W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

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COMMISSION FOR BASIC SYSTEMS

OPEN PROGRAMME AREA GROUP ON INTEGRATED OBSERVING SYSTEMS

EXPERT TEAM ON SATELLITE UTILIZATION AND PRODUCTS

SIXTH SESSION

GENEVA, SWITZERLAND

12-16 DECEMBER 2011

Regulation 42

Recommendations of working groups shall have no status within the Organization until they have been approved by the responsible constituent body. In the case of joint working groups the recommendations must be concurred with by the presidents of the constituent bodies concerned before being submitted to the designated constituent body.

Regulation 43

In the case of a recommendation made by a working group between sessions of the responsible constituent body, either in a session of a working group or by correspondence, the president of the body may, as an exceptional measure, approve the recommendation of behalf of the constituent body when the matter is, in his opinion, urgent and does not appear to imply new obligations for Members. He may then submit this recommendation for adoption by the Executive Council or to the President of the Organization for action in accordance with Regulation 9(5).

EXECUTIVE SUMMARY

The sixth session of the Expert Team on Satellite Utilization and Products (ET-SUP) was convened in Geneva, Switzerland from 12 to 16 December 2011.

Primary objective of the session was to advance the work programme defined by the CBS as concerns in particular the promotion of access and use of satellite data by WMO Members in support of all WMO programmes and WMO co-sponsored programmes.

Among its major outcomes, the session:

- Provided guidance for accessing and using new satellite capabilities;
- Discussed, and provided guidance to, advancing global data dissemination through IGDDS, RARS and GEONETCast;
- Developed a procedure for establishing regional requirements for satellite data and products;
- Revised regulatory and planning material for the GOS (EGOS-IP, Manual) from the perspective of satellite utilization and training, and addressed WIGOS objectives;
- Identified major contributions to the Global Framework for Climate Services through the coordinated generation of satellite climate data records and the emerging architecture for climate monitoring from space;
- Provided substantial guidance on implementing the biennial survey among WMO Members on satellite utilization in 2012;
- Discussed important developments in user training and capacity building, including the Virtual Laboratory for Education and Training in Satellite Meteorology, the GOES-R Proving Ground programme, COSPAR activities, and in relation to space weather-related applications.

From left to right:

Front row: Ignatius Gitonga Gichoni, Lars-Peter Riishojgaard, Luiz Machado, Stephan Bojinski, Suman Goyal, Anthony Mostek
Second row: Hiroshi Kunimatsu, Barbara Ryan, Jean-Louis Fellous, Xiang Fang, Oleg Milekhin
Third row: Nils Hettich, Jerome Lafeuille, Volker Gärtner
Fourth row: Sally Wannop, Anthony Rea

1. ORGANIZATION OF THE SESSION

1.1 Opening of the Session

The meeting opened at 09.00 on Monday 12 December 2011 in Room 7 Lake in WMO Headquarters, Geneva, Switzerland. The meeting was chaired by Luiz Machado (See list of participants in Appendix I).

W. Zhang, Director of the WMO Observation and Information Systems Department, welcomed all participants on behalf of WMO Secretariat. In his opening remarks, he stressed the importance of ET-SUP in providing guidance in light of the challenges many WMO Members face in making optimum use of the substantial satellite assets available today through the space-based Global Observing System. Bridging the gap between satellite data providers and users requires continued attention 'downstream' the data processing and utilization chain. He highlighted discussions in this regard held at the 2nd Asia-Oceania Meteorological Satellite Users Conference and emphasized the importance of regional initiatives in defining their requirements for satellite data, products and training.

The objective of the sixth session of ET-SUP was to advance the work programme defined by the CBS as concerns in particular the promotion of access and use of satellite data by WMO Members in support of all WMO programmes and WMO co-sponsored programmes. The session built on the outcome of ET-SUP-5 held on 15-19 March 2010, discussed results of the actions taken since, and took decisions for the final phase of its work programme in view of CBS-XV in September 2012.

1.2 Adoption of the Agenda

The provisional agenda was adopted, as contained in Appendix II.

1.3 Working Arrangements for the Session

The work of the session was conducted in Plenary and in break-out groups as required. Working documents were available before the meeting, in electronic form only, through the ET-SUP-6 webpage: http://www.wmo.int/pages/prog/sat/meetings/ET-SUP-6.php.

2. CHAIRMAN'S REPORT

The ET-SUP Chairman reported on major relevant activities since the last ET-SUP session and provided his guidance for the session.

He thanked ET-SUP and the Space Programme Secretariat for the work done during this year and highlighted that all but two of the 27 actions and 16 recommendations agreed at the last session of the Team had been addressed.

From the last ET-SUP up to now, the Team's recommendations and actions were brought to the attention of several meetings (Implementation/Coordination Team on the Integrated Observing System (ICT-IOS), Commission for Basic Systems (CBS), Coordination Group for Meteorological Satellites (CGMS), World Meteorological Congress) that approved, validated and/or addressed the recommendations and actions. Moreover, these meetings also discussed the evolution of the Global Observing System and prepared the Implementation Plan for the Evolution of the GOS.

The ICT-IOS drafted an update of the ET-SUP Terms of Reference (ToR) which was subsequently approved by CBS, and the ET-SUP work plan for 2009-2012 was finalized. These two documents clearly frame the focus of ET-SUP activities, the ToR defined the broad lines of the

Team's activities and the work plan described the tasks, the deliverables and the status of specific actions.

The Chair emphasized that space-based activities were at the crossroads: there was an ambitious plan for the Global Observing System (GOS) in 2025 that the users needed to prepare for. Since new generations of operational satellites were scheduled to be launched in the next 5-6 years, large changes from the user side would be necessary, for example in accessing, processing, and analyzing data. In addition, the value of sustained research satellites and satellite constellations for operational purposes has been demonstrated, and upcoming satellites hold further promise in this regard. However, users need to prepare for these changes through early announcement and training. Furthermore, increased interest in space weather data and future space weather satellites would result in a new set of applications and data reception systems

In line with the ET-SUP work plan, a Vision for Satellite Utilization and Products in Support of the WIGOS, consistent with the Vision for the GOS 2025, should be prepared, and corresponding elements should be included in the Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP).

The possibility of the users to discuss with data providers and prepare regional requirements for satellite data would add new value of the data and products to users.

For this session, the Chair highlighted some specific actions:

- Prepare the user community to the new generation of satellites and satellite constellations;
- Include user needs in the Implementation Plan on the Evolution of Global Observing Systems (EGOS-IP);
- Integrate operations and research from the user's perspective;
- Expand the concept of data requirements to all regions;
- Improve the knowledge of satellite users needs;
- Integrate satellite training efforts in the use of DVB-S and the new satellite generation;
- Support the development of freeware and open source algorithms to process satellite data, generate products, and visualize and integrated data systems;
- Expand the RARS concept to hyperspectral sounding.

He looked forward to discussing all these topics and collected our input in order to jointly prepare a new set of actions and recommendations. These would help us bridging the gap between the potential use of satellite data and their current actual use. He concluded that these were ambitious goals that would require efforts from ET-SUP members and the support of the WMO Space Programme office.

The Team stressed that for each new satellite mission, sufficient funding must be reserved for ensuring user preparedness, for providing training, and for guaranteeing a ground segment that supports data utilization and long-term data preservation.

3. GUIDANCE FROM THE CHAIRPERSON OF OPAG IOS

The Chairperson of the Open Programme Area Group on Integrated Observing Systems (OPAG IOS) informed the Expert Team on its expected role. He informed the Team that Cg-XVI had decided on implementing the WIGOS inter alia through modernization and expansion of the GOS such that it meets the needs of all WMO application areas. Key components of WIGOS are:

(a) Integrated governance;
(b) Data delivery and information services through WIS;
(c) Quality management, including monitoring and standardization;
(d) Planning and optimization of observing systems;

(e) Capacity building;
(f) Communications and outreach.

ET-SUP should strive to address in its work the various objectives of WIGOS. He further elaborated on:

- The Architecture for climate monitoring from space: ET-SUP should be aware of the ongoing effort to develop a strategy for such an Architecture, and to take into account the requirements coming out of it; it is expected that this activity will be closely linked to the Global Framework for Climate Services, another major WMO priority area for the upcoming financial period;

- Space weather: a new application area in the WMO context which was of increasing relevance to WMO Members, where the responsibility for monitoring and information in many countries lies with National Meteorological Services (NMS);

- Training: he commended ET-SUP for addressing satellite-related training needs of WMO Members; he further highlighted that the US Joint Center for Satellite Data Assimilation will be hosting the Second Summer Colloquium on Satellite Data Assimilation Santa Fe, New Mexico, USA (24 July – 3 August 2012). The event will feature lectures given by a roster of world leading experts and is open to participants from around the world. The lectures will focus on various aspects of the methods used to translate satellite data into numerical models for weather, climate, ocean and air quality prediction purposes;

- Observing requirements database: the OPAG-IOS Chair noted with appreciation important progress in the upgrade of the online database maintained on the WMO SP website;

- Vision for Satellite Utilization and Products: ET-SUP is encouraged to develop such a Vision, or to incorporate the relevant issues into existing planning documents, such as provided by ET-EGOS;

- Impact of observing systems on NWP: The Fifth WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction is organized under the auspices of the WMO Commission for Basic Systems and will be hosted by the Joint Center for Satellite Data Assimilation in Sedona, Arizona, USA, from 22 to 25 May 2012. The Workshop is co-sponsored by THORPEX, GOES-R and NASA (the latter TBD). Participants are expected to come from all the major NWP centres that are active in the area of impact.

The next session of ICT-IOS will be held in June 2012.

4. OUTCOME OF WMO MEETINGS WITH RELEVANCE TO ET-SUP INCLUDING CBS, CONSULTATIVE MEETINGS AND CONGRESS

The session was informed of the outcome of major WMO meetings that occurred since the fifth meeting of ET-SUP in March 2010:

- Sixth session of the Implementation/Coordination Team on the Integrated Observing System (28 June – 2 July 2010);
- Extraordinary session of the Commission for Basic Systems (CBS-Ext. (10); 17-24 November 2010);
- Workshop on Continuity and Architecture Requirements for Climate Monitoring (13-14 January 2011);
- Sixteenth World Meteorological Congress (Cg-XVI; 16 May – 3 June 2011);
- Eleventh session of the Consultative Meetings on High-level Policy on Satellite Matters (CM; 19 May 2011);
- Sixth session of the Expert Team on the Evolution of the Global Observing System (ET-EGOS;

14-17 June 2011);
- Thirty-ninth session of the Coordination Group for Meteorological Satellites (CGMS-39; 3-7 October 2011).

The meeting was pleased to note that ET-SUP matters were high on the agenda of WMO constituent bodies.

5. STATUS OF ACTIONS FROM PREVIOUS ET-SUP MEETINGS

The session noted with satisfaction that all but two actions and recommendations agreed at previous ET-SUP meetings had been addressed. As for outstanding actions:

The VLab co-chair agreed at the session to circulate the draft generic transition plan to support user readiness for new satellite generations to ET-SUP for comment, with a view to finalize the plan by the upcoming 6th session of the VLab Management Group in September 2012 (this closes Action 5.2).

No requests were received from ET-SUP Members to inform the WMO Space Programme office of any issues related to NRT access, documentation, software tools, and service notifications for R&D satellites of primary interest for operational users, in view of addressing these issues at ET-SAT and with relevant satellite operators (moved to Permanent Action P.1).

WMO Space Programme office has sought input from various areas of the world to illustrate the benefits of satellite data and products for various application areas at VLab meetings in October 2011; no feedback has yet been achieved (Action 5.10 remains open).

VLab to prepare a roadmap towards widening the scope of VLab activities to serve the needs of emerging scientific communities in the developing countries: this issue was discussed by the VLab Management Group (VLMG) and it was suggested to intensify the collaboration with the University components of the CoEs. Some courses were already held at St. Petersburg University, the recent CALMET conference was hosted by University of Pretoria (Action 5.17 remains open).

VLab to make training material available through the GEONETCast training channel in 2012 (this is a new Action which replaces Action 5.18).

Upon investigation, it was not possible to include the VLab logo within the ESRC main page (this closes Action 5.15).

The activities of Regional Focus Group (RFG) in several Regions were strengthened, in particular in Region IV and V, and in Russia. India has announced its intention to join the VLab (this closes Action 5.20).

Furthermore, it was pointed out that ET-SUP should seek closer ties with international expert teams and scientific working groups, for example the CGMS- and WMO-sponsored international scientific groups, by inviting representatives to its next session.

The list of all Actions and Recommendations is given in Appendix XII.

Recommendation 6.1: *WMO to invite the Chairs of the WMO/CGMS co-sponsored international working groups to report to the next session of ET-SUP.*

6. UPDATE ON THE SPACE-BASED GOS

6.1 New CGMS Baseline for the Space-Based GOS

The meeting was informed on the new baseline recently adopted by the Coordination Group for Meteorological Satellites (CGMS) for its contribution to the WMO Global Observing System (GOS) in response to the new Vision for the GOS in 2025 (See: ET-SUP-6/Doc.11.1). The new baseline represents a considerable enhancement with respect to the previous level of commitments from satellite operators. Besides the enhancement of the constellation in geostationary orbit and of the current imagery and sounding missions in sun-synchronous orbit, the new baseline includes sustained scatterometry, ocean surface topography, radio-occultation sounding, atmospheric composition, space environment and other missions, as well as systematic provisions for intercalibration.

ET-SUP acknowledged that this new baseline reflected not only advances in technology to support meteorological missions but also the expanding scope of missions assumed by CGMS members in particular in support of climate and environmental monitoring. Although it is only an intermediate step towards the goal set by the Vision for the GOS in 2025, the new baseline represents already a significant part of the way towards full implementation of this vision.

It was clarified that not every operator commits to perform all missions, and that not all instruments in LEO or GEO orbit would have to fly on the same platform, but that the programmes of all CGMS Members, altogether, were expected to meet the baseline. This was supported by a mapping of the baseline with the actual plans of CGMS members, which was provided to ET-SUP as Information document (ET-SUP-6/Inf.3).

The Chairman underlined that the baseline did not include any sounding mission in low inclination orbit. Indeed, missions in low-inclination orbit are foreseen by the Vision which calls for "Precipitation radars operated in conjunction with passive microwave imagers on various orbits" but no plan is confirmed by CGMS members, for the time being, to sustain such missions. The potential benefit of a sounding mission in low inclination orbit has not been evaluated.

> **Action 6.1:** *WMO SP to inform ET-EGOS and ET-SAT of the need identified by ET-SUP to evaluate the potential benefit of a sounding mission in low-inclination orbit with a view of including such mission, if relevant, in the future update of the Vision for the GOS. (Due date: 31 January 2012)*

ET-SUP agreed that the Manual on the GOS should be reviewed in accordance with the new CGMS baseline, which was done under item 15.2.

6.2 Dossier on the Space-Based GOS: Satellites, Instruments and Products

The meeting was informed of the September 2011 update of the WMO Dossier on the Space-based Global Observing System (GOS Dossier), which incorporates the latest information provided by satellite operators. The GOS Dossier comprises an introduction followed by five volumes:

- Vol. 1 Satellite programmes description
- Vol. 2 Earth observation satellites and their instruments
- Vol. 3 Gap analysis in the space-based component of GOS
- Vol. 4 Estimated performance of products from typical satellite instruments
- Vol. 5 Compliance analysis of potential product performances with user requirements

The Dossier is available for download from the "Information Resources" page of the new WMO Space Programme website (www.wmo.int/sat). This issue of the GOS Dossier includes some change in structure with respect to previous versions and a considerable amount of new information.

Volume 2 now contains more than 400 instrument descriptions. The Secretariat indicated that the contents of the Dossier were being partly transferred to a database, which is expected to facilitate future updates in a consistent manner, and to enable developing a user friendly consultation interface. A preliminary version of the database containing most of the information of the current Volumes 1 and 2 is planned to be available in February 2012.

ET-SUP considered that the Dossier was a very valuable resource for different audiences from students to product developers, or for decision makers in matters of observation. It considered that resources should be allocated to keep it up-to-date and endorsed its migration to a database. ET-SUP agreed to support this process in providing feedback on the prototype version of the database when available.

Anthony Rea highlighted the value of the Volumes 4 and 5 which contained tools to support internal review of requirements. Anthony Mostek recommended to advertise more widely the Dossier, and noted that, in recent deliberations on national mission planning such gap analyses were needed to highlight the core parameters, the relevant satellite instruments and expected resulting quality.

The Secretariat underscored that in its Volumes 3, 4 and 5, the Dossier contained not only factual information but also expert assessments by the author. It is desirable to have this kind of document reviewed with broad involvement of experts.

Action 6.2: *WMO SP office to complete the migration of the tabular information of Vol. 1 and 2 of the Dossier to a prototype database. (Due date: 29 February 2012)*

Action 6.3: *ET-SUP Members to provide feedback on the prototype database of space-based capabilities. (Due date: 31 March 2012)*

Recommendation 6.2: *ET-SUP Members to support the ongoing review process of the Dossier in particular as concerns the assessment of product performances and compliance with user requirements, in collaboration with international scientific working groups and other users.*

6.3 Update on the Global Space-Based Intercalibration System (GSICS)

The Secretariat reported on progress in the Global Space-based Inter-Calibration System (GSICS). The algorithms are completed and implemented for satellite instrument intercalibration, including routine generation of correction coefficients, of the geostationary infrared imagers from EUMETSAT, JMA, NOAA, and shortly CMA and KMA. For IR intercalibration, the EUMETSAT IASI and NASA AIRS hyperspectral infrared sounders are taken as references. The GSICS Procedure for Product Acceptance (GPPA) has been developed and implemented to review and document the GSICS intercalibration and correction algorithms. The GSICS project has established GSICS data servers, wiki pages, and individual satellite operators' websites for communication and data access. Current research efforts are directed towards selecting the best methodology for calibration of solar channels. The number of agencies participating in GSICS is growing, the most recent being IMD, JAXA, and USGS. More information on GSICS is available through the various GSICS web pages accessible through the following portal: http://gsics.wmo.int .

ET-SUP noted that GSICS had taken the initiative to prepare a special issue of the IEEE Transactions on Geoscience and Remote Sensing dedicated to calibration of satellite instruments, in collaboration with the Working Group on Calibration and Validation of the Committee on Earth Observation satellites (CEOS). This responds to the call for better explaining the scope of GSICS, its operating principles and planned deliverables, as raised at the 3rd GSICS Users' Workshop.

ET-SUP strongly supported GSICS efforts, which are expected to be particularly useful for the detection of climate change, for the reduction of measurement bias in NWP, and for the

development of satellite derived products. GSICS corrections ensure the interoperability of different satellites; this is particularly useful for instance in the Asia-Pacific region which is covered by five different geostationary satellite operators.

It was clarified that the "GSICS corrections" are to be applied by the user on top of the operational nominal calibration. In the long run this can be incorporated in, and improve, the operational calibration scheme but this is not done automatically.

V. Gärtner indicated that the next GSICS User Workshop was expected to be held in the context of the 2012 EUMETSAT Meteorological Satellite Conference (Sopot, Poland, 3-7 September 2012).

7. SATELLITE DATA ACCESS: REGIONAL REQUIREMENTS

The session discussed reports on regional efforts to determine user requirements for access to satellite data and products, including existing coordination mechanisms, the suite of required data products, dissemination techniques, and software tools. The development of guidance material for defining and maintaining such regional requirements were also subject to discussion.

7.1 RA I Dissemination Expert Group

. The WMO RA I Dissemination Expert Group, established in 2009 through cooperation between the WMO Secretariat, EUMETSAT and RA I Members, was primarily tasked to consider the data and product requirements for the EUMETCast-Africa service. James Kongoti of the Kenyan Meteorological Department (KMD) is the current meeting Chair, and the members represent all parts of RA I.

The Group's 2nd meeting was held in Darmstadt, Germany, in June 2010, and included discussions on:

- Review of the EUMETCast Dissemination Baseline, where each region provided input regarding their use of products and new requirements (mainly based on MSG, with some GOES, MTSAT, FY-2);
- Evolution of Meteorological Data Dissemination (MDD) on EUMETCast;
- Future enhancements to NWP models by UKMO, DWD, MeteoFrance, ECMWF;
- Situation with PUMA 2010 stations and new product evolution;
- Identifying improvements to team structure and regional support: several Members reported problems in gathering feedback from other NMHSs within their region.

ET-SUP was informed that the AMESD successor MESA will be deployed from 2014 onwards, which will likely include the refurbishment of stations and software. The Team also recognized the challenges of some host countries in keeping pace with new satellite development regarding their ground segment and infrastructure. Requirements included not only products, but also telecommunications, user stations, software, and training.

The next meeting of the RA I Dissemination Expert Group is scheduled to take place in conjunction with the 10th User Forum for Africa, in October 2012, Addis Ababa, Ethiopia.

7.2 RA II Pilot Project

Accomplishments and future plans of the RA II Pilot Project to Develop Support for NMHSs in Satellite Data, Products and Training were reported.

The 14th WMO Regional Association II (XIV-RA II) session held in Tashkent, Uzbekistan, in 2008 adopted a resolution to establish a Pilot Project for the development of support for National Meteorological and Hydrological Services (NMHSs) in the areas of satellite data, products and training. The Pilot Project Coordinating Group is composed of Japan (co-coordinator), the Republic of Korea (co-coordinator), Bahrain, China, Hong Kong (China), India, Kyrgyzstan, the Maldives, Oman, Pakistan, the Russian Federation, Uzbekistan, Vietnam and, as an observer, EUMETSAT (as of 31 May 2011).

The project was established as a partnership of NMHSs in RA II to improve the flow of satellite-related information. The major focus of the initiative is to facilitate the timely provision of satellite-related information by satellite operators themselves to users, i.e., NMHSs in RA II, especially in developing countries including LDCs. As there are also other ongoing activities, such as the Virtual Laboratory (VLab), the need to create synergies and provide greater benefits with a lower level of exertion while avoiding duplication of effort was recognized.

Accomplishments of the Pilot Project in its first and second phase were the organization of a Coordination Group meeting, the provision of information through newsletters to RA II Members, and a website.

Plans for the third phase comprise:

- Ongoing issuance of quarterly newsletters to RA II Members
- Enhancement of Pilot Project webpages on the WMO Space Programme website
- Enhancement of RA II Member and Coordinating Group mailing lists (by April 2012)
- Identification of RA II Member requirements for satellite data and products (by April 2012)
- Alignment of Pilot Project activities and Virtual Laboratory activities to optimize assistance to NMHSs in RA II (by August 2012)
- Planning of the 2nd Meeting of the Coordinating Group to be held in 2012
- Creation of the fourth-phase working plan (by August 2012)

ET-SUP noted with satisfaction the progress achieved in the RA II Pilot Project and expressed its expectation that important lessons could be drawn from this project for other Regions.

7.3 RA III/RA IV Satellite Data Requirements

Formulating data requirements was one of the important steps of the Integrated Global Data Dissemination Strategy (IGDDS) Implementation Plan. This issue had been addressed for RA III (South America) and RA IV (North America, Central America and the Caribbean), through a Satellite Data Requirements Task Team established in June 2009 by the Secretary General of WMO, and placed under the leadership of the RA III Rapporteur on the Space Programme. Since that time, several tasks were accomplished by the Task Team, which:

- Completed and maintained a list of requirements for satellite data and products;
- Revised some priorities, with first priority given to warnings and regional products;
- Paid attention to standard formats such as BUFR mainly for assimilation purposes;
- Discussed respective advantages of GeoTiff and HDF formats for GIS and assimilation applications, and for dissemination over GEONETCast and other channels.

The results of these discussions are documented on an INPE/CPTEC web-based requirements database at http://satelite.cptec.inpe.br/geonetcast/es/datareq.html.

The use of GEONETCast-America is an attractive option to respond to the needs identified in RA III and RA IV, in addition to Direct Readout services and web-based or GTS access. These different means of access have been investigated, and GEONETCast-America was

identified as the preferred option, if robust enough, because such a multi-mission service is able to integrate different sources of data. This is a particular advantage in times of transition between satellite generations (e.g., GOES) and corresponds to the IGDDS strategy.

There is some uncertainty that GEONETCast-America will remain operationally available in the medium or long-term, and whether more satellite data can be included within the available bandwidth. Current plans for maintaining GEONETCast-Americas and EUMETCast South America do not go beyond 2013 (Action 6.6 and Recommendation 6.5 address this issue).

Action 6.4: *Chair of regional task team (Luiz Machado), in coordination with WMO Secretariat (including the Department for Regional Activities), to finalize the activities of the regional requirements task team. (Due date: 31 March 2012).*

7.4 Procedure for Defining / Maintaining Regional Requirements for Satellite Data

Formulating precise requirements for satellite data and product access was one of the important steps foreseen in the Integrated Global Data Dissemination Strategy (IGDDS) Implementation Plan. This exercise was to be conducted at the regional level, since the needs and the capabilities were heavily depending on the technological and meteorological context, which varies considerably from one region to another.

This issue had been addressed for RA I, RA III and RA IV. Several steps were necessary to complete a set of Data Requirements for the Region.

ET-SUP considered it desirable to adopt a standard procedure in order to establish best practices for the development and updating of satellite data requirements at the regional level. This should include appropriate governance by the CBS and ensure recognition by the data providers. This procedure should take into account the positive experiences and lessons learned from RA I, III and IV.

ET-SUP raised the question of whether the regional requirements for satellite data and products should be limited to existing products, or whether theoretical needs for products not yet existing were also to be included. It was clarified that on the whole, user needs are currently expressed in terms of existing products. The Team nevertheless encouraged adopting a broader view on this subject.

A break-out group refined the procedure for defining and maintaining regional requirements for satellite data and products (see Appendix III), for submission to CBS and subsequent implementation. The break-out group furthermore suggested that Regions take an integrated approach in ascertaining their data and product requirements which should be limited to satellite data.

Action 6.5: *WMO Space Programme office to communicate the draft Procedure initially to RA II and RA V in support of their respective needs in formulating requirements, and seek feedback. Subsequently, the Procedure should be communicated to all Regions. (Due date: 15 February 2012)*

7.5 NAEDEX-APSDEU Update

Anthony Rea reported on the 11th Asia-Pacific Satellite Data Exchange and Utilisation – 23rd North America Europe Data Exchange (APSDEU-NAEDEX) joint meeting in Boulder, Colorado, USA, held in May 2011. This was the first joint meeting of the two groups, reflecting the global nature of NWP and the rising importance of the satellite operators in the Asia-Pacific Region.

Both APSDEU and NAEDEX operate outside of WMO, with a WMO Space Programme representative normally attending as an observer. Building on the mature framework developed within NAEDEX, these meetings provide a forum to discuss requirements for existing data and products with a focus on Numerical Weather Prediction (NWP). The next APSDEU-NAEDEX meeting will be held in the UK in October 2012. IMD expressed an interest in joining the discussions of this forum.

Recommendation 6.3: *ET-SUP recommended that the APSDEU and NAEDEX organizers ensure that IMD and ISRO are invited to their next session*.

8. UPDATE ON REGIONAL EVENTS

8.1 Outcome of the Second Asia/Oceania Meteorological Satellite Users Conference

The second Asia/Oceania Meteorological Satellite Users Conference was held successfully from 6 to 9 December 2011, in Tokyo, Japan. The event had around 160 participants and followed in the footsteps of the First Asia/Oceania Meteorological Satellite Users Conference hosted by CMA in November 2010 in Beijing, China. The purposes of the conference were to further enhance exchanges on application techniques among satellite data users in the region, to advance satellite observation technologies, and to promote synergetic development in the field of meteorological satellites.

The Conference statement is as follows: “Sharing data and information from satellites is essential for realizing the potential of meteorological and environmental satellites serving the Asia-Oceania area; for satisfying a variety of users in many Societal Benefit Areas (SBAs); and for establishing pathways for coordinated application.”

ET-SUP commended JMA for hosting this important event and highlighted the importance of such a conference for the Asia-Pacific satellite community. KMA will host the 3rd conference in autumn 2012, and the Australian Bureau of Meteorology the 4th conference in 2013.

Recommendation 6.4: *ET-SUP suggested that a joint meeting of APSDEU-NAEDEX (see item 7.5) and the 4th Asia-Oceania Meteorological Satellite Users Conference be collocated.*

9. SATELLITE DATA ACCESS: UPDATE ON NEW CAPABILITIES (INCLUDING SOFTWARE)

This agenda item addressed data access arrangements for existing and planned missions, including dissemination techniques and software tools made available by satellite agencies to enable data access.

9.1 Report on Evolution of GEONETCast America and Use of GEMPAK

A. Mostek reported on the evolution, recent developments, and activities of GEONETCast America. He explained that GEONETCast-America was not primarily designed to support routine meteorological operations since the development of this capability had to be focussed on filling a gap identified in the data dissemination capability for disaster management support, which is not necessarily resulting of a severe weather situation (e.g. oil spill, earthquake, volcano). It is recognized, however, that the management of such high-impact disasters generally required weather information.

ET-SUP also noted that the GEONETCast had agreed to support the International Charter for Space and Major Disasters, and already performed trials to disseminate specific high-resolution

imagery in emergency mode. It was noted however that weather related disasters, e.g. hurricanes, were also of primary importance in RA IV.

A. Mostek suggested that meteorological communications be addressed with a forward looking view, including e.g. relying on cloud computing, either for operational or for training needs. It was stressed that a training component should go along with the telecommunication aspects, and with the availability of user receiving/processing systems, to avoid any bottlenecks.

The question was raised of whether and to what extent GEONETcast could respond to the CBS guideline to establish DVB-S services in every region for the dissemination of meteorological satellite information, integrated with other data. The Chairman expressed the view that evolving from the current GEONETCast-America to a broader and more sustainable system would require collaborative efforts. He mentioned several mechanisms which could contribute to advance data dissemination issues in the region, including the NOAA Direct Readout Conference and the GOES User Conference (scheduled to be convened in a joint meeting in April 2013), the IGDDS Implementation Group, and the WMO RA III/IV requirements Task Team. These initiatives could help to define a path and trigger collaborative efforts around NOAA towards a future GEONETCast-like system for RA III/IV.

Recommendation 6.5: *NOAA and potential regional partners (INPE, CONAe, CSA) join their efforts to strengthen and expand GEONETCast-America with a view to reinforce its sustainability and leverage its utilization for operational applications as a component of IGDDS.*

Action 6.6: *WMO Secretariat to support discussions with NOAA, INPE, EUMETSAT, GEO and other interested parties to define a roadmap towards a sustainable, enhanced, DVB-S service covering RA III and RA IV. (Due date: November 2012)*

Recommendation 6.6: *The VLab should take advantage of the GEONETCast training channels for dissemination of training resources, in particular for users with limited Internet connectivity.*

A short report was given on GEMPAK as a possible solution for data access and display of weather and climate data and products (see also item 9.13), for consideration by the Virtual Resource Library for the Virtual Laboratory on Education and Training in Satellite Meteorology (VLab). GEMPAK consists of a suite of application programmes, Graphical User Interfaces (GUIs), meteorological computation libraries, graphic display interfaces, and device drivers for the decoding, analysis, display and diagnosis of geo-referenced and meteorological data. GEMPAK works well with data feeds provided from various sources including the McIdas environment. A migration to the NOAA AWIPS-II software environment is being prepared in 2012 or 2013.

9.2 METEOR-M and ELEKTRO-L Data Access

O. Milekhin reported on the current status of Meteor-M № 1 and Electro–L № 1 missions and provided details on data dissemination from MSU-MR/Meteor-M and MSU-GS/Electro-L. ET-SUP noted that on Meteor-M1, the MSU-MR imager was performing correctly in Visible channels but was affected by noise in IR channels 5 and 6. The microwave imager-sounder MTVZA and the side-looking radar cannot be used operationally. Products will be disseminated in different forms corresponding to different levels of data usage: via Direct Readout for specialized users, via FTP for products, and specific products for basic operational users. As concerns the geostationary Elektro-L1, the imager is performing correctly in Visible channels but shows high level of noise in the IR and WV channels. Direct Broadcast in HRIT/LRIT is planned to start in January 2012; details of the HRIT/LRIT mission-specific implementation are to be published; the contents of the LRIT service will be published via internet, and products can be distributed by FTP upon request to SRC Planeta.

O. Milekhin indicated his readiness to explore with EUMETSAT the possible dissemination of Elektro-L data via EUMETCast. No Level 1 data dissemination is planned by MITRA given the bandwidth limitation. Meteor-M2 is prepared for launch by the end of 2012 and Electro-L2 towards the end of 2013. A mission in highly elliptical orbit (Arctica) is planned in 2014 and 2015; its payload will include the same imager.

The proposed Electro-L № 3, to be located at 166°E, is of particular interest to users in the Asia-Pacific and will provide excellent geostationary coverage for Pacific nations, bridging the gap between MTSAT-2 and GOES-W.

S. Goyal expressed the interest of IMD for Electro-L data, especially during the transition period until INSAT-3D is available. IMD should be able to receive Electro-L1 data via the HRIT/LRIT service as well as via LRIT/FTP service if requested (request to SRC Planeta).

Action 6.7: *Roshydromet to communicate to WMO Space Programme office and CGMS Secretariat (EUMETSAT) the HRIT/LRIT Electro-L Mission Specific Implementation, for information of WMO Members and publication on the CGMS website. (Due date: 15 February 2012)*

9.3 FY-3 Data Access

X. Fang reported on the status and capabilities of the two satellites of the FY-3 generation, FY-3A and FY-3B, the range of products derived from these satellites, and provided details on access to their data. There are currently three ways to deliver FY-3 data delivery services:

a. Users can access the data through web-based services after a quick registration on the following web page: http://FY3.satellite.cma.gov.cn, where also additional information on FY-3 is provided;

b. CMACast service (see detailed report on CMACast under 9.10);

c. Possibility to request FTP push for special uses (Point of contact: dataserver [at] nsmc.cma.gov.cn).

ET-SUP highlighted the value of FY-3. In particular, A. Mostek noted that NOAA was planning to use FY-3 sounding data in its routine operations. WMO commended CMA for making data pre-processing software available, as announced at CGMS-39, in response to a recommendation from ET-SUP. The current Point of Contact for requesting the software is X. Fang.

ET-SUP noted that global data from FY-3 were exchanged with EUMETSAT on bilateral basis for distribution within the EUMETSAT Member States. The question was raised whether the global data sets could be requested from CMA and be distributed.

Action 6.8: *X. Fang to investigate the access conditions for global datasets derived from FY-3. (Due date: 1 March 2012)*

ET-SUP noted the current gap between the respective areas of coverage of CMACast and GEONETCast-America, which should be addressed in order to meet the needs of Pacific island countries (see discussion under 9.9).

Interest was expressed by IMD for exchanging products and related technology e.g. for snow cover or dust, for comparison purposes with a view to refine the methodology.

9.4 DMSP and future DWSS Data Access

A. Mostek reported on the developments, plans and activities associated with the US Air Force Defense Meteorological Satellite Program (DMSP) and the planned Defense Weather Satellite System (DWSS) [on 23 January 2012, the US Air Force officially announced cancellation of the DWSS]. The DMSP satellites have a long and successful track record. DMSP satellites were projected to keep operating for several more years (at least 2018) as two more satellites (F19 and F20) are waiting to be launched in 2012 and 2016 respectively. The Direct Broadcast service is not publicly accessible as it is encrypted except over the Polar regions, but data can be accessible by FTP upon request, and a number of products are available on different US websites. ET-SUP invited NOAA to consider collecting DMSP product access information on a single page.

> **Action 6.9:** *A. Mostek to liaise with NESDIS about developing a portal or other form of guidance on available products from DMSP (Such portal could be ultimately part of the Product Access Guide). (Due date: 15 April 2012)*

9.5 NPP and GOES-R Data Access

A. Mostek reported on the developments, plans and activities associated with the NPP and GOES-R satellites. NPP was launched on 28 October 2011 and initial data and products have been successfully generated. NOAA's current plans still call for launch of GOES-R late in 2015.

ET-SUP congratulated NOAA and NASA for the successful launch and initial operation of NPP and looked forward to its early use.

9.5.2 NPP Pre-processing Software Package

ET-SUP was informed of an exchange of letters between the WMO Secretariat and NOAA/NESDIS regarding the planned availability of a pre-processing software package for NPP direct readout data, in response to a recommendation expressed by ET-SUP and the broader direct readout community. This software, the Community Satellite Processing Package (CSPP), is being developed by the Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin, USA, with the support of NOAA Joint Polar Satellite System (JPSS) program scientists. The first version of CSPP is expected to address VIIRS only. CrIS and ATMS data pre-processing will be added in a subsequent release.

ET-SUP was particularly pleased to note that its recommendation had been communicated by WMO and that NOAA had been fully responsive to this request, which will be of great benefit for the scientific and operational user communities.

9.6 INSAT-KALPANA Data Access

S. Goyal reported that the India Meteorological Department (IMD) routinely provides the processed imagery and derived quantitative products from various INSAT satellites to the user community. KALPANA1, the first exclusive Meteorological Satellite (METSAT) launched by Indian Space Research organization (ISRO), has a VHRR capable of imaging the Earth in the visible, thermal infrared and water vapour bands. INSAT (including KALPANA1) satellite data are accessed through two different systems: Digital Meteorological Data Dissemination (DMDD) and Cyclone Warning Dissemination System (CWDS). Ms Goyal highlighted the role of the National Satellite Data Centre for data and product dissemination. In addition, she informed the meeting on Oceansat-2 and Megha-Tropiques, and on the role of the National Remote Sensing Centre (NRSC) of ISRO for data from the satellites.

ET-SUP highly welcomed the readiness of IMD to join the VLab as a Centre of Excellence.

EUMETSAT welcomed the plans of India that, together with Roshydromet's plans, provide good prospect for continuous geostationary coverage of the Indian Ocean, potentially removing the need for EUMETSAT to maintain the Indian Ocean Data Coverage (IODC) mission as a gap-filler.

9.7 MTSAT Data Access

H. Kunimatsu reported on the status of the Multi-functional Transport Satellite (MTSAT), currently operated by JMA, and related data access provisions.

Recommendation 6.7: *ET-SUP welcomes the progress of Himawari-8, 9 Project. In view of the similarities between ABI and AHI imagers, it encourages NOAA, JMA, BOM and other potential users to collaborate on the preparation for their respective communities.*

9.8 COMS Meteorological Imager Operation and Data Service

S. Bojinski, on behalf of Korea Meteorological Administration (KMA), presented the current status and future plan of COMS MI operation and data service. Communication, Ocean and Meteorological Satellite (COMS), the first Korean geostationary meteorological satellite was launched successfully on 27 June 2010 and has been operating at a longitude of 128.2°E since 1 April 2011. COMS meteorological mission is performed by MI (Meteorological Imager) with one visible channel and four infrared channels. KMA has the competence for MI operation and data distribution.

KMA is producing 16 meteorological parameters such as cloud analysis, fog, Asian dust, atmospheric motion vector from COMS raw data for various applications such as nowcasting, numerical weather prediction model, climate monitoring. Among them, 10 COMS meteorological products are distributed to users, and the others would be distributed by the end of 2011.

9.9 EUMETCast and Metop A-HRPT

S. Wannop gave a presentation on the following subjects:

- Status of EUMETCast;
- Status of Metop A-HRPT;
- Operational Scenario for Metop-B;
- Meteosat Long-term Planning.

The meeting was pleased to note that the operation of Metop-A HRPT had been extended and looked forward to the launch of Metop-B.

ET-SUP was furthermore informed on the use of the Multi-mission Administration Message (MMAM), a generic administrative message for use with the Metop satellites and future LEO satellites. The MMAM provides operational announcements; information on spacecraft and instrument status; navigation data, including orbital position, attitude and events; and processing data, including OBT/UTC time correlation information. During the early access phase, a new MMAM is being generated and made available via website, in addition to continuing the current operational Admin service via the spacecraft/website. The MMAM will be operationally used for Metop-B during commissioning.

Action 6.10: *EUMETSAT to report at CGMS-40 on the Multi-Mission Administration Message (MMAM) as a possible matter of harmonization within CGMS. (Due date: CGMS-40).*

The question was raised whether Meteosat data, if provided on GEONETCast-America, could be accessed freely. S. Wannop recalled the EUMETSAT data policy whereby 3-hourly images are free, and all images are free to countries below a defined GNP threshold, which is the case of most RA III Members. EUMETSAT will consider the case of images disseminated over GEONETCast-America if needs arise, reserving the possibility to only transmit image sectors of the region of interest.

Action 6.11: *EUMETSAT to investigate the possibility of providing frequent Meteosat image sectors for RA III/IV in the framework of the EUMETSAT data policy, for consideration as candidate product for GEONETCast-America. (Due date: 30 June 2012)*

In the overall GEONETCast coverage, ET-SUP noted the current gap between the respective areas of coverage of CMACast and GEONETCast-America, which should be addressed in order to meet the needs of many Pacific island countries, as pointed out by the IGDDS Implementation Group. ET-SUP was also informed of the Remote Asia Pacific Information Dissemination BroadCast (RAPIDCast) demonstration project initiated in RA V by USAID, NOAA, and the Australian BoM, which aims to distribute environmental information over the Pacific area through a DVB-S service in Ku band. Building on this initiative would provide a path towards filling the IGDDS gap over the Pacific.

Recommendation 6.8: *Noting the gap in IGDDS and GEONETCast coverage over the Pacific, ET-SUP encourages USAID, NOAA, and their partners in RAPIDCast to pursue the RAPIDCast project and investigate its potential as a system for use by WMO Members in support of operational and training activities.*

9.10 CMACast

X. Fang reported on the status of CMACast. CMACast is ready for full operation at the end of 2011, and CMA propose to cease the FengyunCast service in mid-2012. Efforts to upgrade user equipment to transfer from the FengyunCast, PCVSAT and DVB-S to the CMACast are ongoing. CMA donated CMACast terminals to 16 developing countries and provided technical assistance in a regional WIS training seminar in Beijing this year. Metadata for CMACast data have been published on the CMA WIS portal for user access. CMACast - EUMETCast data exchange and re-dissemination has been established, and an interoperation platform had been set up to apply data policies and to remove language barriers for global interoperability.

ET-SUP expressed its appreciation for the rapid progress made by CMA in implementing CMACast, and for the significant improvement in the available data transmission rates.

9.11 Regional ATOVS Retransmission Services (RARS)

J. Lafeuille reported on the activities pursued on RARS since ET-SUP-5. RARS operations were continuing, are efficiently monitored, and RARS operators have proven their responsiveness to user feedback when needed. The RARS network had progressed with the addition of one station by INPE in Natal, Brazil, as of 5 September 2011. A poster on “RARS Global Network Status and Plans” was presented at the 17th International TOVS Study Conference (ITSC-XVII) and an enquiry was performed among ITWG members; high interest was expressed for RARS at the conference but very few responses were received to the enquiry itself.

An *ad hoc* RARS progress meeting was held in Boulder, Colorado, USA on 4 May 2011, during the APSDEU-NAEDEX Meeting; this meeting discussed action needed with respect to the extension of the RARS network to new sounders including METOP/IASI, FY-3/MWTS-MWHS and NPP/CrIS. Following this meeting, NOAA announced that the optimal selection of 399 channels of the NPP/CrIS sounder had been completed; furthermore, CMA had released technical documentation and software for FY-3 Direct Broadcast pre-processing. Progress was also made by EUMETSAT in EARS extension for IASI. The other actions were still on-going.

V. Gärtner gave a brief update on the progress made by EARS, including the preparation of the X-Band receiving station network for NPP.

A. Rea pointed out the importance for NWP of the consistency of direct readout data with global datasets - a challenge that RARS had successfully addressed with a key support from the EUMETSAT NWP Satellite Application Facility hosted by the Met Office. The challenge will be even greater with the Extension of RARS to new sounders (X-RARS) because of the diversity of instrument types to be processed, and the need to use multiple software packages to generate products. This issue should be addressed at a forthcoming meeting of the RARS Implementation Group.

Recommendation 6.9: *Roshydromet and EUMETSAT to work together towards including Moscow and possibly Novosibirsk and Khabarovsk in the X-RARS phase of EARS.*

Recommendation 6.10: *ET-SUP considers it important that an update on RARS be presented at ITSC-18 (Toulouse, 22-27 March 2012) in order to seek renewed feedback from the NWP community.*

Recommendation 6.11: *WMO Space Programme office to consider convening the RARS Implementation Group, preferably in conjunction with other related meetings to facilitate participation (e.g. ITSC-18 in March 2012, NAEDEX-APSDEU in October 2012).*

9.12 Evolution of Direct Broadcast

J. Lafeuille reported on the ongoing evolution of Direct Broadcast (DB) services. On one hand, the frequency allocation to Meteorological Satellite Services in L-Band (around 1.7 GHz) is now threatened in the United States and possibly worldwide because of the US plan to allocate the upper part of this band (1.695-1.710 GHz) to broadband mobile communication services. This would affect DB services from current LEO satellite generations, which are planned to continue through the next decade.

On the other hand, it is anticipated that DB services from the future generation of LEO systems would be mainly, if not exclusively, in X-Band (7.750-7.850/7.900 GHz), in order to accommodate considerably higher data rates than current satellite systems. Several LEO systems are already using X-Band: Aqua, Terra, NPP, and FY-3 (for the MPT service). This evolution raises several issues:

- Current lack of CGMS standard protocol applicable to X-Band;
- Higher sensitivity than L-Band to weather conditions;
- Higher class of hardware needed for receiving stations;
- Higher class of user hardware and software for handling high data rates.

These issues were discussed at the IGDDS meeting in 2010 and reported to CGMS. CGMS-39 took actions to organize the use of X-Band frequencies for LEO Direct Broadcast ,and to develop a standard. It was furthermore agreed at CGMS that WMO would perform a survey of the global user community in order to assess the need for maintaining a low data rate DB service in L-Band for future systems, in addition to the planned high-rate services in X-Band.

ET-SUP raised the question why the DB services in L-band could not be covered in X-band and reviewed the possible drawbacks of having X-Band only.

- Affordability of systems is an issue; however, it is expected that advanced professional users would at any rate use the X-Band. The less advanced and non-professional users may be able to find adequate satellite data via other means, including e.g. the Internet or Digital Video Broadcast dissemination mechanisms such as GEONETCast;

- It was noted that the RARS concept allows many users to benefit from the data flows received by several ground stations. These kinds of arrangements should be encouraged;
- In terms of weather sensitivity, the experience of Aqua and Terra gives confidence that X-band can be used operationally for DB;
- Standardization will be looked at by CGMS.

Recapitulation of data access information

In a breakout session, ET-SUP developed a summary on the main services available for accessing satellite data in near real time or in delayed mode. It was agreed that for geostationary satellites, the scope of this table should be Level 1 data and derived imagery; for LEO satellites, the scope should be Direct Broadcast, Level 0 and Level 1 global data sets, and pre-processing software for Level0/Level 1 conversion. For higher level products, it was agreed that information would best be captured by other means, e.g. in the Product Access Guide (See item 14.2).

ET-SUP populated the tables accordingly (included in Appendix IV). ET-SUP furthermore agreed on several actions and recommendations with a view to ensure compliance with the GOS requirement that data be fully accessible with the necessary information on how to access it.

Recommendation 6.12: *ET-SUP recommends that IMD consider making Level 1 data from Kalpana and INSAT-3A available in Near Real Time via FTP.*

Action 6.12: *ET-SUP Members to review and update as appropriate the Data Access tables in Appendix IV of the ET-SUP-6 report. (Due date: 15 February 2012)*

List of relevant application software tools

ET-SUP agreed that compiling a list of software would be a useful resource for users who are not aware of what is publicly available and who need initial guidance before collecting more detailed information by their own. Before populating such table, its scope should be defined by objective criteria in order to avoid false expectations, and to ensure that the table will be sustainable and factually correct.

In a breakout session, ET-SUP agreed that the scope should encompass both open source and commercial software, and that it should include a range of software types used for pre-processing as well as for visualization, analysis, and product generation. This should be explained on top of the table. The level of detail should however be limited to essential and most objective features including software name, point of contact with link, list of supported formats (*among a WMO predefined list*) for input and output data, and relevant satellites or instruments in the case of specific pre-processing software. These details should be provided by the software provider to WMO, with a disclaimer excluding WMO's responsibility.

The break-out session discussed mechanisms that would help ensure that information provided in the table is current and kept to a manageable size. A template was developed as included in Appendix V and populated with readily available information. An action was given to ET-SUP and ET-SAT Members to review and complete the table as far as possible.

ET-SUP agreed with these goals and asked the WMO Space Programme office to ensure the information in the table is kept up-to-date.

Action 6.13: *ET-SUP members to review and complete the software list template contained in Appendix 5 of the ET-SUP-6 report. (Due date: 15 February 2012)*

Action 6.14: *WMO Secretariat to circulate to ET-SAT the list of software once completed by ET-SUP members, for review. (Due date: 15 March 2012)*

Action 6.15: *WMO Secretariat to publish the list of software on the WMO Space Programme website, after review by ET-SUP and ET-SAT. (Deadline: 1 June 2012)*

10. SATELLITE PRODUCT DEVELOPMENTS

An overview of recent satellite-based product developments in different thematic areas was given under this agenda item. As agreed by ET-SUP-5, the session discussed results and recommendations by the WMO-CGMS-sponsored International Working Groups on precipitation, winds, sounding, and radio occultation; further, an update on satellite product development for ocean applications and matters related to the WMO-IOC Joint Commission for Oceanography and Marine Meteorology (JCOMM) was presented; the generation of satellite datasets and products for climate applications, including activities in the Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring initiative discussed; the utilization of satellite products for nowcasting and the Severe Weather Forecasting Demonstration Project was addressed, with a concept proposal for the establishment of a global "SCOPE-Nowcasting"; and other product developments presented at CGMS-39 were discussed.

From a general perspective, for all satellite products, ET-SUP supported the principle of conducting evaluations and expressed the need to define provisions for quality assurance. This is one of the objectives of the WIGOS framework. Furthermore, in the context of the Group on Earth Observation (GEO) the Quality Assurance Framework for Earth Observation (QA4EO) stresses the need for quality information to be systematically associated with Earth Observation products. ET-SUP agreed that these considerations be revisited under item 11.2.

10.1 Precipitation Products: IPWG matters

This document reported on the status of the IPWG activities, as reported to CGMS-39.

In spring 2011 an international workshop on space-based snowfall measurements was held in Grainau, Germany, with participation by representatives of the GEWEX Radiation Panel (GRP) and NASA's Global Precipitation Measurement (GPM) and CloudSat Missions. Relevant recommendations to satellite operators were formulated. For example, the snowfall community expressed its confidence in the capabilities of space-borne multi-frequency Doppler radar for global snowfall measurement, and they urged national space and science agencies to plan missions that implement this capability at a minimum. These capabilities could be greatly enhanced through the following technological advances: (1) reduced radar pulse width to enhance near surface detectability and (2) the inclusion of a sub-millimetre-wave radiometer to provide additional constraints on ice water path and constrain ice particle sizes.

At CGMS-39, NOAA reported on issues related to obtaining rainfall datasets over South Africa for validating NOAA and EUMETSAT satellite rainfall products. Because the intensity and frequency of rainfall and the physical mechanisms involved (e.g., convective vs. stratiform; orographic enhancement via the "seeder-feeder mechanism") vary considerably in both time and space, validation data are needed over as wide a variety of climate regimes and seasons as possible to develop robust algorithms and properly evaluate their performance. However, obtaining ground validation datasets of suitable quality at short time scales (instantaneous to 3 h) has proven to be exceedingly difficult. Collaboration between EUMETSAT, NOAA, and the South African Weather Service (SAWS) to develop a high-quality validation dataset for satellite rainfall product development and validation would be highly valuable to the research and operational communities. WMO has taken an action at CGMS-39 to follow up with SAWS accordingly.

Given the strong and sustained contribution of the TRMM mission to precipitation remote sensing in tropical regions, CGMS agencies are encouraged to follow NASA's example of

comprehensive and sustaining science support for satellite missions, including comprehensive validation campaigns.

The International Precipitation Working Group (IPWG) highlighted that in 2011 special emphasis was given to recent achievements, especially:

- IPWG compiled lists of publicly available, quasi-operational and quasi-global precipitation datasets which is available through the IPWG website at: http://www.isac.cnr.it/~ipwg/data/datasets.html.

- IPWG had carried out a survey of different sources of validation rainfall data; the datasets lists are also available on the website together with a list of applications using high resolution satellite precipitation products.

IPWG also informed that the IPWG-6 meeting will take place in Brazil (tentatively 15-19 October 2012) together with a collocated training workshop. Therefore the CGMS operators were asked to provide funding for participants of the 6th IPWG Workshop and to assist the funding of a training event which is planned to be held concurrently with IPWG-6.

ET-SUP commended CNES and ISRO for the successful launch of the Megha-Tropiques mission on 12 October. This mission will be a cornerstone in the GPM mission for the next decade.

10.2 International TOVS Working Group Matters

A summary of the recent 17th International TOVS Study Conference, held in Monterey, California, USA, in April 2010, was provided. There were nearly 150 participants attending the conference, representing 20 countries and three international organisations. Issues of interest to ET-SUP covered at the meeting included:

- Generation and validation of meteorological and environmental products from sounder radiances;
- Atmospheric chemistry and air quality;
- Direct broadcast, pre-processing and calibration of sounder radiances;
- Atmospheric radiative transfer;
- Surface property modelling and sensing;
- Assimilation of raw measurements and derived products in NWP;
- Climate studies; and
- Future sounders and programmes.

ET-SUP noted the ITWG recommendation related to the GIFTS/STORM concept and expressed its reservations. ET-SUP also noted that the large number of recommendations was difficult to digest and that there were no priorities for the recommendations which would possibly facilitate their uptake.

The next International TOVS Study Conference (ITSC-18) will be held 21-27 March 2012 in Toulouse, France.

10.3 International Winds Working Group matters

The tenth International Winds Workshop (10th IWW) was held from 22 to 26 February 2010 in Tokyo hosted by JMA.

IWW was conducted by the International Winds Working Group in its role as a formal working group of the Coordination Group for Meteorological Satellites. The purpose of the IWW was to promote exchange of scientific and operational information between the producers of satellite-derived wind products, researchers and users. In the 10th IWW, there were reports on the

latest techniques of wind data derivation and usage regarding atmospheric motion vectors (AMVs) and other wind data observed by such as microwave radiometers, scatterometer and lidar. In addition, discussions were made in two working groups, the method of AMV derivation (WG-I) and AMV utilization (WG-II), and six recommendations in WG-I and three actions in WG-II were raised, respectively.

The 11th International Winds Workshop was planned to be held from 20 to 24 February 2012 in the University of Auckland, New Zealand.

10.4 International Radio Occultation Working Group Matters

This paper reported on main results from the first workshop of the International Radio-Occultation Working Group (10-11 September 2010, Graz, Austria), and also included more recent developments relevant to radio occultation. The IROWG was established by WMO and CGMS in 2009 as the fourth permanent working group under CGMS. The following priority recommendations from the workshop were reported to CGMS-38 (2010) and are reproduced here:

1. GPS-RO has demonstrated to be a very important element in the global data observing system for NWP. The continuity of GPSRO observations in the future is not sufficiently guaranteed. IROWG recommends that CGMS coordinates efforts between operational data providers and NWP agencies to establish long term continuity plans;

2. Operational NWP centres should be aware of a substantial reduction of available GPSRO data in real time, that has already begun, and will continue (CHAMP down, COSMIC degrading, COSMIC II planned to be commissioned only in 2015). Processing of research data could fill the gap (TERRASAR-X, TANDEM-X, OCEANSAT-2, SAC-D, PAZ, etc, where the first four have already been launched). IROWG recommends that CGMS coordinates efforts between operational data providers, NWP agencies, and research agencies, to investigate and potentially support NRT infrastructure for these data (downlink, processing, dissemination and archiving);

3. Future missions should consider covering 360° in ascending node. The sampling need not be regular in ascending node, but it should definitely extend well beyond 180°. If all 360° is not covered, sinusoidal sampling biases polewards of 50° latitude with the period of constellation precession is present due to selected local time sampling;

4. RO measurements are a valuable information source for NWP and climate. Within NWP, the number of RO instruments has not reached saturation level. Hence IROWG recommends that operational and research organizations consider adding Global Navigation Satellite System (GNSS) RO payloads on all suitable satellite systems;

5. The value of RO data to ionospheric modelling is expected to grow as the amount of available data increases over time. A variety of science and operational missions are in the planning stages, and it seems likely that more may be planned in the near future. IROWG thus recommends encouraging missions flying RO sensors to include a robust ionospheric measurement capability without interference to collection of lower atmosphere data. IROWG also recommends encouraging the development of a standardized ionospheric scintillation measurement capability for RO sensors

The full meeting report is available at http://www.irowg.org/docs/IROWG-1_Minutes_Summary.pdf .

The call for abstracts for the second workshop (28 March – 3 April 2012, Estes Park, Colorado, USA) was open until 16 December 2011 (see http://www.irowg.org/workshops.html).

ET-SUP recognized that the four international scientific working groups were important mechanisms to advance scientific satellite-based applications and should continue to be

supported. For effective uptake of their recommendations by WMO and satellite operators, more prioritization of their needs was considered desirable.

Recommendation 6.13: *ET-SUP recommends that ITWG, IWWG, IPWG and IROWG prioritize their recommendations to ensure more effective uptake by WMO and satellite operators*.

10.5 Ocean Applications and JCOMM Matters

The report on Ocean Applications and JCOMM-related Matters described the need for the development of improved ocean products integrating *in situ* and satellite data, providing a focus for the JCOMM Task Team on Satellite Data Requirements (TT-SAT).

ET-SUP deeply appreciated the report by the JCOMM representative and:

(a) Supported the development of ocean products and the integration of *in situ* and satellite data to improve such products (e.g. *in situ* input to satellite cal/val, satellite input to *in situ* cal/val, blended products);

(b) Encouraged the development by the JCOMM Task Team on Satellite Data Requirements (TT-SAT) of an activity similar to the GHRSST (Group for High Resolution Sea Surface Temperature (https://www.ghrsst.org/) for ocean surface vector winds (OSVW), as integrated *in situ* and satellite OSVW products would substantially improve the operational applications (including those of numerical weather prediction (NWP) (e.g. tropical cyclone development), sea state forecasting and warnings, and coastal applications (e.g. forecasts of storm surge and oil spill trajectory)) that provide socio-economical benefits.

(c) Supported JCOMM plans to support improved use of satellite products for coastal applications, and associated coordination activities for training/technology transfer.

10.6 Climate Products Including SCOPE-CM Matters

S. Bojinski reported on international efforts to generate, or to support the generation of, satellite-derived climate datasets and products. He provided an overview of: (i) the GCOS satellite-related climate monitoring requirements, (ii) international response to these requirements, (iii) the Sustained Co-Ordinated Processing of Environmental Satellite Data (SCOPE-CM) initiative, including climate product status and future plans, (iv) the ESA Climate Change Initiative, (v) the CEOS Working Group on Climate, (vi) the need for international peer-review and assessments, and (vi) the Architecture for Climate Monitoring from Space.

ET-SUP thanked the Secretariat for providing a comprehensive overview of activities in support of coordinated climate monitoring from space.

Recommendation 6.14: *CMA to investigate its contribution to SCOPE-CM and report to the WMO Space Programme office. (Recommended due date: 31 March 2012)*

Recommendation 6.15: *SCOPE-CM to explore possibilities for extension, for example through pilot projects on precipitation (with consideration of IPWG findings) and on ocean altimetry (with consideration of the community around the upcoming altimetry symposium in Italy in 2012).*

10.7 SCOPE-NWC concept of operations outline

A. Rea provided an overview of a draft concept of operations for the Sustained, Co-Ordinated Processing of Environmental Satellite Data for Nowcasting (SCOPE-NWC).

The initial aim of the Sustained, Co-Ordinated Processing of Environmental Satellite Data for Nowcasting (SCOPE-NWC) could be to establish a network of facilities ensuring enhanced and sustained provision of high-quality satellite products related to nowcasting.

The key objective of SCOPE-NWC would be to provide a mechanism through which processed satellite data and products can be made available simply and quickly, primarily for users in the NMHSs of smaller or developing nations, where expertise and facilities for processing and utilizing satellite data may be limited, but also for more advanced nations where there may be efficiencies possible through combining resources and efforts. The SCOPE-NWC would complement the already well-established SCOPE-CM as it will focus particularly on the exploitation of GEO and LEO satellite data for near real time applications (0 to 6 hours).

SCOPE-NWC would leverage existing activities in this domain and facilitate the joint development of enhanced algorithms and methods for providing a sustained nowcasting service in a variety of applications. This should include the consolidation of existing methods and products, as well as the development of new products and methods. This is particularly important to guarantee the optimal exploitation of new sensor data with the onset of new satellite missions. Also included should be the production of software and/or products and the facilitation of regional tuning of those. This will be done with expert partners in the various regions. Guidance from existing scientific groups should be used (e.g. IPWG, IWWG etc.).

The concept for SCOPE-NWC arose from discussions at ET-SUP-5, after consideration of the benefits of the SCOPE-CM initiative. It was felt by ET-SUP-5 that the concept could be usefully expanded to the nowcasting domain, given that:

- The related science is reasonably mature;
- An organized user community is available;
- An established description of the needs of this community exists;
- There are opportunities and synergy with other initiatives.

SCOPE-NWC should be aligned with a number of WMO initiatives, in particular the Severe Weather Forecasting Demonstration Project (SWFDP). SWFDP is focused primarily on numerical weather prediction output.

ET-SUP discussed the matter with a representative of the SWFDP from WMO Secretariat (P. Chen). A SCOPE-NWC could be used as an implementation vehicle, e.g. for introducing output from research efforts, such as under the World Weather Research Project (WWRP) into operations. It was recommended that research groups, such as the WWRP Working Group on Nowcasting Research should be involved when designing such a mechanism.

After discussions in a break-out group, ET-SUP agreed on a refined draft concept of operations for SCOPE-NWC, for further consideration by the Team (see Appendix VI, including discussion notes).

Furthermore, in this context, it was recommended to extend SCOPE-CM by pilot projects on precipitation (with consideration of IPWG findings) and on ocean altimetry (following a recommendation by CM-11, with consideration of the community around the upcoming altimetry symposium in Italy in 2012) (see item 10.7).

Action 6.16: *A Task Team composed of ET-SUP Members (A. Rea, P. Zhang, L. Machado, A Mostek), with support by the WMO Space Programme office, should further refine the draft SCOPE-NWC concept, including the identification of potential pilot projects and contributing agencies and individuals (see Appendix VI for details). (Due date: 31 March 2012)*

Action 6.17: *A. Rea and X. Fang to develop a discussion paper for a SCOPE-NWC Pilot Project focused on globally consistent delivery of basic nowcasting products from geostationary and polar orbiting satellites. (Due date: 30 April 2012)*

Action 6.18*: A. Rea and L. Machado to develop a discussion paper for a SCOPE-NWC Pilot Project focused on aviation products. (Due date: 30 April 2012)*

Action 6.19*: L. Machado, V. Gärtner, A. Mostek and S. Bojinski to develop a discussion paper for a SCOPE-NWC Pilot Project focused on precipitation products. (Due date: 30 April 2012)*

Action 6.20*: X. Fang and H. Kunimatsu to develop a discussion paper for a SCOPE-NWC Pilot Project focused on dust detection and dust storm prediction products. (Due date: 30 April 2012)*

Action 6.21*: Suman Goyal and V. Gärtner to develop a discussion paper for a SCOPE-NWC Pilot Project focused on real time quality controlled ocean surface winds from Oceansat-2. (Due date: 30 April 2012)*

10.8 Other Product Developments at CGMS-39

This document presented a short summary of the discussions on a range of product developments which were held in working group II of CGMS-39 and that are not covered in previous items under agenda item 10. These include cloud, dust and ash products, ocean parameters (sea-surface temperature, ocean surface vector winds), tropical cyclones, total precipitable water, and matters related to satellite calibration and product validation.

11. PROSPECTIVE

In this agenda item, the long-term planning and implementation of the Global Observing System were recalled, and the session discussed a perspective on satellite applications and products in 2025.

11.1 Vision for the Global Observing System in 2025

It was recalled that the Vision for the Global Observing System (GOS) in 2025 had been recommended by the fourteenth session of the Commission for Basic Systems (CBS-XIV, Dubrovnik, 25 March – 2 April 2009) and subsequently approved by the Executive Council at its sixty-first session (EC-LXI) in June 2009.

The Vision provides high-level goals to guide the evolution of the GOS in the coming decades. These goals are intended to be challenging but achievable. It addresses both the space-based and the surface-based components, as well as cross-cutting aspects. (Note: a link to the Vision is available on the Space Programme website http://www.wmo.int/sat under “Space-based GOS” and “Global Planning”.)

The Vision was brought to the attention of ET-SUP primarily as a strategic guidance. Additionally, ET-SUP had an opportunity to provide feedback and suggestions for the next update of the Vision.

11.2 Vision for Satellite Utilization and Products in 2025

The scope of the draft Vision was to provide high-level goals for the utilization of satellite data and products in the coming decades in consistency with the Vision for the Global Observing System in 2025. The overarching goal was to enable users to take full advantage of satellite capabilities in the generation of services and knowledge addressing essential societal needs.

This Vision addresses the following areas:

- Timely availability of data
- Data quality assurance
- Tools for data processing and analysis
- Product generation
- User uptake, awareness and training
- Involvement of users and beneficiaries

ET-SUP agreed that all these headers were important and particularly meaningful in the context of WIGOS. In a break out session it was finally agreed that the highlights of this "vision" could be turned into recommendations to be included in a proposed update of the Implementation Plan for Evolution of the Global Observing systems (EGOS-IP) (See agenda item 11.3). This proposed input is documented in Appendix VII.

11.3 Implementation Plan for the Evolution of Global Observing Systems

The Secretariat introduced the Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP), which is a major component of the Rolling Requirements Review (RRR) process.

The new version of EGOS-IP is primarily responding to the Vision for the GOS in 2025, and closely follows the structure of this Vision. It also aims to respond to the Implementation Plan for the Global Climate Observing System (GCOS-IP), and to emerging requirements of the Global Framework for Climate Services (GFCS) and of the Global Cryosphere Watch (GCW). It defines a set of implementation actions which are required for incremental improvement of global observing systems towards the 2025 Vision. The scope of EGOS-IP embraces both space and surface-based observations, as well as cross-cutting aspects.

A draft version of the Implementation Plan was circulated in January to all OPAG/IOS Expert Team Chairs for review. The ET-SUP Chairman provided valuable comments. The Expert-Team on Satellite Systems (ET-SAT) completed a thorough review of the satellite-related aspects of this plan. These comments have been taken into account in the current version: ftp://ftp.wmo.int/Documents/PublicWeb/www/gos/egos-ip/. The Inter-Programme Coordination Team on Space Weather (ICTSW) prepares an update of the Space Weather section. The plan should be finalized by the Expert Team on Evolution of Global Observing systems in May 2012 for submission to the Commission for Basic Systems in September 2012.

ET-SUP acknowledged that the EGOS-IP contained essential provisions for the establishment of space-based observation capabilities, but did not address the way to efficiently use these capabilities. Since the Vision highlights the expected expansion of space-based observation, the need for fostering international exchange, quality assurance, and integration, this should impact on utilization practices and would need to be further elaborated. This anticipated evolution of practices is the subject of the proposed "Vision for Satellite Utilization".

From this vision, recommendations could be derived for inclusion in the EGOS-IP either as an additional section dedicated to utilization of satellite data, or in the chapter dedicated to space-based observations. The Chairman of OPAG-IOS supported this view, while recalling the

time constraint since the revised EGOS-IP should be finalized by ICT-IOS in June 2012, after review by ET-EGOS in May 2012.

In a break-out session, ET-SUP developed additions to the EGOS-IP that will be submitted to the ET-EGOS (Appendix VII).

Action 6.22: *WMO SP to transmit the proposed modifications to the EGOS-IP to ET-EGOS. (Due date: 20 January 2012)*

12. QUESTIONNAIRE AND MONITORING ISSUES

This session discussed lessons learned from the 2010 evaluation of the WMO biennial questionnaire, and provided recommendations on future monitoring of the use of satellite data and products across WMO Members, with focus on the needs of less well developed Members. Experiences from the Satellite Data Access Pilot Project in RA II informed this discussion.

12.1 Experience of the RA II Pilot Project online questionnaire

The RA II Pilot Project web-based questionnaire on satellite data utilization by RA II Members was a web-based survey system on the status of the availability and use of satellite data and products (see http://www.wmo.int/pages/prog/sat/ra2pilotproject-intro_en.php). The questionnaire and its results were expected to contribute to improving satellite data utilization. The questionnaire was open to RA II Members, and they were invited to answer it by the end of 2011. The requirements from RA II Members identified through the questionnaire would be summarized and reported by April 2012.

Questions in the RA II questionnaire are derived from WMO's biennial survey on the status of the availability and use of satellite data and products by WMO Members. Having the questionnaire available online is expected to increase the response rate for the survey. The questionnaire consists of 17 questions and the themes of the question items are (i) access to satellite data and products, (ii) use of satellite data and products, (iii) applications of satellite data and products, (iv) education and training, (v) additional information.

12.2 Lessons from 2010 Questionnaire and Plans for Future Surveys

WMO had been using biennial questionnaires to establish evidence on the capabilities and deficiencies in satellite data utilization among its Members for the past 15 years. The ET-SUP session discussed the benefits and drawbacks of this methodology, based on ET-SUP-6/Doc. 12.2 and previous discussions at ET-SUP-5 in 2010. A basic decision was taken in 2010 to continue with the practice surveying Member's needs on satellite utilization and related training, but the details on the way forward remained open.

ET-SUP pointed out that surveys require adequate resources (e.g., the GEO survey on observation priorities), especially when they include interviews. Targeted surveys were used at EUMETSAT and NOAA to direct specific questions to individuals, and in part, scientific conferences were used as venues for holding interviews. One should be clear about the motivation for carrying out surveys: a key motivation for satellite data users to respond to a survey lies in the expectation that remedial action will be taken by WMO, satellite operators, processing centres and training facilities, helping to mitigate some of the reported deficiencies and unmet requirements.

Further, ET-SUP members, VLab CoEs and international working groups were identified as necessary and key owners of a future survey.

The complexity of previous surveys was seen to be a potential barrier to completion. In broad terms, ET-SUP agreed that the 2012 WMO survey should be simple, web-based, have a regional focus, and include interviews.

In a break-out session, participants developed comprehensive guidance for conducting the survey in 2012 (see Appendix VIII).

Action 6.23: *ET-SUP Task Team (A. Mostek, S. Wannop, A. Rea) and WMO SP to follow the implementation plan recommended in Appendix VIII of the ET-SUP-6 meeting report.(Due dates: February – October 2012; see Appendix VIII for details)*

13. VIRTUAL LABORATORY FOR EDUCATION AND TRAINING

13.1 Update on VLab

The VLab Management Group (VLMG) co-chair Volker Gärtner presented the status of the WMO/CGMS Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) and reported on upcoming issues and activities to stabilize and enhance the VLab further.

With a focus on developing countries, the VLab through its currently twelve Centres of Excellence is an important vehicle for space agency support to training and research. Through various means such as event weeks (on aviation, dust), Regional Focus Groups and virtual lectures, the VLab provides education and training in satellite meteorology primarily through distant learning.

The Centres of Excellence (CoE) should regularly conduct regional focus group discussions on topics of immediate interest to the Region; more needs to be done to activate such discussions in all Regions, bearing in mind that some CoEs are very active in this area. In some cases, internet connectivity imposes limits on participation.

New CoE candidates have been identified in India and Morocco, and both Members are in the process of sending official candidature letters to WMO. India's participation would fill a critical gap in South Asia, and Morocco could strengthen the VLab in the Arabic and French-speaking world. Furthermore, India hosts the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) which is affiliated to the United Nations (Office for Out Space Affairs). Supported by IMD and ISRO, this centre provides excellent training facilities. During a discussion at the recent advisory board meeting of CSSTEAP in Delhi (24 November) the Director of CSSTEAP, Dr. P.S. Roy expressed also an interest to explore possibilities for cooperation with the VLab.

During the recent SWFDP – Eastern Africa Regional Training Workshop on Severe Weather Forecasting (GDPFS) and Warning Services (PWS) in Arusha, Tanzania (21 November – 2 December 2011) the CoEs Nairobi and Pretoria contributed by sending a lecturer (Joseph Kagenyi) and a distant lecture (Estelle de Coning) to highlight the use of satellite observations for support of SWFDP.

Furthermore the opportunity exists to further support the Lake Victoria project through provision of dedicated training support and delivery of data and information via GEONETCAST/EUMETCast. Discussions are involving also partners at the UK MetOffice (Steve Palmer).

Information flow on training events in the VLab and beyond has been much improved through a training calendar on the updated VLab website (http://vlab.wmo.int). Following this positive example, NOAA has added a training calendar to its Training Portal site (http://weather.gov/training/planning_calendar.php). It was noted that some CoE websites needed to be updated to reflect the structure and content (logo etc.) of the VLab homepage. However,

efforts should be targeted to maintaining the calendar up-to-date, given the broad range of training events, and to share it with similar activities (COSPAR, GEO capacity building, CEOS WGCBDD).

Recommendation 6.16: *VLab to share information in the training calendar with COSPAR and other relevant international training activities.*

Collaboration with COSPAR

The WMO Space Programme had approached the Committee for Space Research (COSPAR) secretariat to suggest seeking areas of cooperation between the VLab and the Capacity Building in Earth Observation activity of COSPAR.

The rationale for this is that VLab and COSPAR (and its Panel for Capacity Building in Earth Observation, PCB/EO) are complementary organizational mechanisms for training in satellite meteorology and satellite EO applications, respectively, in terms of (i) application areas addressed, (ii) research vs operational focus, (iii) resourcing, (iv) host and partner institutions. These differences are significant, but offer potential for substantial cross-benefit. Further avenues of partnering should be explored, for enhancing overall capacity in developing countries. Additional coordination overhead should be kept to a minimum.

It was pointed out that COSPAR only since the mid-2000s had a significant focus on capacity building in Earth observation, by holding regional workshops on oceanography, land surface applications, water cycle and aerosols. There is also a COSPAR panel on training in space weather applications. Workshops for students and young professionals are supplemented by a fellowship programme.

The detailed proposal is presented in Appendix IX.

Recommendation 6.17: *ET-SUP supported the agreement between VLab and COSPAR, and recommended to demonstrate within a year the value of this collaboration.*

To ensure that VLab activities are guided by the strategic objectives of WMO, it was suggested to review the VLab strategy at the VLMG session in 2012, for consideration by CGMS-40 in November 2012.

Action 6.24: *VLMG to review the VLab strategy in light of WMO strategic priorities, and to submit it to CGMS-40 for adoption. (Due date: VLMG-6 Meeting in October 2012)*

The next face-to-face meeting of the VLMG (VLMG-6) will take place in Brazil, from 8-11 October 2012. The National Institute for Space Research (INPE) will be hosting the event in its main campus, in São José dos Campos, state of São Paulo. At CGMS-39 the satellite agencies were asked to foresee funding of representatives from CoEs to allow maximum participation at VLMG-6.

A major challenge to the functioning of VLab was to ensure the funding of the VLab Technical Support Officer for the years 2012 onwards and to aim to include further members from the satellite community. It was confirmed that NOAA and EUMETSAT commit to funding the position through 2012; however, contributions from other CGMS members would be required to ensure continuity of this vital function for the VLab beyond 2012, preferably through a WMO Trust Fund. The WMO Space Programme had sent an e-mail (4 November 2011) to all CGMS agencies to ask for an annual contribution of about 10,000 $ for this purpose.

Action 6.25: *WMO SP, with assistance from NOAA and EUMETSAT, to look into the possibility of using a WMO Trust Fund for ensuring the continuity of the VLab TSO function. (Due date: 15 February 2012)*

Action 6.26: *VLab TSO to ensure that all CoE websites are up-to-date, reflecting the 'look and feel' of the VLab homepage (including the VLab logo). (Due date: 1 March 2012)*

V. Gärtner called upon all satellite operators to develop user preparedness programmes for upcoming generations of instruments, using the example of the GOES-R Proving Ground.

SatMaNu

Through correspondence, the session was informed that Veronica Zwatz-Meise (formerly ZAMG, Austria) and Ab Maas (formerly KNMI, The Netherlands) had developed the "Manual of Synoptic Satellite Meteorology - Conceptual Models" (SatMaNu) as a resource of conceptual models and which could increase the use of satellite data and products in forecasting. WMO recently supported SatMaNu to provide some lectures and support for the RTC in Pretoria. The extension of some of the conceptual models for use in the Southern Hemisphere has been demonstrated. The proposal to extend or adapt SatMaNu for a global audience was discussed at a side event during CALMET and was widely supported by the African and South American participants and email contact with the Bureau Training Centre in Australia also showed interest.

Action 6.27: *VLMG co-chair to ask the VLMG for its opinion to extend the SatMaNu concept to areas outside Europe, especially to the Southern Hemisphere. This should include a discussion on providing the necessary resources to proceed with this activity. (Due date: 31 March 2012)*

13.2 Training plans for new generation satellites

13.2.1 Training Plans for New Generation Satellites: FY-3

CMA has designed many training lessons for FY-3 users, including introduction of FY-3 products, satellite data in short-term nowcasting application, satellite data in disaster monitoring and so on. Most course materials can be downloaded on the website (http://www.cmatc.cma.gov.cn/www/res/satellitemeteorology/index.html). In the future, CMA plan to promote the application of FY-3 data through two ways, one is to set up more training courses, the other is to provide application software.

Monitoring Analysis and Service System Software (MASS) is basic application software designed concerning the FY-3 satellite observation, to provide a specialized remote sensing monitoring and processing platform for professionals and technicians. The 1.0 version of the software has been released in October 2010. So far, this system has been applied successfully in NSMC and provincial meteorological bureaus.

The software contains 7 main functions: (1) Multi-source data reading and displaying, (2) Image processing, (3) Remote sensing processing tools, (4) Monitoring product analysis function, (5) Thematic map of monitoring product function, (6) Operation management function, (7) Monitoring products distribution function.

The session expressed high interest in training material for using FY-3 data and recommended that such material should be made available through the CoE hosted by CMA. ET-SUP considered very useful that the CMA Training Centre arranged for a distant lecture to participants in the Region on visualization and analysis of the FY-3 product suite (including information on downloading, functionality and applicability of products) and commended CMA on its training programme.

Action 6.28: *VLMG Co-Chair to contact CMA VLab CoE to arrange for a distant lecture on the FY-3 product suite for the benefit of all Regions. (Due date: 21 February 2012)*

13.2.2 Training Plans for New Generation Satellites: Meteor-M

The session expressed high interest in training material for using Meteor-M data and recommended that such material should be made available through the CoE hosted by ROSHYDROMET. ET-SUP considered very useful that the Training Centre at the University of St. Petersburg arranged for a distant lecture to participants in the Region on visualization and analysis of Meteor-M product suite (including information on downloading, functionality and applicability of products).

> **Action 6.29:** *O. Milekhin to contact the VLab CoE at the Hydrometeorology University of St. Petersburg (Russian Federation) to arrange for a distant lecture on the Meteor-M product suite for the benefit of all Regions. (Due date: 21 February 2012)*

13.2.3 Training Plans for New Generation Satellites: NPP

A. Mostek presented NOAA training plans for new generation satellites (NPP and GOES-R). These were:

- Considered integral to NOAA programmes and goals
- Address the entire international satellite training community
- Include the NOAA GOES-R Proving Ground programme
- Include Polar Satellites (JPSS/NPP)
- Include many partners in NOAA, collaborative institutes and government agencies

He pointed out the value of the COMET MetEd online training library which was in principle freely available, with to date 200 000 registered users. The Environmental Satellite Resource Center was recognized as the training portal for the VLab. The question was raised whether these resources could be registered in appropriate ways in the catalogue of the WMO Information System (WIS), to allow for broad discovery.

The GOES-R Proving Ground programme (http://cimss.ssec.wisc.edu/goes_r/proving-ground.html) is intended to prepare the satellite user community for using GOES-R data (scheduled launch in 2015). It is a substantial training and user preparation programme which had been included in the GOES-R mission statement from the beginning. The programme foresees sustained interaction between developers and end users for training**,** product evaluation, and solicitation of user feedback, to ensure Day-1 readiness and smooth transition of product use into operations. The different strands to ensure user readiness are:

- Validate and optimize decision aids
- Optimize product display technique
- Environmental event simulator, with a focus on high-impact events
- Decision support products

Inclusion of training modules in support of NPP and JPSS-1 into the Proving Ground is a matter of ongoing work.

ET-SUP expressed its deep appreciation for the training and user preparedness efforts occurring in the GOES-R Proving Ground programme. It noted the upcoming GOES-R Science Week featuring the Proving Ground programme (Kansas City, MO, USA, 30 April – 4 May 2012).

> **Action 6.30:** *A. Mostek, with assistance from COMET and the WMO Space Programme office, to investigate whether ESRC (as a portal) and MetEd (as a repository of training material) can be registered in appropriate ways in the WIS, to allow for broad discovery of their content. (Due date: 1 March 2012)*

Recommendation 6.18: *ET-SUP recommended that parts of the COMET library be disseminated through the GEONETCast training channel.*

13.2.4 Training Plans for New Generation Satellites: MTG & EPS-SG

To prepare the user communities for the new satellite data from MTG and EPS-SG, EUMETSAT plans to follow a similar approach to that taken by the USA through the GOES-R Proving Ground since 2008. The training of the EUMETSAT user communities is crucially dependent on collaboration with national meteorological services and other operational communities as EUMETSAT's role is to provide data to those organizations. Therefore the organization of a coherent training approach across countries is one big challenge, but together with EUMETCAL and the WMO VLab, this goal can be achieved.

Discussions and briefings at recent GOES Users and other Satellite Conferences show a clear demand for expanding the GOES PG to include more partners especially from the International Community. The aim could be to setup a general satellite proving ground. In this context the VLab has established a small task team to define general requirements for introducing new satellite data into operational user communities. The task team is led by Bernadette Connell of CIRA at Fort Collins, CO, USA. The generalized satellite proving ground would enable interested users to get early access to new products even before the satellite systems are launched. The new products will be proxy products generated from simulated data of other satellite systems or from model output

Recommendation 6.19: *ET-SUP recommended that all satellite operators include comprehensive training programmes into the mission statements, for user preparation and capacity building pre- and post-launch. The concept for a generalized satellite proving ground should be developed.*

In the international context, a problem which has to be solved for training purposes is the presentation of new products together with operational products (NWP, SYNOP, Satellite etc). To achieve this, a new web-based display system has been developed by ZAMG (the lead entity of the EUMeTrain project). It is called ePORT and allows placing the current and new products in a visualization context in a web-based environment. The already existing ePORT areas can be found at http://www.eumetrain.org/eport.html.

Besides ePORT-Europe, ePORT-South Africa and ePORT-Eastern Europe, additional areas will be covered by ePORT-Arctic, ePORT-Atlantic and ePORT-Central / North Africa. The training itself will be based on blended learning courses with an ever growing part of online learning modules. This is in line with the approach taken by the VLab. An essential part will be the possibility to handle the new satellite data 'pre-launch' in a laboratory-type environment.

ET-SUP congratulated EuMeTrain for its training efforts. It was pointed out that the VLab CoE (in particular in Africa) could make use of the ePORT visualization tools.

13.3 Training plans in new application areas

Meteorological satellites were becoming increasingly relevant for a number of application areas beyond operational weather forecasting and satellite meteorology, such as climate monitoring, oceanography, land applications. They are being affected by space weather. Observing and assessing the impact of space weather events affecting the Earth's environment had also become a topic under WMO responsibility, for which training capacities need to be developed. These issues were presented and discussed in detail in this session.

13.3.1 Training Plans in New Application Areas: Land / Ocean

Training in Land Surface Application using Satellites

In Europe, EUMETSAT together with its Satellite Application Facility on Land Surface Analysis (LSA) has created a **S**atellite **A**pplications in **L**and surface analyses **G**roup for **E**astern **E**urope (SALGEE). The main purpose of the user group is to foster research and operational activates of land surface processes as well to progress the use of satellite land surface analysis techniques in Eastern Europe and other regions of interest. Since 2009 two workshops had been held in Sofia, Bulgaria, and in Antalya, Turkey, in 2011.

In the context of the WMO VLab, a land surface application training course was held in Maputo, Mozambique for Portuguese speaking countries in November 2009. The course benefitted from a precursor course on land applications which was held in Brazil in 2008. It is anticipated to re-run this course in 2012 in West Africa once the relevant material has been translated into French, probably in the Centre of Excellence in Niamey. Thereafter, this course will also be held in English.

Ocean Training for Marine Forecasters

In Europe a training course for marine forecasters has been held twice together with experts from NOAA and IOC/IODE. The courses were hosted by IOC project Office for IODE in Oostende, Belgium, in December 2011. The training concentrated on the use of scatterometer data (e.g. ASCAT and OSCAT) for operational marine forecasting applications. Also the data of the JASON satellites were discussed.

In the context of the VLab, Brazil also expressed an interest to conduct a joint training course for marine forecasters together with NASA in April 2012. EUMETSAT plans to hold another training course for marine forecasters on the Southern Hemisphere in Cape Town, South Africa during the first half of 2012.

In autumn 2011, an event week on marine applications was conducted by EUMeTrain in form of bundled lectures on the Internet.

The expectation is that in the context of the WMO/CGMS VLab, these ocean training courses will be regularly repeated each year. It is anticipated that in the future, additional applications like ocean colour and fishery support, as well as problems of coastal inundation forecasting and warnings (see related CGMS action) will be addressed, and that appropriate training material can be developed and maintained within the VLab.

13.3.2 Space Weather

The sixteenth World Meteorological Congress held in May 2011 acknowledged the need for a coordinated effort by WMO Members to address the observing and service requirements to protect against the global hazards of Space Weather. It invited the WMO Space Programme, through the Inter-programme Coordination Team on Space Weather (ICTSW), to develop near-term and far-term action plans, including education and training, and work with the WMO Regional Associations to implement a coordinated strategy for Space Weather.

A first version of space weather observing requirements was developed and made available on line as part of the overall WMO Observing requirements database: www.wmo-sat.info/db, under the application name “Space Weather.” Subsequently, an inventory of space weather observing capabilities and plans is being made, including both space-based and surface-based observation infrastructure. The ICTSW will conduct a first assessment of the unmet needs and develop a Statement of Guidance to address the highest priority gaps in observations.

In order to facilitate the use of space weather products, a Space Weather Product Portal is being developed. It aims at gathering information on products that meet minimum requirements, and providing convenient discovery of and access to these products. Global and regional products are being identified according to impact and usage categories, such as ionospheric disturbances, geomagnetic disturbances, radiation environment, and solar conditions. The ICTSW will strive to harmonize the description of end products, including their technical characteristics, validation results, and quality assessment, using a unified metadata template

The Environmental Satellite Resource Centre (ESRC) of the COMET Programme of UCAR, USA is preparing an update to the current Space Weather Basics module for publication at the end of December. It will touch on the sun as a star, energy release, the solar cycle, forecasting and impacts of space weather as well as a short description of the NOAA Space Weather Prediction Center. There will be a print version for easy translation and also a narrated version.

Actions remain to be taken to: (i) supplement this training module with more detailed modules; (ii) develop specific tutorials for the products that will be selected for the web-based Space Weather Demonstration Site (See Section 2.2 of ET-SUP-6/Doc. 13.3(2)), and (iii) translate these modules in as many languages as practical.

ET-SUP noted that COSPAR does have experience in space weather training, and appropriate linkages should be exploited (see item 13.1). It was further recommended that a basic training module on space weather be disseminated to all VLab CoEs.

Action 6.31: *WMO Space Programme office and COSPAR to explore the possibility of developing training modules on space weather, for dissemination to the VLab CoEs. (Due date: 1 April 2012)*

14. WEB-BASED INFORMATION

14.1 WMO Space Programme and related websites, and WMO Product Access Guide

The meeting noted with appreciation the recent re-design and updates on the Space Programme - and related Websites and provided feedback. Besides streamlining the navigation within the Space Programme website (http://www.wmo.int/sat), one major objective was to align its structure with the four main components of the Space Programme as endorsed by WMO congress. New features include a newsfeed, dynamic calendar and improved access to documents. The GSICS website (http://gsics.wmo.int)was redesigned. The VLab website (http://vlab.wmo.int) has also completely been re-designed; its content is maintained externally by the VLab Technical Officer.

Product Access Guide

N. Hettich introduced the proposed concept of a web-based Satellite Product Access Guide within the WMO Space Programme website. The prototype Product Access Guide was developed in response to ET-SUP Recommendation 5.7. Such an Access Guide would give greater visibility to satellite products made available at the global level. The Product Access Guide would not store information on individual products, or the products themselves, but rather point users to the respective sources, through an agreed categorization. This approach is intended to avoid any duplication of satellite operators' catalogues, but to provide a thematic high-level overview on what is available in terms of satellite products and where to get detailed information. The prototype Product Access Guide, partly populated for demonstration purposes, is available under http://www.wmo.int/pages/prog/sat/product-access-guide_en.php.

In the breakout session, ET-SUP-5 agreed on the proposed categorization of products, with the addition of *Ocean Surface Pollution / Oil Spills* to the Oceanic Domain category, and

renaming *Aerosols and Dust* to *Aerosols/Dust/Volcanic ash*. An updated category list is provided in Appendix X.

The group agreed to primarily limit the scope of the product access guide to near-real-time products, climate data series may be considered at a later stage. For the products referenced in this guide, the following information must be displayed:

- Information on access (e.g. Web, FTP, Direct Broadcast)
- Indication of the region covered
- Source (Instrument)
- Resolution
- Update Frequency
- A quality indication
- Reference of validation information

ET-SUP recommended that a special section be added for “high impact events”, such as tropical cyclones, thunderstorms, volcanic ash plumes. The section would provide indication of relevant satellite products, and how to make use of them to support the management of such situations. It was also suggested that, at a later stage, the product access guide should offer search possibilities by keyword.

ET-SUP members endorsed the concept of the PAG in which the central page located in the WMO website, is linked to distributed pages maintained by the product providers, which will contain the actual information on products. The distributed pages shall be developed by product providers in accordance with the agreed categorization and contents.

Action 6.32: *ET-SUP members who are product providers to create product pages in accordance with the agreed categorization, for inclusion in the product access guide. (Due date: 31 December 2012)*

Action 6.33: *VLab to develop a draft page for guidance on the use of satellite products in support of high-impact events management, with a view to include it in the Product Access Guide. (Due date: 1 May 2012)*

14.2 Requirements database

ET-SUP took note on the new online Database of Observational Requirements. (http://www.wmo-sat.info/db). It is the foundation of the Rolling Requirements Review (RRR) process, and represents one part of the future integrated WMO Database of Observing Requirements and Capabilities which is currently being developed. The database is open to the public for consultation. Through a secured on-line interface, the requirements can be remotely updated by focal points designated for each application area.

ET-SUP members confirmed the usefulness of such on-line tools to and encouraged the WMO Secretariat to proceed with the integration of currently text-based information contained in the “Dossier on the space-based GOS” into a dynamic, web-based system.

Recommendation 6.20: *ET-SUP recommended integrating the new Observing Requirements Database with the future database of space-based capabilities, to support the critical review of requirements and capabilities.*

15. PUBLICATIONS

The session was briefed on the development of new guidance material: the *Guide to Instruments and Methods of Observation* ('CIMO Guide', WMO-No. 8) is being revised, with a substantial new section on measurement principles of satellite remote sensing in support of meteorology, climatology, hydrology and related applications. Further, Chapter IV of the Manual on the Global Observing System was in the process of being updated.

15.1 New CIMO Guide / Part IV

New material was being developed by WMO with the aim to replace the current Chapter on Satellite Observations in the Guide to Meteorological Instruments and Methods of Observation (CIMO Guide). Given the increasing importance of space-based observations to WMO Members, it would be a new part entirely dedicated to space. It provided a range of basic information on the principles of satellite observations, mission types, instrument techniques and applications.

ET-SUP members were informed that the material prepared for the CIMO guide is currently under review by the Expert Team on Satellite Systems (ET-SAT). The draft text could be found at: http://www.wmo.int/pages/prog/sat/meetings/documents/ET-SAT-6_Doc_08-01_add-CIMO-Guide.zip

15.2 Updating of the Manual on the Global Observing System

Following the adoption by CGMS of a new baseline for its contributions to the Global Observing System (GOS) as reported in ET-SUP-6/Doc. 6.1, the relevant part of the Manual on the GOS (WMO-N° 544, Edition 2010) should be updated in order to reflect the advances made by CGMS.

In a break-out session, ET-SUP developed an updated version of Part IV of the Manual on the Space-based Observing System (see Appendix XI). This update will be delivered to the Regulatory Document Review Board in spring 2012, with the aim to submit the update to the Commission for Basic Systems (CBS) for adoption in September 2012.

16. ANY OTHER BUSINESS

No other relevant business was discussed..

17. REVIEW AND ADOPTION OF THE DRAFT REPORT

The meeting was invited to review and adopt a summary report of the presentations, discussions and conclusions by 20 January 2012. The Secretariat agreed to distribute a draft report for comments to all participants by 23 December 2011.

18. DATE AND PLACE OF NEXT SESSION

The meeting decided on holding a reduced session, including the Chair, during the meeting of ET-EGOS-7 in May 2012. It tentatively agreed to hold its next full session in January 2013, pending confirmation by CBS in 2012.

19. CLOSURE OF THE MEETING

The session was closed at 15h00 on Friday 16 December 2011.

APPENDIX I

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APPENDIX II

FINAL AGENDA AND WORK SCHEDULE

12 DECEMBER 2011

		Approx.Time incl. Discussion
8:30	Registration (Salle 7 LAKE)	
9:00	**1. ORGANIZATION OF THE SESSION** **1.1** Opening of the session **1.2** Adoption of the agenda **1.3** Working arrangements for the session	20’
9:20	**2. CHAIRMAN’S REPORT** (Machado)	10’
9:30	**3. GUIDANCE FROM THE CHAIRPERSON OF OPAG IOS** (Riishojgaard)	10’
9:40	**4. OUTCOME OF WMO MEETINGS WITH RELEVANCE TO ET-SUP INCLUDING CBS, CONSULTATIVE MEETINGS, AND CONGRESS** (Secretariat)	30’
10:10	**5. STATUS OF ACTIONS FROM PREVIOUS ET-SUP MEETINGS** (Secretariat)	20’
10:30	*Break*	30’
11:00	**6. UPDATE ON THE SPACE-BASED GOS** **6.1** New CGMS Baseline for the Space-based GOS (Secretariat) **6.2** Dossier on the Space-based GOS : Satellites, Instruments and Products (Secretariat) **6.3** Update on GSICS (Secretariat)	 10’ 15’ 15’
11:40	**7. SATELLITE DATA ACCESS : REGIONAL REQUIREMENTS** 7.1 RA I Dissemination Expert Group (Wannop)	 30’
12:10	*Lunch Break*	80’
13:30	7.2 RA II Pilot Project (Kunimatsu) 7.3 RA III/RA IV Satellite Data Requirements (Machado) 7.4 Procedure for Defining / Maintaining Regional Requirements for Satellite Data (Machado) 7.5 NAEDEX-APSDEU Update (Rea)	20’ 20’ 30’ 10’
14:50	**8. UPDATE ON REGIONAL EVENTS** **8.1** Outcome of the Second Asia/Oceania Meteorological Satellite Users Conference (Kunimatsu)	 20’
15:10	**9. SATELLITE DATA ACCESS: UPDATE ON NEW CAPABILITIES (INCLUDING SOFTWARE)** **9.1** Evolution of Geonetcast America and Gempak (Machado/Mostek) **9.2** Meteor-M and Elektro-L data access (Milekhin)	 20’ 20’
15:50	*Break*	20’
16:10	**9.3** FY-3 data access (Fang for P. Zhang) **9.4** DMSP and future DWSS data access (Mostek) **9.5** NPP and GOES-R data access (Mostek) **9.6** INSAT-Kalpana data access (Goyal for Singh)	20’ 20’ 20’ 20’

	9.7	MTSAT data access (Kunimatsu)	20'
17:30	*Adjourn for Day 1*		
18:00	*Cocktail Reception in WMO Attic Restaurant*		

13 DECEMBER 2011

			Approx.Time incl. Discussion
9:00	**9.8**	COMS MI Operation and Data Service (J.-D. Jang)	20'
	9.9	EUMETCast and METOP HRPT (Gärtner/Wannop)	20'
	9.10	CMACast (Fang for P. Zhang)	20'
	9.11	RARS (Rea/Gärtner/Secretariat)	20'
	9.12	Evolution of Direct Broadcast (Secretariat)	10'
10:30	*Break*		30'
11:00	**10. SATELLITE PRODUCT DEVELOPMENTS**		
	10.1	Precipitation products: IPWG matters (Gärtner)	20'
	10.2	Int'l TOVS Working Group matters (Rea)	20'
	10.3	Int'l Winds Working Group matters (Kunimatsu)	20'
	10.4	Int'l Radio Occultation Working Group matters (IROWG co-chairs)	20'
12:20	*Lunch Break*		80'
13:40	**10.5**	Ocean applications and JCOMM matters (Fellous)	20'
	10.6	Climate products including SCOPE-CM matters (Secretariat)	20'
	10.7	Nowcasting products and SWFDP matters (Rea/P. Zhang)	20'
	10.8	Other product developments at CGMS-39 (Gärtner)	20'
15:00	**11. PROSPECTIVE**		
	11.1	Vision for the Global Observing System in 2025 (Secretariat)	10'
	11.2	Vision for Satellite Utilization and Products in 2025 (Machado and Secretariat)	20'
	11.3	Implementation Plan for the Evolution of Global Observing Systems (Secretariat)	10'
15:40	*Break*		20'
16:00	**12. QUESTIONNAIRE AND MONITORING ISSUES**		
	12.1	Experience of the RA II Pilot Project online questionnaire (Kunimatsu/Secretariat)	15'
	12.2	Lessons from the 2010 questionnaire and plans for future surveys (Secretariat)	15'
16:30	**13. VIRTUAL LABORATORY FOR EDUCATION AND TRAINING**		
	13.1	Update on VLab (Gärtner)	20'
	13.2	Training plans for new generation satellites	
		13.2.1 FY-3 (Fang for P. Zhang)	10'
		13.2.2 Meteor-M (Milekhin)	10'
		13.2.3 NPP (Mostek)	10'
		13.2.4 MTG, EPS-SG (Gärtner)	10'
	13.3	Training plans in new application areas	
		13.3.1 Land/ocean, Climate (Gärtner)	10'
		13.3.2 Space weather (Secretariat)	10'
17:50	*Adjourn for Day 2*		

14 DECEMBER 2011

		Approx.Time incl. Discussion
9:00	**14. WEB-BASED INFORMATION**	
	14.1 Update on WMO Space Programme and related Websites, and WMO Product Access Guide (Secretariat/Wannop)	20’
	14.2 Observing Requirements Database (Secretariat)	15’
9:35	**15. PUBLICATIONS**	
	15.1 New CIMO Guide /Part IV (Secretariat)	10’
	15.2 Updating of the Manual on the GOS / Chapter IV (Secretariat)	15’
10:00	Organization of the first break out session: *Guidance to the working groups / expected outcome* *Tentative subjects: Procedure for regional satellite requirements / Survey on satellite utilization*	30’
10:30	*Break*	80’
11:00	First break-out session	80’
12:20	*Lunch Break*	80’
13:30	Continuation of first break out session	90’
15:00	Plenary: Interim report from the break-out sessions (3 x 10’)	30’
15:30	*Break*	20’
15:50	Continuation of first break out sessions and drafting report	100’
17:30	Organization of the second break-out session *Guidance to the working groups / expected outcome* *Tentative subjects: Training / Data access / Integration / User communities*	30’
18:00	*Adjourn for Day 3*	

15 DECEMBER 2011

9:00	Second break-out session	90’
10:30	*Break*	30’
11:00	Continuation of second break-out session	90’
12:30	*Lunch Break*	90’
14:00	Draft report of Day 1, 2 and 3	30’
14:30	Plenary: Interim report of the second break-out session	30’
15:00	Continuation of second break-out session	30’
15:30	*Break*	20’
15:50	Continuation of second break-out session and preparation of reports	140’
18:00	*Adjourn for Day 4*	

16 DECEMBER 2011

9:00	Report from WG 1	30’
9:30	Report from WG 2	30’
10:00	Report from WG 3	30’
10:30	*Break*	30’
11:00	Report from WG 4	30’
11:30	Report from WG 5	30’
12:00	Report from WG 6	30’
12:30	*Lunch Break*	75’

13:45	**16. ANY OTHER BUSINESS**	15’
14:00	**17. REVIEW AND ADOPTION OF THE DRAFT REPORT**	45’
14:45	**18. DATE AND PLACE OF NEXT SESSION**	15’
15:00	**19. CLOSURE OF THE MEETING**	

APPENDIX III

PROCEDURE FOR REGIONAL DATA REQUIREMENTS

Preamble

The development of a regional set of data requirements implies interactions between data providers, product producers, the data users in interaction with the stakeholders and end users. This can best be accomplished if the process is coordinated within the WMO framework and clear guidelines are defined, based on experiences and lessons learnt from pilot initiatives.

The present procedure is proposed to be followed to develop a set of data requirements that reflects the needs of a region in the areas of interest of WMO Programmes and Co-sponsored Programmes.

The needs depend on the climatological context and the regional socio-economic priorities. The feasibility of the requirements also depends on the available data and information sources, the telecommunication infrastructure and the capabilities of the NMHS itself, which include subject matter expertise, tools, and software. Therefore the requirements should best be formulated at the regional level. The requirements should also be regularly reviewed to adapt to evolving needs and capabilities.

Procedure to Develop Regional Data Requirements

Scope

1. The primary scope of this procedure is to identify the needs of WMO Programmes and Co-sponsored programmes for satellite observation data and derived products in order to enable WMO Members to fulfil their national or international role in support of protection of life and property and other socio-economic benefits.
2. Depending on the other mechanisms existing in each specific region, this exercise could encompass the expression of non-satellite data requirements – e.g. surface-based observations or model outputs. In the long run, such an integrated approach should be encouraged.
3. This process should consider both operational and non-operational satellite data, taking advantage of research and demonstration satellite missions.

Establishment of a Requirements Task Team

4. A Satellite Data Requirements Task Team is established by the Secretary General of WMO, in consultation with the Presidents of the Regional Association and of the Commission for Basic Systems (CBS), and placed under the leadership of the CBS.

5. Participants in the Task Team are nominated by Permanent Representatives upon proposal by WMO. The Task Team lead shall be a space based applications specialist in the region (e.g. ET-SUP Member, CoE representative). As far as practical, the Task Team membership should reflect the sub-regional diversity and the different fields of expertise involved in WMO programmes and co-sponsored Programmes. It is understood that the Task team Members should – collectively – strive to represent the interest of the whole region including WMO Members who have no direct representative in the Task team.

6. Representatives of the main satellite data providers of the region shall be invited to participate in Task Team activities. The Task Team shall also be supported by the WMO Secretariat, through the Space Programme and the WIS.

7. Draft Terms of Reference of the Task Team are defined by the WMO Secretariat following a common template, which sets the scope, purpose, duration, methodology and reporting scheme of the Task team.

Workflow

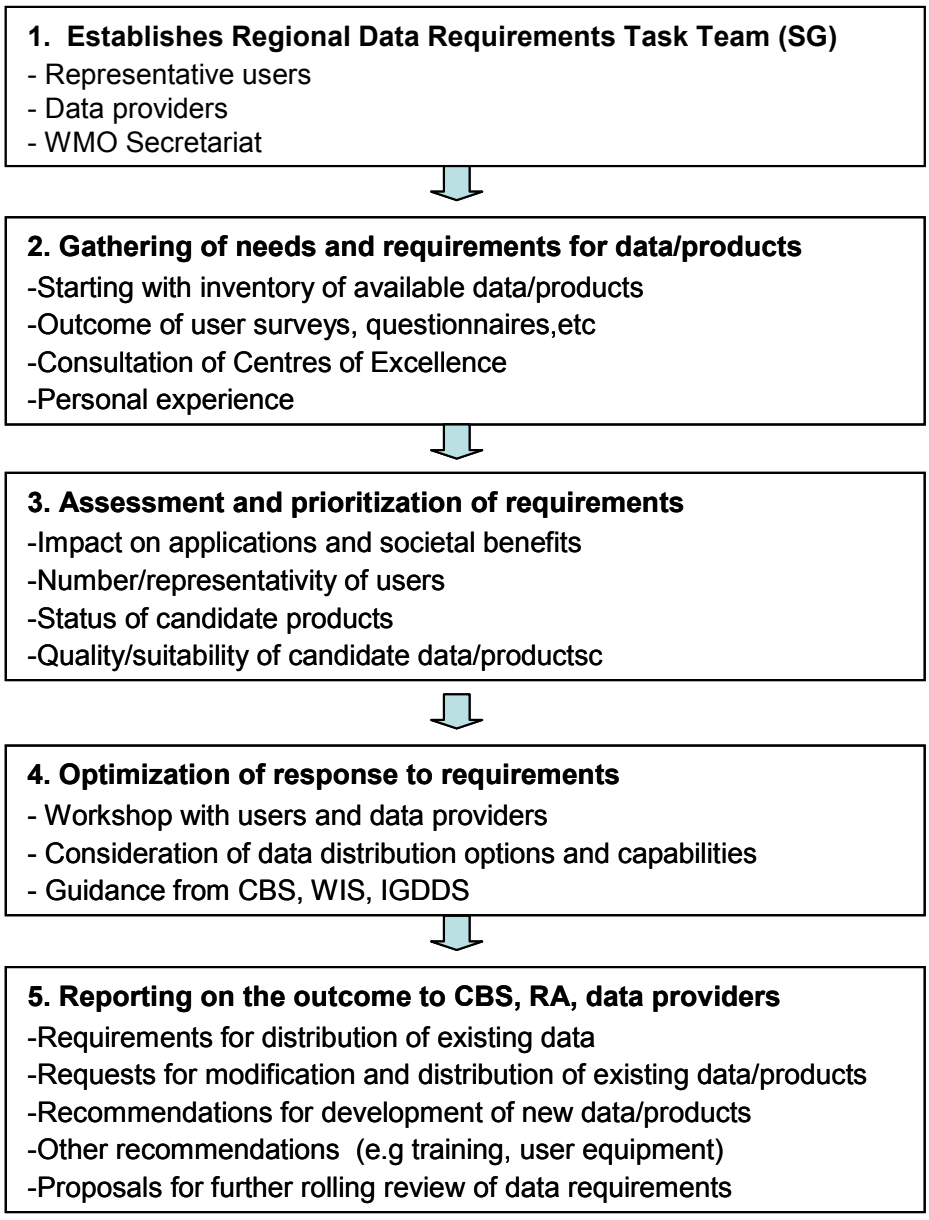

Fig.1: Block diagram of the tasks to be performed to develop an initial set of regional data requirements

Task Team Activities

8. The Task Team identifies the data already available through the existing services (GTS, Internet, bilateral FTP transmission, Direct Readout, multi-mission broadcast services such as GEONETCast, etc.). Data and products shall be classified by categories of variables and derived products.

9. The Task Team with help of WMO Secretariat and data providers, gathers information on existing products and related inventories, as for example the WMO Product Access Guide and space agencies' product catalogues.

10. The Task team reviews the potential sources of regional needs including: the outcome of WMO surveys on availability and use of satellite data; input from regional Centres of Excellence; the personal experience of the Task Team Members; global requirements registered in the WMO RRR database (including community-based requirements by GCOS and in the IGOS theme reports); other available documents such as the Earth Observation priorities identified by the Group on Earth Observation (GEO) for the various Societal Benefit Areas (SBA) supported by NMHSs.

11. The Task Team analyzes the requirements for each relevant category of product, and flags which requirements are not adequately met by existing services. The unmet requirements are prioritized taking into account:

    a. The applications supported and their impact

    b. The number and representativeness of the users

    c. The status of the required data or products

    d. The quality and suitability of the required data or products.

12. The WMO Secretariat convenes a meeting, in the region, with the Task Team, data providers, and specialists in the use of satellite data. In this meeting with users and providers, the prioritized list of unmet requirements is reviewed in order to define the optimal response, taking into account the technical options available for data distribution, and their available capacity.

13. In conclusion the Task Team formulates recommendations pertaining to:

    a. Existing data/products (with detailed references) to be included in existing distribution services (e.g. new product on DVB-S service) or moving a product from one service to another (e.g. Internet product to be put in LRIT) or assigning lower priority to an existing product (or removing it if obsolete).

    b. Amendments of existing products or development of new products

    c. Evolution (upgrade, or consolidating) of data dissemination means, or other (e.g. user stations)

    d. Short-term action plan to implement these recommendations

14. Based on this agreed set of requirements, data providers will strive to accommodate the new Data Requirements in the operational dissemination procedure. This phase requires active collaboration between the users and data providers in order to test the operational procedures to deliver and use the data in the list.

15. An implementation group including at least the data providers and a representative of users is nominated to perform the short-term implementation actions. The requirements list is updated accordingly.

16. The Task Team prepares a final report including the latest status of requirements, the status of implementation actions, and a proposal for the regular review of the requirements in the longer term. The final report is provided to the relevant Regional Association bodies and to the CBS.

17. The Task Team is then disbanded.

Practical guidelines

18. WMO Space Program provides a template for identifying requirements, as well as the data requirements already elaborated in others regions as a matter of example. The document can include for instance: Product Name, Data characteristics (e.g., spatial resolution, accuracy, spectral range, length of record), Format, Geographical area, Frequency, Format expected in the Future, Final Size (compressed), Basic Application, Priority, Timeliness (min), Required data rate (kb/s).

19. The Task Team leader supports the communication within the team and organizes its work. The Task Team shall use appropriate tools to support collaborative work (web page, Google doc, teleconferences or web meetings) and manage the different versions of the data requirements to facilitate consultation and feedback from the regional user community.

20. The Team aims to complete a first draft version of the requirements after 4 months, hold the prioritization meeting, and finalize the first version of the Data Requirement no more than three months after the meeting by consensus among the Task Team Members, the WMO Secretariat and the data providers.

APPENDIX IV

DATA ACCESS

I. GEO SATELLITES: DATA ACCESS TO LEVEL 1 AND PROCESSED IMAGERY (DRAFT)

The table focuses on “L1 and “image data”. Higher level products are not the scope of this table but will be ultimately referenced in the Product Access Guide. Near Real Time should be understood as “not more than twice the refresh cycle”.

Satellite	**Near Real Time access to L1.5 data (Links to detailed information**	**Near Real Time access to image data (Links to detailed information)**	**Non real time access (Links to detailed information)**
Kalpana	(Under consideration)	http://www.imd.gov.in/section/satmet/dynamic/insat.htm	FTP upon request Register on: (IMD website, Satellite page)
INSAT-3A	(Under consideration)	http://www.imd.gov.in/section/satmet/dynamic/insat.htm	FTP upon request Register on: (IMD website, Satellite page)
INSAT-3D (planned 2012)	HRIT/LRIT (details to be provided)		
MTSAT	Rebroadcast HRIT/LRIT JDDS (FTP) http://www.jma.go.jp/jma/jma-eng/satellite/nmhs/table2.html		
Meteosat-0°	EUMETCast http://www.eumetsat.int/Home/Main/DataAccess/EUMETCast/index.htm?l=en Rebroadcast LRIT http://www.eumetsat.int/Home/Main/DataAccess/DirectDissemination/index.htm?l=en	EUMETSAT website, image gallery http://www.eumetsat.int/Home/Main/Image_Gallery/Real_Time_Imagery/index.htm?l=en	EUMETSAT Data Centre http://www.eumetsat.int/Home/Main/DataAccess/EUMETSATDataCentre/index.htm?l=en
Meteosat IODC	Rebroadcast HRI http://www.eumetsat.int/Home/Main/DataAccess/DirectDissemination/index.htm?l=en	EUMETSAT website, image gallery http://www.eumetsat.int/Home/Main/Image_Gallery/Real_Time_Imagery/index.htm?l=en	EUMETSAT Data Centre http://www.eumetsat.int/Home/Main/DataAccess/EUMETSATDataCentre/index.htm?l=en
Electro-L	Rebroadcast HRIT/LRIT (planned) LRIT FTP (planned) : http://planet.iitp.ru	Planeta website: http://planet.iitp.ru (planned)	FTP upon request to Planeta (planned)

APPENDIX IV

GOES	GVAR rebroadcast http://goes.gsfc.nasa.gov/text/databook/databook.pdf	RAMSDIS on line: http://rammb.cira.colostate.edu/ramsdis/online/ OSDPD product pages http://www.ssd.noaa.gov/	NOAA data centre
FY-2	S-VISSR CMACast http://satellite.cma.gov.cn/ArssEn/Ord/Satellite.aspx?seriesCode=FY2X	CMACast: http://satellite.cma.gov.cn/ArssEn/Sup/Nephogram/CloudAnimation.aspx	http://satellite.cma.gov.cn/ArssEn/Ord/Satellite.aspx?seriesCode=FY2X
COMS	Rebroadcast HRIT/LRIT http://www.cgms-info.org/docs/publications-and-reference-documents/2011/05/05/coms-mission-specific-implementation-hrit.pdf http://www.cgms-info.org/docs/publications-and-reference-documents/2011/05/05/coms-mission-specific-implementation-lrit.pdf		

APPENDIX IV

II. LEO SATELLITES: DIRECT READOUT, GLOBAL DATA, AND L0/L1 PREPROCESSING SOFTWARE (DRAFT)

The scope of this table includes satellites with near real time data access with potential to support operational services

Satellite	**Information on Direct Broadcast access (L0)**	**Information on Regional services**	**Links for Global Data access (L0/L1)**	**Pre-processing software (L0-L1)**	**Non real time data access**
Metop	HRPT (with technical limitation for Metop-A) http://www.eumetsat.int/Home/Main/DataAccess/DirectDissemination/index.htm?l=en	EARS/EUMETCast EARS/GTS	EUMETCast/Europe http://www.eumetsat.int/Home/Main/DataAccess/EUMETCast/index.htm?l=en GTS (GRAS, IASI) (link)	AAPP for ATOVS (http://www.nwpsaf.org/)	Data Centre (See above)
NOAA/POES		EARS		AAPP (http://www.nwpsaf.org/) ITPP	
DMSP					
FY-3A, 3B	HRPT MPT (See: CGMS-39, CMA-WP-03)	EARS (planned)	CMACast http://satellite.cma.gov.cn/ArssEn/Ord/Satellite.aspx?seriesCode=FY3X	FY3L0PP V1.0 FY3L1PP V1.0	http://satellite.cma.gov.cn/ArssEn/Ord/Satellite.aspx?seriesCode=FY3X
Meteor-M	HRPT http://planet.iitp.ru/english/index_eng.htm				FTP upon request to Planeta
NPP	Direct Readout X-Band http://directreadout.sci.gsfc.nasa.gov/index.cfm?section=missions&page=nppMission	EARS (planned)			
Aqua	Direct Readout X-Band http://directreadout.sci.gsfc.nasa.gov/				

Terra	Direct Readout X-Band http://directreadout.sci.gsfc.nasa.gov/	http://terra.nasa.gov/Gallery/			
Oceansat-2					
TRMM		http://pmm.nasa.gov/data-access			
Windsat					

APPENDIX V

SOFTWARE LIST TEMPLATE

Table 1: Pre-processing, satellite-specific software (DRAFT)

Note: this table reflects the information communicated to WMO by the providers of the respective software. WMO bears no responsibility in the case of erroneous or incomplete information. Any accuracy can be reported to the WMO Space Programme:…

Name	Provider	For Satellite / Instrument	Formats (in)	Formats (out)	(Last update)
AAPP (AVHRR ATOVS Processing Package)	Met Office (EUMETSAT SAF NWP)	ATOVS / NOAA POES, Metop			
(MODIS/AIRS Processing Package) IMAPP	University of Wisconsin	MODIS, AIRS			
FY3L0PP		FY-3			
		Meteor-M / MSU-MR			

Table 2: Free/ Open source Software (DRAFT)

Note: this table reflects the information communicated to WMO by the providers of the respective software. WMO bears no responsibility in the case of erroneous or incomplete information. Any accuracy can be reported to the WMO Space Programme:…

Name	Provider	Formats (in)	Formats (out)	(Last update)
MC IDAS-V and HYDRA	Unidata			
SATAID	JMA			
AWIPS II	Unidata			
BILKO	Unesco			
DIANA	Met Institute Norway	NetCDF, BUFR, GeoTIFF, other		
SIGMACast	INPE			

APPENDIX V

Table 3: Commercial Software (DRAFT)

Note: this table reflects the information communicated to WMO by the providers of the respective software. WMO bears no responsibility in the case of erroneous or incomplete information. Any accuracy can be reported to the WMO Space Programme:…

Name	Provider	Formats (in)	Formats (out)	(Last update)
SYNERGIE	MeteoFrance International			
2met	VCS	NetCDF, BUFR, GeoTIFF, other		
ArcGIS product family	ESRI			
GEOMATICA	PCI Geomatics	NetCDF, BUFR, GeoTIFF, other		
IDL	Exelis	NetCDF, GRIB		
SIGMACast				
VISUAL WEATHER	IBL Software	BUFR, CLIMAT, TEMP, GRIB, other	Bitmap formats SVG, other	
ENVI product family	Exelis			
NINJO	EuMetSys			
MEOS	Kongsberg Spacetec			
MAGICS ++	ECMWF	GRIB, NetCDF BUFR		

APPENDIX VI

REVISED OUTLINE OF SCOPE-NWC CONCEPT
(DRAFT 15 DECEMBER 2011)

Introduction

1. The aim of the Sustained, Co-Ordinated Processing of Environmental Satellite Data for Nowcasting (SCOPE-NWC) is to establish a network of facilities ensuring continuous and sustained provision of high-quality satellite products related to nowcasting.

Background

2. The concept for SCOPE-NWC arose from discussions at ET-SUP-5, after consideration of the benefits of the SCOPE-CM initiative. It was felt by ET-SUP-5 that the concept could be usefully expanded to the nowcasting domain, given that:

- The related science is reasonably mature;
- An organized user community is available;
- An established description of the needs of this community exists;
- There are opportunities and synergy with other initiatives.

3. SCOPE-NWC is aligned with a number of WMO initiatives, in particular SCOPE-CM and the Severe Weather Forecasting Demonstration Project (SWFDP). SWFDP is focused primarily on numerical weather prediction output; the observational focus of SCOPE-NWC has the strong potential to complement and enhance the SWFDP.

4. Should it move to an implementation phase, SCOPE-NWC will need to operate as far as possible within the WIS-WIGOS framework, including as concerns delivery mechanisms for products.

Objectives

5. The key objective of SCOPE-NWC is to provide a mechanism through which satellite data can be made available simply and quickly, primarily for users in the NMHSs of smaller or developing nations, where expertise and facilities for processing and utilizing satellite data may be limited, but also for more advanced nations where there may be efficiencies possible through combining resources and efforts.

6. To achieve this goal, SCOPE-NWC must facilitate the provision of sustained products. That is, the satellite products must:

    a) have a long-term stable status, beyond individual satellite missions;
    b) be generated operationally in a routine and repeatable manner; and
    b) include provisions for smooth adaptation to different satellite sources so that users do not have to change systems or implement new training every time a spacecraft changes.

7. The products must also be coordinated. That is:

    a) Products need to be consistent across platforms using equivalent algorithms;
    b) Products should be generated in consistent, standard formats;and
    c) Products from different satellites should be interoperable.

Concept and Scope of Operations

8. The concept for SCOPE-NWC builds on the WIS framework as concerns the metadata definition, data discovery and operational data flow. In addition, it shall include user interaction for consultation on needs, gathering feedback and ensuring outreach, and an expert

component for defining standard products and formats and for validation of the products and their documentation. In essence, a finite number of standard products will be defined by the governing body. In addition, the governing body will define a finite number of areas of interest.

9. The scope of SCOPE-NWC is limited to nowcasting products, that is products that are useful in the timeframe of zero to six hours. The products to be considered by SCOPE-NWC fall into four broad categories:

    a) Basic Nowcasting Products: these are primarily qualitative products such as visible and infrared imagery, RGB composites and enhancements, fog detection and cloud products;

    b) Advanced Nowcasting Products: these include quantitative products requiring the application of algorithms for their generation; products such as precipitation, atmospheric motion vectors, stability indices, total precipitable water, convective initiation and sounding products, and other products to support aviation such as turbulence or aircraft icing;

    c) Realtime Ocean Products: these include scatterometer data for sea surface winds and sea state data from altimetry;

    d) Realtime Atmospheric Composition Products: these include fire detection, smoke, dust, aerosols and volcanic ash,

10. Products may be generated from geostationary or polar data and, where possible, the higher resolution afforded by polar orbiters should be used to improve interpretation of geostationary data. For example, the interpretation of a lower resolution geostationary fog detection product may be aided if used in conjunction with an interoperable product derived from a polar orbiting satellite.

11. Products will be generated in real time over the defined areas of interest by the Data Providers and sent to the Host Agencies. There may be multiple Data Providers for any one area of interest. The host agencies will act as a repository for the products and provide online access, and will push products to specific Client Agencies as required. The concept of operations is depicted in Figure 1.

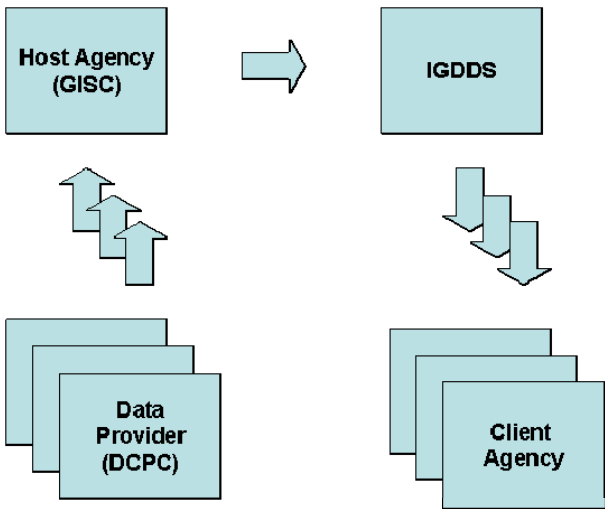

Figure 1 – SCOPE-NWC Concept of Operations

Roles

12. The SCOPE-NWC concept requires a number of different roles to be filled, these are:
    a) Client agency;
    b) Host agency;
    c) Data provider;
    d) Steering Committee.

Each of these roles is described in detail below.

Client Agency

13. The *Client Agency* is the primary user of the products provided through SCOPE-NWC. The primary roles of the Client agency are:
a) to define their requirements and make a formal request for products to be generated over their area of interest;
b) to make appropriate use of the products to serve their end-users and to provide feedback on issues or errors.

Host Agency

14. The *Host Agency* operates the repository for products to be delivered to Client Agencies. In this sense, the Host Agency functions as a Global Information System Centre under the WIS framework. The primary roles of the Host agency within SCOPE-NWC are:
    a) to gather data from the various Data Providers;
    b) to make data available to Client Agencies in a timely and effective manner;
    c) to provide a contact point for Client Agencies to raise issues or report problems.

Data Provider

15. The *Data Provider* is responsible for generating SCOPE-NWC products and providing these to the Host Agency. In this sense, the Data provider functions as a Data Collection or Production Centre (DCPC). A data provider can be a satellite operator, or another organisation with real-time access to satellite data. The primary roles of the Data Provider within SCOPE-NWC are:
a) to generate products covering areas of interest;
b) to provide products to the Host Agency in a timely and reliable manner;
c) to provide a point of contact for data problems and issues.

Steering Committee

16. The SCOPE-NWC *Steering Committee* is responsible for overseeing all SCOPE-NWC activities and ensuring that activities are coordinated appropriately. The Steering Committee will fulfil the following roles:
a) to agree on standard products, formats and areas of interest;
b) to respond to requests for new products from Client Agencies;
c) to designate Data Providers and Host Agencies and identify what products will be generated and disseminated by each;
d) to provide a central coordination point for SCOPE-NWC activities and point of contact for all external enquiries;
e) to liaise with the user community, data providers and other WMO groups and initiatives as required to ensure efficient and effective operation with no duplication of effort.

Links to Underlying Science and Related Initiatives

17. The SCOPE-NWC will need to build on product development in the scientific community, where such products are mature and have demonstrated benefits. For specific product areas, there

will be links to both related scientific communities and governance arrangements within WMO. For example, for precipitation products there would be a clear link to the International Precipitation Working Group.

Benefits

18. Benefits of this approach will be:
a) Improved access to satellite data by member states;
b) Improved confidence in products generated through SCOPE-NWC;
c) Reduced operating costs associated with technological change and software upgrades;
d) Reduced training overheads;
e) Improved cooperation between NMHSs through access to shared products.

Pilot Initiatives

19. To progress the SCOPE-NWC concept, it is proposed that a number of specific pilot projects be initiated. These pilot projects should target each of the four application areas identified. For basic nowcasting products, a global project is suggested; this reflects the fact that such products require little regional tuning. In the other application areas a regional focus should be taken, reflecting the relative complexity of the products and also the tuning which may be required to provide good results over the target region. which would require are suggested, across the four application areas:

Potential Further Actions

20. A possible action plan is as follows:
a) establish a working group;
b) finalise the concept of operations;
c) define selection criteria for products and generic requirements to be satisfied;
d) agree on a preliminary set of products;
e) establish a number of pilot projects, in consultation with SWFDP and other related initiatives.

APPENDIX VI

Notes from SCOPE-NWC Discussion (15 December 2011)

The group discussed a number of options for progressing the SCOPE-NWC concept, focusing on a number of specific pilot projects. Pilot projects were considered in each of the four application areas for SCOPE-NWC across both global and regional scales.

For *Basic Nowcasting* products, the group considered that consistent products and formats are the key requirement and that a subset of products should be selected to form a pilot project. This project would require the engagement of the satellite operators and consultation with the user community on specific requirements. This consultation could be carried out in cooperation with the SWFDP.

Action: Anthony Rea and [satellite operator rep] to develop a discussion paper for a SCOPE-NWC Pilot Project focused on globally consistent delivery of basic nowcasting products from geostationary and polar orbiting satellites.

For *Advanced Nowcasting* products, the group considered a number of different applications. Candidates for pilot projects are ice cloud detection and turbulence products to support aviation, and precipitation products from blended geostationary and polar orbiting satellites.

Action: Anthony Rea and Luiz to develop a discussion paper for a SCOPE-NWC Pilot Project focused on aviation products.

Action: Luiz, Volker, Stephan to develop a discussion paper for a SCOPE-NWC Pilot Project focused on precipitation products.

A suggested regional initiative in the *Atmospheric Composition Products* area is an operationalization of the dust storm forecasting tool developed by CMA. This offers the potential to provide useful warnings of dust storm threats for China and surrounding nations.

Action: FANG Xiang and Hiroshi Kunimatsu to develop a discussion paper for a SCOPE-NWC Pilot Project focused on dust detection and dust storm prediction products.

Another potential initiative for *Ocean Realtime* products is the real time provision of quality controlled ocean surface wind data from Oceansat-2. This produce would have benefits to tropical cyclone analysis and other nowcasting applications in coastal and ocean areas. FANG Xiang led a discussion on and Suman Goyal expressed interest in progressing the SCOPE-NWC initiative. For CMA and JMA, the interest is around dust storm prediction based on fusion of satellite and other data.

Action: Suman Goyal and EUMETSAT to develop a discussion paper for a SCOPE-NWC Pilot Project focused on real time quality controlled ocean surface winds from Oceansat-2.

Other ideas for pilot projects:

1) Deforestation in Tropical Forest Regions: Detection of vegetation change , daily time resolution) over cloud free and cloud cover regions. Medium resolution image and microwave – SAR – (comment: this is not nowcasting)

2) Dust Detection and propagation forecasting in Africa - MSG data and forecasting models - data in real time. – (comment: covered by Xiang action)

3) Drought monitoring - number of days without rain and total rain in the month - Agricultural application - Africa region. – (comment: not nowcasting)

4) Precipitation from warm clouds in coastal region - total precipitation in 6, 12 hours and 1, 2 and 3 days. Coastal tropical regions. (comment: covered by discussion paper on precipitation)

5) River Flooding detection and monitoring - vulnerable areas. Using microwave or SAR data. – (comment: not nowcasting)

6) Clear air turbulence and ice clouds - Aviation application - all regions. (comment: retain idea for later consideration)

APPENDIX VII

ET-SUP INPUT FOR EGOS-IP (V10)

NEW/MODIFIED TEXT IN YELLOW

Section 2.1

[…]

Quality Management Framework (QMF).
WIGOS is expected to provide timely, quality-assured, quality-controlled and well-documented long-term observations. Implementing Quality Management procedures is required to enable better utilization of existing and emerging observing capabilities.
WIGOS will address high-level observing requirements by establishing the effective and sustained organizational, programmatic, governance and procedural structures. These structures will enable a common standardization approach, uniform implementation of WMO regulations, data compatibility and interoperability across all WIGOS observing components. It will also provide a single focus for integrated and coordinated operational management of all WMO observing systems and a mechanism for coordination with WMO co-sponsored and contributing observing systems.
WIGOS will embrace QMF procedures to ensure that observations, records and reports on weather, water, climate and other environmental resources, operational forecasts, warnings, related information and services are of identified quality, and in compliance with relevant joint standards agreed upon with other international organizations.
This should be based on agreed-upon quality assurance and quality control standards, with the goals of developing and implementing an integrated Quality Management System (QMS); in doing this, and only after effective national implementation, it will deliver reliable and timely data streams with adequate quality control and relevant metadata.

Action: Members should incorporate QMF procedures in the operation of the observing systems to the WIGOS.
Who: Members
Time-frame: 2015
Performance indicator: Level of compliance with QMF procedure.

Section 3.1

[…]

The operational system includes the acquisition (measurement), the transmission to a pre-processing centre, and archiving and dissemination to all the users with a procedure which is compatible with the WIS. These activities may or may not imply a transfer of responsibility from one organization to another. Whenever new or upgraded observing technologies or data processing systems are developed it is essential that there be interaction between the developers, the intermediate and end users to assess requirements and the impact of the new or evolving system before implementation. This will help ensure that all essential requirements are captured, including requirements for homogeneity of observations in time. Provisions should be made to enable users to prepare for new observing systems well in advance of system deployment in terms of data reception, processing, and analysis infrastructure, and associated education and training.

Action C1

Action: Set up an organizational framework for sustained operation of relevant research-based observing systems, once their validation has shown they are sufficiently mature enough and their cost-effectiveness has been assessed.
Who: All organizations operating component observing systems
Time-frame: Continuous

Performance indicator: Number of sustained systems

Action C2

Action: Ensure all operators producing observations are encouraged to adhere to the WIS standards*1;*
Who: Organizations and agencies operating observing programmes
Time-frame: Continuous
Performance: Extent to which WIS standards are applied

Action C3

Action : Assess the impact of new observing systems (or changes to existing systems) through prior and ongoing consultation with data users and the wider user community.
Who: All organizations operating component observing systems
Time-Frame: Continuous
Performance Indicator: Extent to which user community concerns are captured.

Action C4

Action: Prepare data users for new generations of observing systems through the provision and upgrade, as appropriate, of data reception, processing and analysis infrastructure, and the provision of education and training programmes.
Who: All organizations operating component observing systems
Time-Frame: Continuous
Performance Indicator: Extent to which users can satisfy their needs

Section 6.2

6.2. Generic issues: data calibration, data exchange, product generation, data stewardship, education and training

There will be a tendency towards higher spatial, temporal and spectral resolution for all satellite observing systems. It will enhance the information available, particularly to monitor and predict rapidly-evolving small-scale phenomena. It will increase the demand on data exchange and on processing capabilities. The spatial, temporal and spectral resolutions of the satellite data used in operational forecasting are generally coarser than the resolutions of the instruments, because of limitations in computer resources and in data assimilation methodologies. The resolution of the satellite data which are actually assimilated in meteorological and oceanic models is expected to increase faster than the instrument resolutions, by 2025, because of improvements in data assimilation techniques.

The progress on instrument capabilities and on the use of satellite information will be fully successful only if it is accompanied by actions aiming at improving the availability and the timeliness of the data for the different users and the different applications, from global assimilation in meteorological or oceanic models to the local use in Nowcasting. For LEO satellites, direct readout capabilities should be provided wherever possible. In addition, through development of the RARS (Regional ATOVS[2] Re-transmission Systems), timeliness of data delivery has been improved from LEO satellites. This type of “quick re-transmission” action on satellite radiances for polar orbiting sounders has considerably helped NWP in the recent years, and it will help more and more regional and local forecast systems in the future. Applying such concepts to other data, e.g. imagery, would be beneficial to many other application areas.

For GEO satellites, the data delivery is easier within the geographical area corresponding to the Earth disk which is observed directly by each satellite. The main challenge is the rapid processing and the rapid and global exchange of processed data (such as atmospheric motion vectors, AMVs)

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1 See http://www.wmo.int/pages/prog/wis/
2 Advanced TIROS Operational Vertical Sounder

which are needed for global NWP with a hourly frequency at least. Other applications have identified different requirements for data latency.

User-friendly data dissemination techniques (internet, Digital Video Broadcast) should be provided as appropriate. These various techniques all contribute to the WIS and should also be used to disseminate products and training material.

Provisions should be made to enable users to effectively use the capabilities provided by the space-based GOS, and to prepare for new satellite capabilities well in advance of system deployment. This includes data reception, processing and analysis infrastructure, including software.

Users relying on satellite-based datasets and products require sufficient information on their quality (e.g., accuracy), the algorithms used, and fitness for purpose. Satellite operators should provide full description of all steps taken in the generation of satellite products, including algorithms used, specific satellite datasets used, and characteristics and outcomes of validation activities. This should be in adherence with the QMF procedure (see Action XX under QMF, section 2.1). Metadata should follow the WMO core metadata profile and compliant with internationally-agreed formats recognized by WMO (see WMO Guidelines on the use of metadata for WIS, 2010).

For climate monitoring and studies of other long-term phenomena, extended satellite time-series (e.g., Fundamental Climate Data Records) are needed. Long-term data stewardship under scientific guidance is necessary to achieve homogeneous long-term records, which should include regular reprocessing (roughly every five years). User-friendly arrangements for access to data archives should be put in place.

As part of continuous improvement in Members' capacity, such preparation should include the necessary provision of education and training to users, for example through the WMO-CGMS Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) and its Centres of Excellence. The user requirements related to satellite data, products, infrastructure and training should be regularly assessed on global and regional level, as appropriate, in order to monitor the effectiveness of the Actions proposed.

Action: Enable Members, as appropriate, to fully benefit from evolving satellite capabilities through adequate data reception and dissemination systems, including the necessary infrastructure upgrades.
Who: IGDDS Implementation Group, GEONETCast Implementation Group
Performance Indicator: Level of satisfaction of Members' user needs
Time-frame: Continuing

Action: Satellite operators to provide full description of all steps taken in the generation of satellite products, including algorithms used, specific satellite datasets used, and characteristics and outcomes of validation activities.
Who: Satellite operators in CGMS and CEOS
Performance Indicator: Number of products fully documented, adhering to the Quality Management Framework procedure
Time-frame: Continuing

Action: Satellite operators to ensure long-term data preservation and scientific stewardship of data, including regular reprocessing (roughly every five years).
Who: Satellite operators, in coordination with SCOPE-CM, WCRP, GCOS
Performance Indicator: Existence of long-term satellite data archives, with regular reprocessing
Time-frame: Continuous.

Action: Members should be enabled to benefit from evolving satellite capabilities through adequate, application-oriented education and training activities (including distance learning).
Who: WMO-CGMS VLab, including Centres of Excellence, and partners

Performance Indicator: Level of satisfaction of Members' training needs
Time-frame: Continuing

Action: Regions should determine and maintain requirements for satellite datasets and products.
Who: Regional task teams and VLab Centres of Excellence, in coordination with Regional Associations and satellite operators
Performance Indicator: Completeness and currency of set of regional requirements
Time-frame: Continuous

APPENDIX VIII

QUESTIONNAIRE

ET-SUP-6 WMO Space Programme Revised Survey Proposal

Overview
The aim of this revision is as follows:

- Improve survey uptake
- Increase clarity in the question wording to avoid ambiguity
- Broaden user community responses (beyond the strict NMHS community)
- Reduce time and effort taken to analyse and process results
- Establish a mechanism to gather more detailed data information on particular topics of interest to ET-SUP and satellite data providers

Task team have established the need for a "Basic Survey" for generic feedback from a broad user community and a tailored "Interview Survey" for dedicated feedback.

Basic Survey
Basic Survey Construction:

- Generic survey covering topics - data access, data usage, benefits of data usage & training needs
- Focus questions on multiple choice answers
- Include some optional questions for additional information
- Use of clear, plain English and consider using translation services for certain user communities
- Potential to modify the basic survey for specific targeted events/data provider requirements
- Web-based survey using off-the-shelf survey software (without password protection)
- Allow the option to provide contact details for survey follow-up and result distribution
- Contents of the basic survey to be reviewed by ET-SUP on a 1-yr cycle

Basic Survey Notification:

- Maintain a cycle of a 1-yr survey in 2012, although delivery may to staggered throughout the year depending upon regional requirements
- Web link via the WMO Space Programme website and satellite operator (CGMS member) websites
- Establish a home page for the survey with some welcoming text to encourage participation, to provide feedback on key successes of previous survey/s, timetable of survey results, etc.
- ET-SUP Members would play a role in the promotion of the survey campaign/s within their region
- Communication via email to know user communities and/or by specific bodies (Centres of Excellence, VLAB, RA Leads, COSPAR, etc.).
- Targeted notification via specific events (conferences, workshops, etc.)

Interview Survey

Proposed Approach:

- Targeted to a specific/expert user community (e.g. application area/or region, etc.)
- Called up to either support the ongoing Basic Survey campaign or to respond to a specific requirement of ET-SUP or satellite provider
- Results of such surveys would be presented to working groups/ meeting reports, etc.

APPENDIX VIII

Implementation Plan

i. Final review edit of revised Questionnaire (Through ET-SUP and WMO SP office) - Due by Feb 2012
ii. Prepare analyse potential web survey tools (Survey Monkey, etc.) – Feb 2012
iii. Create develop Web page and new 2012 WMO Space Programme survey
    – New SP Web page with welcome announcement from D/SAT: Positive message saying how important your survey will help with SP activities, and how it will help us help you with satellite data and product utilisation
iv. Test Web page and tool as soon as ready – ET-SUP and CoEs – March 2012
v. Launch new Survey from WMO SP Website – (See Survey implementation plan) – for period April to October 2012
vi. Announce April and May 2012
vii. Monitor progress of survey – Secretariat
viii. Alert ET-SUP and CoEs of urgent feedback
ix. Preliminary report to CBS September 2012
x. Prepare draft report for ET-SUP 7
xi. Assess and modify survey and process based upon report findings and as required
xii. Identify requirements for future Interview Surveys

APPENDIX VIII

W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

= =

QUESTIONNAIRE ON THE AVAILABILITY AND USE OF SATELLITE DATA AND PRODUCTS (DRAFT)

INTRODUCTORY NOTE

(TBD)

PLEASE ENTER YOUR DETAILS BELOW

Name of Country: .....

Name of your Organization? [1] .....

Type of Organisation: (NMHS, Geoscience, Research, Educational, Environmental, Private, Other)

Contact details (optional):

name
email
telephone

Are you responding on behalf of;
Self, team (ask which?), organisation?

[1] *The word "Organization" is used in the questionnaire to mean either the NMHS, or an external entity, as appropriate. If the use of satellite data involves several services within a NMHS (e.g. territorial services or functional branches) in a given WMO Region, please consolidate the input from these units in order to provide no more than one reply from the NMHS in a given WMO Region, plus possible replies from external entities as appropriate.*

SECTION 1 – Utilisation of SATELLITE DATA AND PRODUCTS

Question 1 **Do you (routinely) access satellite data and/or products from any source or do you have plans to do so in the near future?**

For information on satellite data and products and availability and access please feel free to visit the Internet pages of the WMO Space Programme: http://www.wmo.int/pages/prog/sat/index_en.html

Select one from these drop-down selections ⟶ **CLICK FOR OPTIONS ...**

Possible answers:
- ☐ Yes
- ☐ No
- ☐ On an irregular basis

If you answered **"Yes"** to Question 1 please jump directly to Question 3.
If you answered **"No"** to Question 1 please proceed with Question 2. (May need to be corrected…)

Question 2 **What do you use satellite data for (select all appropriate answers):**

1. **Operations**
2. **Research and Development**
3. **Education**
4. **Value added services**
5. **Other**

Question 3 **Is your use of satellite data changing:**

1. **Increasing**
2. **Decreasing**
3. **Remaining the same**

Question 4 **What is your most important source of satellite data?**

1. **geostationary**
2. **polar orbiting**
3. **both**
4. **(other?)**
5. **unsure**

Question 5 (Optional) Which geostationary satellites are used

Please indicate which satellites data and products are used (Check one or more boxes]

Optional – to be updated and expanded (split geo vs polar)

Sat. type	Satellite name	Indicate below if data are RECEIVED
Operational geostationary satellites	METEOSAT (0°)	☐
	METEOSAT (9.5°E) [Rapid Scan Service]	☐
	METEOSAT (57.5°E)	☐
	GOES-E (75°W)	☐
	GOES-W (135°W)	☐
	GOES-SA (60°W)	☐
	MTSAT-1R (140°E)	☐
	FY-2C (105°E)	☐
	FY-2D (86.5°E)	☐
	INSAT-3 (93.5°E)	☐
	KALPANA-1 (74°E)	☐
	Electro-L (76 E)	☐
	Others (describe in??)	☐

Question 6 (Optional) Which polar orbiting satellites are used

Please indicate which satellites data and products are used (Check one or more boxes]

Operational low earth orbiting satellites	NOAA series	☐
	METOP series	☐
	FY-1, FY-3 series	☐
	Others (describe in Final Entry))	☐
R/D & other environmental satellites	ERS series	☐
	DMSP series	☐
	SPOT series	☐
	ENVISAT	☐
	Meteor-M (Move up to Operational)	
	Terra / Aqua	☐
	TRMM	☐
	JASON series	☐
	ALOS	☐
	CBERS series	☐
	Others (describe in Final Entry))	☐
	Landsat	
	Oceansat-2	
	Megha Tropiques	
	Space Weather	
	COSMIC, etc	

Question 7 How do you receive your satellite data (select all appropriate):

1. **Direct reception**
2. **GTS**
3. **Internet**
4. **DV-B (Check terminology) (EUMETCast, CMACast, GeoNetCast Americas, Mitra)**
5. **Mobile services**
6. **Other**

Question 8 Please indicate 3 below which types of satellite data and products you use or are planning to use.
[Check one or more boxes]

Table 3

Data / products used			
	Used	Planned	Unsure
Satellite Images			
Raw satellite radiances			
Surface reflectance			
Sounder data			
Other level 1 data (describe in Section 5)			
Wind Products (Atmospheric motion vectors)			
Temperature / humidity profiles			
Cloud products			
Sea surface / oceanographic products			
Land surface products			
Precipitation products			
Snow and ice products			
Atmospheric composition, air quality products			
Other level 2 / level 3 products (describe in Section 5)			

Question 9 Do you have a need for training related to the use of satellite data? (Yes/No)

Question 9(a) If yes, what are the key areas where training is being provided or is needed?

Skill Area	Being delivered	Needed
Equipment operation & maintenance	☐	☐
Satellite image interpretation	☐	☐
Use of software tools (May need more explanation??)	☐	☐
Product (utilisation and generation)		
Physical basis for remote sensing	☐	☐
Others (describe in Section 5)	☐	☐

Question 9(b) If yes, what are the preferred modes of delivery for training?

1. Residential
2. Distance interactive (web-based, broadcast)
3. Pre-recorded media
4. Blended (mix of instructor-led and pre-recorded)

Question 9(c) Optional: if using distance-based training, which services are you aware and which of them do you use to support training activities?

Select from Table 7 below

Table 7

Internet-based Training Opportunity	Weblink, for more information	**Being aware** of existence	**Used** to support training
CGMS Virtual Laboratory (VL) for Training in Satellite Meteorology	http://www.wmo.int/pages/prog/sat/CGMS/CGMS_virtuallab.html		
COMET	http://www.comet.ucar.edu/		
EUMETCAL	http://www.eumetcal.org/		
EUMeTRAIN	http://www.zamg.ac.at/eumetrain/		
IOC Bilko training Resources	http://www.noc.soton.ac.uk/bilko/courses.php		
... ...			
... ... *>>> to be completed*			
... ...			
Others (Please describe in Section 5)			

Question 10 Please indicate below which application areas benefit from the use of satellite data

Application Area & Services	No benefit	Yes, some benefit	Yes, essential
weather forecasts and warnings	☐	☐	☐
climate predictions and assessments	☐	☐	☐
hydrological forecasts, warnings and assessments	☐	☐	☐
ocean condition monitoring, forecasts and related warnings	☐	☐	☐
Space weather,	☐	☐	☐
Disaster mitigation Land monitoring (Biodiversity,…)	☐	☐	☐

Question 11 Do you face any challenges in the access and use of satellite data (select all applicable)?

1. Data Access
2. Knowledge and understanding of available data
3. Knowledge and understanding of how to use data
4. Lack of resources (Human, equipment, communications, etc.)
5. Other (please specify)

Question 12 What methods do you use to retrieve information on availability and access to satellite data and products?

For information on Earth Observation Portals please feel free to visit the relevant Internet Pages of the WMO Space Programme: http://www.wmo.int/sat

[Check one or more boxes]

(Refer back to Product Access Guide)

☐ Internet Search engines
☐ Conferences and meetings
☐ Word of mouth
☐ Social networks
☐ WMO Space Programme website
☐ Satellite Operator websites

Question 13 (Final comments, questions, issues, or anything else you want to tell us about)

Please use this section to and provide any additional information not captured by the question above.

========== END OF QUESTIONNAIRE ==========

APPENDIX IX

VLAB-COSPAR

Rationale for linking the WMO-CGMS Virtual Laboratory for Education and Training (VLab) and the Capacity Building in Earth-observation of the Committee on Space Research (COSPAR)

Main rationale for partnership and recommendation:

VLab and COSPAR PCB/SC-A are complementary organizational mechanisms for training in satellite meteorology and satellite Earth Observation applications, respectively, in terms of (i) application areas addressed, (ii) research vs operational focus, (iii) resourcing, (iv) host and partner institutions. Differences are significant, but offer potential for substantial cross-benefit. Further avenues of partnering should be explored, for enhancing overall capacity in developing countries. Additional coordination overhead should be kept to a minimum.

COSPAR Scientific Commission A on Space Studies of the Earth's Surface, Meteorology and Climate and Panel on Capacity Building

Current status:
COSPAR's objectives (http://cosparhq.cnes.fr) at large are to promote on an international level scientific research in space, with emphasis on the exchange of results, information and opinions, and to provide a forum, open to all scientists, for the discussion of problems that may affect scientific space research. Among others, COSPAR acts mainly as an entity that "strives to promote the use of space science for the benefit of mankind and for its adoption by developing countries and new space-faring nations, in particular through a series of Capacity Building Workshops which teach very practical skills enabling researchers to participate in international space research programs."

Activities related to Earth observation are overseen by its Scientific Commission A on "Space studies of the Earth's surface, meteorology and climate" (SC-A, current chair: Nadine Gobron, European Commission Joint Research Centre Ispra), with three sub-commissions on atmosphere, meteorology and climate; ocean dynamics and productivity; and land processes and morphology.

COSPAR organizes biennial assemblies and is supported by a council, a bureau and a secretariat (current Director: Jean-Louis Fellous).

Tools: Workshops
Capacity-Building Workshops are held at a rate of about 3 workshops in each two-year period, possibly increased to 2 workshops per year in the coming period. These workshops have as a main objective the encouragement of the scientific use of space data by scientists in developing countries. This is particularly pertinent in view of the large number of extensive archives of data from past and current space missions and the ready access to these and the associated analysis software which is afforded by the internet. The typical workshop aims to provide a highly practical training in the use of one or more of these, based on current missions. However, any training activity which is related to science covered by one of the COSPAR commissions is eligible for support. The CB program is led by a Panel (PCB) chaired by Dr Mariano Mendez (University of Groningen, The Netherlands), with Dr Pierre-Philippe Mathieu (ESA/ESRIN, Italy) as Vice-Chair representing SC-A.

The programme of Workshops is not directed but relies on proposals from scientists of standing within the international space science community. It is targeted at a range of participants from final year postgraduate students to young university faculty members in developing countries, usually within a broad geographical region. Practical requirements will often limit the workshop capacity to 25-35 "students" over typically 2 weeks. Usually, the character of the workshop is expected to meet some general selection criteria and then COSPAR expects to provide substantial funding, the level depending of course on particular requirements. However, it is also expected that the project will be

in collaboration with the host country, which also will need to provide significant (mostly in-kind) funding. It is hoped that the workshop will be related to either a space project, or some other strategic scientific objective in the host country, but this is by no means always possible.

COSPAR is also willing to provide limited co-sponsorship to workshops with other major agencies, provided these fit the general character of this programme.

Tools: Fellowships

To enable young scientists who have been participants of one of the COSPAR Capacity Building workshops to build on skills gained, the Committee also organizes fellowships. This programme provides for visits of 2-4 weeks duration for the purpose of carrying out joint research at institutions which collaborate with COSPAR for this project (current list of institutions available at http://hea-www.harvard.edu/~rsmith/cospar/fellowship.htm). These fellowships are intended to foster research collaborations between scientists in developing countries and those at the receiving laboratories; they are not primarily for training purposes. For this reason the quality of the proposed research will be an important criterion for success in selection. The programme must be presented jointly by the applicant for the fellowship and an identified scientist who has agreed to receive and work with the applicant in their laboratory. Funding for these trips primarily comes from the host scientist and/or institution, with secondary funding from the applicant's institute or country. COSPAR provides limited funding, typically for direct travel costs only, in cases where the first two sources are insufficient. Fellows will be required to submit a report on their visit within 6 weeks of their return to their home country. The COSPAR Fellowship program is placed under the oversight of a subgroup chaired by Dr Randall Smith (Smithsonian Astrophysical Observatory, Cambridge, MA, USA), PCB Vice-Chair.

VLab:

Current status

The Virtual Laboratory for Education and Training in Satellite Meteorology (VLab, http://vlab.wmo.int) was established in 2000 by the World Meteorological Organization (WMO) and the Coordination Group for Meteorological Satellites (CGMS) to help improve the world wide utilization of satellite data and products by member countries of WMO, with a focus on developing countries. The VLab is a global network of currently 12 specialized training centres, "Centres of Excellence in Satellite Meteorology (CoE)", benefiting from a partnership with one or more satellite operators (in total eight) that are members of CGMS (see table below; status 31 December 2011). The CoE, often collocated with WMO Regional Training Centres (RTC), are established in all WMO Regions (continents) to meet the needs of operational forecasters and other scientists for skills and knowledge in using satellite data within their Region. Each CoE is responsible for conducting training activities and normally supports one or more Regional Focus Groups involving meteorological and hydrological services from its region.

The day-to-day running of the VLab is maintained by a Technical Support Officer, with support from the WMO Space Programme. VLab governance is provided by a Management Group currently chaired by Kathy-Ann Caesar (Barbados Met Service) and Volker Gärtner (EUMETSAT).

Centre of Excellence for training (Focal points on http://vlab.wmo.int)	Partner satellite agencies
National meteorological service of Argentina and University of Buenos Aires (Buenos Aires, Cordoba)	NOAA, CONAE
Bureau of Meteorology Australia (Melbourne)	JMA
Caribbean Institute for Meteorology and Hydrology Barbados (Bridgetown)	NOAA
Centre for Weather Forecasts and Climatic Studies, INPE, Brazil (Cachoeira Paulista)	INPE, NOAA
China Meteorological Administration Training Centre (Beijing) and Nanjing University of Information Science and Technology	CMA

University of Costa Rica (San José)	NOAA
Kenya Meteorological Department (Nairobi)	EUMETSAT
African School of Meteorology and Civil Aviation, Niger (Niamey)	EUMETSAT
Meteorological Service of Oman (Muscat)	EUMETSAT
Korea Meteorological Administration (Jincheon)	KMA
Russian State Hydrometeorology University (St. Petersburg) and ROSHYDROMET (Moscow)	ROSHYDROMET
South African Weather Service (Pretoria)	EUMETSAT

Tools

Training activities are regionally-based through online courses or a blend of face-to-face and distant learning modules, using, *inter alia*, a virtual repository of training material (including the Environmental Satellite Resource Centre) and the online course management system Moodle. Centres of Excellence maintain topical regional focus groups which meet regularly largely using webconferencing tools.

Regional 'event weeks' consisting of a series of expert-led online sessions on a specific theme (e.g., aviation, dust, Mediterranean weather) are open to participants from all over the world. These events provide an opportunity for the exchange of expertise and the establishment and strengthening of communication between professionals of meteorology from different regions.

Regional Focus Groups are online sessions organised by VLab CoEs, where participants (e.g., students, trainers, researchers, practitioners) get together on a regular basis to discuss a chosen topic on satellite imagery and products. Topics are usually presented by a trainer and then discussed with the participants who have the opportunity to ask questions and add comments, new ideas and suggestions. These online sessions have proved to widen the access to training events and training resources to countries within the regional area of VLab CoEs. The benefits of these events are numerous, most importantly that these learning activities are representative of a practice-based culture, strengthening regional collaboration amongst professionals. Two of the most active VLab RFGs are the Americas and Caribbean Focus Group and the South African SATREP Online.

Strategy and Plans:

The VLab currently focuses on providing training and training resources for NMHS staff, noting that this includes a diversity of profiles from core synoptic weather forecasting to a range of applications in related fields, as the activities of operational services tend to expand. It will be necessary to provide training that exploits the full potential of satellite data and products from both operational ***and*** several R&D satellites and, in so doing, prepare the various user communities for the next generation of spaceborne Earth observing systems. According to its 5-year strategy 2008-2013, the VLab has the following aims:

Based on currently available expertise in the VLab network, to provide training on:

- Satellite remote sensing (physical basics and principles)
- Meteorology (convective systems, heavy rain and floods, storms, impacts on transport)
- Climate (inter-calibration, radiation budget, ocean and cryosphere, aerosols and ozone)
- Hydrometeorological disasters (fire, wind-related)

Where regional requirements are identified, VLab activities could be widened to support training related to:

- Ocean applications (marine meteorology)
- Land applications
- Hydrology and water management
- Atmospheric chemistry and air quality
- Environmental monitoring.

It is further envisaged to (i) expand the number of Centre of Excellence, with sponsorship from additional satellite agencies, to (ii) provide training in support of more GEO societal benefit areas, and to (iii) comply with the evolving requirements in the "Guidelines for the Education and Training of Personnel in Meteorology and Operational Hydrology" (WMO-No. 258).

VLab Issues

Many VLab participating Centres have expressed the need to:
- Leverage national/regional resources and skills related to satellite remote sensing;
- Better liaise with academia (scientists, lecturers, students) nationally and internationally, including the exchange of staff;
- Reach out and learn from satellite application areas beyond satellite meteorology;
- Learn more about incorporate R&D satellite data in their operational environment;
- Overcome institutional barriers at the national level (e.g., between the national meteorological service and universities);
- Have larger bandwidth available for effective participation in online training.

Possible benefits for VLab from partnering with COSPAR
- Collaboration of VLab and COSPAR host institutions, and partner satellite agencies, in organizing capacity building events in developing countries
- Leveraging national resources and liaising academic institutions with VLab institutions
- Involvement of COSPAR workshop lecturers in VLab training events
- Access to COSPAR workshop material (i.e., region-specific training material in EO science beyond current VLab topics which are currently largely sat meteorology and marine meteorology)
- Support by COSPAR to face-to-face meetings of VLab CoEs

Possible benefits for COSPAR from partnering with VLab
- Use of virtual infrastructure (tools, training resources)
- Use of edu/training material in COSPAR workshops
- Take-up of research results in operational environment
- Linkage to operational environments through fellowships of scientists in host institutions (e.g., ECMWF)
- Promote event weeks to COSPAR community
- Promote liaison between institutions through workshop proposals to COSPAR
- Participation of regional CoEs in COSPAR workshops (as lecturers)
- Participation of students associated with VLab institutions in COSPAR
- Support by WMO to COSPAR meetings

Possible avenues of partnership with COSPAR:
- Letter of agreement between WMO/CGMS and COSPAR
- Inform VLab participants of COSPAR, and vice versa
- Exchange lists of contact points and encourage collaboration between host institutions
- Provide limited mutual sponsorship of training events (mainly in-kind)

Summary:
VLab and COSPAR PCB/EO are complementary organizational mechanisms for training in satellite meteorology and satellite EO applications, respectively, in terms of (i) application areas addressed, (ii) research vs operational focus, (iii) resourcing, (iv) host and partner institutions. These differences are significant, but offer potential for substantial cross-benefit. Further avenues of partnering should be explored between WMO/CGMS and COSPAR, for enhancing overall capacity in developing countries. Additional coordination overhead should be kept to a minimum.

Next steps
- Involve WMO Space Prog (done on 7 Nov), WMO Edu and Training (done on 3 Nov)
- Involve J-L Fellous (COSPAR secretariat), PCB/SC-A, VLab Mgmt Group chairs (done)
- Involve CGMS, COSPAR PCB chairs, VLab Tech Support Officer

APPENDIX X

PRODUCT CATEGORIES FOR THE PRODUCT ACCESS GUIDE

- Cross-Cutting
  - Satellite imagery
  - Radiances
- Atmospheric Domain
  - Temperature and Humidity
  - Wind Vectors
  - Clouds
  - Radiative Fluxes
  - Precipitation
  - Lightning
  - Aerosols/Dust/Volcanic ash
  - Ozone and Trace Gases
- Oceanic Domain
  - Sea Surface Temperature
  - Sea level
  - Sea State
  - Ocean Surface Wind
  - Ocean Colour
  - Ocean surface pollution/ Oil spills
  - Salinity
  - Sea Ice
- Terrestrial Domain
  - Land Surface Temperature
  - Vegetation and Land use
  - Floods
  - Snow and Ice
  - Fire
  - Volcanic eruptions
  - Surface radiation and Albedo
  - Soil moisture

APPENDIX XI

***DRAFT UPDATE OF THE MANUAL ON THE GOS, PART IV* - UPDATED AT ET-SUP-6**

MANUAL ON THE GLOBAL OBSERVING SYSTEM

PART IV: SPACE-BASED SUB-SYSTEM

0 Observations from Space

Satellite systems should provide quantitative data and qualitative information enabling, independently, as a constellation, or in conjunction with surface-based observations, the determination of:

(i) Three-dimension fields of atmospheric temperature and humidity;
(ii) Temperature of sea and land surfaces;
(iii) Wind fields at the ocean surface and aloft;
(iv) Cloud properties (amount, type, top height and temperature, and water content);
(v) Radiation balance;
(vi) Precipitation;
(vii) Lightning detection;
(viii) Total column ozone; ozone profile
(ix) Greenhouse gases;
(ix) Snow and ice cover;
(x) Vegetation cover;
(xi) Flood and forest fire monitoring;
(xii) Volcano ash cloud detection;
(xiii) Ocean colour;
(xiv) Wave height, direction and spectra;
(xv) Sea level and surface currents;
(xvi) Sea ice monitoring;
(xvii) Space environment.

1 COMPOSITION OF THE SUB-SYSTEM

The space-based sub-system shall be composed of operational geostationary satellites, operational satellites on distributed sun-synchronous orbits, additional operational satellites in appropriate Low Earth Orbits (LEO), research and development (R&D) satellites, an intercalibration system, associated systems for data collection, dissemination, and provisions for data stewardship. The space segment shall provide for a global coverage. Development of the GOS should be considered as a constellation of operational satellites (with firm contingency plans), sustained satellites (with long-term continuity) and R&D satellites.

NOTE: Information on the characteristics, capabilities and uses of the current system of operational meteorological satellites is contained in the Dossier on the Space-based Global Observing System (GOS Dossier) available via the WMO Space Programme: http://www.wmo.int/sat .

Information on the current status and plans of meteorological and environmental satellite programmes is available from the Coordination Group of Meteorological Satellites (CGMS) website: http://www.cgms-info.org .

1.1 Operational geostationary Satellites

The following capability should be provided:

a) Multispectral visible and infrared imagery;

b) Infrared sounding;

c) Lightning mapping;

d) Data collection from in-situ observing systems;

e) Space environment monitoring;

f) Other capabilities as appropriate, e.g. Broadband and spectral visible and infrared (for Earth radiation budget estimates), high spectral resolution UV sounding (for atmospheric composition), high-spectral resolution visible and infrared imaging (for ocean colour), solar activity monitoring.

1.2 Operational satellites on distributed sun-synchronous orbits

The following capability should be provided on several, distributed orbital planes:

a) Multispectral visible and infrared imagery;

b) Infrared sounding;

c) Microwave imagery;

d) Microwave sounding;

e) Scatterometry (for ocean surface winds);

f) Radar altimetry (for ocean surface topography);

g) Radio-occultation sounding;

h) Broadband visible and infrared radiometry for Earth radiation budget measurements;

i) Passive UV sounding (for atmospheric composition monitoring);

j) Space environment monitoring including particle detection and magnetic field measurement;

k) Solar activity monitoring;

l) Data collection from in-situ observing systems;

m) Direct broadcast;

n) Other capabilities as appropriate.

1.3 Other operational/sustained satellites in appropriate Low Earth Orbits

The following capability should be provided:

a) High-precision radar altimetry (for ocean surface topography);

b) Radio-occultation sounding from non sun-synchronous orbits;

c) Total solar irradiance;

d) Dual-angle view infrared imagery (for high-accuracy sea surface temperature measurement);

e) Narrow-band Visible and Near Infrared imagers for ocean colour, vegetation and aerosol monitoring;

f) High-spatial resolution multispectral Visible and Infrared imagery.

1.4 Research and Development satellites

The following observing capabilities should be provided, to the extent possible, that would permit:

a) Observation of the parameters necessary to understand for example the water cycle, the carbon cycle, the energy budget and the chemical processes of the atmosphere;

b) Demonstration of innovative instruments and systems for measuring parameters stated as WMO observational requirements.

2. IMPLEMENTATION OF THE SUB-SYSTEM

2.1 General

2.1.1 Operators of environmental satellites should meet, to the extent possible, the uncertainty, timeliness, temporal and spatial resolution requirements (include reference to RRR database) of the GOS.

2.1.1a Operators of environmental satellites should perform rigorous prelaunch instrument characterization and calibration, including radiance confirmation against an international radiance scale provided by a national metrology institute.

2.1.1b All passive instruments should be inter-calibrated on a routine basis against reference instruments or calibration targets, using agreed methodologies.

2.1.1c A period of overlap for new and old satellite systems should be ensured to determine intersatellite biases and maintain the homogeneity and consistency of timeseries observations.

2.1.2 Receiving and processing facilities should provide for the reception of remote-sensing and DCP data from operational satellites and/or the processing of quality-controlled environmental observation information, with a view of further near-real time distribution.

2.1.3 Members operating environmental observation satellites should make satellite data available to other Members over the WMO Information System (WIS) in accordance with WIS data management practices, and shall inform the Members of the means of obtaining these data through catalogue entries and metadata enabling their meaningful use.

2.1.4 Satellite data archives should include Level 1B, together with all relevant metadata pertaining to the location, orbit and calibration procedures used. The archiving system should be capable of providing on-line access to the archive catalogue with a browse facility, and description of data formats, and allowing users to download data.

2.1.5 Technical coordination: Members operating satellites should ensure the greatest possible compatibility between their different systems, through following recommended CGMS practices, and publish details of the technical characteristics of their instrumentation, data processing and transmissions, as well as the dissemination schedules.

2.1.6 Contingency arrangements: The satellite operators, working together under the auspices of the Coordination Group for Meteorological Satellites (CGMS) or otherwise, should ensure the continuity of operation, and the data dissemination and distribution services of the satellites comprising the Baseline Space Segment.

2.2 Number, distribution and availability of operational geostationary spacecraft

2.2.1 The constellation of satellites in geostationary orbit should provide full disc imagery at least every 15 minutes, throughout a field of view between 60^0 S and 60^0 N. On-demand rapid-scan capabilities should be provided where feasible. This implies the availability of at least six operational satellites located at roughly evenly distributed longitudes, with in-orbit redundancy.

2.2.2 Imagery should be available at least 99 (TBC) per cent of the time from at least six evenly-spaced geostationary satellites. Contingency plans, involving the use of in-orbit stand-by flight models and rapid call up of replacement systems and launches, should be in place.

2.3 Number, distribution and availability of operational spacecraft on distributed sun-synchronous orbits

2.3.1 The number and orbital configuration of satellites in sun-synchronous orbits should be sufficient to provide Visible, Infrared and microwave imagery and Infrared and microwave sounding global coverage at least six times per day with a regular temporal sampling. This will require sun-synchronous satellites operated along three orbital planes: one ante-meridian (a.m.) orbit with a descending equatorial crossing around 9:30 Local Solar Time (LST), one post-meridian (p.m.) orbit with an ascending equatorial crossing around 13:30 LST, and one early-morning orbit with an equatorial crossing between 17:00 and 19:00 LST. There should be at least one operational satellite on each of these planes, with redundancy on the am and pm orbits.

2.3.2 At least two of these satellites, one in am and one in pm, should perform Infrared sounding with a hyperspectral sensor.

2.3.3 Data from these satellites should be acquired on a global basis, without gaps (blind orbits), and delivered to users to meet timeliness requirements. Imagery and sounding data should be available from at least three polar orbiting satellites, in a.m., p.m. and early morning orbit, on not less than 99 per cent of occasions. The system design should provide for ground segment, instrument and satellite redundancy, and rapid call up of replacement launches or a.m. and p.m. spares, to achieve this.

2.3.4 At least two satellites, one in am and one in pm, should be equipped with radio-occultation sounders;

2.3.5 At least two satellites, on well separated orbits, should be equipped with wind scatterometers;

2.3.6 At least two satellites, one in am and one in pm, should perform broadband Visible/Infrared Earth radiation monitoring;

2.3.7 At least two sun-synchronous satellites, on well separated orbits, should be equipped with altimeter packages for global ocean surface topography monitoring.

2.4 Number, distribution and availability of other operational/sustained spacecraft on appropriate Low Earth Orbits

2.4.1 A ocean surface topography mission on high-precision, inclined orbit should complement the two altimetry missions in sun-synchronous orbits to build a robust constellation;

2.4.2 A constellation of dedicated spacecraft with radio-occultation sensors on appropriate orbits should complement the radio-occultation missions in sun-synchronous orbits;

2.4.3 At least one satellite should perform downward solar irradiance monitoring, with provisions for overlap between consecutive missions in order to maintain measurement continuity;

2.4.4 A sun-synchronous spacecraft should be maintained on an a.m. orbit with high-accuracy Infrared imagery to provide reference measurements of sea surface temperature;

2.4.5 Continuity should be provided for at least one narrow-band Visible and Near Infrared imager on a sun-synchronous a.m. orbit to monitor ocean colour, vegetation and aerosols;

2.4.6 Several sun-synchronous satellites in a.m. orbit should be equipped with high-resolution (10-m class) multispectral Visible / Infrared imagers to build a constellation providing sufficient coverage of the land surface.

2.5 Research and Development satellites

2.5.1 The main purposes of research and development satellites are to support scientific investigations on atmospheric, oceanic and related processes, to test new instrumentation and/or to improve existing sensors and satellite systems.

2.5.2 Pathfinders for future operational missions should include for instance: precipitation radars, Doppler lidars, low-frequency microwave radiometers, geostationary microwave imagers and

sounders, geostationary narrow-band Visible and Near Infrared imagers, gravimetric sensors, and imagery missions in high-inclination highly elliptical orbits.

2.5.3 Although neither long term continuity of service nor a reliable replacement policy are assured, research and development satellites also provide, in many cases, information of great value for operational use. To this purpose, and in order to promote the early use of new types of data in an operational environment, provisions shall be made when relevant to enable near-real time data availability.

2.6 Provisions for inter-calibration

2.6.0 All passive instruments should be inter-calibrated on a routine basis against reference instruments or calibration targets, using common methodologies.

2.6.1 Spacecraft with at least one high-quality Infrared and one high-quality Visible Hyperspectral instrument should be maintained in a LEO orbit to provide reference measurements for intercalibration of operational Visible and Infrared instruments in geostationary or LEO orbit. Advantage should be taken of satellite collocation to perform instrument intercalibration.

2.6.2 A range of ground-based calibration targets should be maintained, with precise characterization, in order to support routine Visible channel calibration operations.

2.7 Data collection from in-situ platforms

All operational environmental observation satellites should be equipped to provide for the collection and relay of data from various kinds of observing and data-collection platforms (DCP);

(i) Members responsible for satellites with this capability should establish and maintain the necessary technical and operational co-ordination, in order to ensure compatibility. A number of channels should be identical on all geostationary satellites to allow movement of mobile platforms between their individual footprints.

(ii) The satellite operators should publish details of the technical characteristics and operational procedures of their data-collection missions, including the admission and certification procedures.

2.8 Data dissemination

All operational environmental observation satellite systems should ensure near-real-time data dissemination by direct broadcast as per the requirement of Members, as appropriate, or re-broadcast via telecommunication satellites

Additionally:

(i) The satellite operators should establish dissemination contents and schedules that take into account the data requirements of users as documented in the RRR database.

(ii) Direct broadcast frequencies, modulations, and formats for polar-orbiting satellites should allow a particular user to acquire data from either satellite by a single antenna and signal processing hardware. To the extent possible, the frequency bands allocated to Meteorological Satellites should be used.

(iii) Direct broadcast should be provided in two data streams as follows:

- a high data rate stream, such as the High Resolution Picture Transmission (HRPT) or its evolution, to provide meteorological centres with all the data required for Nowcasting and numerical weather prediction (NWP), and other real-time applications;

- a low data rate stream, such as the low rate picture transmission (LRPT) and low rate information transmission (LRIT) services, to convey an essential volume of

data for Nowcasting and short period forecasting to users with lower connectivity or low-cost receiving stations.

(iv) Re-broadcast via telecommunication satellites[] should complement and supplement direct broadcast services, which allows cost-efficient access to integrated data streams including data from different satellites, non-satellite data and geophysical products.

2.9 Data stewardship

2.9.1 In order to maximize the contribution of the above missions mainly in support of the monitoring of climate, it is essential to preserve long term, carefully calibrated, data records, reprocessing them as appropriate, with the necessary traceability information to achieve consistent Fundamental Climate Data Records. Operators of environmental satellites should consider this requirement when planning their launch, calibration, validation, processing and archival strategies. There should be sufficient overlap between consecutive missions, to allow intercalibration unless reliable transfer standards are available.

2.9.2 Operators of environmental satellites should provide full description of all steps taken in the generation of satellite products, including algorithms used, specific satellite datasets used, and characteristics and outcomes of validation activities.

3 USER SEGMENT

3.1 Users' stations

All Members should endeavour to install and maintain in their territory at least one system enabling access to digital data from both LEO and geostationary operational satellite constellations, either a receiver of re-broadcast service providing the required information, or a combination dedicated direct broadcast receiving stations.

Members requiring access to data from research and development satellites will need to download these data from the appropriate servers, or install a relevant re-broadcast service providing the required information, or install an appropriate direct broadcast user station, if the R&D satellite has such direct broadcast capability.

Data-collection platforms: In order to extend the Global Observing Systems by the use of the data-collection and relay capability of the environmental observation satellites, Members should establish fixed or moving DCP systems, in particular to cover data-sparse areas.

3.2 Education and Training

High priority should be given to the education and training of instructors in the use of satellite data and capabilities at a sub-set of Regional Meteorological Training Centres (RMTCs) acting as Centres of Excellence (CoE) in satellite meteorology, in order to build up expertise and facilities at a number of regional growth points. Individual environmental satellite operators should focus their assistance, to the extent possible, on one or more of these CoEs within their service areas and contribute to the Virtual Laboratory (VLab) for training and education in satellite meteorology. The aim of the Education and Training strategy implemented through the VLab is strategy is to systematically improve the use of satellite data for meteorology, operational hydrology, and climate applications, with a focus on meeting the needs of developing countries. For smooth transition to new satellite capabilities, provisions should be made for appropriate preparation of the users through training, and plans to upgrade receiving equipment and processing software. In addition to working through the VLab, Members should, as appropriate, exploit partnerships with organizations providing education and training in environmental satellite applications, depending on their specific needs.

[] Formerly referred to as “Advanced dissemination methods” (ADM), this technique generally uses Digital Video Broadcast (DVB) standard.

APPENDIX XII

ACTIONS FROM ET-SUP-6 AND PREVIOUS ET-SUP MEETINGS

I. Actions from ET-SUP-6
Action 6.1: WMO SP to inform ET-EGOS and ET-SAT of the need identified by ET-SUP to evaluate the potential benefit of a sounding mission in low-inclination orbit with a view of including such mission, if relevant, in the future update of the Vision for the GOS. (Due date: 31 January 2012)
Action 6.2: WMO SP office to complete the migration of the tabular information of Vol. 1 and 2 of the Dossier to a prototype database. (Due date: 29 February 2012)
Action 6.3: ET-SUP Members to provide feedback on the prototype database of space-based capabilities. (Due date: 31 March 2012)
Action 6.4: Chair of regional task team (Luiz Machado), in coordination with WMO Secretariat (including the Department for Regional Activities), to finalize the activities of the regional requirements task team. (Due date: 31 March 2012).
Action 6.5: WMO Space Programme office to communicate the draft Procedure initially to RA II and RA V in support of their respective needs in formulating requirements, and seek feedback. Subsequently, the Procedure should be communicated to all Regions. (Due date: 15 February 2012)
Action 6.6: WMO Secretariat to support discussions with NOAA, INPE, EUMETSAT, GEO and other interested parties to define a roadmap towards a sustainable, enhanced, DVB-S service covering RA III and RA IV. (Due date: November 2012)
Action 6.7: Roshydromet to communicate to WMO Space Programme office and CGMS Secretariat (EUMETSAT) the HRIT/LRIT Electro-L Mission Specific Implementation, for information of WMO Members and publication on the CGMS website. (Due date: 15 February 2012)
Action 6.8: X. Fang to investigate the access conditions for global datasets derived from FY-3. (Due date: 1 March 2012)
Action 6.9: A. Mostek to liaise with NESDIS about developing a portal or other form of guidance on available products from DMSP (such a portal could be ultimately part of the Product Access Guide). (Due date: 15 April 2012)
Action 6.10: EUMETSAT to report at CGMS-40 on the Multi-Mission Administration Message (MMAM) as a possible matter of harmonization within CGMS. (Due date: CGMS-40)
Action 6.11: EUMETSAT to investigate the possibility of providing frequent Meteosat image sectors for RA III/IV in the framework of the EUMETSAT data policy, for consideration as candidate product for GEONETCast-America. (Due date: 30 June 2012)
Action 6.12: ET-SUP Members to review and update as appropriate the Data Access tables in Appendix IV of the ET-SUP-6 report. (Due date: 15 February 2012)
Action 6.13: ET-SUP members to review and complete the software list template contained in Appendix 5 of the ET-SUP-6 report. (Due date: 15 February 2012)
Action 6.14: WMO Secretariat to circulate to ET-SAT the list of software once completed by ET-SUP members, for review. (Due date: 15 March 2012)
Action 6.15: WMO Secretariat to publish the list of software on the WMO Space Programme website, after review by ET-SUP and ET-SAT. (Deadline: 1 June 2012)
Action 6.16: A Task Team composed of ET-SUP Members (A. Rea, P. Zhang, L. Machado, A. Mostek), with support by the WMO Space Programme office, should further refine the draft SCOPE-NWC concept, including the identification of potential pilot projects and contributing agencies and individuals (see Appendix VI for details). (Due date: 31 March 2012)
Action 6.17: A. Rea and X. Fang to develop a discussion paper for a SCOPE-NWC Pilot Project focused on globally consistent delivery of basic nowcasting products from geostationary and polar orbiting satellites. (Due date: 30 April 2012)

Action 6.18*:* A. Rea and L. Machado to develop a discussion paper for a SCOPE-NWC Pilot Project focused on aviation products. (Due date: 30 April 2012)
Action 6.19: L. Machado, V. Gärtner, A. Mostek, and S. Bojinski to develop a discussion paper for a SCOPE-NWC Pilot Project focused on precipitation products. (Due date: 30 April 2012)
Action 6.20*:* X. Fang and H. Kunimatsu to develop a discussion paper for a SCOPE-NWC Pilot Project focused on dust detection and dust storm prediction products. (Due date: 30 April 2012)
Action 6.21*:* Suman Goyal and V. Gärtner to develop a discussion paper for a SCOPE-NWC Pilot Project focused on real time quality controlled ocean surface winds from Oceansat-2. (Due date: 30 April 2012)
Action 6.22: WMO Space Programme office to transmit the proposed modifications to the EGOS-IP to ET-EGOS. (Due date: 20 January 2012)
Action 6.23: ET-SUP Task Team (A. Mostek, S. Wannop, A. Rea) and WMO SP to follow the implementation plan recommended in Appendix VIII of the ET-SUP-6 meeting report. (Due dates: February – October 2012; see Appendix VIII for details)
Action 6.24: VLMG to review the VLab strategy in light of WMO strategic priorities, and to submit it to CGMS-40 for adoption. (Due date: VLMG-6 Meeting in October 2012)
Action 6.25: WMO Space Programme, with assistance from NOAA and EUMETSAT, to look into the possibility of using a WMO Trust Fund for ensuring the continuity of the VLab TSO function. (Due date: 15 February 2012)
Action 6.26: VLab TSO to ensure that all CoE websites are up-to-date, reflecting the 'look and feel' of the VLab homepage (including the VLab logo). (Due date: 1 March 2012)
Action 6.27: VLMG co-chair to ask the VLMG for its opinion to extend the SatMaNu concept to areas outside Europe, especially to the Southern Hemisphere. This should include a discussion on providing the necessary resources to proceed with this activity. (Due date: 31 March 2012)
Action 6.28: VLMG Co-Chair to contact CMA VLab CoE to arrange for a distant lecture on the FY-3 product suite for the benefit of all Regions. (Due date: 21 February 2012)
Action 6.29: O. Milekhin to contact the VLab CoE at the Hydrometeorology University of St. Petersburg (Russian Federation) to arrange for a distant lecture on the Meteor-M product suite for the benefit of all Regions. (Due date: 21 February 2012)
Action 6.30: A. Mostek, with assistance from COMET and the WMO Space Programme office, to investigate whether ESRC (as a portal) and MetEd (as a repository of training material) can be registered in appropriate ways in the WIS, to allow for broad discovery of their content. (Due date:: 1 March 2012)
Action 6.31: WMO Space Programme office and COSPAR to explore the possibility of developing training modules on space weather, for dissemination to the VLab CoEs. (Due date: 1 April 2012)
Action 6.32: ET-SUP members who are product providers to create product pages in accordance with the agreed categorization, for inclusion in the product access guide. (Due date: 31 December 2012)
Action 6.33: VLab to develop a draft page for guidance on the use of satellite products in support of high-impact events management, with a view to include it in the Product Access Guide. (Due date: 1 May 2012)
II. Recommendations from ET-SUP-6
Recommendation 6.1: *WMO to invite the Chairs of the WMO/CGMS co-sponsored international working groups to report to the next session of ET-SUP.*

Recommendation 6.2: *ET-SUP Members to support the ongoing review process of the Dossier in particular as concerns the assessment of product performances and compliance with user requirements, in collaboration with international scientific working groups and other users.*
Recommendation 6.3: *ET-SUP recommended that the APSDEU and NAEDEX organizers ensure that IMD and ISRO are invited to their next session.*
Recommendation 6.4: *ET-SUP suggested that a joint meeting of APSDEU-NAEDEX (see item 7.5) and the 4th Asia-Oceania Meteorological Satellite Users Conference be collocated.*
Recommendation 6.5: *NOAA and potential regional partners (INPE, CONAe, CSA) join their efforts to strengthen and expand GEONETCast-America with a view to reinforce its sustainability and leverage its utilization for operational applications as a component of IGDDS.*
Recommendation 6.6: *The VLab should take advantage of the GEONETCast training channels for dissemination of training resources, in particular for users with limited Internet connectivity.*
Recommendation 6.7: *ET-SUP welcomes the progress of Himawari-8, 9 Project. In view of the similarities between ABI and AHI imagers, it encourages NOAA, JMA, BOM and other potential users to collaborate on the preparation for their respective communities.*
Recommendation 6.8: *Noting the gap in IGDDS and GEONETCast coverage over the Pacific, ET-SUP encourages USAID, NOAA, and their partners in RAPIDCast to pursue the RAPIDCast project and investigate its potential as a system for use by WMO Members in support of operational and training activities.*
Recommendation 6.9: *Roshydromet and EUMETSAT to work together towards including Moscow and possibly Novosibirsk and Khabarovsk in the X-RARS phase of EARS.*
Recommendation 6.10: *ET-SUP considers it important that an update on RARS be presented at ITSC-18 (Toulouse, 22-27 March 2012) in order to seek renewed feedback from the NWP community.*
Recommendation 6.11: *WMO Space Programme office to consider convening the RARS Implementation Group, preferably in conjunction with other related meetings to facilitate participation (e.g. ITSC-18 in March 2012, NAEDEX-APSDEU in October 2012).*
Recommendation 6.12: *ET-SUP recommends to IMD to consider making Level 1 data from Kalpana and INSAT-3A available in Near Real Time via FTP.*
Recommendation 6.13: *ET-SUP recommends that ITWG, IWWG, IPWG and IROWG prioritize their recommendations to ensure more effective uptake by WMO and satellite operators*
Recommendation 6.14: *CMA to investigate its contribution to SCOPE-CM and report to the WMO Space Programme office. (Recommended due date: 31 March 2012)*
Recommendation 6.15*: SCOPE-CM to explore possibilities for extension, for example through pilot projects on precipitation (with consideration of IPWG findings) and on ocean altimetry (with consideration of the community around the upcoming altimetry symposium in Italy in 2012)*
Recommendation 6.16: *VLab to share information in the training calendar with COSPAR and other relevant international training activities.*
Recommendation 6.17: *ET-SUP supported the agreement between VLab and COSPAR, and recommended to demonstrate within a year the value of this collaboration.*
Recommendation 6.18: *ET-SUP recommended that parts of the COMET library be disseminated through the GEONETCast training channel.*
Recommendation 6.19*: ET-SUP recommended that all satellite operators include comprehensive training programmes into the mission statements, for user preparation and capacity building pre- and post-launch. The concept for a generalized satellite proving ground should be developed.*
Recommendation 6.20: *ET-SUP recommended integrating the new Observing Requirements Database with the future database of space-based*

capabilities, to support the critical review of requirements and capabilities.	
III. Permanent Actions for ET-SUP	
ET-SUP Action P.1: ET-SUP Members will inform the WMO Space Programme office of any issues related to NRT access, documentation, software tools, and service notifications for R&D satellites of primary interest for operational users, in view of addressing these issues at ET-SAT and with relevant satellite operators	
ET-SUP Action P.2: The VLab Technical Support Officer, on behalf of the WMO Secretariat, should regularly ask the Centres of Excellence for status reports on their activities, especially regarding training and satellite data utilization in their respective regions.	
IV. Actions from ET-SUP-5	
ET-SUP-5 Action 5.10: WMO Space Programme office, through the VLMG, to seek input from various areas of the world to illustrate the benefits of satellite data and products for various application areas. (Due date: End 2010)	OPEN; WMO requested CoEs to provide cases that illustrate benefit of VLab (at VLab web meetings 25/26 Oct 11) for featuring in WMO outlets and VLab website
ET-SUP-5 Action 5.17: VLab Co-chairs, in consultation with WMO Space Programme and other relevant WMO Departments, to prepare a roadmap towards widening the scope of VLab activities to serve the needs of emerging scientific communities in the developing countries. This roadmap shall be reviewed by VLMG in July 2010 and presented to CGMS-38 for approval. (CGMS Action)	OPEN . - A preliminary roadmap was discussed at VLMG-5 and approved by CGMS. Includes four steps a) Set up special VLab task force to identify gaps b) Develop list of topics c) Identify information sources & training resources d) Report at CGMS-39; Further discussion deferred to VLMG-6 2012 - Bernadette Cornell volunteered to draft roadmap (VLab web meeting 25/26 Oct 11) - VLMG suggested to intensify the collaboration with the University components of the CoEs. Some courses were already held at St. Petersburg University, the recent CALMET conference was hosted by University of Pretoria.