGMS concerns related to the notification process of MSG. **Deadline: December 2001.**

Action 29.20 USA to inform CGMS Members on the results of the demonstration of its interference location system (TLS). **Deadline: March 2002.**

Action 29.21 CGMS further consider a four time-slot scenario and WMO provide advice on the need for sounding instruments in the 05:30 a.m. and 17:30 p.m. orbits. **Deadline: CGMS XXX.**

Action 29.22 USA to distribute technical information on low cost L-band antenna systems to CGMS Members. Deadline: February 2002.

Action 29.23 CGMS to establish Terms of Reference for an *ad-hoc* Task Force on Integrated Strategy for Data Dissemination from Meteorological Satellites which will meet in Geneva prior to the next meeting of the Expert Team on Satellite System Utilization and Products. Deadline: April 2002.

Action 29.24 CGMS satellite operators to submit proposals for discussion at the *ad-hoc* Task Force on Integrated Strategy for Data Dissemination from Meteorological Satellites. Deadline: February 2002.

Action 29.25 WMO to inform R & D satellite operators about alternative dissemination methods, at the 2nd WMO Consultative Meeting, being held in Geneva in February 2002.

Working Group II

Action 29.26 Satellite operators to post on the CGMS homepage available relevant papers on satellite radiance (VIS, IR, WV) inter-comparisons and to start routine inter-comparisons of LEO and GEO calibrations as soon as possible, striving to post results every quarter on their own web pages. **Deadline: June 2002.**

Action 29.27 The Chairman OPAG IOS is asked to bring to the attention of the CBS Management Group, as a matter of urgency, the need for a designated CBS Open Programme Area Group with responsibility for the monitoring of satellite data as well as the need for an expert meeting to discuss associated issues. CGMS Members are asked to indicate their willingness, as appropriate, to participate in such a WMO planning meeting. **Deadline: March 2002.**

Action 29.28 WMO to report on Nowcasting user requirements and observing system capabilities and the statements of guidance resulting from a critical review of these; NOAA/NESDIS is requested to report on their experiences using the GOES sounders for Nowcasting applications; and EUMETSAT to report on its process for setting

Nowcasting requirements to be met by their Meteosat Third Generation. **Deadline: CGMS XXX.**

Action 29.29 EUMETSAT and USA report on their plans for developing and supporting Direct Broadcast processing packages for IASI/AVHRR/AMSU and CrIS/VIIRS/ ATMS, respectively, at ITWG (March 2002) and CGMS XXX (October 2002).

Action 29.30 ITWG, at its March 2002 meeting, to (a) summarise the successful characterisation of problems with AMSU-A & B direct broadcast (DB) data (e.g. humidity profiles derived with AMSU-B) and post these on a web site for DB users, (b) characterise the DB profile retrieval packages (three are known to CGMS – AAPP, IAPP, ISDAP), (c) provide an update on the status of using satellite data over land for retrievals and other products, (d) explore the quantitative use of cloud products, (e) discuss the necessity for CO_2 profile measurements for improving atmospheric temperature profile retrieval, and (f) investigate multi-satellite utilisation for profile retrieval, specifically radio occultation with high spectral resolution infrared radiometers.

Action 29.31 Satellite operators to report at CGMS XXX on their monitoring procedures and practices for satellite data and products placed on the GTS using EUM-WP-15 as an example.

Action 29.32 CGMS to invite the EUMETSAT Nowcasting SAF to host the next IPWG meeting in 2002. **Deadline: December 2001.**

Action 29.33 CGMS Members to propose lists of parameters and data which should be contained in "meta-data" to accompany reprocessed data, at CGMS XXX.

Working Group III

Action 29.34 EUMETSAT to report at CGMS XXX on the progress concerning the production of winds from rapid scans and the relevant feedback from users.

Action 29.35 JMA to report on the progress of the experiment using targeted CMW observations around Typhoons and related model impact studies at CGMS XXX.

Action 29.36 The 6th International Winds Workshop to discuss the compatibility of spatial resolution and image repeat cycle for winds tracking and to provide pertinent recommendations to CGMS satellite operators. **Deadline: May 2002.**

Action 29.37 The 6th International Winds Workshop to discuss the template size for tracking features in relation to the question whether the displacement vector represents a local wind vector. A

pertinent recommendation should be provided to CGMS satellite operators. **Deadline: May 2002.**

Action 29.38 The 6th International Winds Workshop to discuss and encourage the use of geometric (and other) height allocation methods for comparison with and validation of multi-spectral infrared height assignment methods of wind vectors which are used operationally. **Deadline: May 2002.**

Action 29.39 The 6th International Winds Workshop to revisit the current concepts of height allocation techniques (e.g. IR-W EBBT, WV intercept, CO_2 slicing and WV EBBT) for assigning atmospheric motion vectors to a single level height and to provide relevant results to CGMS satellite operators. **Deadline: May 2002.**

Action 29.40 The 6th International Winds Workshop to analyse the status of the implementation of quality indicators assigned to wind vectors and to report back to CGMS on current benefit to NWP. **Deadline: May 2002.**

Action 29.41 All CGMS Members to provide feedback on the 'Integrated Satellite Wind Monitoring Report' to Pauline Butterworth (pauline.butterworth@metoffice.com), with copy to the Secretariat **by 31 March 2002.** Comments of general interest should be provided through the CGMS Wind List-Server at WMO.

Action 29.42 USA to report on potential plans for a reprocessing of winds at CGMS XXX.

J.6 APPROVAL OF DRAFT FINAL REPORT

The Senior Officials, together with the Plenary, reviewed the Draft Final Report of the meeting and approved it with minor amendments. 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 by 9 November 2001. It was agreed that CGMS Members would submit any further modifications to the Secretariat by 30 November, at the latest, 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 XXIX Working Papers.

J.7 DATE AND PLACE OF NEXT MEETINGS

CGMS was pleased to accept an offer from India to host CGMS XXX in Bangalore, with a provisional date being the week commencing 28 October 2002.

The Chairman thanked all participants for their cooperation and fruitful participation in the 29th meeting of CGMS, adding that there had been many important and interesting discussions during the Working Group and Plenary sessions. He also thanked the Rapporteurs and Secretariat for preparing the Final Report. Participants thanked EUMETSAT for a very efficient and productive meeting, and for hosting the meeting in such a beautiful location. The meeting adjourned at 14.15 hours on 25 October 2001.

ANNEXES:

AGENDA OF CGMS XXIX
22 – 25 October 2001

---------- 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 (item F from Plenary)
I/3.1 Status and Problems of IDCS
I/3.2 Ships, including ASAP
I/3.3 ASDAR
I/3.4 Dissemination of DCP messages (GTS or other means)
I/4 Coordination of Data Dissemination
I/4.1 Dissemination of satellite images via satellite
I/4.2 Dissemination of satellite products via satellite, GTS or other means
I/4.3 Global exchange of satellite image data via satellite or via the GTS
I/5 Conclusion and preparation of the WG report

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 Training (item H.4 from Plenary)
II/8 Conclusion and preparation of the WG Report

WORKING GROUP III: SATELLITE TRACKED WINDS

III/1 Preparation of the 5th 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: GLOBAL CONTINGENCY PLANNING

AGENDA OF CGMS XXIX
22 – 25 October 2001

---------- PLENARY SESSION ----------

A. INTRODUCTION

A.1 Welcome
A.2 Election of Chairman
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 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 Reconfiguration of future combinations of LEO and GEO missions

D. OPERATIONAL CONTINUITY AND RELIABILITY

D.1 Global planning, including orbital positions
D.2 Inter-regional contingency measures
D.3 Long-term global contingency planning

E. SATELLITE REQUIREMENTS OF WMO PROGRAMMES

E.1 World Weather Watch
E.2 Other Programs

F. COORDINATION OF INTERNATIONAL DATA COLLECTION & DISTRIBUTION (discussed in WG I under I/3)

G. COORDINATION OF DATA DISSEMINATION (discussed in WG I under I/4)

G.1 Dissemination of satellite images via satellite
G.2 Dissemination of satellite products via satellite, GTS or other means
G.3 Global exchange of satellite image data via satellite or via the GTS

H. OTHER ITEMS OF INTEREST

H.1 Applications of Meteorological Satellite Data for Environment Monitoring
H.2 Search and Rescue (S&R)
H.3 Meteorological Data Distribution via satellite
H.4 Training (discussed in WG II under II/7)
H.5 Information
H.6 Any other business

J. FINAL SESSION

J.1 Appointment of Chairman of final session
J.2 Reports from the Working Groups
J.3 Nomination of CGMS Representatives at WMO and other meetings
J.4 Nomination of Chairmen of Working Groups for CGMS XXX
J.5 Any Other Business
J.6 Summary List of Actions from CGMS XXIX
J.7 Approval of Draft Final Report
J.8 Date and Place of Next Meetings

LIST OF WORKING PAPERS SUBMITTED TO CGMS-XXIX

ESA

ESA-WP-01	Status of the ESA Earth Observation Missions	C.1

EUMETSAT

EUM-WP-01	Review of Action Items	A.5
EUM-WP-02	Status of the Meteosat System	B.2
EUM-WP-03	EPS Programme and Development Status	C.1
EUM-WP-04	Status of Preparation of MSG	C.2
EUM-WP-05	Network of EUMETSAT Satellite Applications Facilities	C.2
EUM-WP-06	Towards an updated/upgraded Global Observing System	C.3
EUM-WP-07/08	Status and Problems of the IDCS	I/3.1 (F.1)
EUM-WP-09	Report on EUMETSAT Training Activities	II/7 (H.4)
EUM-WP-10	Preparation for the Use of MSG in Africa (PUMA) – Status of Project	H.5
EUM-WP-11	EUMETSAT Conferences and Publications	H.5
EUM-WP-12	Update of on-line version of CGMS Consolidated Report	H.5
EUM-WP-13	Preparation of the World Radio Conference 2003	I/1
EUM-WP-14	Results from EUMETSAT IR and WV satellite inter-calibration work	II/2
EUM-WP-15	Report on monitoring procedures for products	II/4
EUM-WP-16	Report on BUFR encoding of satellite-tracked wind products	III/1
EUM-WP-17	Operational multi-spectral methods for the height assignment of cloud-tracked winds	III/1
EUM-WP-18	Status of archive data reprocessing at EUMETSAT	II/6
EUM-WP-19	Status of EUMETSAT Unified Archive and Retrieval Facility (U-MARF).	II/6
EUM-WP-20	Report on experiments on targeted observations.	III/1
EUM-WP-23	Performance of Meteosat-7 black body calibration.	II/2
EUM-WP-24	Performance of Meteosat-5 calibration using a satellite cross calibration technique.	II/2
EUM-WP-21	Update on rapid scan schedules and applications.	III/3
EUM-WP-22	Meta-data required for satellite data reprocessing for climate applications	II/6
EUM-WP-25	Update on the NWP SAF integrated satellite winds monitoring report.	III/4
EUM-WP-26	The ATOVS Retransmission Service.	II/3
EUM-WP-27	CGMS Working Group on Cloud Motion Winds: Report at CGMS XXIX	III/1

INDIA

IND-WP-01	Status of Indian National Satellite (INSAT) System	B.2

IND-WP-02	Results of recent improvements in the quality of operational derived CMVs from INSAT data	III/4
IND-WP-03	Use of Microwave Remote Sensing Data Products derived from IRS-P4 for Meteorological Applications	II/4
IND-WP-04	Qualitative Preceptation Estimates for various Meteorological Sub-divisions of India derived from IR data of INSAT	II/4
IND-WP-05	Review of Action Items from CGMS XXVIII	A.5
IND-WP-06	India's experience on stray light contribution in CCD payload of INSAT-2E and technical approach used to avoid it on future satellites	B.2

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	Future Plan on Multi-functional Transport Satellites	C.2
JPN-WP-04	Status and Problems of the GMS IDCS	I/3.1 (F.1/F.4)
JPN-WP-05	Schedules of MTSAT-1R Observations and Image Data Dissemination	G.1
JPN-WP-06	Promotion of Satellite Data Exchange and Utilization in Asia-pacific Region	G.2
JPN-WP-07	Improvement of CAL Systems in JMA	II/7 (H.4)
JPN-WP-08	Activities for the Establishment of Virtual Laboratory in JMA	II/7 (H.4)
JPN-WP-09	A Training Plan for MTSAT/LRIT Data Utilization	II/7 (H.4)
JPN-WP-10	Preparation for WRC-2003 and Report of JMA Activities on the Frequency Matters	I/1 I/3
JPN-WP-11	Present Status of Intercalibration Activities in MSC/JMA	II/2
JPN-WP-12	Quality Check and BUFR Encoding for the Exchange of Cloud Motion Winds	III/4
JPN-WP-13	Height Assignment of Cloud Motion Wind for Semi-transparent Clouds in JMA	III/4
JPN-WP-14	Re-processing of Cloud Motion Wind	III/4
JPN-WP-15	Impact Experiment on NWP with Rapid Scan CMW	III/4

PEOPLE'S REPUBLIC OF CHINA

PRC-WP-00	Review of Action Items from Previous CGMS Meetings	A.5
PRC-WP-01	Current Status of FY-1C	B.1
PRC-WP-02	Current Status of FY-2B and FY-2A Satellites	B.2
PRC-WP-03	Automatic Navigation of FY-2 Geosynchronous Meteorological Satellite Images	B.2
PRC-WP-04	FY-1D Meteorological Satellite Ready for Launch	C.1
PRC-WP-05	Development of FY-3A Meteorological Satellite	C.1
PRC-WP-06	Plan for Developing Chinese FY-2C Geostationary Meteorological Satellite	C.2

PRC-WP-07	NSMC Products On-line	II/7(H.4)
PRC-WP-08	Height Assignment Method in the NSMC Wind Derivation Scheme	III/1

RUSSIAN FEDERATION

RUS-WP-00	Review of action items from previous CGMS meetings	A.5
RUS-WP-01	Status of Russian polar-orbiting meteorological satellite system	B.1
RUS-WP-02	Status of preparation of METEOP-3M N1 polar-orbiting meteorological satellite	C.1
RUS-WP-03	Future geostationary meteorological satellite GOMS/Electro N2	C.2
RUS-WP-04	Status of preparation of Russian DCS	I/3 (F.1)
RUS-WP-05	Roshydromet activities on frequency coordination and protection Preparation to WRC 2003	I/1
RUS-WP-06	Russian State Archive of Satellite Data.	II/6
RUS-WP-07	Regional temperature/ humidity soundings of the atmosphere NOAA-16 ATOVS measurement	II/3
RUS-WP-08	Arctic sea ice satellite monitoring	II/4

USA

USA-WP-01	Review CGMS XXVIII 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	USA Considerations for stray light in the CMA Radiometer	B.2
USA-WP-05	USA Consideration for meeting the WMO Requirements for Satellite Images in the Southern hemisphere	B.2
USA-WP-06	Anomalies from Solar Events	B.3
USA-WP-07	Report on the Geosynchronous Imaging Fourier Transform Spectrometer (GIFT) Instrument	C.2
USA-WP-08	Future Polar Orbiting Meteorological Satellite System	C.1
USA-WP-09	Availability of NPOESS Level 1-B Data	C.1
USA-WP-10	Report on the status of future Geostationary Meteorological Satellite System	C.2
USA-WP-11	Status and Problems of IDCS	I/3 (F.1)
USA-WP-12	Dissemination of DCP messages (GTS or other means)	I/3.4 (F.4)
USA-WP-13	The Current Status of the GOES LRIT Service	G.1
USA-WP-14	LRIT Operational Capabilities Requirements	G.1
USA-WP-15	LRIT Receiver Specification	G.1
USA-WP-16	LRIT Transmitter Specification	G.1
USA-WP-17	LRIT System Performance	G.1
USA-WP-18	LRIT System Transition and Test Plans	G.1
USA-WP-19	SARSAT System Overview and Performance	H.2
USA-WP-20	Updates for the CEOS/WMO Database	A.5
USA-WP-21	Updates for WMO Tables on Satellites Operations and Services	G.1

USA-WP-22	Status and Plans of Future GVAR and VISSR Stations	I/1
USA-WP-23	Technical Input to the Space Frequency Coordination Group and ITU-R	I/1
USA-WP-24	Technical Information on Interference between MTSAT and GOES	I/1
USA-WP-25	ITU Cost Recovery for Satellite Network Filing	I/1
USA-WP-26	Status on the Development and Implementation of a TLS for DCS	I/1
USA-WP-27	Report on SFCG-20 Meeting	I/1
USA-WP-28	Intercalibration of Geostationary and Polar-orbiting Infrared and Water Vapor Radiances	II/2
USA-WP-29	Report on the ITOVS Working Group	II/2
USA-WP-30	Report on the Availability of SSMIS Data	II/3
USA-WP-31	2000/2001 Report on NOAA/NESDIS Satellite Derived Winds	III/1
USA-WP-32	2000/2001 Report 0n NOAA/NESDIS GOES Soundings	II/3
USA-WP-33	Cloud Motion Vector Height Assignment Techniques	III/4

WMO

WMO-WP-01	CGMS satellite ground receiving database	H.5
WMO-WP-02	Review of action items from previous CGMS meetings	A.5
WMO-WP-03	Matters related to APT/WEFAX and conversion	G.1
WMO-WP-04	CGMS list-servers	H.5
WMO-WP-05	Global Contingency Planning	IV/1
WMO-WP-06	Coordination of data formats and frequency planning for polar-orbiting satellites	I/1
WMO-WP-07	Redesign of the WWW Global Observing System	E.1
WMO-WP-08	Review of satellite related WMO publications	H.5
WMO-WP-09	ASDAR status report	I/3.3 (F.3)
WMO-WP-10	WMO code form changes	II/5 (G.2)
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 (F.2)
WMO-WP-14	International Precipitation Working Group	II/
WMO-WP-15	WMO Executive Council Consultative Meetings	H.5
WMO-WP-16	Other programmes, Joint WMO/IOC Technical Commission	E.2
WMO-WP-17	Virtual Laboratory Focus Group	H.5
WMO-WP-18	Regional Contingency Plans	IV/1
WMO-WP-19	Nomination of CGMS representatives at WMO and other meetings	J.3
WMO-WP-20	Future Monitoring Policy for IPS	II/3
WMO-WP-21	WMO Activities towards the redesign of the Global Observing System	E.1

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APPENDIX A: ADDITIONAL INFORMATION SUBMITTED TO CGMS XXIX

Appendix A-1 **Table 1 and 2 of EUM-WP-06**

Appendix A-2 **Draft Preliminary Terms of Reference for the CGMS *Ad hoc* Task Force on Integrated Strategy for Data Dissemination from Meteorological Satellites**

Appendix A-3 **Structure and Goals for the CGMS Virtual Laboratory Focus Group**

TABLE 1 AND 2 OF EUM-WP-06

Table 1 of EUM-WP-06
"Manifest" of developments/demonstrations to be taken over for operational follow-on
(Background: GOES, MSG, MTSAT, GOMS, F-2, INSAT, NOAA/NPOESS, METOP, METEOR, FY-1 in < 2015; NPOESS in > 2015)

System	Improved parameters	Instrumentation
All GEO's upgraded (> 2015) **+** **GEO SmallSat (> 2008).**	Temperature, humidity, ozone profiles, winds at specified heights. Atmospheric instability index, tropopause height/temperature, height of PBL top. Cloud pattern, cover, type, top temperature and height. Sea-surface temperature, land surface temperature, permafrost, fires. Short- and long-wave outgoing radiation at TOA. Earth surface short-wave radiation/reflectance, long-wave radiation/emissivity. Products from 4-D assimilation (specifically: wind profile and precipitation field).	Frequent-sounding IR imaging spectrometer exploiting Large Focal Plane Array detectors. Fast VIS/IR imager. ERB radiometer. Short-wave channels.
	Precipitation rate and index.	Lightning mapper.
	All-weather temperature and humidity frequent sounding. Cloud water, cloud ice and precipitation frequent sounding.	MW/Sub-mm radiometer.
MediumSat (post-METOP) (> 2015) **+** **SmallSat for Clouds and Radiation (> 2008).**	Temperature, humidity and ozone profiles; total columns of key trace gases. Cloud pattern, cover, type, top temperature and height. Sea/land/ice surface temperatures, sea-ice cover, icebergs, NDVI, fires. Profiles or total columns of selected key trace gases.	IR/MW sounder. UV/VIS/NIR spectrometer. Improved VIS/IR imager. Narrow-band spectrometer.
	Sea-surface wind and temperature, sea-ice cover and surface temperature. Icebergs, glacier cover, snow cover and melting conditions. Precipitation rate, precipitation index.	MW radiometer with multi-polarisation and multi-viewing.
	Cloud pattern, cover, type, top temperature, height, optical thickness, drop size. Cloud water, cloud ice and aerosol profiles; aerosol size. Short- and long-wave outgoing radiation at TOA. Earth surface short-wave radiation/reflectance, long-wave radiation/emissivity. NDVI, LAI, PAR, FPAR (large scale).	Imagers covering UV, VIS, NIR, SWIR, MWIR, TIR, FIR and Sub-mm, with multi-polarisation and multi-viewing.
MiniSat for ocean Topography (> 2008).	Significant wave height, sea level, ocean topography, geoid. Polar ice thickness and sheet topography.	Medium-class altimeter (follow-on of Jason).
SmallSat for wind Profile (> 2015).	Wind profile in clear air. Aerosol profile (large scale).	Doppler lidar (follow-on of Aeolus).
SmallSat for salinity & moisture (> 2008).	Ocean salinity (large scale). Soil moisture (large scale).	Low-frequency MW radiometer.
Mini-satellites constellation (> 2008).	Temperature/humidity profile, heights of tropopause and PBL top. Total Electron Content and Electron density profile. Precipitation rate, precipitation index. Short- and long- wave outgoing radiation at TOA. Significant wave height (sea-state).	Radio-occultation sounder. MW radiometer. Lightning mapper ERB radiometer. Large-swath altimeter.

Table 2 of EUM-WP-06
"Manifest" of data of operational interest from R&D or commercial programmes

No.	Recommendation	Remark
04	Active sensing of water vapour by DIAL for high-vertical resolution profiling should be pursued, primarily for research purposes, procuring that data are accessible for operational use.	New development Requested.
05	Temperature profiles in the higher stratosphere from missions oriented to atmospheric chemistry exploiting limb sounders should be made available for operational use.	Permanent requirement.
09	Any wind profile data available from experimental satellites, e.g., by passive Doppler spectroscopy of the upper atmosphere, should be made available for operational use.	Permanent requirement.
11	Wind profiles from Doppler lidar technology demonstration programmes must be made available for operational use.	Interim requirement waiting for a SmallSat
15	Profiles of species other than ozone, and total columns of species requiring instrumentation exceeding the operational one, as well as high-vertical resolution ozone by DIAL lidar, should be made accessible from scientific programmes for operational use.	Permanent requirement.
18	Accurate measurements of cloud top height and observation of cloud base height performed by research satellites should be made available for operational use.	Permanent requirement.
19	Data from the Global Precipitation Mission must be made available for operational use, and arrangements should be sought to ensure long-term continuity to the system.	Permanent requirement.
24	An exploratory mission should be implemented, to collect spectral information in the Far IR region, with specific emphasis on water vapour profiling significant of the UT/LS region, and on improved knowledge of the water vapour continuum.	New development Requested.
25	Data from process study missions on clouds and radiation as well as from R&D multi-purpose satellites addressing Earth's surface characterisation and aerosol should be made available for operational use.	Permanent requirement.
26	Till the advent of NPOESS, high-quality sea-surface temperature data from R&D satellites must be made available for operational use, specifically for climate monitoring.	Interim requirement waiting for NPOESS
29	In the near and mid term future, sea-surface wind data from R&D satellites must be made available for operational use, and relevant satellites programmes should possibly be coordinated so that a two-satellite coverage is achieved.	Interim requirement waiting for NPOESS.
31	Data from geodetic-class radar or lidar altimeters from R&D satellites should be made available for operational use, specifically for the cryosphere.	Permanent requirement.
33	Data from SAR for wave spectra and other observations of ocean and ice should be acquired from R&D and commercial satellite programmes for operational use.	Permanent requirement.
34	In the near and mid term future, ocean colour data from R&D satellites must be available for operational use. In the NPOESS era, continued access may be useful for specific purposes, particularly in coastal zones.	Interim requirement waiting for NPOESS, continued in coastal zones.
36	Observations of ocean salinity from R&D satellites with horizontal resolution suitable for applications in coastal zones should be made available for operational use.	Permanent requirement.
37	SAR observation data of land snow and ice from R&D and commercial satellites should be made available for operational use.	Permanent requirement.
39	In the near and mid term future, vegetation data from R&D and commercial satellites must be available for operational use. In the NPOESS era, continued access may be useful for small-scale applications.	Interim requirement waiting for NPOESS, continued for small-scale applications.
40	High-resolution optical and SAR imagery data of use for agrometeorology and hydrogeology should be procured from R&D and commercial satellites.	Permanent requirement.
42	Observations of soil moisture from R&D satellites with horizontal resolution suitable for small-scale applications should be made available for operational use.	Permanent requirement.

DRAFT PRELIMINARY TERMS OF REFERENCE FOR THE CGMS *AD HOC* TASK FORCE ON INTEGRATED STRATEGY FOR DATA DISSEMINATION FROM METEOROLOGICAL SATELLITES

GOAL: To establish an integrated data dissemination strategy which will maximize access to all data from all CGMS satellites, taking into account direct broadcast and alternative dissemination methods, and including appropriate transition strategies.

In achieving this goal, the Task Force will:

1. review CGMS satellite operation plans for data dissemination from present and planned satellite systems.

2. evaluate the potential volume of data to be disseminated.

3. evaluate Alternate Dissemination Methods (ADM) presently in effect.

4. consider WMO's requirement for an integrated strategy for data dissemination and ADM.

5. propose possible ADM.

6. propose interconnectivity between regional ADM.

This strategy to be reviewed at CGMS XXX.

STRUCTURE AND GOALS FOR THE CGMS VIRTUAL LABORATORY FOCUS GROUP

Management structure

Co-chaired by one satellite operator and one representative from the "centres of excellence". Served by the WMO Satellite Activities Office as the Secretariat. Membership should include:

- representatives of science teams as appropriate;
- remaining satellite operators and "centres of excellence";
- other interested parties as appropriate.

VL Strategic Goals

(1) To provide high quality and up-to-date training resources on current and future meteorological and other environmental satellite systems, data, products and applications;

(2) To enable the "centres of excellence" to facilitate and foster research and the development of socio-economic applications at the local level by the NMHS through the provision of effective training and links to relevant science groups.

VL Immediate Goal

(1) To implement a baseline VL and to foster its logical growth.

VL Connectivity Goal

(1) To assure links between the 6 "centres of excellence" (and supporting satellite operators) with a **minimum** data rate of 56 kbs, to support communication (email, voice), the exchange of software and limited image data sets (e.g. case studies and some near real-time data sets);

(2) "Centres of excellence" to consider means to increase link capacity to a minimum of T-1 within 5 years;

(3) A preferred method in the short-term would be the direct insertion of data from a ground receiving station into the Virtual Laboratory servers. As an alternative, the Internet can be used to route data and products to the VL servers.

Virtual Resource Library (VRL) Goals

(1) To establish a list of usable training resources (includes image data sets, s/w, tools);

(2) To implement a structure for the depository of training resources which will allow easy access by the "centres of excellence" trainers;

(3) To populate this structure with a core set of material from the training resources list;

(4) To consider a more general access to the resource library by students (forecasters);

(5) To consider the provision of additional (enhanced) material from the resource library to all 6 "centres of excellence".

VL Utilization Goals

(1) To establish a VL user tracking and feedback mechanism, from the outset, (for analysis, refinement, reporting to VL management, and to assess overall usefulness);

(2) To keep abreast of user requirements for the VL (baseline being WMO Pub No. 258). Assume: analysis of user responses focused on education and training to questionnaires within their region and other user feedback is carried out by "centres of excellence" and results are reported to VL management;

(3) To train meteorological students to an operational level of expertise as well as to allow daily weather discussions during training events, near real-time data and products are a strong requirement. Near real-time data are needed to train forecasters on the effective use of new satellite reception and processing systems. Depending on the application, the need for near real-time data availability may not be as stringent.

Long-Term Evaluation of the VL

(1) After five years, conduct a comprehensive review of the VL.

Typical activities to be undertaken to meet the goals

- Consolidate documentation of the range of skills/competencies for operational meteorologists and specialists;
- Examine which online (Web-based learning), Computer Aided Learning. CDs and hard copy learning materials are currently available for use in the Virtual Laboratory. This activity will include contacting groups such as ASMET, COMET, CIRA, EuroMET, BMTC and CIMSS who have complementary projects under way and relevant science groups (such as the EUMETSAT SAFs, the TOVS Working Group, the Winds Working Group and the proposed quantitative precipitation working group);
- Negotiate with the copyright holders of the training material rights to either link to their material and/or to acquire the rights to use their material at the

designated centres of satellite training expertise (this includes the centres making the material available to on- and off-site users);

- Working with groups such as ASMET, COMET or EuroMET, design and test possible user interfaces, educational approaches for delivering the material, and examine methods for online tracking of student participation;
- On a trial basis, evaluate the proposed Virtual Laboratory material in conjunction with one of the WMO satellite training workshops for more user feedback;
- Incorporate user feedback into the educational approach and review the content of the Virtual Laboratory;
- Move to a wider implementation of the material;
- Undertake a periodic review of the Virtual Laboratory sites in conjunction with reviews of the skills and competencies of the operational meteorologists and specialists;
- Prepare sample data sets for the various data streams now being provided or planned for in the near future. The data sets would be used within the VL concept;
- Provide for continuous monitoring of user requirements for Education and Training as well as the effectiveness of the Virtual Laboratory.

IMPLEMENTATION PLAN

Action items:

Prepare an inventory of which training resources and materials are presently available for the core VRL by the end of July 2001 and provide response to J. Wilson (Wilson and all VL participants).

Each satellite operator should identify which data and products could be linked into the core VRL by the end of July 2001 and provide information to R. Francis (Francis and satellite operators).

CIRA to establish a web server for an initial set near real time data and products by the end of November 2001 and report to the VL list-server (Purdom).

EUMETSAT to establish a server for an initial site for training resources and materials by the end of July 2001 and report to the VL list-server (Francis).

Additional specific actions and timetable:

0 to 1 year

- During the next 6 months, all “centres of excellence” to evaluate content, and how and what can be maintained on a server at the “centre”;
- Train satellite operators and “centres of excellence” on the use of RAMSDIS using VISITview;

- Increase training event effectiveness through the use of VISITview;
- Add the SATAID training resource to the VRL and utilize VISITview on the use of that tool.

1 to 2 years

- Within 1 ½ years, all satellite operators to strive to have a server online and connected to the VL;
- Each "centre of excellence" will strive to have a server online and connected to the VL;
- To establish a voice channel capability within VISITview;
- To evaluate and find ways to improve the VRL;
- To evaluate the quality of submitted materials by the "centres of excellence", completeness (e.g., speaker notes), appropriate deletion dates, compatibility issues, and virus protection.

5 years

- Conduct comprehensive review

APPENDIX B: GENERAL CGMS INFORMATION

CHARTER FOR THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES (CGMS)

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 Organization (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 harmonized 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 worldwide , 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,

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, such as reporting on current meteorological satellite status and future plans, telecommunications matters, operations, inter-calibration 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, data formats and downlink frequencies.

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

MEMBERSHIP

d) CGMS Membership is open to all operators of meteorological satellites, to prospective operators having a clear commitment to develop and operate such satellites, and to the WMO, because of its unique role as representative of the world meteorological data user community.

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

The table of Members shows the lead Agency in each case. Delegates are often supported by other Agencies, for example, ESA (with EUMETSAT), NASDA (with Japan Meteorological Agency) and SRC Planeta (with Hydromet Service of the Russian Federation).

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LIST OF ABBREVIATIONS AND ACRONYMS

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)
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
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
ATMS	Advanced Technology Microwave Sounder
ATOVS	Advanced TOVS
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
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
CEOS	Committee on Earth Observation Satellites
CEPT	Conference Européenne des Postes et Télécommunications
CGMS	Coordination Group for Meteorological Satellites
CHRPT	Chinese HRPT (FY-1C and D)
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
CLS	Collecte Localisation Satellites (Toulouse)
CMD	Cyclone Warning Dissemination Service
CMS	Centre de Météorologie Spatiale (Lannion)
CMV	Cloud Motion Vector
CMW	Cloud Motion Wind
COSPAR	Committee on Space Research

CPM	Conference Preparatory Meeting (WRC)
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
DIF	Directory Interchange Format
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)
DWS	Disaster Warning System (India)
EARS	ATOVS Retransmission Service
EBB	Electronic Bulletin Board
EC	Executive Council (WMO)
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)
ENVISAT	ESA future polar satellite for environment monitoring
EO	Earth Observation
EOS	Earth Observation System
EPS	EUMETSAT Polar System
ERBE	Earth Radiation Budget Experiment
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
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
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)
GOMS	Geostationary Operational Meteorological Satellite (Russ. Fed.)
GOS	Global Observing System
GSLMP	Global Sea Level Monitoring Programme
GPCP	Global Precipitation Climatology Project
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
HiRID	High Resolution Imager Data
HIRS	High Resolution Infrared Sounder
HR	High Resolution
HRDCP	High Rate DCP
HRPT	High Rate Picture Transmission
HSRS	High Spectral Resolution Sounder (MSG)
ICWG	International Coordination Working Group (EO)
IDCP	International DCP
IDCS	International Data Collection System
IDN	International Directory Network (CEOS)
IFRB	International Frequency Registration Board
IKFS-2	advanced IR atmospheric sounder
IMT-2000	International Mobile Telecommunication 2000 (before FPLMTS)
INSAT	Indian geostationary satellite
IPO	Integrated Program Office (NOAA)
IPOMS	International Polar-orbiting Meteorological Satellite Group
IR	Infrared
IRTS	Infrared Temperature Sounder (EPS)
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
ITT	Invitation to Tender
ITU	International Telecommunication Union
ITWG	International TOVS Working Group
IWW	International Winds Workshop
JMA	Japan Meteorological Agency
JRA-25	“Japanese Re-Analysis 25 years " JMA research project of long-range re-analysis of global atmosphere
LR	Low Resolution
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
MDD	Meteorological Data Distribution (Meteosat)
MDUS	Medium-scale Data Utilization Station (for GMS S-VISSR)
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
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)
NASA	National Aeronautics and Space Agency
NASDA	National Space Development Agency of Japan
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
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service (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)
OWSE-AF	Operational WWW Systems Evaluation for Africa
PC	Personal Computer
POEM	Polar-orbiting Earth Observation Mission (ESA)
POES	Polar-orbiting Operational Environmental Satellite (USA)
PRC	People's Republic of China
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)
RMS	Root Mean Square
RMTC	Regional Meteorological Training Centre (WMO)
Rosaviakosmos	Russian Space Agency
RSMC	Regional Specialised Meteorological Centre
RSO	Rapid Scan Operations (NOAA)
RSS	Rapid Scan Service (EUMETSAT)
S&R	Search and Rescue mission
SAM	Satellite Anomaly Manager
SAF	Satellite Application Facility (EUMETSAT)
SAFISY	Space Agency Forum on the ISY
SARSAT	Search And Rescue, Satellite supported facility
SATOB	WMO code for Satellite Observation
SBUV	Solar Backscattered Ultra Violet (ozone)
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)
SRF	Spectral Response Function
SRS	Space Research Service (frequency regulation)
SSP	Sub-Satellite Point
SST	Sea Surface Temperature
SSU	Stratospheric Sounding Unit
S-VISSR	Stretched VISSR
TD	Technical Document
TIROS	Television Infrared Observation Satellite

TOMS	Total Ozone Mapping Spectrometer
TOVS	TIROS Operational Vertical Sounder
TPW	Total Precipitable Water
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
VAS	VISSR Atmospheric Sounder
VHF	Very High Frequency
VIIRS	Visible Infrared Iamging 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
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)