

**WORLD METEOROLOGICAL ORGANIZATION**

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**COMMISSION FOR BASIC SYSTEMS**  
**OPEN PROGRAMME AREA GROUP ON INTEGRATED OBSERVING SYSTEMS**  
**EXPERT TEAM ON SATELLITE UTILIZATION AND PRODUCTS**

**FIFTH SESSION**

**GENEVA, SWITZERLAND**

**15-19 MARCH 2010**

**FINAL REPORT**



## **WMO General Regulations**

### **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 on 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 fifth session of the Expert Team on Satellite Utilization and Products (ET-SUP) was convened in Geneva, Switzerland from 15 to 19 March 2010.

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. The session has built on the outcome of the ET-SUP Reduced session held on 7 and 8 October 2009 that had performed a preliminary review of the work programme and identified key actions and priorities.

Among its major outcomes, the session:

- With regard to monitoring the progress of the Space Programme to respond to the needs of WMO Members:
    - Reviewed the status of the questionnaire on availability and use of satellite data by WMO Members;
    - Defined a roadmap to exploit the replies to this questionnaire with a view to present a summary of its outcome to the Commission for Basic Systems in November 2010; and
    - Discussed further evolution of such questionnaires for the longer term;
  - With regard to the need to raise the awareness of WMO Members on available and planned satellite capabilities:
    - Confirmed the importance of the Space Programme Web pages;
    - Performed a detailed review of these pages; and
    - Suggested further improvements that could be made with the support of the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab);
  - With regard to capacity building:
    - Reviewed the status and activities of the VLab;
    - Provided guidance for its future activities and expansion; and
    - Recommended using the Environmental Satellite Resource Centre (ESRC) made available by NOAA and the COMET Programme as a portal to training resources;
  - With regard to enhancing access to satellite data and products:
    - Provided guidance to IGDDS and RARS activities on overall strategy and priority objectives to be included in a revised IGDDS Implementation Plan;
    - Initiated a review of software tools to provide guidance to WMO Members in this respect;
    - Emphasized the importance of the initiative taken in RA III and RA IV to gather satellite data requirements at the regional level, to support dialogue among users and data providers, and encouraged other regions to undertake a similar approach;
  - With regard to its representativeness of the broad user community:
    - Welcomed the participation of JCOMM and SWFDP in ET-SUP discussions, as well as the report from informal NWP user requirements groups;
    - Reviewed an inventory of expert groups in satellite matters;
    - Reviewed the linkage between ET-SUP and the relevant groups and suggested maintaining a particular relationship with the four international scientific groups that are sponsored by WMO and CGMS (IPWG, ITWG, IROWG, IWWG).
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*From left to right: Ignatius Gitonga, Volker Gaertner, Jacki Pilon, Jean-Louis Fellous, Luiz Machado, Barbara Ryan, Hiromi Owada, Tony Mostek, Jerome Lafeuille, Wolfgang Benesch, Lars Peter Riishojgaard, Azusa Sakamoto, Jim Purdom, Dick Francis, Anthony Rea, Peng Zhang, Sally Wannop, Victor Saulskiy, Wenjian Zhang. (Not on the picture: Craig Donlon, Alice Soares).*

## **1. ORGANIZATION OF THE SESSION**

### **1.1 Opening of the session**

The fifth session of the Expert Team on Satellite Utilization and Products was opened at 09h00 on Monday 15 March 2010, at the WMO Headquarters in Geneva, Switzerland.

Ms Barbara Ryan, Director of the Space Programme, welcomed the participants (See Appendix I) on behalf of the WMO Secretary-General. She underlined the importance of ET-SUP to advise the CBS with a users' perspective on satellite matters and highlighted that ET-SUP was expected to adopt a broad user perspective across all WMO Programme areas.

### **1.2 Adoption of the agenda**

The provisional agenda was adopted as contained in Appendix II. The Expert Team welcomed the inclusion of a presentation on the latest developments of the Meteor-M1 commissioning phase under item 7.

### **1.3 Working arrangements for the session**

The meeting agreed to conduct its work in plenary for the first two days, in small working groups as required during the following two days, and to convene again as a plenary for the concluding session.

## **2. CHAIRMAN'S REPORT**

The ET-SUP Chairman, Dr Luiz Machado, gave an overview of past ET-SUP achievements. He recalled that the ET-SUP Reduced session had:

- Agreed on key issues for expanding satellite data utilization across WMO Members and WMO (and co-sponsored) programmes, as included in the ET-SUP work programme;
- Acknowledged the ongoing pilot activities in RA II and in RAs III/IV as excellent initiatives to advance some important objectives of ET-SUP at the regional level;
- Agreed on short-term actions for the Questionnaire on Availability and Use of Satellite Data and Products by WMO Members that enabled issuing it early 2010;
- Decided to review the approach to this questionnaire for future editions, with more emphasis on monitoring the use of satellite data and products in a wider range of thematic areas and communities;
- Noted the Virtual Laboratory (VLab) achievements made possible by the availability of a Technical Support Officer, and agreed to review the potential use of the COMET Environmental Satellite Resource Centre (ESRC) as a host for the Virtual Resource Library;
- Recommended strengthening coordination and synergy with user groups or other entities with satellite-related activity of direct relevance to the work of ET-SUP;
- Established the preliminary agenda for this fifth meeting of the Expert Team and allocated actions accordingly.

The Chairman furthermore expressed his views on the future steps to be accomplished by the Expert Team. Among the new challenges to be addressed by the Expert Team, he suggested in particular:

- Facilitating easy and cost-effective data access, e.g. through DVB-S systems;
- Facilitating easy access and preparing the users to the new satellite generation;
- Stimulating the use of adequate data formats and open source software tools;

- Expanding the RARS network to hyperspectral sounders;
- Supporting satellite data assimilation;
- Enhancing dialogue among data users and providers;
- Unifying the approach of R&D and operational satellite data usage;
- Increasing coordination and synergy among communities of practices and scientific groups;
- Developing an active communication between the Space Programme Office, ET-SUP, and regional points of contacts;
- Carefully investigating users' needs e.g. through additions to the questionnaire;
- Extending training efforts to all WMO Members;
- Keeping active the VLMG activities.

### **3. GUIDANCE FROM THE CHAIRPERSON OF OPAG IOS**

Dr Lars-Peter Riishojgaard, Chairperson of the Open Programme Area Group on Integrated Observing Systems (OPAG IOS) informed the session on the expected role of ET-SUP in the context of OPAG IOS. He emphasized in particular the importance of facilitating data access to stimulate the use of, and take maximum benefit from, meteorological and environmental satellites.

He informed the session on major relevant outcomes of sessions that he had attended as Chairperson of OPAG IOS, including CBS-XIV, CM-10, and the fifth session of the Expert Team on Evolution of the Global Observing System. In particular he emphasized the update of Observing Requirements in several WMO application areas (Global and Regional NWP, Seasonal and Interannual Forecasting) and an initiative to synthesize these requirements following a proposal from the WMO Space Programme. The ET-EGOS has also discussed the need for Observing System Experiments (OSE) and Observing System Simulation Experiments (OSSE) to evaluate the impact of specific observation sources, and had recommended that the following new OSEs/OSSEs should be considered by Members:

- In the presence of GPS-RO data, what radiosonde coverage is needed in the stratosphere? To which height, and for which latitude ranges? OSSEs are needed to assess saturation level for GPS-RO data.
- In the presence of dense satellite observation of ocean surface wind, what is the requirement for the density of in-situ surface pressure observations?
- Guidance is needed on desirable coverage of Automated Ship-borne Aerological Programme (ASAP) sounding over the ocean.
- In support of Regional NWP, what observations are needed for the planetary boundary layer? Which variables and what space/time resolution?
- Studies are needed to address identification of critical locations for surface-based stations.

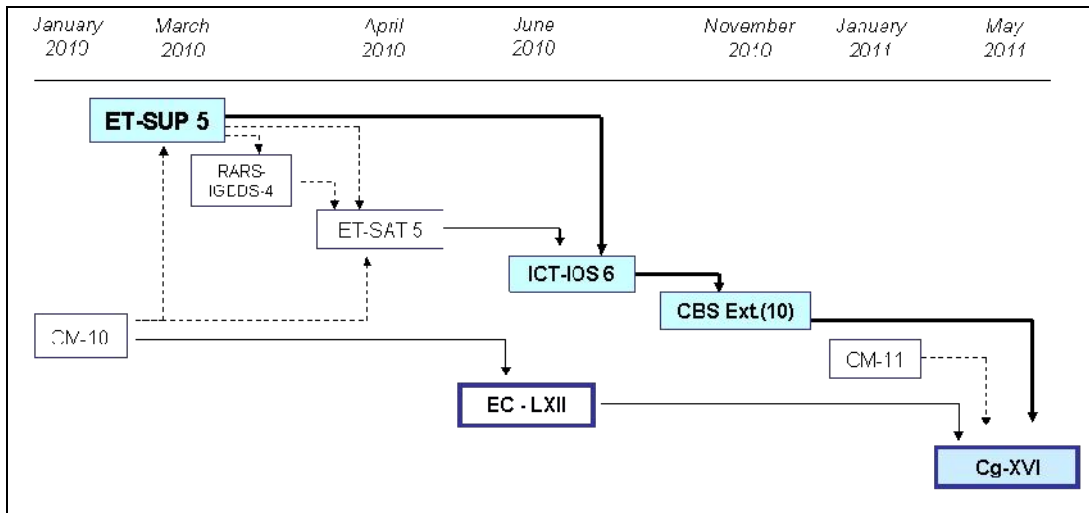
### **4. ET-SUP TERMS OF REFERENCE, WORK PROGRAMME**

The Secretariat (J. Lafeuille) gave a brief introduction on the organization of the Secretariat and on the overall WMO governance structure, explaining how the outcome of ET-SUP was consolidated with the outcome of other OPAG IOS Expert Teams (such as ET-SAT and ET-EGOS) and presented to CBS, which in turn would inform the decisions made by the Executive Council and the Congress.

The meeting was informed of the ET-SUP Terms of Reference defined by the fourteenth session of the Commission for Basic Systems (CBS-XIV) held in Dubrovnik, Croatia in March-April 2009, and of the work programme subsequently developed for ET-SUP by the CBS Management Group at its tenth meeting (CBS-MG-X) held in Geneva in June 2009. This work programme is defined for the period leading up to CBS-XV, which is expected to be held in the last quarter of 2012. An intermediate milestone will be the CBS Extraordinary session, to be held in November 2010 in Namibia. It was also pointed out that the OPAG IOS Chairperson would be in a position to

provide immediate feedback from the ET-SUP session to the eleventh session of the CBS-MG to be held during the second part of the week in parallel with ET-SUP.

The most relevant milestones for ET-SUP-5 were highlighted, as indicated in the Figure below:



## 5. OUTCOME OF WMO MEETINGS INCLUDING CONSULTATIVE MEETINGS, EXECUTIVE COUNCIL AND CBS, WITH DIRECT RELEVANCE TO ET-SUP

The session reviewed relevant conclusions of the ninth and tenth sessions of the WMO Consultative Meetings on High-level Policy on Satellite Matters (CM-9 and CM-10), the fourteenth session of the Commission for Basic Systems (CBS-XIV) and the sixty-first Executive Council (EC-LXI).

It was noted that CM had requested to publish information on the conditions of access to data from GOS contributing satellites, stressed the need for continuous geostationary coverage of South America, supported the inclusion of Global Space-based Inter-calibration System (GSICS) as a Pilot Project for the WMO Integrated Global Observing System (WIGOS), and requested to advance integration of space-based observations at the level of product quality.

CBS has finalized and endorsed the Vision of the GOS in 2025 that had been reviewed by ET-SUP and ET-SAT, adopted the VLab five-year strategy developed by the Virtual Laboratory Management Group (VLMG) and ET-SUP, confirmed the two new Centres of Excellence in Pretoria and Moscow, confirmed the value of a regular questionnaire to monitor the progress of satellite data availability and use, while recommending regional initiatives to address the issues revealed by such enquiries. CBS had also supported the SCOPE-CM initiative and suggested future expansion of the concept to other areas of application of satellite data. It had furthermore defined the Terms of Reference of an Inter-programme Coordination Team on Space Weather. All these initiatives were subsequently approved by the EC.

The recent CM-10 session had recommended giving greater visibility to space matters in WMO activity and had discussed in depth the support of space-based activities for climate monitoring and the future Global Framework for Climate Services. It emphasized the complementary role of research and operational entities and activities, and discussed ways forward to improve global coordination of satellite programmes in this respect. In addition, information was given on the planned coordination among Canada, the Russian Federation and WMO for future programmes in Highly Elliptical Orbit (HEO) including the Arktica and Polar Communications and Weather (PCW) missions.

In the light of this report, the ET-SUP session was pleased to note that its deliberations and recommendations had been taken into account at the highest level and facilitated significant progress in WMO activities.

## 6. STATUS OF ACTIONS FROM PREVIOUS ET-SUP MEETINGS

The session reviewed the status of actions agreed at previous ET-SUP meetings. It was noted that, apart from a few exceptions indicated below, all the actions from previous meetings had been completed; many of them were closed at the Reduced session in October 2009 already, or shortly afterwards.

The following actions that were still ongoing were addressed in the course of the meeting:

- *Actions 3.10, regarding Regional Focus Groups, and 4.1, regarding the update of WMO Publication N° 258, were discussed under agenda item 10 and transferred to the Virtual Laboratory Management group.*
- *Action 4.14, regarding the illustration of benefits from space-based observation was discussed under agenda item 9 and reformulated.*
- *Actions 4.15, 4.16, 4.17 regarding interaction with the Expert Team on Automatic Weather Stations (ET-AWS) was discussed under agenda item 13 and is proposed to be completed through participation in the next ET-AWS meeting.*
- *Action R1\_1, regarding the Web training calendar was discussed under Item 9 and should be completed as part of the redesign of the VLab pages by VLMG and TSO.*
- *Action R1\_9, to establish a Task Team for exploiting the questionnaire was completed when discussing item 8.2.*

At the end of the meeting, it was thus agreed that these actions were either completed or replaced by new actions, and should therefore be closed. The ET-SUP was pleased to underline that the conclusions and actions of its previous meetings were all efficiently addressed or implemented.

## 7. STATUS OF THE SPACE-BASED GOS

### ***Meteor-M1***

A comprehensive presentation was given by Dr Victor Saulskiy on the latest developments of the Meteor-M1 commissioning phase. It highlighted the number of products that were being generated in support of meteorological and environmental applications. The session welcomed this information and congratulated ROSHYDROMET for these achievements. It was confirmed that Meteor-M data were disseminated in HRPT and LRPT. The ET-SUP members looked forward to using this data. Given the interest of the global community for Meteor-M data, the session urged ROSHYDROMET to make detailed information openly available on Direct Readout data access characteristics. At the moment, no detail has been provided to WMO for inclusion in the WMO-CGMS Web pages.

**Action 5.1:** ROSHYDROMET, through V. Saulskiy, to inform the WMO Secretariat on detailed implementation of HRPT/LRPT for Meteor-M data and other relevant information (e.g. calibration) for the global Direct Readout community. (Due date: One month after end of Meteor-M N1 commissioning.)

### ***Space-based GOS Overview***

The Secretariat summarized the latest status of the space-based Global Observing System and its evolution planned in the short- and long-term. Information was based, among other sources, on the outcome of the last meeting of the Coordination Group for Meteorological Satellites (CGMS). It was underlined that major evolutions were being prepared, including a transition to new generation of geostationary satellites occurring around 2015 for several satellite operators. The attention was raised to the impact of these forthcoming evolutions for the user community,



both in terms of opportunity and in terms of risk. ET-SUP should consider appropriate measures to ensure readiness of the user community for such changes.

### **Current geostationary status**

The Vision of the GOS in 2025 calls for geostationary satellites separated by no more than 60 degrees, the group recognized that the current distribution could be improved towards this goal, noting the wider separation of satellites over the central Pacific Ocean.

**Recommendation 5.1:** *ET-SUP recommends that WMO further encourage satellite operators and CGMS to optimize the global coverage when making decisions about satellite locations, for instance to increase the overlap of satellite footprints over the central Pacific for a better coverage of the North and South Pacific.*

### **Future Geostationary Satellites**

The Expert Team underlined the remarkable advances that the new generations of satellites will allow for hydrometeorology, oceanography and environmental monitoring. In particular, the advent of hyperspectral sounders in geostationary orbit will represent a significant jump in capability, with benefits for operational meteorology and air quality, atmospheric chemistry, climate and many other areas. With the next generation of geostationary satellites, high temporal resolution and new data streams such as hyperspectral sensors or lightning detectors will provide numerous opportunities for new scientific work, but will also present a challenge for users.

The group recognized that continuity of service is essential and that, whilst new data streams are important, the next generation of satellites should provide data that is backwards compatible with legacy systems, at least in the short term. This can also be achieved through planning some overlap of the operations of the new satellites with the preceding generation. Such an overlap is also recommended by the GCOS Climate Monitoring Principles.

**Recommendation 5.2:** *Planning for new generation satellites should include an appropriate overlap period between current and future satellite generations to allow inter-comparison and validation of products, and to facilitate a smooth transition for users.*

The importance of training was recognized in the introduction of new satellite systems. Users require a significant effort to prepare their systems for the introduction of these new data streams. These efforts can be assisted by the provision of demonstration data well in advance of the satellite mission. As an example, ET-SUP noted the activities supported by NOAA within the GOES-R Proving Ground Programme.

The group also noted the success of the PUMA initiative (Preparing Users for MSG in Africa), followed by Africa Monitoring of the Environment for Sustainable Development (AMESD), which had the purpose to prepare RA I Members to take advantage of Meteosat Second Generation and other data. This could be regarded as another example of preparing users to new generation satellites.

With reference to Himawari-8, ET-SUP noted that users require time to prepare their processing systems for data of this new generation of JMA geostationary satellites. As the data will be provided via the Internet, there is no implications on direct readout ground stations; however, the delivery of data via the Internet raises a new set of potential difficulties, in particular for countries with poor Internet connectivity.

ET-SUP encourages JMA to assist users with the transition to Himawari-8 by:

- Early provision of documentation about sensor characteristics and data formats;
- Generating and providing synthetic data enabling users to test their Internet access and processing systems;

- Providing in test mode, well in advance of operations, the full set of future operational products via the planned operational delivery channels. These products could be generated initially using synthetic data, then using pre-operational data during the spacecraft commissioning phase; and
- Considering the broad range of user needs when defining the set of data and products to be delivered.

Whilst the recommendations above are directed to Himawari-8, this should be seen as an example; ET-SUP considered that these principles are general enough to apply to all new satellite systems.

ET-SUP encouraged JMA and CMA to consider dissemination of a set of Himawari data on the Asian component of GEONETCast, as follow-on to the current dissemination of some MTSAT data.

### **Specific Issues Related to Direct Readout from Low Earth Orbiting Satellites**

ET-SUP also considered the Low Earth Orbit environmental satellites, including the meteorological and oceanographic satellite systems, planned over the next five to ten years, such as:

- NPP/JPSS (2011-2014)
- Fengyun-3A/B/C/D/E/F (2008-2014)
- Meteor-M and Meteor MP (2009-2020)
- Jason-2 and -3 (2006-2013)
- Sentinel-3 (2013)

From a user perspective, it was felt that limited documentation was available to assist users in taking advantage of the data from these satellites, in particular as concerns the meteorological satellites whose operational use relies to a large extent on Direct Readout.

**Recommendation 5.3:** *ET-SUP recommends that satellite operators provide the user community with full details of their planned operational spacecraft, as early as possible. These details should include as a minimum:*

- *Orbital ephemeris;*
- *Data transmission frequencies and polarizations (for Direct Readout services);*
- *Data formats;*
- *Instrument details such as spectral bands and response functions (when relevant).*

The group recognized the excellent work that had been done by NASA in the preparation for the Terra and Aqua spacecraft, and by EUMETSAT in preparation for Metop. All other operators should be encouraged to take similar steps.

### **General remarks**

For each new satellite series, a training package should be available, that should address:

- Information for telecommunication engineers;
- Conversion of digital counts to geolocated radiances;
- Level-1 applications;
- Level-2 applications.

Software for converting digital counts to radiances is seen to be desirable for all new satellites with radiometric instruments.

Taking note of previous user preparation activities, in particular PUMA, the group recommends the preparation of a generic transition plan for satellite operators and user communities. This plan could be used as a guideline by satellite operators when defining implementation plans for new spacecraft generations. As a minimum, the plan should include:

- Providing documentation about sensor characteristics and data formats;
- Considerations of data access mechanisms;
- Generating and providing synthetic or proxy data so that users can test for example their reception and processing systems and develop their capabilities;
- Provision of processing software; and
- Provision of appropriate training packages.

**Action 5.2:** The Virtual Lab Management Group should prepare a generic transition plan to support user readiness for new satellite generations, incorporating the elements discussed by ET-SUP-5, and present it to ET-SUP-6. (Due date: ET-SUP-6)

## **Use of Research and Development Satellites in an Operational Context**

A large number of research and development satellites have the potential to directly support operational applications, in addition to their primary experimental or demonstration objectives. This is especially the case when:

- Data are accessible in near real-time;
- Documentation is available to the operational community;
- Software tools are available;
- Users are kept informed of service changes.

It is agreed to review to what extent these conditions are fulfilled by the missions for which there is a priority interest for operational use by WMO Members. Any difficulty would be brought to the attention of ET-SAT and/or the relevant satellite operators by the WMO Space Programme.

**Action 5.3:** 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. (Permanent action)

## **8. QUESTIONNAIRE AND MONITORING ISSUES**

### **8.1 Status of the 2010 questionnaire**

A report was given on the biennial enquiry on status of availability and use of satellite data and products by WMO Members for the period 2008-2009, and the plans for exploiting its outcome. As agreed at the ET-SUP Reduced session in October 2009, the questionnaire had been revised with input from ET-SUP members, and translated from English to French, Russian and Spanish. It was sent out and published on line on 13 January 2010, with responses requested for 15 March. At the time of the ET-SUP meeting, 60 responses had already been received. (Note: at the time of writing this report, 89 replies have been received).

The session defined a schedule and nominated a Task Team comprised of Richard Francis and Francesco Zauli (TBC) to perform the interpretation. It was furthermore suggested that the Technical Document synthesizing the outcome should include information from other groups (e.g. the CGMS- and WMO-sponsored international scientific groups) following guidance to be supplied by the WMO Space Programme. This would, however, make final drafting dependent on the availability of these inputs.

**Action 5.4:** WMO Space Programme Office to extract questionnaire responses and store them in a form suitable to support the interpretation activities. (Due date: End May 2010)

**Action 5.5:** WMO SP to invite Chairpersons of the CGMS- and WMO-sponsored international scientific groups to provide feedback on availability and use of satellite data in their application area and on evolution over the 2008-2009 two-year period. (April 2010, for response by September 2010)

**Action 5.6:** Task Team consisting of R. Francis and F. Zauli will coordinate sharing the workload and produce a draft Technical Document for presentation by the time of CBS and finalize the Technical Document for subsequent publication. (Due dates: End of June 2010 for the draft TD containing main outcomes derived from questionnaire responses; end of 2010 for a finalized TD for publication)

## 8.2 Plans for future questionnaires

The meeting discussed possible evolutions of the concept of biennial enquiries.

ET-SUP agreed that the revised questionnaire structure, as proposed in the Appendix to ET-SUP-5 Doc. 8(2), represents a good basis for the next edition. This next edition should be finalized by the end of 2011 for issuance early 2012. However, ET-SUP noted that questions related to mechanisms of satellite data reception, omitted from the proposed update, should be re-introduced.

ET-SUP noted that, in the future, an effectively maintained WMO Member "Country Profile Database" could obviate the need for routine questionnaires; however, in the absence of such a resource it was felt that regular questionnaires are still required, and the two-year cycle should be retained. Plans for developing the next edition of the questionnaire are based on the assumption that ET-SUP meetings will continue to occur annually. If this would not be the case then the Secretariat and the ET-SUP Chair should define a way forward utilizing other means (e.g. email, dedicated task teams, etc.).

The structure of the next edition of the questionnaire should allow responses to be used to generate indicators of progress of the WMO Expected Results (ER). This could be achieved by a simplified first section of the questionnaire asking simple, general, factual questions. A second section of the questionnaire would include more detailed questions to complete the full picture.

**Action 5.7:** R. Francis to present an updated version of the questionnaire for finalization at ET-SUP-6. (Due date: ET-SUP-6)

In addition to the questionnaire, which covers a broad range of issues and addresses all WMO Members in a uniform way, ET-SUP considered there would be merit in pursuing more focused inquiries, centred on specific topics. An example is the inquiry made under NOAA and CEOS auspices to investigate the lack of usage of satellite-derived surface winds by many NMHS or marine services in Southern Hemisphere countries. ET-SUP suggested supplementing the gathering of information via interviews. It was felt this approach cannot replace the questionnaire itself but rather complement it to inform the Space Programme and the relevant Regional Associations on potential critical issues or key achievements.

**Action 5.8:** J. Pilon, A. Rea and L. Machado to propose interview themes, structure (e.g. template/guidance document) and suggested interviewers (possibly from ET-SUP membership or VLab CoEs) and interviewees. These considerations to be captured into a discussion document for ET-SUP. (Due date: ET-SUP-6)

ET-SUP considered the significance of the RA II pilot project (See item 15.1 below). The progress of this pilot project was very much appreciated and seen as a promising basis for similar projects addressing other regions. In the context of the questionnaire it was felt that considerations

of the form of the questionnaire can continue within ET-SUP but that the experiences from the pilot project should be taken into account when distribution mechanisms for the next edition is considered. ET-SUP wished that consistency of contents and schedule be maintained between the global and the regional questionnaires.

## **9. WEB-BASED INFORMATION**

### **9.1 Feedback from the ET-SUP enquiry and way forward**

The meeting reviewed the feedback from ET-SUP members on the Space Programme Web pages, and the actions taken by the Secretariat in response to this feedback. Generally speaking, the meeting acknowledged that the Space Programme Web pages provided a considerable amount of up-to-date information that was of great value to WMO. It encouraged the Secretariat to continue its efforts to maintain these pages.

The meeting formulated recommendations and actions to further improve the Web site. It was agreed to seek assistance of the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) through its Management group (VLMG) that was represented at the ET-SUP meeting by its two Co-chairs, V. Gaertner and Luiz Machado, and by A. Mostek:

**Action 5.9:** The VLMG to design a new VLab Home page and review and update the design of other VLab Web pages, including the calendar of training events. (Due date: October 2010)

**Recommendation 5.4:** *The revised VLab pages should be directly accessible from the main Space Programme Home page and use the domain name "vlab.wmo.int", following the example of "GSICS.wmo.int" and "CGMS.wmo.int".*

**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)

**Recommendation 5.5:** *Software Tools List - WMO Space Programme should maintain the list of software tools recommended by ET-SUP-5 (Appendix VI) and make it available on the Web under a section revised as "Data Access and Software Tools." Ultimately, if a portal is implemented (See Recommendation 5.7), this information would be accessed through this portal.*

**Recommendation 5.6:** *Translation - The Space Programme Web pages are currently only provided in English. WMO should consider having the Space Programme Web pages translated into additional official languages.*

There is a need for harmonized information on satellite products. The page on "Links to on-line products and catalogues" is a step towards addressing this need. However it is not fully populated. WMO should investigate developing a "portal" site. The effort should be properly focused to avoid duplication with existing catalogues available from satellite operators or other organizations. The information about satellites and instruments should also be made available through a portal. A lot of information is available in the Dossier on the Space-based GOS that can be downloaded from the FTP server, but there is no direct access to this information. For instance, the CEOS Land Surface Imaging Constellation portal: <http://wgiss.ceos.org/lcip/index.shtml> is an excellent example of user-friendly presentation of information on satellite missions. The "Instrument" html pages in their present form are convenient for consultation, but not easy to maintain. Accessing this information through a single portal would be helpful. As a first step the portal could provide thematic access to Earth Observation products.

**Recommendation 5.7:** *Space Programme Portal - WMO SP to consider the development of a portal for access to all relevant satellite based products, software and documentation.*

**Action 5.11:** EUMETSAT and WMO Space Programme to establish a task team by July 2010 to prototype a portal for EO products with a view of including it on the WMO Web site.

**Recommendation 5.8:** *Decentralization of Web Pages – The development and maintenance of some Space Programme Web pages should be decentralized. This would allow ET-SUP members and the VLMG the option to help maintain these pages.*

The above approach could allow for a flexible and more sustainable Web site updating process. An example is the Space Programme Web pages for GSICS, which is already using a decentralized update approach. In addition to the GSICS pages, the CGMS and Virtual Lab pages could be candidates for decentralization.

**Action 5.12:** WMO SP with support from ET-SUP members to identify which Web pages are best suited for decentralizing. (August 2011)

## **10. VIRTUAL LABORATORY FOR EDUCATION AND TRAINING**

### **10.1 Report on possible use of ESRC for the VLab Resource Library**

A report was given on the potentialities offered by the Environmental Satellite Resource Centre (ESRC) as a Virtual Resource Library for the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab). The meeting acknowledged the attractiveness of ESRC and was convinced that the use of ESRC would greatly benefit the users. The ET-SUP expressed its high appreciation to COMET and NOAA to make the ESRC available as the resource library for the VLab activities. It expressed the wish that practical modalities for use of the ESRC by the VLab be rapidly defined for endorsement by the Virtual Laboratory Management Group (VLMG) at its next meeting.

The following actions were agreed:

**Action 5.13:** VLMG Co-chairs in conjunction with UCAR/COMET to provide recommendations on working on best practices and roles for joint use of the ESRC as the VLab resource library. (Due date: June 2010)

**Action 5.14:** VLMG to review the new working procedures for usage of the ESRC with the aim to endorse them during VLMG-5 meeting in July 2010. (Due date: July 2010)

**Action 5.15:** VLMG Co-chairs to check whether the VLab logo (See Appendix IV) can be included within ESRC main page. (July 2010)

### **10.2 VLab Activity report**

The session reviewed the overall progress made by the VLab over the past two years and was informed on the future plans including: future local or regional training events, Common Time Zone Compatible Training Event, expansion of the VLab to new application areas and to the research community, new partnership. The meeting expressed its high appreciation of the work done by the VLab through all its partners and sponsors, including the Technical Support Officer (TSO). There was no doubt that the VLab was an active and growing community that provided benefit to WMO Members in a widening range of areas, which was highly needed. The meeting provided guidance to the VLab through a number of actions and recommendations listed below.

Recalling Action 37.12 of the last CGMS meeting, ET-SUP confirmed the importance of the TSO position and the benefit of maintaining this position in the future. Mechanisms for further funding the TSO position should be investigated.

**Action 5.16:** The Secretariat (Director of the Space Programme) to send a new letter to satellite operators highlighting the benefit gained from having a Technical Support Officer (TSO) position and calling for continued funding of this position in 2011 and beyond. (May 2010).

Recalling that the VLab five-year strategy foresees training activities in a range of application areas, ET-SUP wished that the training needs of JCOMM and of the Severe Weather Forecasting Demonstration Project (SWFDP) will be addressed by the VLab in the future.

Furthermore, ET-SUP recalled and endorsed CGMS Action 37.16:

**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) (July 2010).

**Action 5.18:** VLMG to provide practical guidance for delivering training in those areas where Internet connectivity is limited (use of GEONETCast training channel, VISITview, etc.). (July 2010).

**Action 5.19:** 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. (August 2011)

It was furthermore agreed that Actions 3.10 and 4.1 from previous meetings would be taken up by the VLMG, which led to the following two actions:

**Action 5.20:** VLMG to contact each Regional Focus Group (RFG) and facilitate establishing monthly RFG sessions in all regions. In particular collaboration is sought to facilitate the establishment of an RFG in Asia. (Due date: July 2010)

**Action 5.21:** V. Gaertner and L. Machado, as VLMG Co-chairs, to ensure that VLMG, involving a subgroup as appropriate, provides updated information for the current revision of publication WMO-No. 258. (Due date: End 2010)

**Recommendation 5.9:** *ET-SUP also recommended that the CoEs monitor the status of responding to the 2010 questionnaire on satellite data availability and use, for their area of responsibility.*

## 11. DATA DISTRIBUTION ISSUES

A report was given on the progress of the Integrated Global Data Distribution Service ([IGDDS](#)) and the Regional ATOVS Retransmission Services ([RARS](#)) projects and related activities. The meeting provided guidance for the IGDDS and RARS Implementation Group meetings that will be held during the following week.

### Integrated Display and Data Access Tools

The group recognized the efforts that have already been made in the provision of integrated data access and display tools. These tools underpin the provision of regional training activities where, for example, the participating agencies each use different operational systems.

Such integrated tools provide a common platform, facilitating these important capability building activities. In addition, such systems provide an alternate means of data access which may provide operational support in some situations, including in support of the SWFDP. Some examples of these, which were commended by the group, are RAMSDIS on line, SataID, Satrep Online, SIGMA, and VisitView.

### **Data Formats**

There is a need for satellite operators to define the appropriate level and format for data exchange. Data formats are somewhat dependent on the timeliness requirements and on the bandwidth constraints of the end users. For bandwidth-constrained users, appropriate low volume products should be created.

The group recognized the benefits of providing available data sets in formats compatible with widely available software and Web tools such as Google Earth (global), Satrep Online (for Europe and Africa), SataID (for the Asia-Pacific), RAMSDIS and Visitview (for the Americas).

***Recommendation 5.10:*** Operators should endeavour to adhere to existing standard formats.

The group welcomed the announcement that JMA has implemented an operational ADDE server for MTSAT-1R data, following CGMS recommendation 36.10 "CGMS Members to pursue the provision of further satellite data of common interest via ADDE servers for training and scientific cooperation activities".

### **Data Dissemination Strategy and IGDDS Implementation Plan**

ET-SUP supported the idea that the Integrated Global Data Dissemination Service (IGDDS) activity should be communicated in terms of (1) an overall strategy for satellite data and product dissemination, and (2) an implementation plan highlighting priority actions to be supported and monitored. It stressed the overall goal of the strategy should be to improve timely availability of satellite data and products needed by all programmes, to all Members including those in Developing Countries.

ET-SUP noted that products can be downloaded via Internet in addition to the data and products that are operationally disseminated, however for many weather services poor Internet connectivity is a key limiting factor. For the generation of forecasts and warnings, data timeliness should take precedence over complexity. For example, single channel data from geostationary satellites is a basic need for Nowcasting.

***Recommendation 5.11:*** Taking into account the timeliness requirements and bandwidth constraints of users, the group recommends that appropriate low-volume products should be created and delivered through available dissemination channels including DVB-S, ftp and Internet.

The group reviewed the proposed priorities for the IGDDS Implementation Plan and suggested the following:

- Organizing the formulation of data requirements (both from a regional approach and a thematic approach) and the dialogue between data users and providers;
- Implementing regional DVBS dissemination systems in every region to offer a cost efficient and integrated access to satellite data sources;
- Demonstrating the inclusion of all relevant data types in the broadcast services, including interregional data exchange;
- Support harmonization of future Direct Broadcast systems as well;
- Support the implementation of complementary data access and distribution via the Internet;



- Implementing WIS data standards and conventions, satellite operators becoming Data;
- Collection or Production Centre (DCPC) within the WIS framework;
- Permanent information resources through adequate portals, and active user information, including links to appropriate software tools;
- Monitoring the progress and seeking feedback.

## 12. SOFTWARE PROCESSING TOOLS

The meeting considered user needs and existing opportunities with respect to satellite data processing software tools with a view to provide guidance to WMO Members for the choice and subsequent use of such software tools, especially in support of operational activities in less advanced countries.

The group recognized that utilization of satellite data products is reliant on data access mechanisms and on the availability of software tools.

A key task is to identify criteria to allow users to better choose the software most appropriate to their needs. These needs will reflect a range of differing contextual factors including geographic and economic factors.

### Category 1 Users

*Category 1* users are those with a direct readout capability or specialized centres who are dealing with “raw data”. For this category of users, software tools are used to transform raw data to level 1 (data calibrated, navigated) and level 2 (geophysical parameters). Freely-available standard software packages, such as the International MODIS and AIRS Processing Package (IMAPP), provide a number of significant benefits, including reduced duplication of effort, and facilitate the exchange of data between agencies in standard formats.

***Recommendation 5.12:*** *The group urged satellite operators to provide the necessary metadata and, where possible, processing software to facilitate the use of direct broadcast and archived data by end users. Ideally this information should be provided well in advance of operations to facilitate the uptake of data from these satellites by the international community.*

The group encourages the operators of recently launched satellites, and those to be launched in the near future, to provide such information, for example:

- ROSHYDROMET to provide users with the necessary documentation, metadata and software relating to Meteor-M1 after its commissioning is completed; and
- CMA to further inform users on the relevant documentation and data access modalities relating to Fengyun-3A, through appropriate insertion in the Space Programme Web pages, in collaboration with the WMO Space Programme.

### Category 2 Users

*Category 2* users are meteorological, oceanographic or other end users with a real-time requirement. Such users can access satellite products from the Internet or by Digital Video Broadcast (DVB) dissemination services, which allow the reception of large amounts of products using low-cost receiving equipment. These receiving systems can be complemented by inexpensive display systems having enough processing power to perform complementary local treatments, which allows a great flexibility concerning the place to generate the products, either in a central facility or in local units.

The session discussed the minimum functionalities that should be included in software tools for exploiting satellite imagery and the general requirements that should be complied with. These functionalities and requirements are listed in Appendix V. The session also developed an

initial list of software tools and a template for possible categorization of such tools for WMO Members, which is provided in Appendix VI.

### **13. INTEGRATION OF SPACE-BASED OBSERVATIONS**

A report was given on the WMO Integrated Global Observing System (WIGOS) and on the progress of the Global Space-based Inter-calibration System (GSICS). The meeting discussed the satellite-related aspects of WIGOS.

The meeting welcomed the comprehensive analysis of the various aspects of “integration” of space-based observation, which provided a sound conceptual framework for future actions. It was suggested however to emphasize the link with the GEOSS approach. The meeting noted the distinction made between:

- Ensuring interoperability and consistency of observation data through standardized data management, instrument inter-calibration, and quality assurance practices;
- Coordinated planning, design and implementation of space-based observing systems at instrument or mission level;
- Coordination of efforts for the development, validation and operational delivery of products, including composite products based on multiple data sources;
- Consideration of mutual support interaction of surface-based and space-based observations.

To set the context for its discussions, the Expert Team considered that ideally, from a user perspective, the global space component of the GOS would contain multiple identical satellites, providing optimal coverage, producing identical measurements, made available via identical data services (formats, standards, access methods, etc). Any steps, however small, towards this direction should be encouraged.

#### **(i) Maximizing interoperability and consistency of space observation data**

##### ***Data management***

ET-SUP strongly supports the relevant ongoing initiatives: Integrated Global Data Dissemination Service (IGDDS), Regional ATOVS Retransmission Services (RARS), and Task Force on Satellite Data Codes (TFSDC).

In particular, end users benefit from the harmonized approach that exists in the various RARS services. In a similar way, the harmonization of formats and standards across the various DVB-S components of IGDDS would be beneficial to the end users from both a technical and financial (user reception system) perspective.

ET-SUP recognizes that for some planned missions, particularly for ‘next generation’ satellites, different options are under consideration to best achieve data distribution. The motivations which allowed the adoption of harmonized and standardized data formats and dissemination mechanisms for current missions (e.g. HRPT, HRIT, etc.) are no less relevant for missions currently in the planning stage. Hence ET-SUP strongly encouraged re-visiting these considerations through CGMS and other relevant bodies, with a view of harmonization for the benefit of the end users. It invites the IGDDS Implementation Group to examine the issue.

##### ***Instrument inter-calibration***

ET-SUP strongly supports the activities of GSICS and in particular developing the capability for operational inter-calibration of geostationary and low earth orbit satellite data for use in near real time applications.

## **(ii) Planning and implementation of space-based observation means**

### ***Harmonization or sharing of instruments***

Sharing of instruments is certainly desirable but in some cases might raise practical / political issues. However, end users would benefit significantly if harmonization could be achieved with instrument output data (e.g. similar spectral characteristics).

**Recommendation 5.13:** *The group encouraged ET-SAT to consider the harmonization of minimum instrument characteristics, with a priority on multispectral imagers.*

### ***Coordinated mission planning and operation***

Users are interested in coordination of two projects of monitoring the Arctic region from highly elliptical orbits: Russian “Arktica” and Canadian “Polar Communications and Weather (PCW)” missions. The aim of the coordination is to achieve identical composition and characteristics of the above-mentioned HEO satellites and optimal choice of their orbital parameters.

ET-SUP welcomed the intention of ROSCOSMOS and ROSHYDROMET from one side and Canadian Space Agency from the other side to coordinate the composition and characteristics of their HEO satellites and their orbital parameters, as reported at CM-10. Such coordination would result in a better integrated component of the GOS.

## **(iii) Product integration**

### ***Sharing the product development and processing effort***

A coordinated set of satellite products derived from the various satellites in orbit (as far as possible) would be very helpful to the end user (e.g. for Nowcasting). Weather systems do not respect the boundaries of satellite field-of-view and characterizing them using the same products wherever they occur is important. This could imply the need for a SCOPE type of approach for such products.

## **(iv) Integration of space and surface-based observing networks**

### ***AWS requirements and Collaboration with GRUAN***

ET-SUP was unsure about what particular *in situ* measurements from AWS would best contribute to provide ground truth for satellite calibration / validation or quality control activities. If relevant, the capability for AWS observations to be made at a place and time that coincide with satellite observations (e.g. ‘off-hour measurements’) should be exploited.

Concerning the possible elaboration of requirements from ET-SUP towards ET-AWS planning activities, it was previously reported that “... *ET-SAT and ET-SUP should both take action on this subject. In order to focus their considerations, the Expert Teams also wished to have a better idea of what AWS networks were under consideration in terms of geographical coverage.*”

**Action 5.22:** In order to better understand the opportunities for interaction between AWS networks and satellite systems, a satellite expert should attend the relevant part of the next meeting of the ET-AWS (20-23 April 2010) and report back to ET-SUP.

## **14. SCOPE-CM AND EXPANSION OF THE SCOPE CONCEPT**

The meeting reviewed the progress of the Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) and provided guidance on the

further development of this activity as well as the possible expansion of the “SCOPE” concept to other application areas, beyond Climate Monitoring.

The Expert Team considered that the following criteria should be used to ascertain whether a topic is suitable for the SCOPE ‘model’:

- The related science should be reasonably mature;
- Availability / representation of an organized user community;
- An established description of the needs of this community;
- The presence of opportunities and synergy with other initiatives.

The extension of the SCOPE concept to operational areas is thought to be more straightforward than the establishment of SCOPE-CM, taking into account the experience gained with SCOPE-CM (project structure and lessons learned ), and the fact that operational applications may be more mature and should not pose the same challenges as climate monitoring.

The EUMETSAT Satellite Application Facilities (SAFs) are seen as a useful reference. The following applications were suggested as “promising” candidates for the extended “SCOPE” concept:

- Ocean applications (noting the role of JCOMM representing the user community, and the EUMETSAT Ocean and Sea Ice (OSI) SAF as an existing and successful initiative);
- Nowcasting (illustrated by the SWFDP considerations, and with the EUMETSAT Nowcasting and Very Short-term Forecasting (NWC) SAF as an existing and successful initiative);
- Precipitation estimates (Regularly requested via Questionnaire responses, and noting the possible relationship with the Hydrology SAF and the [IGWCO](#) theme).

Other possible candidates suggested were:

- Land surface processes (diverse user community, with possible relationship with Land Surface Analysis (LSA) SAF);
- Air quality and atmospheric chemistry (a very broad subject, with a diverse user community, and possible overlap with LSA).

**Actions 5.23:** A. Rea and P. Zhang to prepare a concept paper on the establishment of a global “SCOPE-NWC” for discussion at ET-SUP-6.

## **15. REPORTS ON REGIONAL ACTIVITIES**

### **15.1 Pilot Project in RA II**

A report was presented on behalf of the co-leads of the RA II Pilot Project for satellite applications. ET-SUP was informed that at its fourteenth session in December 2008, Regional Association II (Asia) adopted a resolution to establish a Pilot Project whose main focus is to support NMHSs through enhanced information on satellite data, products and related training issues.

The WMO Secretariat invited RA II WMO Members to join the Pilot Project Coordinating Group, whose members as of 30 September 2009 are Japan (Co-coordinator); the Republic of Korea (Co-coordinator); Bahrain; China; Hong Kong, China; India; Kyrgyzstan; Oman; Pakistan; the Russian Federation; Uzbekistan; Viet Nam and, as an observer, EUMETSAT.

The Terms of Reference of the Pilot Project Coordination Group are:

- (a) To identify the requirements of NMHSs of developing countries, and in particular least developed countries in the Region, regarding satellite imagery, data and products in support of their weather services, including forecasts and warnings;
- (b) To develop a brief and effective action plan, taking into account the relevant existing activities, for consortium members and recipient Members;
- (c) To facilitate communication between centres willing to develop the required products and recipient Members;
- (d) To organize assistance to recipient Members in accessing and utilizing available satellite imageries, data and products, as a first priority through training;
- (e) To monitor the progress of the project.

In a first phase, the Pilot Project initiated issuing a bi-monthly newsletters for RA II Members. A set of pilot project Web pages have been developed, to be hosted on the WMO Space Programme Web site. Mailing lists were created for RA II Members and for Coordinating Group members. Emphasis is put on improving the information on access to satellite data, products and related training. In this context, MTSAT image data will be available for users on request through JMA's ADDE server that can be accessed using McIDAS-V or McIDAS-Lite. A questionnaire is being prepared to identify in more details the needs and expectations of RA II Members.

In the course of 2010, the Pilot Project will proceed with identification of requirements through the above activities and with the preparation of a survey of RA II Members in order to organize assistance to recipient Members. Pilot project activities will be aligned with Virtual Laboratory activities to optimize assistance to NMHSs in RA II, and with the developments of the WMO questionnaire to ensure consistency and avoid duplication. A working plan will be developed for the second phase of the project.

The meeting welcomed the progress made by the Pilot Project and the networking effort among the co-leads and all participating members. It wished to be kept informed of the progress of the project and of the lessons learned for possible application in other regions.

## **15.2 Data requirements gathering in RA III and RA IV**

A report was given on the outcome of the Satellite Data Requirements Workshop for RA III and RA IV held in Sao Jose dos Campos, Brazil in February 2010. It was recalled that the expression of data and product requirements is one of the important steps foreseen in the Integrated Global Data Dissemination Strategy (IGDDS) Implementation Plan, and was requested in the context of the WMO Information System (WIS). This process shall be conducted at the regional level, since it has to take into account specific regional context for example in terms of meteorological applications, communications infrastructure, or available data sources and processing capabilities.

This issue has been addressed for RA III and RA IV, with the support of 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, Dr Luiz Machado (Brazil). A template for identifying requirements was defined, and requirements were developed by the task team and a workshop was held on 1-3 February 2010 in Brazil to review the outcome of this requirements gathering exercise and to define a way forward.

Among its major outcomes, the workshop enabled:

- Better understanding of the technical and operational context of WMO Members in the area;
- Better understanding of the capabilities of existing and planned data dissemination means;
- Review and update of the data requirements, as included in Annex 3;

- Demonstration of a process for requirements gathering and subsequent dialogue among data users and providers;
- Definition of a way forward with a number of precise actions, aiming to respond to the highest priority needs in the short-term, and recommendations to prepare a sustainable response to regional needs in the longer term.

**Recommendation 5.14:** *In view of the very positive outcome of the RA III/IV Satellite Data Requirements Workshop, ET-SUP recommended that a similar approach be followed in other regions facing comparable issues regarding satellite data access.*

## **16. INTERACTION OF ET-SUP WITH USER COMMUNITIES**

### **16.1 Mapping of user groups and application areas**

As requested by the Reduced session, the meeting reviewed a mapping of existing satellite expert groups to application areas, with a view to avoid unnecessary duplication but, instead, to build or strengthen relationships with relevant groups in order to allow the ET-SUP to adequately serve the needs and expectations of the various programme areas.

ET-SUP agreed that the inventory of relevant satellite-related groups interacting with ET-SUP provided in Doc. 16(1) should be completed by the SWFDP (Steering Group and regional sub-project team) and the Ocean Surface Topography Science Team (OSTST). See Appendix VII.

ET-SUP agreed that it should maintain a working relationship with the International Scientific Groups sponsored by WMO and CGMS (International ATOVS Working Group, International Winds Working Group, International Precipitation Working Group, International Radio-Occlusion Working Group), that should be mainly based on exchange and assessment of reports. In particular, the following was suggested:

- Reports from ET-SUP meetings should be distributed to these groups;
- The regular report of the WMO Secretariat to ET-SUP on “Relevant Events” should contain not only information from WMO constituent bodies, but also from these groups;
- The WMO SP Office Web pages should enable a direct link (Internet access) to the pages of these international scientific groups;
- When opportunities arise, we should encourage and take advantage of ET-SUP members’ or close colleagues participation in such groups and collocation of meetings;
- The future Technical Documents on “Status of availability and use of satellite data and products by WMO Members” should not only be based on the responses to the biennial questionnaire, but also on feedback from these international scientific groups.

Link between ET-SUP and GEWEX Radiation Panel, SCOPE-CM and some other comparable groups should be via the Secretariat.

**Action 5.24:** The WMO Secretariat to update the list of related “User Groups and Application Areas” and relationship to ET-SUP and to make the list accessible via the Space Programme Web pages with direct links to all these groups. (Due date: September 2010)

**Action 5.25:** The WMO Secretariat to include under the relevant permanent agenda item of future ET-SUP meetings, a summary report on items of relevance resulting from meetings of the international scientific groups. (Due date: ET-SUP-6)

### **16.2 Report from JCOMM**

The JCOMM representatives reported on JCOMM satellite activities and expectations based on inputs from the JCOMM Expert Teams. The team noted that priority satellite observation

requirements in support of JCOMM applications are detailed in the JCOMM Observations Programme Area strategic work plan for building a sustained Global Ocean Observing System in support of the Global Earth Observation System of Systems. The priority variables (Essential Climate Variables) include at the time being:

- (i) Sea surface temperature,
- (ii) Sea surface height,
- (iii) Surface vector winds,
- (iv) Surface currents
- (v) Ocean colour, and
- (vi) Sea ice.

The team noted that satellite data are the only means for providing high-resolution data in key ocean areas where *in situ* observations are sparse or absent, and better integration of met-ocean measurements into NHMSs and their sustainability are needed. They are in some instances the unique source of key ocean observations. The team noted that better ocean currents are required from space (e.g. from emerging techniques based on the use of SAR, altimetry and scatterometer data).

The team was informed that the third session of JCOMM (JCOMM-III, Marrakech, Morocco, 4-11 November 2009) recognized that much progress had been achieved in the last ten years in addressing the ocean community requirements for satellite data. However, efforts remain to be made to ensure the sustainability of some of the satellite missions and the Commission appealed to its members to address the issue nationally with a view to increasing national support to space programmes contributing to ocean observations.

It was noted that JCOMM-III also strongly recommended continued close coordination with the *in situ* systems for a comprehensive ocean observation system, and requested all JCOMM Programme Areas to liaise with the WMO Space Programme and address the UNESCO/IOC Strategy for the use of Remote Sensing in Oceanography.

Noting that the initial ocean observing system for climate depends on space-based global measurements of 1) sea surface temperature, 2) sea surface height, 3) surface vector winds, 4) ocean colour, and 5) sea ice, the team understood that these satellite contributions are detailed in other international plans, but continued close coordination with the *in situ* systems is essential for comprehensive ocean observation.

JCOMM Services and application areas were reviewed in a presentation given by the JCOMM representatives. The team noted that key services requiring satellite measurements include in the maritime sector:

- Maritime Safety Systems including the Global Maritime Distress and Safety System (GMDSS);
- Maritime Search and Rescue Services;
- Marine Pollution and Emergency Support;
- Operational Wave forecasting systems;
- Tsunami Warning systems;
- Numerical Ocean Prediction systems;
- Numerical Weather Prediction systems;
- Sea Ice services;
- Climate Services in the Maritime domain;
- Data for maritime operations, planning and design.

The team noted that satellite data are the only means for providing high-resolution data in key ocean areas where *in situ* observations are sparse or absent. *In situ* and satellite observations are complementary for data assimilation in the numerical models for ocean mesoscale forecast

and weather prediction. Some variables cannot presently be easily derived from satellite products (e.g. sea level pressure) while other variables observed by satellites require sparse *in situ* ocean observations for ground (or surface) truth or bias correction. It is essential that the measurements returned through both *in situ* and space-based systems are properly documented, coherent, and traceable.

The team noted that data management in the JCOMM Data Management Programme Area (DMPA) is focused on *in situ* observations. There is no intention to duplicate the data management activities that are employed in the satellite community. However, it is important to build bridges to that community so that data handled by JCOMM and data acquired by satellite operators can easily be combined and compared. Within oceanography, netCDF is an emerging standard for satellite data sets (as used by international projects such as GHRSSST, GlobColour, GlobWave, Ocean Modelling Community etc). Satellite product and product dissemination standards and interoperability are developing and stabilizing within the JCOMM community building on these large projects which provide an excellent basis for collaborative work under the WMO WIS and WIGOS.

The team was informed and noted that within JCOMM, standards for satellite validation work are developing through the CEOS QA4EO process. However, standards for satellite data product uncertainty estimation are poor and need to be developed. Numerical Ocean Forecasting (NOP) is today a reality and needs operational satellite data feeds Altimeter SSH, SST, salinity, winds, waves, ice parameters, colour, and ocean currents. If the full potential of satellite data are to be realized within the NOP and NWP community, full uncertainty estimation is required with all data products and ideally, for each satellite measurement.

The team noted that many maritime systems are making extensive use of satellite measurements provided from research and development systems. There are significant issues related to transition of R&D to operations and sustainability of data streams although there are notable successes in terms of the transition from research to operations such as the Jason Altimeter system. However long-term sustainability of these and other satellite systems is an ongoing challenge.

The team was informed of the UNESCO Bilko project dedicated to developing capacity in marine remote sensing (<http://www.bilko.org>). The project is based on the provision of a freely available but extremely powerful Windows based image processing system together with extensive prepared lessons and data sets that teach the application of marine remote sensing. The system is based on a distance learning approach and is therefore self standing in terms of resource requirements. Bilko lessons are available in English, Spanish and Russian.

The meeting was pleased with the participation of JCOMM representatives as members of ET-SUP and expected that they would continue to actively contribute to ET-SUP activities to ensure that the needs and applications of the oceanographic and marine communities are properly addressed by the WMO Space Programme. For example, the involvement of JCOMM representatives was felt essential for the design of future questionnaires or enquiries and to provide input regarding ocean remote sensing training materials, tools and workshops.

### **16.3 Inter-regional cooperation on use of satellite data in NWP**

An update was provided on the outcome of recent meetings of two informal groups addressing the exchange of satellite data for Numerical Weather Prediction (NWP) use: the twenty-second North America – Europe Data Exchange Meeting (NAEDEx-22) and the tenth Asia Pacific Satellite Data Exchange and Utilization (APSDEU-10).

Recognizing that these groups are focused on NWP issues, ET-SUP encourages an interaction between these two groups and appreciates continued participation of satellite operators.



When opportunities arise, participation in these groups should be encouraged taking advantage of ET-SUP members', or close colleagues or Secretariat. It is important that these groups are aware of the capabilities of the WIS and more in particular of IGDDS.

#### **16.4 Severe Weather Forecasting Demonstration project (SWFDP)**

An update was provided on the Severe Weather Forecasting Demonstration Project (SWFDP), based on the outcome of its Steering Group meeting held on 23-26 February 2010. The Team noted that the SWFDP is an initiative that aims to contribute to capacity-building and to help developing countries in particular to have available and implement the best possible use of existing NWP/EPS products for improving severe weather forecasting and warnings of hazardous weather conditions and weather-related hazards. Global-scale products, as well as data and information provided by other regional centres, are integrated and synthesized by a designated Regional Specialized Meteorological Centre (RSMC), which, in turn, provides daily guidance for short-range (days 1 and 2) and medium-range (up to day 5) on specified hazardous phenomena (e.g. heavy rain, damaging waves, etc.) to participating National Meteorological Centres of the region. This is a "Cascading" concept of the forecasting process.

The Team noted that the SWFDP commenced with its first project in Southeast Africa in 2006, focused on heavy rain and strong winds. The SWFDP was currently being expanded to include all sixteen countries of southern Africa and to span all seasons and a number of meteorological and related hazards (heavy rain, strong winds, large waves, cold temperatures, etc.). A second Regional Subproject was in its early stage of implementation for the South Pacific Islands (Fiji, Samoa, Solomon Islands, and Vanuatu), which addressed heavy rains, strong winds, and damaging waves. Other possible regional projects were being considered, including for example, in southeast Asia, which was the subject of a workshop (Hanoi, Viet Nam, February 2010), to explore the region's needs of and possible benefits from a SWFDP project for Cambodia, People's Democratic Republic of Lao, Thailand and Viet Nam, focused on hazards associated with tropical cyclones.

While noting that the SWFDP has been successful in improving the lead-time of alerting of severe weather in the medium-range, the Team noted that at a very early stage of the SWFDP implementation, it realized that the issuing of warnings of imminent threat was part of forecasting in the first few hours of the forecasting range, and therefore, it identified the need for tools for very short-range forecasting, including Nowcasting, the rapid onset of localized severe thunderstorms, heavy precipitation and strong winds, in absence of radar coverage.

Noting that satellite data processing systems are able to generate new and powerful products for very short-range forecasting, including Nowcasting, the Team discussed opportunities for interaction between the SWFDP and ET-SUP, including aspects related to training, satellite information (data and products, and dissemination mechanisms) required to support the project, and collaborating arrangements to formally establish a liaison between the SWFDP and ET-SUP.

The project should benefit from satellite capabilities in the Nowcasting timescale, and in particular:

- basic satellite imagery with highest possible repetition rate, appropriate resolution and minimal data latency, for specific geographical areas and only some selected spectral channels;
- derived products from satellite data suitable to support Nowcasting applications, e.g. instability indices.

Issues of access to, or availability of, data and product are still to be considered for some Regions, as discussed under agenda item 11.

In terms of training (See also agenda item 10.2):

- SWFDP participating centres should keep abreast of the VLab (Virtual Laboratory on Education and Training in Satellite Meteorology), in particular as concerns training events and resources on Nowcasting aspects;
- The VLab being based on a regional structure, SWFDP members are encouraged to participate in regional (Nowcasting) training events which are typically based on Internet based training;
- Active involvement of the VLMG (Virtual Laboratory Management Group) is needed to provide appropriate support.

Communication between the SWFDP and ET-SUP should be maintained:

- At the scientific level, since ET-SUP membership involves all WMO Regions, there would be benefit in developing communication between the Regional SWFDP Sub-Team and the ET-SUP member(s) of the same Region;
- At the management level: a person of ET-SUP or the WMO Space Programme Office should be a member of the SWFDP Steering Group;
- SWFDP should report back to ET-SUP on achievements, benefits or remaining issues. A working relationship between SWFDP and ET-SUP is to be maintained. A member of the SWFDP Steering Group or the WMO Secretariat (GDPFS) should participate in ET-SUP meetings as appropriate.

For the future, the establishment of a SCOPE-NWC concept should be considered, as discussed under agenda item 14. An appropriate model may be the EUMETSAT SAF on Nowcasting and Very-Short Term Forecasting (NWC SAF), to be implemented for other WMO Regions.

**Actions 5.26:** ET-SUP members to consider supporting the SWFDP Regional Sub-project Teams on issues related to the availability or access to appropriate satellite information in support of Nowcasting in their region, as requested by SWFDP. (Due date: SWFDP request by February 2011, ET-SUP support by April 2011).

**Recommendation 5.15:** *ET-SUP member(s) or the WMO Space Programme Office to support the SWFDP Steering Group as appropriate.*

**Actions 5.27:** The VLMG to discuss with the SWFDP Regional Sub-project Teams the potential for support in training on the use of satellite data for Nowcasting, especially as related to severe weather events. (February 2011)

**Recommendation 5.16:** *A member of the Steering Group of the SWFDP or the WMO Secretariat (GDPFS) should participate in ET-SUP meetings as appropriate.*

## 17. ANY OTHER BUSINESS

### 17.1 DCP format migration to TDCF

The session was informed that the ongoing migration of Traditional Alphanumeric Codes (TAC) towards Table Driven Code Forms (TDCF) such as BUFR was raising practical difficulties for the owners of Data Collection Platforms (DCP) located in remote areas, such as buoys in the ocean. Therefore, different solutions were investigated for applying a conversion module from TAC to TDCF after retransmission of the DCP data on the ground, but before their injection to the GTS. It was agreed that the IGDDS Implementation Group should be informed of the issue.

## **17.2 VLab Co-chairmanship**

L. Machado indicated his wish to be replaced as a VLab Co-chair. It was recalled that the VLMG has two Co-chairs, one representing a CoE and the other representing a sponsoring space agency. The two Co-chairs should normally be originating from two different WMO Regions. Suggestions for replacement will be discussed at VLMG-5.

## **17.3 ET-SUP Vice-chair**

Given the temporary unavailability of the Vice-chair for both the Reduced session and this Fifth session, the suggestion was made that the CBS Management Group be invited to nominate a second Vice-chair.

## **17.4 Participation of W. Benesch**

Upon announcement of his retirement, ET-SUP members and the WMO Secretariat expressed their thanks to W. Benesch for his longstanding contribution to ET-SUP and its predecessor groups. His dedicated contribution to the development and interpretation of the questionnaires, and his chairmanship and hosting of ET-SUP-4 were particularly appreciated.

## **17.5 Link with Regional Associations**

ET-SUP recalled action R1-16 from the Reduced session: "WMO Secretariat to identify the relevant points of contacts for Space Programme activities in the six Regional Associations, when no Space Programme Rapporteur is designated. (February 2010)"

ET-SUP agreed that the ET-SUP members could serve as Points of Contacts in each WMO Region, in liaison with the appropriate structure established by each Regional Association for CBS matters.

## **17.6 Future ET-SUP meeting and working modalities**

In view of the heavy work programme and the growing interactions with different communities, ET-SUP expressed the need to hold an annual face-to-face meeting. Furthermore, it was suggested to coordinate with the VLMG and take advantage of the VLMG virtual meetings, as appropriate.

## **18. REVIEW AND ADOPTION OF THE DRAFT REPORT**

The draft report of the meeting, including its appendices, was reviewed and adopted, subject to editorial finalization by the WMO Secretariat in consultation with the Chairman.

## **19. CLOSURE OF THE SESSION**

The session was closed at 15:12 on Friday, 19 March 2010.

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APPENDIX I

**LIST OF PARTICIPANTS**

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**AGENDA**

- 1. ORGANIZATION OF THE SESSION**
    - 1.1 Opening of the session
    - 1.2 Adoption of the agenda
    - 1.3 Working arrangements for the session
  - 2. CHAIRMAN'S REPORT**
  - 3. GUIDANCE FROM THE CHAIRPERSON OF OPAG IOS**
  - 4. ET-SUP TERMS OF REFERENCE, WORK PROGRAMME**
  - 5. OUTCOME OF WMO MEETINGS INCLUDING CONSULTATIVE MEETINGS, EXECUTIVE COUNCIL AND CBS, WITH DIRECT RELEVANCE TO ET-SUP**
  - 6. STATUS OF ACTIONS FROM PREVIOUS ET-SUP MEETINGS**
  - 7. STATUS OF THE SPACE-BASED GOS**
  - 8. QUESTIONNAIRE AND MONITORING ISSUES**
    - 8.1 Status of the 2010 questionnaire
    - 8.2 Plans for future questionnaires
  - 9. WEB-BASED INFORMATION**
    - 9.1 Feedback from the ET-SUP enquiry and way forward
  - 10. VIRTUAL LABORATORY FOR EDUCATION AND TRAINING**
    - 10.1 Report on possible use of ESRC for the VL Resource Library
    - 10.2 VL Activity report
  - 11. DATA DISTRIBUTION ISSUES**
  - 12. SOFTWARE PROCESSING TOOLS**
  - 13. INTEGRATION OF SPACE-BASED OBSERVATIONS**
  - 14. SCOPE-CM AND EXPANSION OF THE SCOPE CONCEPT**
  - 15. REPORTS ON REGIONAL ACTIVITIES**
    - 15.1 Pilot Project in RA II
    - 15.2 Data requirements gathering in RA III and RA IV
  - 16. INTERACTION OF ET-SUP WITH USER COMMUNITIES**
    - 16.1 Mapping of user groups and application areas
    - 16.2 Report from JCOMM
    - 16.3 Inter-regional cooperation on use of satellite data in NWP
    - 16.4 Severe Weather Forecasting Demonstration project (SWFDP)
  - 17. ANY OTHER BUSINESS**
  - 18. REVIEW AND ADOPTION OF THE DRAFT REPORT**
  - 19. CLOSURE OF THE SESSION**
-

## SUMMARY OF ACTIONS

**Action 5.1:** ROSHYDROMET, through V. Saulskiy, to inform the WMO Secretariat on detailed implementation of HRPT/LRPT for Meteor-M data and other relevant information (e.g. calibration) for the global Direct Readout community. (Due date: One month after end of Meteor-M N1 commissioning.)

**Recommendation 5.1:** *ET-SUP recommends that WMO further encourage satellite operators and CGMS to optimize the global coverage when making decisions about satellite locations, for instance to increase the overlap of satellite footprints over the central Pacific for a better coverage of the North and South Pacific.*

**Recommendation 5.2:** *Planning for new generation satellites should include an appropriate overlap period between current and future satellite generations to allow inter-comparison and validation of products, and to facilitate a smooth transition for users.*

**Recommendation 5.3:** *ET-SUP recommends that satellite operators provide the user community with full details of their planned operational spacecraft, as early as possible. These details should include as a minimum:*

- *Orbital ephemeris;*
- *Data transmission frequencies and polarisations (for Direct Readout services);*
- *Data formats;*
- *Instrument details such as spectral bands and response functions (when relevant).*

**Action 5.2:** The Virtual Lab Management Group should prepare a generic transition plan to support user readiness for new satellite generations, incorporating the elements discussed by ET-SUP-5, and present it to ET-SUP-6. (Due date: ET-SUP-6)

**Action 5.3:** 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. (Permanent action)

**Action 5.4:** WMO Space Programme Office to extract questionnaire responses and store them in a form suitable to support the interpretation activities. (Due date: End May 2010)

**Action 5.5:** WMO SP to invite Chairpersons of the CGMS- and WMO-sponsored international scientific groups to provide feedback on availability and use of satellite data in their application area and on evolution over the 2008-2009 two-year period. (April 2010, for response by September 2010)

**Action 5.6:** Task Team consisting of R. Francis and F. Zauli will coordinate sharing the workload and produce a draft Technical Document for presentation by the time of CBS and finalize the Technical Document for subsequent publication. (Due dates: End of June 2010 for the draft TD containing main outcomes derived from questionnaire responses; end of 2010 for a finalized TD for publication)

**Action 5.7:** R. Francis to present an updated version of the questionnaire for finalization at ET-SUP-6. (Due date: ET-SUP-6)

**Action 5.8:** J. Pilon, A. Rea and L. Machado to propose interview themes, structure (e.g. template/guidance document) and suggested interviewees (possibly from ET-SUP membership or VLab CoEs) and interviewees. These considerations to be captured into a discussion document for ET-SUP. (Due date: ET-SUP-6)



**Action 5.9:** V: Gaertner, A. Mostek and L.Machado, to task the VLMG to design a new VLab Home page and review and update the design of other VLab Web pages, including the calendar of training events. (Due date: October 2010)

**Recommendation 5.4:** *The revised VLab pages should be directly accessible from the main Space Programme Home page and use the domain name “vlab.wmo.int”, following the example of “GSICS.wmo.int” and “CGMS.wmo.int”.*

**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)

**Recommendation 5.5:** *Software Tools List - WMO Space Programme should maintain the list of software tools recommended by ET-SUP-5 (Appendix VI) and make it available on the Web under section revised as “Data Access and Software Tools.” Ultimately, if a portal is implemented (See Recommendation 5.7), this information would be accessed through this portal.*

**Recommendation 5.6:** *Translation - The SP web pages are currently only provided in English. WMO should consider having the SP Web pages translated into additional official languages.*

**Recommendation 5.7:** *Space Programme Portal - WMO SP to consider the development of a portal for access to all satellite based products, software and documentation.*

**Action 5.11:** EUMETSAT and WMO Space Programme to establish a task team by July 2010 to prototype a portal for EO products with a view of including it on the WMO Web site. (Due date: July 2010)

**Recommendation 5.8:** *Decentralization of Web Pages – The development and maintenance of some Space Programme Web pages should be decentralized. This would allow ET-SUP members and VLMG the option to help maintain these pages.*

**Action 5.12:** WMO SP with support from ET-SUP members to identify which Web pages are best suited for decentralizing. (Due date: August 2011).

**Action 5.13:** VLMG Co-chairs in conjunction with UCAR/COMET to provide recommendations on working on best practices and roles for joint use of the ESRC as the VLab resource library. (Due date: June 2010)

**Action 5.14:** VLMG to review the new working procedures for usage of the ESRC with the aim to endorse them during VLMG-5 meeting in July 2010. (Due date: July 2010)

**Action 5.15:** VLMG Co-chairs to check whether the VLab logo (See Appendix V) can be included within ESRC main page. (Due date: July 2010)

**Action 5.16:** The Secretariat (Director of the Space Programme) to send a new letter to satellite operators highlighting the benefit gained from having a Technical Support Officer (TSO) position and calling for continued funding of this position in 2011 and beyond. (May 2010)

**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)

**Action 5.18:** VLMG to provide practical guidance for delivering training in those areas where Internet connectivity is limited (use of GEONETCast training channel, VISITview, etc.). (July 2010)

**Action 5.19:** 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. (August 2011)

**Action 5.20:** VLMG to contact each Regional Focus Group (RFG) and facilitate establishing monthly RFG sessions in all regions. In particular collaboration is sought to facilitate the establishment of an RFG in Asia. (Due date: July 2010)

**Action 5.21:** V. Gaertner and L. Machado, as VLMG Co-chairs, to ensure that VLMG, involving a subgroup as appropriate, provides updated information for the current revision of publication WMO-No. 258. (Due date: End 2010)

**Recommendation 5.9:** *ET-SUP also recommended that the CoEs monitor the status of responding to the 2010 questionnaire on satellite data availability and use, for their area of responsibility.*

**Recommendation 5.10:** *Operators should endeavour to adhere to existing standard formats.*

**Recommendation 5.11:** *Taking into account the timeliness requirements and bandwidth constraints of users, the group recommends that appropriate low-volume products should be created and delivered through available dissemination channels including DVB-S, ftp and Internet.*

**Recommendation 5.12:** *The group urged satellite operators to provide the necessary metadata and, where possible, processing software to facilitate the use of direct broadcast and archived data by end users. Ideally this information should be provided well in advance of operations to facilitate the uptake of data from these satellites by the international community.*

**Recommendation 5.13:** *The group encouraged ET-SAT to consider the harmonization of minimum instrument characteristics, with a priority on multispectral imagers.*

**Action 5.22:** In order to better understand the opportunities for interaction between AWS networks and satellite systems, a satellite expert should attend the relevant part of the next meeting of the ET-AWS (20-23 April 2010) and report back to ET-SUP. (April 2010)

**Actions 5.23:** A. Rea and P. Zhang to prepare a concept paper on the establishment of a global "SCOPE-NWC" for discussion at ET-SUP-6. (ET-SUP-6)

**Recommendation 5.14:** *In view of the very positive outcome of the RA III/IV Satellite Data Requirements workshop, ET-SUP recommended that a similar approach be followed in other regions facing comparable issues regarding satellite data access.*

**Action 5.24:** The WMO Secretariat to update the list of related "User Groups and Application Areas" and relationship to ET-SUP and to make the list accessible via the Space Programme Web pages with direct links to all these groups. (Due date: September 2010)

**Action 5.25:** The WMO Secretariat to include under the relevant permanent agenda item of future ET-SUP meetings, a summary report on items of relevance resulting from meetings of the international scientific groups. (Due date: ET-SUP-6)

**Actions 5.26:** ET-SUP members to consider supporting the SWFDP Regional Sub-project Teams on issues related to the availability or access to appropriate satellite information in support of Nowcasting in their region, as requested by SWFDP. (Due date: SWFDP request by February 2011, ET-SUP support by April 2011).

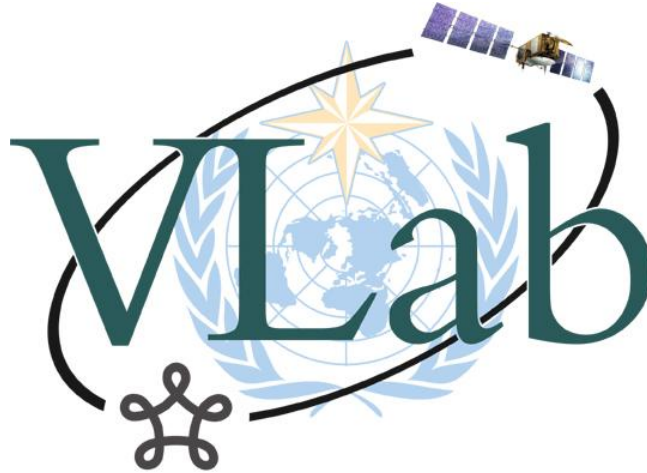
**Recommendation 5.15:** *ET-SUP member(s) or the WMO Space Programme Office to support the SWFDP Steering Group as appropriate.*

**Actions 5.27:** The VLMG to discuss with the SWFDP Regional Sub-project Teams the potential for support in training on the use of satellite data for Nowcasting, especially as related to severe weather events. (February 2011).

**Recommendation 5.16:** *A member of the Steering Group of the SWFDP or the WMO Secretariat (GDPFS) should participate in ET-SUP meetings as appropriate.*

APPENDIX IV

VIRTUAL LABORATORY LOGO



**WMO-CGMS Virtual Laboratory**  
for Education and Training in Satellite Meteorology

## MINIMUM FUNCTIONALITIES AND GENERAL REQUIREMENTS FOR SOFTWARE TOOLS FOR EXPLOITING SATELLITE IMAGERY

The software used to exploit satellite imagery should have the following functionalities as a minimum set:

- ✓ Capability to accept and display most of the common products received through numerical broadcast (like Geonetcast), and if possible from a specific satellite;
- ✓ Capability to provide different projections and geographical domain extractions;
- ✓ Basic functions like: threshold, isocontouring, display of quality of data, value at mouse pointer, basic image processing (channel differences, contrast images, etc); basic computations on quantitative products (mean, min-max, cumulative values);
- ✓ Synchronized animations;
- ✓ Capability to mix satellite products and other meteorological information (radar, conventional observations, numerical models outputs,...) or non meteorological (but georeferenced) information
- ✓ Capability to deal with real time / archived products, respectively for everyday activities / replays and studies
- ✓ Capability to deal with a combination of locally (through DVB reception or direct broadcast) and remotely (FTP retrieval from server) located data
- ✓ Be open to exchanges and interoperability : OGC, SOA, Web services
- ✓ Ability to read and write standard formats such as: GRIB, BUFR, netCDF, HDF, GeoTIFF, plain text, KMZ
- ✓ Ability to exploit metadata, in particular quality flags and product status
- ✓ Be able to readily accept new products as they become available without the need for complex and expensive software patches.

The software should also satisfy the following general requirements:

- ✓ Freely available software > Low cost > Costly  
... but this needs to be evaluated on the long term (hidden costs);
  - ✓ Fully open source software > Black box ;
  - ✓ Be both sustainable and maintainable;
  - ✓ Existing documentation (user manual in native language > in English if not n.l.);
  - ✓ Associated training possibilities for operation (level 1) and development (level 2);
  - ✓ Run on state of the art operating systems (Linux, Windows) if stand alone software;
  - ✓ Either stand alone software or Internet application (through a Web navigator)
  - ✓ Allow a clear separation between administrator and user
-



APPENDIX VII

**INVENTORY OF EXPERT GROUPS WITH RELEVANCE TO ET-SUP (Version 1)**

<b>Group</b>	<b>Full Name</b>	<b>Parent Organization</b>	<b>Main Application</b>	<b>Main Function</b>	<b>Parameters</b>	<b>Proposed link to ET-SUP/SAT</b>
GSICS EP	Global Space-based Intercalibration System Executive Panel	WMO, CGMS	All	Calibration	All	Report to ET-SAT
GRWG	GSICS Research Working Group	GSICS EP	All	Calibration	All	Report to ET-SAT
GDWG	GSICS Data Management Working Group	GSICS EP	All	Calibration	All	Report to ET-SAT
WGCV	Working Group on Calibration and Validation	CEOS	All	Calibration	All	Via GSICS
WGISS	Working Group on Information Systems and Services	CEOS	All	DataExchange	All	
IGDDS-IG	Implementation Group of the Integrated Global Data Dissemination Strategy	WMO SP	All	DataExchange	All	<b>Report to ET-SUP</b>
RARS-IG	Regional ATOVS Retransmission Services Implementation Group	WMO SP	NWP	DataExchange, DataManagement	All	<b>Report to ET-SUP</b>
TF-SDC	Task Force on Satellite Data Codes	CGMS, WMO	All	DataManagement	All	<b>Report to ET-SUP</b>
NAEDEX	North-America Europe Data Exchange	Informal	NWP	DataExchange	All	<b>Informal Report to ET-SUP</b>
APSDEU	Asia-Pacific Satellite Data Exchange and Utilization	Informal	NWP	DataExchange	All	<b>Informal Report to ET-SUP</b>
EPEG	EUMETCAST Product Expert Group for Africa	EUMETSAT, RA I	All	DataExchange	All	<b>EUMETSAT repres. in ET-SUP</b>
WGEDU	Working Group on Education, Training and Capacity Building	CEOS	All	Training	All	<b>Via VL-MG</b>
VL-MG	Virtual Laboratory Management Group	WMO, CGMS	All	Training	All	<b>Report to ET-SUP</b>
ITWG	International TOVS/ATOVS Working Group	IAMAS Radiation Commission	NWP	Development	Temperature and Humidity profile	TBD
IWWG	International Winds Working Group	CGMS	NWP	Development	Wind	TBD
IROWG	International Radio-Occultation Working group	CGMS	NWP	Development	Temperature and Humidity profile	TBD
IPWG	International Precipitation Working Group	CGMS, WMO	Hydro	Development	ECV Precipitation	TBD

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Group	Full Name	Parent Organization	Main Application	Main Function	Parameters	Proposed link to ET-SUP/SAT
WOAP	WCRP Observation and Assimilation Panel	WCRP		Research		TBD
SWFDP	Severe Weather Forecasting Demonstration Project	WMO	Forecasting	Operational use Training	wind, precipitation, derived products (instability indices), lightning	ET-SUP report to regional SWFDP sub-project team and chair/secretariat at SG-SWFDP
OSTST	Ocean Surface Topography Science Team	EUMETSAT, CNES, NOAA, NASA	Ocean circulation, climate	Research	Sea surface height	TBD

Group	Full Name	Parent Organization	Main Application	Main Function	Parameters	Proposed link to ET-SUP/SAT
GAW SAG	Global Atmospheric Watch Scientific Advisory Groups (Ozone, GHG, Aerosols)	CAS	Climate		Ozone, GHG, aerosols	TBD
GHR SST	GODAE High Resolution Sea Surface Temperature	OOPC	Forecasting, Climate	Development	ECV Sea Surface Temperature	Via JCOMM representative
IOCCG	International Ocean Colour Coordination Group		Climate	Research	ECV Ocean Colour	Via JCOMM representative
GEWEX RP	GEWEX Radiation Panel	WCRP	Climate	Research	Cross-cutting Atmosphere	TBD
AOPC	Atmospheric Observation Panel for Climate	GCOS, WCRP	Climate	ObsRequirements	Cross-cutting Atmosphere	TBD
OOPC	Oceanic Observation Panel for Climate	GCOS, WCRP	Climate	ObsRequirements	Cross-cutting Oceans	TBD
TOPC	Terrestrial Observation Panel for Climate	GCOS, WCRP	Climate	ObsRequirements	Cross-cutting Terrestrial	TBD
SCOPE-CM	Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring	WMO, CGMS, CEOS	Climate	Production	All	TBD
PTC	WMO/ESCAP Panel on Tropical Cyclones	WMO, ESCAP	Tropical Cyclones	OperationalUse	Wind, Precipitation, Temperature, Water Vapour, SST, Sea level, Sea state	TBD
RA-IV-HC	RA IV Hurricane Committee	RA IV	Tropical Cyclones	OperationalUse		TBD
RA-V-HC	RA V Hurricane Committee	RA V	Tropical Cyclones	OperationalUse		TBD



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ICTSW	Inter-Programme Coordination Team on Space Weather	CBS, CAeM	Space Weather	All	Total Electron Density, X-Ray Radiation, Particle flow	Via Secretariat
IAA SG SW	IAA Study Group on Space Weather	IAA, OOSA	Space Weather	All		Via Secretariat
IAVWOG	International Airways Volcano Watch Operations Group	ICAO	Space Weather			Via Secretariat
ET-EGOS	Expert Team on Evolution of the Global Observing System	CBS	All	ObsRequirements	All	ICT-IOS
ET-SAT	Expert Team on Satellite Systems	CBS	All	Satellites	All	ICT-IOS and joint sessions
ET-SUP	Expert Team on Satellite Utilization and Products	CBS	All	All	All	

**ACRONYMS**

<i>WMO CONSTITUENTS</i>	
CAeM	Commission for Aeronautical Meteorology
CAS	Commission for Atmospheric Science
CBS	Commission for Basic Systems
CCI	Commission for Climatology
Chy	Commission for Hydrology
CIMO	Commission for Instruments and Methods of Observation
RA I	Regional Association I (Africa)
RA II	Regional Association II (Asia)
RA III	Regional Association III (South America)
RA IV	Regional Association IV (North & Central America & the Caribbean)
RA V	Regional Association V (South-West Pacific)
RA VI	Regional Association VI (Europe)