WORLD METEOROLOGICAL ORGANIZATION
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COMMISSION FOR BASIC SYSTEMS
OPEN PROGRAMME AREA GROUP ON INTEGRATED OBSERVING SYSTEMS

EXPERT TEAM ON SATELLITE SYSTEMS

SIXTH SESSION

GENEVA, SWITZERLAND, 12-15 APRIL 2011

ET-SAT-6/Doc. 3
(29.III. 2011)

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ITEM: 3

Original: ENGLISH

OUTCOME OF MEETINGS WITH RELEVANCE TO ET-SAT

(Submitted by the WMO Secretariat)

Summary and Purpose of Document

The document contains a brief summary of the outcome of major meetings held since the fifth session, on topics of direct relevance to ET-SAT. These include the sixty-second Executive Council (EC-LXII, the fifteenth session of the Commission for Instruments and Methods of Observation (CIMO-XV), the 38th meeting of the Coordination Group for Meteorological Satellites (CGMS-38), the 2010 Extraordinary Session of the Commission for Basic Systems (CBS Ext.(10)) and the Workshop on Continuity and Architecture Requirements for Climate Monitoring.

ACTION PROPOSED

The Expert Team is invited to note and take into account the outcome of these meetings in its deliberations.

OUTCOME OF MEETINGS WITH RELEVANCE TO ET-SAT

1. INTRODUCTION

Since the last meeting of ET-SAT in April 2010, the following major meetings have taken place, which have addressed issues of direct relevance to ET-SAT:

- The sixty-second session of the WMO Executive Council (EC-LXII) from 6 to 18 June 2010;
- The fifteenth session of the Commission for Instruments and Methods of Observation (CIMO-XV) from 2 to 8 September 2010 in Helsinki, Finland;
- The sixteenth session of the Regional Association I (Africa) from 1 to 8 November 2010 in Marrakech, Morocco;
- The 38th meeting of the Coordination Group for Meteorological Satellites (CGMS-38) from 8 to 12 November 2010 in New Delhi, India;
- The 2010 Extraordinary Session of the CBS (CBS Ext.(10)) from 16 to 26 November 2010 in Windhoek, Namibia;
- The Workshop on Continuity and Architecture Requirements for Climate Monitoring on 13 and 14 January 2011 in Geneva.

Highlights of these meetings, with respect to satellite matters, are reported below.

2. MAIN OUTCOME OF THE 62ND EXECUTIVE COUNCIL

R&D and operational programmes

After noting with appreciation the contribution of WMO Members to the GOS through their operational meteorological satellite programmes, the Council reaffirmed the strong contribution of Research and Development satellite missions to the GOS. It noted the increasing use of R&D satellite data by global NWP centres, which was enabled by the development of advanced data assimilation methods. These research platforms often provide, over their shorter lifetimes, key observations for weather and climate, including the solid earth surface and oceans. Their non-replacement often imperils significant advances in skill of the related modelling systems. The Council urged space agencies to consider carefully the impact of these satellites and platforms on operational systems, and the potential transition of these missions to operational or quasi-operational status.

Wind scatterometry

Noting the impact of the loss of the QuikScat satellite and the value of satellite ocean surface wind vector data especially from scatterometry, noting also that radar altimeter wave height observations are essential for the real-time calibration of ocean wave models, the Council stressed the importance of improving availability of ocean surface wind vector data, as well as other ocean surface microwave radiometric observation and satellite radar altimetry data. The Council was informed that the commissioning of Oceansat-2, launched in September 2009 by ISRO, was nearly completed and welcomed the confirmation that India will make Oceansat-2 scatterometer data openly available in near-real time to the global community. Because of the narrow data swath, it is preferable that several platforms be available. The Council encouraged Members and Organizations involved in space-based observations to further address this issue.

Molnyia orbits

The Council also noted the planned collaboration between Canada and the Russian Federation regarding their respective missions on Highly Elliptical Orbits (HEOs), and encouraged the international community, with interests in the polar regions, to support this collaboration.

Climate monitoring from space: role of CGMS and need for an architecture

The Council noted that a collaborative effort by all Members supporting Earth observation space agencies was needed to monitor the Earth's climate from space. Climate monitoring requirements have been identified by GCOS and the WCRP, and could be supplemented by future requirements arising from the Global Framework for Climate Services (GFCS). In view of the long-standing experience of satellite system coordination by the Coordination Group for Meteorological Satellites (CGMS), the Council wished that CGMS would expand its activity to the coordination of operational missions in support of climate monitoring. It invited the WMO Space Programme, in coordination with GCOS and with the support of relevant technical commissions, to work with space agencies, the CGMS, the Committee on Earth Observation Satellites (CEOS), and the Group on Earth Observations (GEO) in order to develop an architecture for sustained, space-based climate monitoring as a component of the future WIGOS and GFCS, for consideration by next Congress.

Consultative meetings

The Council noted that participation of senior satellite agency officials in the Consultative Meetings on High-Level Policy on Satellite Matters (CM) had decreased during recent years. It acknowledged that increased participation by the non-WMO-focused operational and research environmental satellite agencies is necessary to improve the effectiveness of the meetings, particularly in addressing the requirements of monitoring Earth's climate from space. The Council agreed to hold the CM every two years and to schedule the meeting preferably in conjunction with the Executive Council or Congress beginning in 2011. Should exceptional circumstances warrant the need for CM to meet outside of its two-year sequence, or if a CM cannot be held in conjunction with Executive Council or Congress, WMO leadership may, in collaboration with CM satellite agency principals, schedule such a meeting. The Council adopted Resolution 3.4/4 (EC-LXII) - Schedule of Consultative Meetings on High-Level Policy on Satellite Matters. (Accordingly, CM-11 will be convened on 19 May 2011, from 9h00 to 13h00, in parallel with the Congress session.)

Importance of satellite matters

The Council also agreed that greater emphasis should be placed on discussion of critical satellite matters in the agenda of all WMO constituent body sessions, including re-instating a specific agenda item for the Executive Council and Congress, in order to ensure that all WMO Members will continue to use and benefit from the full spectrum of satellite capabilities.

Noting the increasing impact of space-based observations on WMO activities, and particularly the GFCS, the Council extended its appreciation to CMA, DWD, EUMETSAT, JAXA and NASA for their proposed contributions in terms of either financial and/or in-kind resources to the WMO Space Programme Office in 2010. The Council went on to recommend that other Members similarly increase their support to these activities so that international coordination and collaboration for monitoring the Earth's environment from space can be leveraged to the greatest extent possible.

Space Weather

The Council was informed of the severe impact of Space Weather on key meteorological space-based observation and telecommunications infrastructure, and its anticipated increase in the upcoming solar cycle. Noting that the current international coordination mechanism for Space

Weather, the International Space Environment Service (ISES), had limited capability to coordinate operational warnings, it encouraged further involvement of WMO in this area. The Council welcomed the establishment of an Inter-Programme Coordination Team for Space Weather (ICTSW), co-chaired by representatives from the Commission for Aeronautical Meteorology (CAeM) and CBS, and thanked all the Members who had named points of contact for Space Weather and nominated representatives to serve on the ICTSW. The Council supported funding Space Weather coordination activities for the sixteenth financial period.

3. CIMO-XV

At its fifteenth session, CIMO acknowledged the importance of satellite observations. It noted the need to address the field of ground-truth validation of satellite remote-sensing of surface variables, but recognized that more details on the specific requirements from the satellite community would be needed. The Commission agreed to collaborate with CBS and address in its future work plan the ground-truth validation of satellite remote-sensing of surface variables in coordination. This would be accomplished in line with the development of WIGOS.

CIMO implemented a new structure of expert teams and theme leaders, which includes now a Theme Leader on Satellite Observations with the following terms of reference:

i. Liaise with CBS ET-SAT and ET-SUP to review and report on requirements for calibration of satellite instruments and requirements for ground truth observations. Propose priorities for the meteorological variables needed by WIGOS.
ii. Contribute to the review of the GSICS WIGOS Pilot Project on existing satellite calibration and validation programme.
iii. Work with CBS ET-SAT and ET-SUP in updating the CIMO Guide chapter on Satellite Observations, especially with respect to the requirements for calibration and ground truth observations, as required to improve standardization of satellite observations for WIGOS.
iv. Collaborate with relevant CIMO Expert Teams in preparing recommendations for providing measurements of the quality required for ground truth.

4. RA I (AFRICA)

RA I was informed that EUMETSAT and WMO had established a “EUMETCast Product and Dissemination Expert Group” with a mandate to review the contents of EUMETCast dissemination over Africa and to formulate requirements for additional products on behalf of all RA I Members and programmes. The group had an initial meeting in Ouagadougou, Burkina Faso, on 25 September 2010 and is planned to meet in Darmstadt, Germany on 28-30 June 2011.

5. CGMS 38

All the deliberations of CGMS are of direct relevance to ET-SAT and cannot be all summarized here. The report of CGMS-38 has now been published by the CGMS Secretariat and is available online: http://www.eumetsat.int/groups/sir/documents/document/pdf_cgms_rep38.pdf

It is highlighted that CGMS-38 has agreed that the baseline for CGMS Members’ contributions to the space-based Global Observing Systems (GOS) should be gradually updated to take into account the additional missions undertaken by CGMS Members, in particular for climate monitoring. CGMS gave the action to WMO, through its Expert Teams (primarily ET-SAT) to refine the definition of the new baseline. This is the subject of agenda item 8.2 of ET-SAT-6.

6. CBS EXT.(10)

Requirements and capabilities database

The Commission endorsed a strategy for the evolution and future hosting of the Rolling Review of Requirements (RRR) database, and requested the Open Programme Area Group on Integrated

Observing Systems (OPAG-IOS) to invite potential candidates willing to host the RRR database and to evaluate candidates according to a process to be defined by ICT-IOS. The Commission also requested OPAG-IOS to expand existing application areas to cover specific requirements of Polar Regions, and the Cryosphere in general.

Access to satellite data and products

The Commission noted the need for increased attention to satellite data and products delivery, particularly in developing countries, and agreed that, in the context of the Integrated Global Data Dissemination Service (IGDDS) and GEONETCast, the strategy for improving data access should consider among its priorities:

- To organize the formulation of data requirements and the dialogue between data users and providers; considering the positive outcome of the RAs III/IV Satellite Data Requirements Workshop, the Commission encouraged a similar approach in other Regions where satellite data access is a limiting factor;
- To implement sustainable regional DVB-S dissemination systems offering cost efficient access to satellite data in every region;
- To integrate all relevant data types in such broadcast services, including inter-regionally exchanged data; and
- To support harmonization of future Direct Broadcast systems as well as the implementation of complementary data access and distribution services via the Internet, recognizing the different user needs.

The Commission was informed that the first Asia-Oceania Meteorological Satellite Users' Conference had been held in Beijing, China in November 2010, and welcomed the intention of China, Japan and the Republic of Korea to collaborate on the organization of similar events in the future.

Architecture for climate monitoring

The Commission endorsed the proposal for a space-based architecture for climate monitoring based on the requirements established by the Global Climate Observing System (GCOS) and the Essential Climate Variables (ECVs) that can be derived from space-based observations. The Commission noted that an end-to-end system, much like what has been developed for weather monitoring and forecasting over the last fifty years, needs to be developed for climate monitoring. The proposed architecture will enhance, and is modelled after, the end-to-end system which has been created for weather observations, research, modelling, forecasting, and services. It will be part of the space-based component of the WMO Integrated Global Observing System (WIGOS). Other components of this end-to-end system would include the inter-calibration activities of the Global Space-based Inter-calibration System (GSICS), additional calibration and validation activities to be conducted in coordination with CIMO, the product generation efforts as done within the Sustained Co-Ordinated Processing of Environmental satellite data for Climate Monitoring (SCOPE-CM) and the training and capacity building activities of the WMO/CGMS (Coordination Group for Meteorological Satellites) Virtual Laboratory (VLab).

The Commission supported the initiative to prepare a workshop focussing on the specific requirement for continuity of climate observations, and on architectural implications of these special requirements; this workshop would respond to the request from the Coordination Group for Meteorological Satellites (CGMS) to convene a "contingency planning workshop" for the climate observations reflected in the Vision for the GOS in 2025.

Space Programme Office

Given the magnitude of developing a space-based architecture for climate monitoring and the importance of this effort to the GFCS, the Commission invited Members to further support the WMO Space Programme either through secondments to the Office or voluntary contributions to the Space Programme Trust Fund.

*Space W*eather

The Commission expressed its support to all the Members who nominated technical experts to serve on the Inter-Programme Coordination Team for Space Weather (ICTSW), and to China and the United States for their willingness to provide co-chairs. The ICTSW was encouraged to pursue its work plan, including a review of Space Weather observing requirements, and data management standardization, as priority issues.

New Centre of Excellence in Republic of Korea

The Commission welcomed the expansion of the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) through the creation of a Centre of Excellence on remote sensing applications and satellite meteorology training at the National Satellite Meteorology Centre (NSMC) of the Korea Meteorological Administration (KMA) in Jincheon, Republic of Korea. It thanked KMA for its commitment on this training activity. The Commission congratulated the Republic of Korea for the successful launch of COMS in June 2010 and welcomed the announcement that COMS data and products will be made available in support of meteorological activities including typhoon monitoring.

Ad-hoc expert team on atmospheric chemistry requirements for satellite observations

The Commission noted that satellite observations are recognized as an integral part of the implementation of the IGACO strategy within the GAW programme. At the same time there is considerable activity in the satellite community including by operational satellite operators, in support of atmospheric composition observation and monitoring. These activities will result in a substantial contribution to meeting the objectives of the WIGOS/GAW programme. Taking into account the cross-cutting nature of satellite programmes and missions and the need to coordinate data requirements for satellite observations for atmospheric composition monitoring, the Commission recommended that an *ad hoc* team of experts be established between CBS and the Commission on Atmospheric Science (CAS) to address this issue. It requested its president to coordinate this with the president of CAS.

Volcanic ash monitoring

The Commission requested the OPAG-IOS to work closely with other technical commissions, ICAO and other relevant organizations to advise on the design and implementation of a sustainable capability for the observation of volcanic ash. The Commission further joined with the United Kingdom on behalf of the London VAAC in expressing sincere thanks to those Members who shared specialized observational data during the eruption of the Eyjafjallajökull volcano. The ICAO representative indicated the willingness of ICAO to contribute to the work of the OPAG-IOS related to volcanic ash, in view of its prime importance and urgency for international aviation.

7. WORKSHOP ON CONTINUITY AND ARCHITECTURE REQUIREMENTS FOR CLIMATE MONITORING FROM SPACE

In response to a request from CGMS and guidance given by ET-SAT-5, the Workshop on Continuity and Architecture Requirements for Climate Monitoring was convened on 13 and 14

January 2011 in Geneva, in coordination with GCOS. The goal was to analyze and refine the "continuity aspects" of the GCOS requirements in order to inform the definition of a space-based architecture for climate observations. This was considered as the first of a possible series of workshops on architecture for climate monitoring from space. Documents, presentations and conclusions of the workshop can be found on: http://www.wmo.int/pages/prog/sat/meetings/ .

As recommended by ET-SAT, a Gap Analysis mapped to the GCOS Essential Climate Variables (ECV) was provided in advance of the workshop (See ET-SAT-6/Doc. 6). The workshop noted that the Gap Analysis shows need for additional long-term planning for several ECVs, or for specific ECV-related products. As examples, the working group highlighted in particular: Earth Radiation Budget (including solar irradiance), global precipitation, atmospheric composition (as measured by limb sounding instruments) as areas of anticipated gaps. The workshop thus recommended agencies to urgently consider planning for continuous availability of at least one broad-band radiometer and one Total Solar Irradiance instrument as of 2020. It encouraged scientific cooperation to support such missions, and recommended to consider a follow-on to the planned GPM DPR mission of NASA/JAXA noting its expected benefit for climate, weather and hydrology applications. More consideration should also be given to climate instruments (such as limb sounders) on board future operational missions. It was highlighted that the process to identify needs and priorities based on a systematic Gap Analysis was a critical step in the definition of an architecture.

The workshop furthermore suggested increasing communication and coordination among the CGMS-sponsored international scientific working groups (IPWG, IROWG, ITWG, IWWG) and the CEOS Virtual Constellations.

It recommended continuity of high-accuracy and stable reference instruments as anchors to increase the value of operational instruments for climate purpose, and wished that GSICS in consultation with WGCV explore mechanisms to implement this approach.

In parallel with these technical discussions, participants discussed policy and governance aspects of the development of an architecture for climate monitoring from space. These issues are addressed in ET-SAT-6/Doc. 7.3 to be considered under agenda item 7.

8. CONCLUSION

ET-SAT is invited to note the information above as background for its deliberations.

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