

WORLD METEOROLOGICAL ORGANIZATION

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

SECOND SESSION

GENEVA, SWITZERLAND

23-26 FEBRUARY 2016

MEETING 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 second session of the Inter-Programme Expert Team on Satellite Utilization and Products (IPET-SUP, formerly ET-SUP) was convened in Geneva, Switzerland from 23-26 February 2016.

The primary objective of the session was to advance the work programme defined by the World Meteorological Organization (WMO) Commission for Basic Systems (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.

During its session, the Team discussed: global and regional data exchange issues; technical and programmatic aspects of satellite data distribution and access; simplifying the use of data formats by using data conversion tools; satellite data performance monitoring in the context of the WMO Integrated Global Observing System (WIGOS); Sustained Coordinated Processing of Environmental Satellite Data (SCOPE) mechanisms for consistent satellite product generation; user preparation activities for the new generation of satellites; training and education through the WMO-Coordination Group for Meteorological Satellites (CGMS) Virtual Laboratory for Education and Training in Satellite Meteorology (VLab).

In particular, the session:

- Discussed the status of developing satellite-specific WIS metadata, and options for developing satellite data monitoring reports;
 - Reviewed progress with SCOPE-Nowcasting and SCOPE-CM;
 - Stressed the importance of developing consolidated satellite observation requirements for oceanographic and marine forecasting services (JCOMM);
 - Discussed principles that should apply to critical satellite data for WMO applications;
 - Discussed and endorsed the proposed Satellite Skills and Knowledge for Operational Meteorologists, pending minor clarifications;
 - Considered update and maintenance issues of OSCAR/Space;
 - Finalized the Reference User Readiness Project, and advised on a way forward in preparing users in RA III/IV;
 - Provided input to the draft "Vision of the WIGOS space-based components in 2040";
 - Prepared the proposed work plan for the period 2016-2019.
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From bottom row left: Sergei Uspensky, Bernie Connell, Simon Keogh, Anthony Rea, Stephan Bojinski, Eduard Podgaiskii, Grigory Chichasov, Marie Doutriaux-Boucher, Ignatius Gitonga Gichoni, Stephen English, Suman Goyal, Sally Wannop, Daisaku Uesawa, Mikael Rattenborg, Rainer Hollmann, Fang Xiang, Luiz Machado, Richard Eckman, Jérôme Lafeuille, Jean-Louis Fellous

1. ORGANIZATION OF THE SESSION

1.1 Opening of the session

Anthony Rea opened the session at 9.00 on Tuesday 23 February 2016 in Room 7 LAKE in WMO Headquarters, Geneva, Switzerland.

Peiliang Shi, Director of the WMO WIS Branch, welcomed participants to WMO HQs on behalf of the WMO Secretary-General and of Wenjian Zhang, Director of the Space Programme, and of the Observations and Information Systems Department. He noted the increasing collaboration between the WIS and the Space Programme, and good progress in areas of common interest, in particular: global and regional data exchange issues; technical and programmatic aspects of satellite data distribution and access, including through the WIS; consistent use of metadata for discovering and describing satellite data; and SCOPE mechanisms for consistent satellite product generation. A key charge for the Team is to help users to better utilize satellite data in an increasing number of application areas. He also noted advances in data processing using Big Data concepts, and a recent EUMETSAT workshop in this area. GFCS is a major priority for WMO, and identifying user requirements for observation data will be important, and needs to be appropriately communicated to CBS and CGMS. Standardization of metadata is important to ensure efficient data flow and exploitation.

Two major priorities for WMO are, for consideration by the Team: (1) preparing users for the new generation of meteorological satellites (novel data types, higher data volumes), both in developed countries and in countries which are less capable of receiving and exploiting satellite datasets, (2) development of the Vision of the WIGOS space-based component systems in 2040. The Team has an important role to contribute to both priorities.

1.2 Adoption of the agenda

The provisional agenda was adopted. Participants introduced themselves in a tour-de-table.

2. CHAIRMAN'S REPORT, WORK PLAN

The IPET-SUP Chairman provided his views and priorities in advancing the Team's work programme, and specific guidance for the session. He welcomed participants by the CCI, JCOMM, and the VLab, and welcomed the availability of input from the hydrological community. He was pleased with overall progress by the Team, despite constraints on members' time. Inter-session teleconferences have helped in this regard, and it is intended to continue these quarterly.

He referred to the IPET-SUP work plan and the current proposal (INF.8) should be reviewed by the Team and will be endorsed by CBS-16 in November for the 2016-2019 period. It will be important to provide a user view to the Vision Space 2040 which was discussed at a workshop in November 2016.

3. GUIDANCE FROM THE CHAIRPERSON OF OPAG IOS

The Chairperson of the CBS Open Programme Area Group on Integrated Observing Systems (OPAG IOS), Jochen Dibbern, in coordination with the Chair (who is also vice-chair of the OPAG IOS), informed the Expert Team on his expectations from IPET-SUP in the context of OPAG IOS.

The Inter-Programme Expert Team on Satellite Utilisation and Products exists within the broader context of the Commission for Basic Systems (CBS). More broadly, satellite observations fall under the banner of the WMO Integrated Observing System (WIGOS). In terms of the CBS

structure, IPET-SUP is part of the Open Program Area on Integrated Observing Systems (OPAG-
IOS).

Within CBS, WIGOS remains the single most important activity for the work of IPET-SUP. WIGOS is moving to a pre-operational phase which will see the acceleration of some activities, in particular the gradual phasing out of the Manual on the Global Observing System and its replacement with WIGOS Regulatory Material.

The decision to initiate the development of a new Vision of WIGOS component observing system in 2040 has also been very important. IPET-SUP has already provided some input through the Chair and there will be further opportunity to comment on the draft vision as it evolves.

As representatives of satellite users, IPET-SUP input to the new Vision will be crucial. Through the Vision, the Team can raise the awareness within WMO on the expected future capabilities of space-based observation, and introduce novel ideas beyond the simple extrapolation of current systems. Experience has shown that formulating and sharing a Vision is the best way to foster voluntary collaboration and cooperation to progress towards a coordinated system. If looking at the current space-based component, many of the goals of the current Vision for 2025 have been realized, or are near realization.

In April 2016, there will be meetings of the Inter Program Expert Team on Observing System Development and Evolution (IPET-OSDE) and the Integration Coordination Team for Integrated Observing Systems (ICT-
IOS). This meeting will consider the future work programme for IPET-SUP into the next four-year period and will recommend that work programme to the CBS Meeting in November.

CBS are expected to endorse the continued operation of IPET-SUP and also endorse the proposed 2016-2019 work programme. The membership of the team will be opened up through this process and there will be an opportunity for WMO members to reconsider their commitments and nominees. We would expect to see some change and renewal of the team membership through this process.

Anthony Rea mentioned results of the CBS Management Group and expects that the IPET-SUP will continue after CBS, with probably minor changes.

4. ACTION REVIEW AND RELEVANT MEETING OUTCOME

The Chair and Secretariat provided a review of current IPET-SUP Actions and a short briefing on results of meetings held in the inter-sessional period relevant to the Team, such as 17th World Meteorological Congress 2015, the 43rd session of CGMS, the WMO Integrated Global Observing System (WIGOS) Space 2040 workshop, the 5th session of the Inter-Commission Coordination Group on WIGOS (ICG-WIGOS-5), and the 13th session of the Consultative Meetings on High-level Policy on Satellite Matters.

Participants noted that proposed global satellite monitoring reports need to strike a balance between additional effort needed by the institution generating them, and usefulness for the WMO community.

Regarding the WMO 2016 user survey, S. Wannop suggested to screen results prior to survey closure to target response collection in geographic areas of need.

ACTION 2.1: Secretariat to screen WMO 2016 survey responses for any major geographic or user community gaps prior to closure, for remedial action. By 10 March 2016.

The list of remaining Actions, and new Actions from the session, is provided in Appendix IV.

5. DATA EXCHANGE AND DISSEMINATION

The session reviewed progress and plans of Region-based satellite data user mechanisms. The session also considered evolving needs of the global NWP community organized in the GODEX-NWP mechanism (Global Data Exchange for NWP; formerly known as North America-Europe Data Exchange (NAEDEX) and Asia-Pacific Satellite Data Exchange and Utilisation (APSDEU)).

Further, the session provided comments on the draft Guide to the Direct Broadcast network for near-real time relay of low-Earth orbit satellite data (DBNet). It discussed developing a position paper on what satellite data should be considered essential (in the sense of WMO Resolution 40).

Finally, participants were encouraged to raise specific issues or problems of data exchange, especially concerning near-real time access to data from R&D satellites.

5.1 Satellite Data Dissemination Strategy

Under this agenda item, M. Rattenborg addressed both strategic and technical aspects of satellite data dissemination, at global and regional levels. Quantitative performance indicators for assessing progress with elements of the Satellite Data Dissemination Strategy will be discussed, building on the WIS and contributing to the IGDDS. The indicators should

- Represent critical success indicators for SDDS
- Cover all 5 main strategic areas of strategy
- Be produced with reasonable amount of effort on a sustained basis

He provided example for existing progress indicators (such as DBNet coverage), and ideas for new ones. The possibility of generating monitoring results on satellite data availability at global NWP centres was discussed.

RECOMMENDATION 2.1: The session suggested that Secretariat should systematically report at sessions of the Team on usage statistics of its online resources (SATURN, OSCAR/Space, PAG – see IPET-SUP-2/INF.4).

For satellite data, none of the success criteria for WIS implementation defined by CBS are currently fulfilled; however it will take years for the WIS to be able to provide these, in collaboration with its users. In the interim, a discussion should be held on generating satellite data monitoring reports based on monitoring activities performed by existing global NWP centres.

In the context of WIGOS data quality monitoring, the Team started discussing the format of a global satellite data monitoring report. S. Keogh and S. English noted that additional resources may be needed. Other NWP centres may also need to be involved in this discussion. This should be done before the 9th session of ICT-IOS in April 2016.

This item was further discussed in break-out group 1.

5.2. Status in Regions

5.2.1 Region I

S. Wannop provided an overview of the current work of the WMO RAI Dissemination Expert Group (RAIDEG) which was established in 2010, to discuss and review data access requirements for

Region I. In particular, the Group focuses on updates to the EUMETCast-Africa Dissemination Baseline. Current data exchange and dissemination topics of key importance to the Group are:

- Status of the EUMETCast-Africa service and baseline
- Start of the PUMA Maintenance and upgrade
- MTG for Africa Study
- RARS Africa Project

The next meeting of the Group is scheduled for 12-16 September 2016 in Kigali, Rwanda, together with the 12th EUMETSAT User Forum in Africa.

As part of the CGMS roadmap on Indian Ocean Data Coverage, it is proposed to locate MSG-4 at 41.5°E to cover a longitude range from 40°W to 120°E, and a related decision will be made by the EUMETSAT Council meeting in June 2016. According to plans, there will be a period of parallel operations with Meteosat-7 from October 2016 to mid-January 2017.

The EUMETCast Africa contract is available until mid-2018. The service has an allocated net bandwidth of 2.8Mbps. An increase of bandwidth took place in July 2015 to enhance the timeliness of lower priority services on EUMETCast Africa.

RAIDEG have established a rolling table of requirements for inclusion on EUMETCast-Africa. In the period March 2015 to February 2016, a range of enhancements to the EUMETCast-Africa have taken place. New products added to the baseline include:

- Copernicus Global Land service: VITO Water Bodies v.2, FAPAR product & Vegetation Condition Index
- OSI SAF: IASI L2P Sea Surface Temperature (GHRSSST) - Metop
- CMA FY-2E products replacing FY-2D at 86.5 deg East
- Dust forecast products from the Barcelona Dust Forecast Centre
- WAVE WATCH III products from DMN, Morocco

The following services have been removed from the EUMETCast Africa baseline:

- ATOVS Sounding Products – Metop-A: due to degradation of the AMSU instrument
- Image data - MTSAT-2: due to end of satellite service.

S. Wannop briefed on the status of the MTG for Africa Preparation Study. This focuses on the use of the FCI imager and the Lightning Imager, and a successful workshop was held in conjunction with RAIDEG-6 in August 2015. An evaluation of MTG priorities and needs took place through a consultation process with RAIDEG members.

She also provided an update on the MESA project, and on RARS Africa.

The MESA project follows the Preparation for the Use of Meteosat Second Generation in Africa (PUMA) project (from 2002 to 2006) and the African Monitoring of the Environment for Sustainable Development (AMESD) project (2007-2013). It has an operational duration of 66 months and should therefore last until September 2017. MESA will deploy some 170 stations across the African continent. The PUMA 2015 and MESA stations will start to be deployed in Africa as of February 2016 and should be concluded by end of 2016. This deployment should ensure continuous operational access by all the RA I NMHS to data disseminated for the next five years

The main purpose of RARS Africa is to develop, implement and operate an African component of RARS. Based on a preliminary analysis of the RARS Africa coverage, and knowledge of local capacities in terms of operations of satellite ground segment facilities, it was proposed to deploy four RARS Stations in the following countries: Gabon, South Africa, Kenya and Niger. EUMETSAT has agreed with the EU and the African Development Bank that they will provide technical support

to the programme, based on their experience in operating the EUMETSAT RARS network (EARS). EUMETSAT hosted the RARS Africa Workshop at EUMETSAT in April 2015.

It was noted that beneficiaries of the RARS Africa project should be involved in the wider DBNet user group, given the potential benefit of the project to the global NWP community, as well as for African users. The session raised the question of sustainability of the deployed infrastructure.

5.2.2 Region II

D. Uesawa reported on progress with the Coordinating Group of the WMO Regional Association II (Asia) WIGOS Project to Develop Support for National Meteorological and Hydrological Services (NMHSs) in Satellite Data, Products and Training. The third meeting of the Group was held at the headquarters of the Japan Meteorological Agency (JMA) in Tokyo, Japan, on 14 November 2015 in conjunction with the 6th Asia-Oceania Meteorological Satellite Users' Conference. The event was attended by RA II Member representatives and a number of RA V Member observers.

The work programme of the Coordination Group 2015-2016 consists of :

- Support for the preparation of satellite data users in relation to the new generation of geostationary meteorological satellites
- Establishment of close coordination between the ongoing RA II WIGOS Project to Develop Support for NMHSs in Satellite Data, Products and Training and the RA V Task Team on Satellite Utilization
- Successful hosting of the 7th Asia-Oceania Meteorological Satellite Users' Conference by KMA and co-hosting by the American Meteorological Society
- Ongoing issuance of quarterly newsletters

He presented the results of a survey on the utilization of data from the new generation of geostationary meteorological satellites. The questionnaire was designed to poll WMO RA II/V Members on requirements, expectations and challenges with regard to Himawari-8 and other such satellites. Results were achieved from 32 NMHSs, highlighting hazards of major concern (tropical cyclones, etc.), benefits expected from new-generation satellites (multi-spectral bands, rapid scanning, etc.), requirements for reaping such benefits (training, product documentation, etc.), and utilization of rapid scan observations.

He and A. Rea mentioned a joint JMA/ BOM Australia study on Himawari-8 rapid scan, to support a RA II / V WIGOS satellite project for disaster risk reduction. During a trial period, BOM Australia generates the command files to trigger rapid-scanning by Himawari-8. This may be subject of a report to the next session of IPET-SUP.

RECOMMENDATION 2.2: JMA and BOM to provide a report on the Himawari-8 rapid scan study in support of the RA II/V WIGOS satellite project to the next session.

D. Uesawa also mentioned progress with SCOPE-Nowcasting and support to SWFDP in RA II and RA V.

The session stressed that there should be more focus on the western parts of RA II. A next regional survey should encompass questions related to data access. Results from the WMO 2016 survey should be used.

RECOMMENDATION 2.3: The RA II WIGOS Project Coordination Group should pay due attention to the needs of Members in the western part of RA II in its deliberations; the report to the next session should reflect this.

5.2.3 Region III/IV

Luiz Machado presented the situation of satellite data access in Region III/IV. Formulating Region-based requirements for satellite data access and exchange has been recognized by WMO as a priority (see WMO Executive Council Resolution 12 (EC-65, 2013)). The last face-to-face meeting of the Coordination Group on Satellite Data Requirements in Region III and Region IV was held in the US during the April 2015 NOAA Satellite Conference. The Group also held eighteen teleconferences since October 2013, the last on 19 January 2016.

This document described the initiatives and actions taken in the last meetings, as well the activities to support the users in the transition to the new satellite generation and the activities to create an operational, sustained Region-based satellite data distribution plan that is endorsed and supported by all Region Members.

Version 1.0 of the “Roadmap for Regional Satellite Data Distribution in Region III and IV” is available:https://docs.google.com/document/d/1eeo2qQynE6H_aLs44aWpdstliBoyGVcPSze0c2lb-v4/edit?usp=sharing

23 countries responded to the regional user survey. He raised the question of how to prioritize (accumulated scores, prevailing highest priority scores). The session recommended that, as general rule, accumulated scores should be used as metric; however if this leads to non-consideration in the dissemination of a dataset or product that is of high priority to a country, the decision should be reconsidered. There is great expectation in the Region for the priority datasets to be delivered. So far no country has a GRB station. 70-80% of countries use the internet as primary data access mechanism – a potential issue given the large volume of GOES-R data.

The question was raised whether dedicated terrestrial lines could be used as an alternative to GRB or GNC-A. This may be possible but arguably more expensive than a GNC-A station.

It was clarified that the requirements table is not geared towards any particular data distribution or dissemination system.

To make further progress in preparing the Region to using GOES-R, an accelerated effort is required in 2016; possible measures were discussed in break-out group 7.

5.2.4 Region V

Anthony Rea provided an update on the activities of the RA V Task Team on Satellite Utilization. Progress has been made by the Team to be more representative of the spectrum of users in the Region. Connection of the Team to the satellite operators JMA, CMA, KMA and NOAA has been satisfactory.

The group has met via teleconference three times since July 2015; in addition, many of the members also met at a side meeting of AOMSUC-6, in Tokyo, November 2015.

The Task Team will focus on collaboration in the RA II/V WIGOS activity on disaster risk reduction and recovery. The aim of this collaboration is to strengthen the capabilities of Members to use geostationary satellite images and derived products in support of Disaster Risk Reduction, and to develop a protocol for the NMHSs in the project countries to request event-driven rapid-scan imagery for their respective national areas of interest. Work on this has not yet commenced.

The Team has identified a need for improved communication across the Region, and as a result, the Melbourne VLab Centre of Excellence has run monthly online Regional Focus Group meetings since early 2014. These meetings are a forum for news and information exchange on topics such as data access and training, and are regularly attended by approximately 20 people from across RA V.

Issues relating to data exchange in RA V include:

- Internet reliability and speeds
- Lack of training/skills/tools, particularly in creating tailored products such as RGBs, and in the use of multispectral data
- Visualisation of data and products
- Large volume of new data streams

The most common natural hazards in the region are tropical cyclones, severe thunderstorms and rain, torrential rain and flash floods. Other hazards include volcanic eruptions, forest fires and dust.

In summary, the Task Team's work plan for 2016 will be to:

- a) review and finalise the compiled set of prioritised requirements for satellite observations (using the template recommended by IPET-SUP)
- b) collaboration on the RA II/V WIGOS activity on disaster recovery
- c) identify any barriers that impede the effective use of important data streams such as Himawari, and
- d) develop a report with recommendations that address issues related to access and utilisation of satellite data in RA V.

5.2.5 Region VI

S. Wannop provided an overview of the current work performed by the EUMETSAT Secretariat to support members of the wider WMO RA VI (Europe) community, i.e., outside of the EUMETSAT Member States.

Since 2009, EUMETSAT has organised on a regular basis 'Information Days' for WMO RA VI members outside of the EUMETSAT Member State community. These events provide the opportunity for EUMETSAT to maintain a close relation with its user community in the Eastern European, Western Balkan and Caucasus regions and are in line with the EUMETSAT strategy to maximise the benefits of the investments made in satellite infrastructure by ensuring that all WMO RA VI countries (including non-EUMETSAT Member States) can develop capacities to exploit these data and products in various applications areas (weather, climate and environment). The focus of the cooperation is to increase the benefits of satellite data for the countries through their integration in the daily operational forecasting activities of the NMHS.

During 2015, EUMETSAT conducted two Information Days, one for NMHSs of the Western Balkan region and the other for NMHSs of Eastern Europe and Caucasian countries. The focus of both events was to:

- Present the status of EUMETSAT programmes, including the contribution to Copernicus;
- Update on EUMETSAT data and products and on EUMETCast;
- Approach for regional training;
- Feedback from the NMHS of the region on their use of satellite data and needs;
- Discussion on future activities, in cooperation with WMO and the EU (Instrument for Pre-Accession).

The EUMETSAT Information Day for Western Balkan NMHSs took place in Albania on 18-19 March 2015. Participants agreed on the following main recommendations, which are grouped in four main categories:

1. Infrastructure to access satellite and other meteorological information data via EUMETCast
2. Regional Training
3. Regional cooperation and projects
4. Continuous interaction between NMHS and EUMETSAT

Requirements from RA VI members outside EUMETSAT member states are addressed at the Information Days. It is noted that whilst these users have access to the full suite of satellite data on EUMETCast-Europe, additional requirements specific to their service can also be considered by EUMETSAT. Challenges are to have access to additional resources or external funding to support capacity building, such as enhancing data processing, maintaining reception equipment and exploiting the use of satellite data.

5.3 Guide to the Direct Broadcast Network (DBNet)

M. Rattenborg briefed the Team on the latest version of the DBNet Guide on behalf of the DBNet Coordination Group. The Guide is intended as guidance for Members and satellite operators to participate in the network. It also aims at achieving more recognition of DBNet at the WMO level. The Guide is based on feedback at various user meetings including the 2015 CSPP workshop and the ITSC-20, and on Secretariat-internal discussion with the WIS branch. An earlier draft of the Guide was presented to IPET-SUP-1.

The Space Programme office of the Secretariat is the lead to develop and maintain the document, in consultation with the WIS branch. The document is submitted to two parallel endorsement paths: (i) for WIS aspects: TT-GISC, then sent to the Chairs of ET-WISC and ET-CTS, then to ICT-ISS; (ii) for SAT aspects: IPET-SUP, then CGMS, then ICT-IOS.

It will be then submitted to CBS-16 in November 2016 by the ICT-IOS, acknowledging the consultation with ICT-ISS.

EUMETSAT committed to extract from the Guide the satellite operator-related elements, for endorsement by CGMS as best practice (in particular related to downlinks, pre-processing packages, coding). The Guide is also intended to broaden the user base of NRT LEO data, and to secure support by WMO Members. The Guide also helps GISCs and DCPCs to ingest DBNet data into the RMDCN.

Modelling of data rates on the RMDCN, including due to the ingest of CrIS and IASI data has been done using a tool designed by the Secretariat. This helps design communication lines and reception systems. Current areas of investigation are to use a read-out station on Easter Island. It is subject of ongoing discussion how to use data reduction methods (e.g., through principal components) to reduce the data load on the networks.

M. Rattenborg recalled the participating DBNet sub-networks and related services. He also briefed on the high-level requirements of the services (IR/MW sounding, coverage, etc.), and the responsibilities for pre-processing packages at level 0 and 1.

The Team acknowledged the significant effort by the DBNet Coordination Group and Secretariat in coordinating the DBNet initiative, and in codifying the Guide.

RECOMMENDATION 2.4: The Secretariat to ensure continuous provision of the DBNet data load modelling tool.

The session endorsed the final version of the DBNet Guide, and recommended the document for endorsement by CBS as best practices for DBNet. It also noted that a stand-alone document will be presented to CGMS-44 for endorsement as satellite operator best practices in support of local and regional processing of LEO Direct Broadcast Data.

RECOMMENDATION 2.5: The session endorsed the final version of the DBNet Guide, and recommended the document for endorsement by CBS as best practices for DBNet.

5.4 GODEX-NWP Data Exchange Mechanism

A. Rea briefed on the combined 14th Asia-Pacific Satellite Data Exchange and Utilisation (APSDEU) and 26th North America Data Exchange (NAEDEX) Meeting (now referred to as "GODEX-NWP") which was held in Montreal, Canada, on 6-9 October 2015. This international data exchange meeting provides an important forum linking meteorological satellite operators with major numerical weather prediction centres. The meetings are not WMO sponsored but the WMO Space Programme attends as an observer.

The requirements document compiled by GODEX-NWP currently takes the form of a large spread sheet, organised by data type for satellite data and in situ (non-satellite) data. There are three tabs, one for each region, thereby separating the requirements according to the region providing the data: North America, Asia-Pacific and Europe. Each tab has 50 to 100 entries.

The requirements document is updated ahead of each meeting. Each of the three NAEDEX/APSDEU regions updates the document separately, under the coordination of a regional lead. There are three types of update to be done

- (i) Update the availability of observations from own region - any new satellites or other data types? Any new means of accessing data sets?
- (ii) Update the NWP requirements for observations from the other two regions.
- (iii) Update the status of observation access from the users perspective, for data from the other two regions.

The updated requirements document (its three updated versions) are reviewed by the meeting, and new actions are formulated. After the meeting the meeting host merges the requirements information into one single requirements spread sheet, to go forward to the next meeting.

A working group has been set up to review the documentation of requirements by GODEX-NWP.

The October 2015 meeting was briefed on the availability of Copernicus Sentinel-3A data.

ACTION 2.2: Secretariat to draft a letter to EUMETSAT indicating the needs of the global NWP centres for accessing near real-time Sentinel-3 data, with a request to explore options for distribution of such data. High-level requirements of the centres for such data should be included in the letter. By 31 May 2016.

The letter should include indication to what extent Sentinel-3 data will be made available on the WIS.

The GODEX-NWP mechanism has been useful to organize also the exchange of in-situ datasets.

5.5 Essential Satellite Data: Position Paper

S. Bojinski presented an update of the draft IPET-SUP position paper on satellite data essential for protection of life and property, based on IPET-SUP-1/Doc.5.5 and an iteration by the IPET-SUP task team (S. English, L. Machado, S. Wannop, A. Rea). It was noted that data policy issues were discussed in the 13th session of the WMO Consultative Meetings on High-Level Policy on Satellite Matters on 28-29 January 2016 (see IPET-SUP-2/Doc.4 for details).

The session stressed that transparency and traceability in data generation were key criteria for using data. A position paper should help Members define high-level best practices regarding the use of basic satellite observations generated by private companies. A supplement to WMO Resolution 40 Annex I may be an option.

This subject was further discussed in break-out group 4.

6 PREPARING USERS TO NEW SATELLITES

This item focused on user experiences from the first new-generation geostationary satellite Himawari-8, including the JMA perspective on addressing user needs. In addition, discussions were held on upgrading the online Satellite User Readiness Navigator portal (SATURN) with information on planned low-Earth orbit satellites, and a user feedback mechanism. The session was invited to finalize the draft Reference User Readiness Project, guidance to Members and satellite operators in structuring the preparation for new satellite system, for endorsement by CGMS-44 in June.

6.1 SATURN Status

M. Rattenborg informed on the status of the Satellite User Readiness Navigator online portal (SATURN). Posts on two LEO satellites (JPSS-1, FY-3E in the early-morning orbit) have been added. He commended JMA collaboration in updating Himawari-8-related content and emphasized the importance of a dedicated resource with satellite operators to provide information to users. He described recent additions of content on Electro-L and FY-4. GOES-R content needs renewed attention, given the launch in six months. EUMETSAT are establishing a user readiness project for MTG.

The RA III-IV Roadmap for Satellite Data Distribution should be added to the GOES-R content. NOAA should be reminded regarding JPSS-1 information. Other content is being established as soon as available.

ACTION 2.3: Secretariat to add, in coordination with NOAA, the RA III-IV Roadmap for Satellite Data Distribution to the GOES-R content on SATURN. By: 15 March 2016.

It was noted that IMD are responsible for the INSAT-3D content (Virendra Singh). FY-4A will be a R&D satellite (and likely more in terms of service level as FY-3A and 3B). The session noted that work is ongoing to provide pre-processing software for Meteor-M.

6.2 Himawari-8: Experiences and Lessons Learned

D. Uesawa informed that Himawari-8 began operation on 7 July 2015, replacing the MTSAT-2 satellite. HimawariCloud latency for the first segment imagery data is 7 minutes after observation time, and the final scan is available 4-5 minutes after scanning the last segments. HimawariCast latency for the first segment imagery data is 8 minutes, and the final scan is available 7 minutes after scanning the last segments.

The image navigation error is mostly less than 0.3 pixels, using coastlines. The Himawari operation status is available at <http://www.jma-net.go.jp/msc/en/index.html>. RGBs are generated from AHI. Cloud analysis products generated, with some tailored to countries (e.g., Viet Nam). He provided other product examples, such as AMVs, CSR, which are generated and assimilated into NWP models on an hourly basis.

AOMSUC-6 was held at Tokyo, Japan, on 9-13 November 2015. 170 scientists from 37 countries attended. Plenary sessions featured 26 country reports (see IPET-SUP-2/Doc.5.2.2 and INF.7.1).

WMO in cooperation with JMA has conducted a HimawariCast project, which is deploying HimawariCast receiving systems in RA II and V countries. JMA is offering a technical training course for Himawari-8 satellite imagery utilization to NMHSs with HimawariCast receiving system.

Lessons learned from Himawari-8 operations focus on three issues:

- dramatic increase in data
- parallel observation and data distribution; parallel operation of MTSAT-2 and Himawari-8 has been helpful to many users in the transition

- collaboration on product development; the importance was stressed of having a framework that encourages cooperation between JMA and satellite users on product development

Peer-reviewed publications are available, documenting Himawari-8. Regarding collaboration on product development, the Secretariat noted the RA II WIGOS Coordination Group and SCOPE-Nowcasting as existing mechanisms, as well as AOMSUC.

The JMA website serves as the main user information channel, along with SATURN. The HimawariCast service currently has 3 Mbps bandwidth.

6.3 Himawari-8: User Feedback (BOM)

On behalf of BOM, A. Rea provided a perspective for the group on the Australian experiences and lessons learned from the commencement of operations of Himawari-8. He briefed on lessons learned and challenges associated with the transition from MTSAT-2 to Himawari-8. Introducing the new system led to incompatibilities in many parts of the processing chain (e.g., reception, visualization systems), and some of the required changes were major, with many knock-on effects throughout the institution. A BOM internal project was set up with a budget of around 2M AUD. The direct internet link to JMA had to be established. Many delays were incurred, and since major procurements were not launched early enough, many other development phases had to be compressed significantly. The 9 months of parallel operations of MTSAT-2 and Himawari-8 were very useful to manage the transition relatively smoothly, and were seen as a minimum of time needed.

The procurement of delivery system should start early to enable testing of all other technical and scientific aspects of the processing chain (see IPET-SUP-2/Doc.6.5 on the Reference User Readiness Project, for guidance).

6.4 Himawari-8: User Feedback (NOAA NWS)

B. Connell reported on activities related to the reception and use of Himawari-8 data in the US territories of the Asia-Pacific region and associated training for users of the new data and products. She emphasized the value of satellite imagery in the Pacific Region, and the planned use of Himawari-8 data by the NOAA centres. The Himawari-8 data flow includes use of HimawariCloud and HimawariCast services. She informed about the training these centres received in utilizing the data. The Satellite Information Familiarization Tool (SIFT) was used for this purpose. Participants queried whether the tool could be made available for GNC-A users.

Testing of hardware to handle the new data streams is important and should be done using proxy or synthetic datasets.

R. Hollmann noted the usefulness of overlap between missions for generating a climate record, and the utility of having this overlap from MTSAT-2 to Himawari-8.

The session stressed that user readiness projects take these experiences into account.

6.5 Reference User Readiness Project

M. Rattenborg presented the latest status of the Reference User Readiness, after review by IPET-SUP during the inter-sessional period, and CGMS Working Groups. The document addresses both user organizations, as well as satellite operators.

The session endorsed the revised version of the Reference User Readiness Project, pending some suggestions for change. It recommended the version for endorsement by CBS as best practice for NMHS User Readiness Projects. It noted that this version will be presented to CGMS-44 for endorsement as satellite operator best practice.

Break-out group 7 looked into details of the Project and provided comments.

7 SCOPE PROJECTS: NOWCASTING AND CLIMATE MONITORING

Updates on progress in the four SCOPE-Nowcasting pilot activities were provided: improving the provision of basic imagery and RGB composites in support of users in RA II and RA V; intercomparison of volcanic ash cloud retrieval algorithms and use of the results in operational aviation services; global estimates of precipitation using a web-mapping service; sand and dust monitoring in RA II. The discussion focused on how to enhance progress and Members' engagement in these activities. In this regard, the Team reviewed the work plan and considered potential new pilot activities (see http://www.wmo.int/pages/prog/sat/scope-nowcasting_en.php for details).

Break-out group 2 reviewed the status of SCOPE-Nowcasting and provided comments.

7.1 SCOPE-Nowcasting

7.1.1 Pilot Project 1: Basic imagery for RA II and V (SWFDP support)

This Project focuses on RGB products derived from Himawari-8 and delivered to the Region and specifically to SWFDP focus regions.

The Chair commended JMA for their support to the Region including the training activities for countries. He suggested that the Project will only show its full value once an additional advanced imager will be available (such as on FY-4A, GEO-KOMPSAT-2A) and there will be user demand for consistent, or at least coordinated, provision of data and products.

Feedback by users in SWFDP regions has been limited on the RGBs since these are relatively little known; more training will be needed in this regard. Some SWFDP users want access to raw data, not only imagery or heavy rainfall potential area products.

7.1.2 Pilot Project 2: Volcanic Ash Algorithm Intercomparison

M. Pavolonis informed the session about the status of this Project, and key recommendations from the intercomparison activity that took place in 2014-2015. Since some of the findings of the intercomparison exercise were not conclusive to be of full value to end users (e.g., ICAO), some more work is required by a dedicated resource over a 12-18 months period to solidify the results and establish best practices. This includes:

- Generate additional human expert analysis, from multiple analysts, and compare to the ash detected by the satellite algorithms over the course of an event (ensure that GEO and LEO comparisons can be made)
- Acquire DLR aircraft data and compare to satellite products in a manner that is analogous to the UK-FAAM analysis
- Where possible, acquire independent estimates of ash optical depth and mass loading from space-based lidar (CALIOP), ground-based lidar (EARLINET), and sun photometers and compare to passive satellite retrievals
- Gain detailed insight into differences: Compare all retrieval inputs (satellite measurements and ancillary data) for a select number of common pixels, co-located with validation data, with different background conditions (water background, land background, meteorological cloud background, etc.). For the same common pixels, analyze all retrieval outputs.
- Where practical, partition validation data according to certain scene attributes (underlying cloud layers, land surface, water surface) and compare to satellite retrievals

- Assess the impact of viewing angle on the accuracy of satellite retrievals through comparisons to CALIOP and analysis of internally generated uncertainty estimates
- Inter-compare volcanic ash products derived from the first of the next generation geostationary satellites (Himawari-8 AHI) to volcanic ash products derived from heritage LEO and GEO sensors
- Develop a database of existing “state of the art” volcanic ash optical and microphysical properties

A. Baklanov noted that the WMO GAW programme is establishing a new Scientific Advisory Group on modelling and prediction. Collaboration of the modelling community with the VA intercomparison community will be important, for validation and assimilation purposes. M. Pavolonis agreed with strategic needs of collaboration with the modelling community and noted that the satellite-based algorithms do not even agree on detection of ash, so it will take additional effort before the results are fit for use by the modelling community.

The session discussed to what extent the additional effort could be supported. Coordination among WMO programmes will be required to this end, and potentially by ICAO and the aviation industry.

The proposal for continuing the analysis of the intercomparison results will be submitted to an April 2016 workshop on VAAC Best Practices, joint with the ICAO MetPanel work stream on Volcanic Ash, to discuss potential funding opportunities. ICAO normally does not fund research projects; such a request could be met by existing large-scale projects, such as the European CESAR.

RECOMMENDATION 2.6: The Team commended the effort undertaken on volcanic ash algorithm intercomparison under SCOPE-Nowcasting Pilot Project 3, congratulated the group for its achievements so far, supported future collaboration with the modelling community and recommended that opportunities be explored to fund the continuation of analysing the results of the intercomparison.

7.1.3 Pilot Project 3: Global Quantitative Precipitation Estimates

Luiz Machado summarized the status of this Pilot Project, providing a web mapping service of quantitative precipitation estimates and up to 3-hour nowcast. There is potential interest in this product by RAIDEG members. Regarding the quality of the product, generic validation has been performed of the Hydro-Estimator, and under the IPWG. Actual data including on geolocation can currently not be extracted from the tool, but it is recommended to implement this.

The open IPET-SUP Action to publicize the service and collect user feedback was noted.

7.1.4 Pilot Project 4: Sand and Dust Monitoring in RA II

X. Fang introduced the plan for the next two years on dust remote sensing observation in RA II under SCOPE-Nowcasting. He also summarizes the main progress of last year, including haze monitoring experiments using Himawari-8 data (AOD), information and publication of dust monitoring results, and the establishment of a long-term thematic dust dataset of satellite remote sensing.

Commonalities of imagers on Himawari-8, FY-4A, GOES-R and MODIS can be exploited to generate AOD products. It is planned to do comparison studies for heavy pollution haze events over China.

The session raised the question how the Project deals with representativity and collocation of the measurements. It is only possible to infer near-ground PM_{2.5} from AOD for well-mixed boundary layers.

CMA generates time series of AOD to monitor the occurrence of dust events (2006-2015). The products were applied in a regional dust forecasting model (assimilation, and verification).

Plans for the next two years in this Project include:

- Spring experiment for dust monitoring using Himawari-8 data, and compare the CMA algorithm with the JMA algorithm
- Compare FY-4A AOD product algorithm with Himawari-8 AOD product
- Standardize the description of dust concentration
- Cross-verification of dust products from different satellites
- Assimilation satellite products into dust forecasting models (in collaboration with the Asian node of the SDS-WAS)
- Sharing products across the Region

The Chair commended CMA and JMA for their progress made in this Pilot Project in achieving consistent satellite products.

A. Baklanov recommended close collaboration of the project with SDS-WAS Asian node; comparison with, and assimilation of, lidar data should also be considered. Sharing of experience with the SDS-WAS Northern Africa-Middle East-Europe (NA-ME-E) Node may also be worthwhile, given their experience in working with EUMETSAT Meteosat and other data.

The session also commented that methodologies to compare AOD products with sun photometer data, and on comparing AOD with PM_{2.5} need to be scientifically sound.

RECOMMENDATION 2.7: SCOPE-Nowcasting Pilot Project 4 should seek collaboration with the SDS-WAS Asian node and potentially other SDS-WAS centres; consideration of lidar data should also be considered when comparing AOD results from various sources.

7.2 SCOPE-CM

M. Doutriaux-Boucher briefed the Team on the status of SCOPE-CM. The aim of the Sustained, Co-Ordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) project is to enable the continuous and sustained provision of high-quality datasets for climate monitoring and services. The foundation of SCOPE-CM is an international network of relevant space agencies and other organizations (including GSICS) to develop, extend and preserve the capabilities and skills required for the generation of Climate Data Records (CDR). SCOPE-CM is a main contribution to the second pillar of the climate architecture (climate record creation and preservation). SCOPE-CM has completed its phase-1 activity whereby the international collaborators' network and the structure of the specific CDR projects were set up. SCOPE-CM is entering the third year of its phase-2 activity, the objectives of which are to establish a systematic approach to increase the sustainability (maturity) of its CDRs and to establish the structures necessary for the routine, operational generation of CDRs.

Nine projects are now active and are generating both Fundamental and Thematic Climate Data Records. All projects show significant progress resulting from the SCOPE-CM coordination and may result in efficiencies realized by the individual participating agencies.

She showed a typical SCOPE-CM project life cycle, and introduced the currently-active projects. There are a number of interactions between the projects. She showed the results of a recent self-assessment of each project's maturity using the maturity matrix developed in the European CORE-CLIMAX project.

The next meeting of the SCOPE-CM Executive Panel is planned for September 2016, during the EUMETSAT Meteorological Satellite Conference in Darmstadt, Germany.

Some multi-agency CDRs identified in the CEOS Atmospheric Composition Constellation could be eligible for acceptance in SCOPE-CM, so are other thematic records such as on sea ice. Mature projects will be included in the ECV Inventory to be established by the CEOS-CGMS Working Group Climate. She also noted a major revision of the ECV inventory under the auspices of the CEOS-CGMS Working Group Climate.

S. English enquired on the connection of SCOPE-CM to other CDR initiatives, such as the ESA CCI and the EUMETSAT CMSAF; these are strong, by virtue of having the same players active in various groups.

RECOMMENDATION 2.8: The session recommended that the project self-assessment of maturity be discussed at the next meeting of the SCOPE-CM Executive Panel. A review of open Actions (including identification of potential ICDRs) as well as a clear specification of SCOPE-CM plans over the next 3 years in the context of the Climate Architecture should be developed at this meeting.

8 VISION FOR THE WIGOS COMPONENT SYSTEMS IN 2040

The extraordinary CBS session in 2014 decided to develop a new Vision for the WIGOS space-based component systems in 2040, as high-level guidance for the future development and coordination of global observing systems in support of WMO applications. The Secretariat provided a presentation which outlined the initial elements, process and timeline of the Vision.

The team raised a number of questions in relation to the Vision, including:

- Is data dissemination and access by users adequately addressed?
- Is the draft visionary enough? Are science questions addressed (microphysics, turbulence)?

It was noted that meteorological observations in numerical models may be reaching saturation and that in future, the highest impact on Earth system models may come from non-meteorological missions; these could be stressed more in the Vision.

Further discussion on the Vision was referred to breakout session 8.

9 SATELLITE APPLICATIONS

As an Inter-Programme Team, the session reaches out to collect views from application-related WMO technical commissions regarding satellite data requirements and utilization, currently through the Commission for Climatology and the WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM). The Commission for Climatology established a task team on satellites, and a report on its work plan was provided. An update on the documentation of JCOMM requirements for satellite data and products by the Task Team on Satellite Requirements (TT-SAT) was also presented, as well as results from a survey among hydrological services regarding their satellite-specific needs and priorities. IMD also provided an example on the use of INSAT-3D data for precipitation monitoring and its validation.

9.1 Report by CCI Task Team on the Use of Remote Sensing Data for Climate Monitoring

R. Hollmann briefed on the goals of this Task Team: identifying remote sensing products (radar, lightning, satellite-based) for climate monitoring. The main intention is to establish connections with satellite operators, make recommendations regarding the enhanced use of satellite-based datasets and products for the annual WMO Statement on the Status of the Global Climate, and assess available satellite climate data records for their applicability to operational climate monitoring.

The Chair suggested whether better linkage of the CCI Team to IPET-SUP should be established, for example through cross-membership of the Teams.

9.2 JCOMM Needs for Satellite Data

J.-L. Fellous recalled the JCOMM mandate and the role of its Task Team on Satellite Data Requirements (TT-SAT) established in March 2014. TT-SAT was tasked to develop a strategy document addressing the "Marine meteorology and oceanographic forecasting service requirements for integrated satellite products". A first draft was made available to the session for review and comment.

The draft report was referred to a breakout session (break-out group 3) for review and recommendations back to TT-SAT.

9.3 Satellite data needs of the hydrological community

The Secretariat presented the results of a January 2016 survey among national hydrological services on their awareness and use of satellite data. The survey was conducted in January 2016 and sent to the members of the Commission for Hydrology.

The team noted the results of the survey and the Chair encouraged continued outreach to the hydrological community to both understand their requirements for satellite data and also outline the potential useful sources of data available to the community.

Potential action or addition to work programme should be considered, and a set of case studies for the use of satellite data in hydrology should be collected.

9.4 Validation of INSAT-3D derived rainfall

S. Goyal gave an overview of using INSAT-3D imagery and sounding data for detecting precipitation. Results from two separate algorithms, INSAT multi-spectral rainfall algorithm (IMSRA) and the Hydro-Estimator, were discussed. Results were also shown of the experiments run by merging IMD raingauge data to these algorithms.

The team noted the work being done within IMD and recommended further comparisons of the two methods, and use of the validation protocol developed by the IPWG.

9.5 Proposed Integrated Global GHG Information System (I3GIS)

O. Tarasova presented on the I3GIS concept and principles, noting the intent to get the implementation plan approved by WMO EC-68. The approach taken is largely user-driven, to complement countries' bottom-up reporting on their GHG emissions. Satellite monitoring of GHG is an important component of the future vision, with complementary airborne and surface-based observations. A key aim is to reduce the latency in reporting on GHG emissions (Paris Agreement demands five-yearly reporting, and three-year additional latency) to a yearly or even in near-real time.

The team noted the information provided.

10 METADATA, DATA FORMATS AND TOOLS

Development of metadata standards to enable consistent description and discovery of satellite data (on the WIS) is currently underway, in the WIGOS and WIS context. The Team has been providing input to both efforts, and progress is being reviewed. Both standards should be

developed to a mature stage by May 2016, to facilitate discussions by CBS in November. ECMWF will report on the latest release of the ecCodes data conversion tool, and on building an international user community of the tool.

10.1 WIS Metadata: Report by CGMS-WMO Task Force

M. Rattenborg reported on progress by the CGMS-WMO Task Force on Metadata Implementation. The main deliverables of this task force are:

- a CGMS information model for satellite data (Level 1,2 and 3), including the set of mandatory attributes allowing a user to accurately find a satellite product and obtain from the catalogue a complete description for this product;
- Mapping of the information model to the WMO Metadata Profile and identifying gaps where aspects essential to satellite data cannot be represented in WMO profile; and
- Building on best practices and examples of satellite products' metadata to create a coherent search experience regarding satellite data products.

The team noted that an information model initial version had been developed, with examples. The value of standardized metadata for discovering datasets is mainly for GISC catalogue searches, but also other catalogues that harvest entries, such as the GEO portal.

The Task Force recommended the use of an "Abstract" field to contain key information and sought guidance from IPET-SUP on its structure and content. This work was referred to a separate breakout session (break-out session 1).

10.2 WIGOS Metadata Standard: Satellite Community Update

L. Nunes updated the Team on the status of developing a WIGOS metadata standard (WMDS) for the description of satellite observations. IPET-SUP-1 had recommended review of an earlier version of the Standard, and an ad-hoc workshop was held in 2015 with participation by IPET-SUP-delegated experts to discuss the applicability of the Standard for describing space-based observations. As a result, some additions were agreed that are still being implemented. The workshop also agreed that the WMDS is applicable and should be used by the meteorological satellite community.

The Standard consists of 10 categories and 65 elements to describe observations. A next draft of the Standard will be circulated in the coming months, for review and comment. The Guidance material for the use of WMDS to be made available in July 2016 will not yet include the changes proposed by the satellite community.

The team emphasised that collaboration from the satellite community to further development of the Standard continues to be essential. Although the current Standard cannot officially be modified until Cg-18, the Team was encouraged by the WIGOS Project Office to continue improving the existing Standard, based on the recommendations.

Agencies such as EUMETSAT and NOAA are using OGC-based standards for describing data for their future programmes; the team recommended the investigation of whether these standards can be mapped onto the WIGOS Metadata Standard. A presentation on an interim version of the Standard (taking into account comments by the satellite community) should be provided to the CGMS-44 WG IV session.

ACTION 2.4: Secretariat to make available an interim version of the WIGOS Metadata Standard, for further discussion by the satellite community (CGMS operators, other providers of satellite data and products). Deadline: 1 May 2016

E. Fucile encouraged that the WMDS will be mapped onto existing representations of data (BUFR, netCDF).

10.3 ecCodes Update

E. Fucile provided an update on the status of ecCodes. It was noted that there had been substantial feedback from the user community after release of the beta version of ecCodes and that this may have been assisted by the recommendations of IPET-SUP-1. A new version of ecCodes (an evolution of GRIB-API) was released in May 2015, with an updated decoder which is checking the decoding bit stream. In November 2015, the BUFR encoding was partially implemented and new examples were developed (tropical cyclones, scatterometry, upper-air observations). This includes a BUFR validator for consistency with the WMO Manual on Codes. Performance of GRIB de-/encoding has also been improved and as of February 2016, BUFR encoding is fully implemented.

A web seminar on ecCodes was held in December 2015 with 100 participants, showing substantial user interest, and the first training course will be held on 29 Feb – 4 March 2016, with 25 participants.

The Team expressed its high appreciation to the development and community-building of ecCodes.

11 OSCAR/Space V2.0

J. Lafeuille recalled the status and recent developments of the space-based capabilities module of the Observing System Capabilities Analysis and Review resource (OSCAR). The main features of the new version are based on a novel expert system approach with around 2000 rules. This new version, called “OSCAR 2.0”, aims to provide more accurate assessments of instrument performances, while ensuring greater transparency and facilitating the onward scientific maintenance. It is currently at a prototype stage and should be available for beta-testing in the near future.

A demonstration of a beta version of the new version was made to the Team.

The team noted the short-term plan to validate this new version before replacing the current version of OSCAR/Space. In a longer term perspective, the possible involvement of experts teams such as IPET-SUP or thematic science groups in the collaborative evolution of this resource may be required.

The team recommended that for maintenance of the expert rules, international science groups should be engaged to oversee a set of rules related to their expertise.

The ongoing management, development and maintenance of OSCAR/Space was referred to a breakout session 6.

12 USER SURVEYS

Global and regional user surveys are an important tool to guide action of IPET-SUP and related groups. The Team discussed results from a regional survey undertaken in Region III/IV and suggested follow-up. The questionnaire of the WMO 2016 Survey on the Use of Satellite data is provided in document IPET-SUP-2/INF.5.

12.1 Results of Regional Survey in RA III/IV

L. Machado presented results from the draft report of the 2015 Satellite Data User Survey for Regions III (South America) and IV (North America, Central America, and the Caribbean), carried out under the auspices of the WMO Coordination Group on Satellite Data User Requirements in Regions III and IV (SDR). 31 institutions answered the survey from 23 countries, from 10 countries in Region III and 13 countries from Region IV. An update of the satellite data requirements table was produced as a result of the Survey, with indication of user priorities.

The team noted that the results indicate a very high interest in GOES-R and high interest in JPSS. Users in the Regions have a high reliance on the internet for data access. Users also indicated a strong intention to use GEONETCast-Americas in the future.

The survey also highlighted a very high level of interest in virtual training across the Regions.

The team advised that a future survey should focus on application areas that need to be addressed, or gaps filled. The session took note of the survey and recommended that the report be published as a WMO Space Programme publication, in English and Spanish.

ACTION 2.5: INPE to finalize the report on the Regional Survey in RA III/IV in English, Spanish, and Portuguese; the report should be published on the RA III/IV SDR Group website and on the WMO Space Programme website. By 30 April 2016

13 TRAINING AND EDUCATION

The session reviewed overall progress made in training and education on satellite applications within the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab), including the new VLab strategy 2015-2019. The Team provided strategic and tactical comments on the VLab and its activities. Possibilities to augment visibility and effectiveness of the VLab were discussed, including re-emphasizing the expectations from satellite operators and training centres of excellence, structured pre- and post-event reporting on planned learning outcomes, audience etc.

13.1 VLab Update

On behalf of the VLab Co-chair, E. Podgaiskii reported on activities within the WMO-CGMS Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) along with future plans. Since IPET-SUP-1, VLab members have offered a variety of training opportunities; with highlights being the Train the Trainer Workshop on GEONETCast Americas and the training activities around Science Week.

Furthermore, two major events were held addressing the next generation of satellites: The Himawari-8 Training Campaign and Preparing for the Next Generation of Satellites provided very good opportunities for stakeholders from all WMO Regional Associations to be informed and make effective use of new technology and data that is or will soon be available.

The issue of performance of CoEs and commitment by satellite operators was raised. The team noted that measures of quality management of the Centres may need to be introduced, 15 years into the VLab (publication of an article in the Bulletin in March 2016), possibly through external evaluation, to review and reconfirm Centres. Self-assessment (the RTC review every four years has developed a review questionnaire) or activity-based assessment could be used.

The set of “Satellite Skills and Knowledge for Operational Meteorologists” presented to IPET-SUP-2 for endorsement and was referred to a separate breakout session.

ACTION 2.6: VLMG should develop a process for quality management of the CoEs, including self-assessment, using the review of the WMO Regional Training Centres as a model. By: VLMG-8

13.2 Conceptual models for the Southern Hemisphere: Results and Way Forward

E. Podgaiskii reported on the achievements of the VLab project “Conceptual Models for Southern Hemisphere”, which started in 2013. Until now the project consists of two phases, during which altogether 15 Conceptual Models have been documented and described. The second phase of the project is ongoing and will end in March 2016.

The project’s first two phases have been funded by WMO and EUMETSAT. The project group consists of expert teams at VLab Centres of Excellence in Southern Hemisphere - Argentina, Brazil, South Africa, Australia. An expert team from BMKG Indonesia participated in the second phase of the project.

The small amount of seed funding provided by WMO and EUMETSAT has leveraged monetary and in-kind contributions by the Southern Hemisphere CoEs. The team raised a question on the uptake of the existing conceptual models by users and noted that more should be done to promote their availability. For example, by featuring them in a VLab event week or training event.

The session noted the important achievements of the Project and recommended that future funding should be considered in the broader context of the VLab Trust Fund, rather than being treated as a separate issue.

RECOMMENDATION 2.9: Future funding of CM4SH should be considered in the broader context of the VLab Trust Fund, rather than being treated as a separate issue.

14 COMMUNICATION PLAN

This item was not covered at the meeting due to a lack of time. The Chair agreed to facilitate completion of the plan and provide it to members for comment out of session, by 30 June 2016. An existing action from IPET-SUP-1 covers this task.

15 SPACE WEATHER

15.1 WMO Coordination and 2016-2019 Plan

T. Onsager, the Chair of the Inter-Programme Coordination Team on Space Weather (ICTSW), informed the Team on the status of WMO coordination in the area of space weather (currently defined as “the physical and phenomenological state of the natural space environment, including the sun, the solar wind, the magnetosphere, the ionosphere and the thermosphere, and its interaction with the Earth”). This includes ionospheric, geomagnetic, solar and inter-planetary phenomena, and energetic particle flux.

He recalled the increasing national and international recognition of the importance of space weather and the need to develop a coordinated, global strategy to deliver space weather services to help mitigate the hazardous impacts of space weather. He described the recent involvement of WMO in the coordination of space weather activities and the progress that has been made to date by the Inter-Programme Coordination Team on Space Weather (ICTSW).

He also described the efforts proposed in the draft Four-Year Plan for WMO Coordination of Space Weather Activities, which will be submitted to EC-68 for approval, as requested by Cg-17.

Continuity of ICTSW will be through an Inter-Programme Coordination Team on Space Weather (IPT-SWISS) that reports to CBS and CAeM.

The team questioned the extent that the global community benefits from observations taken by the military sector, such as the case of DMSP. T. Onsager pointed out that there are large amounts of civilian data that are currently not available, and some progress has been made in getting access to data that have previously been classified, such as energetic particle measurements by GPS satellites.

15.2 COSPAR Training Event on Space Weather

J.-L. Fellous provided an overview of COSPAR capacity building events, the partnership with WMO, and information on capacity building events planned in the area of space weather. Two expressions of interest were received in Spring 2015, from INPE, Brazil (but this proposal has not yet been accepted, pending clarification on a number of issues) and from the IKIR, Russian Federation, for an capacity building training course in Kamchatka (which has been accepted by COSPAR after a site visit in January 2016).

It was noted that a COSPAR Capacity Building Workshop on Space Weather is now planned in Kamchatka, Russia, in August 2016. A Local organizing committee has been formed within the Institute of Cosmo-physical Research and Radio waves Propagation (IKIR). It is recommended that this workshop be co-sponsored by WMO in the framework of the Memorandum of Understanding signed by COSPAR and WMO in 2012 and renewed in 2015.

The Team took note of the information provided on current plans to hold a COSPAR capacity building workshop on Space Weather in Russia in 2016.

RECOMMENDATION 2.10: The Team noted the opportunity presented by the COSPAR workshop for capacity building in space weather, and recommended that the WMO Secretariat provide financial support, advertise the workshop and contribute to orienting the workshop to respond to operational user as well as research needs.

16 UPDATE BY GEO

B. Ryan, Director of the GEO Secretariat, pointed out the key objectives of GEO which is transitioning to the next decade 2016-2025. GEO targets the political interface and tries to advocate for EO-based services. The new Societal Benefit Areas were presented, and it was noted that Weather and Climate are seen as underpinning all Areas and are no longer identified as separate SBAs.

GEO advocates for free and open data access by government programmes. GEO currently has 102 Members and 92 Participating Organizations, many of which have linkages to the satellite domain. A GEO Foundational task is on GEOSS Satellite EO resources (including advocacy for continuity), which includes identification and formalizing user requirements. Key activities include the GEO Carbon Cycle and the Carbon Flagship initiative.

Regarding data access, the increase in data volumes from satellites is recognized. The GEO Common Infrastructure is interoperable with the WIS, and because of this, datasets, generally not available through WIS (biodiversity, ecosystems, etc.) are now discoverable and available to WIS users. Conversely, data discoverable through WIS are now being viewed by broader communities.

The team noted the benefits of GEO advocacy for free and open data sharing, in particular the opening of the Landsat archive for free and open access, and the economic benefits derived from open data policies.

The team questioned if GEO had a long-term vision for GEONETCast; it was noted by GEO that more harmonization among the GEONETCast providers is needed.

MATTERS ARISING FROM INFORMATION DOCUMENTS

The Team was invited to raise any issues or questions regarding the documents submitted for information only.

BREAK-OUT GROUPS

Breakout groups were formed to address specific issues raised during the main meeting.

Break-out Group 1 (WIS Metadata, Satellite Data Monitoring)

Bernie Connell, Mikael Rattenborg, Eduard Podgaiskii, Steve English, Simon Keogh, Sergei Uspensky, Sally Wannop

The group discussed issues relating to WIS and WIGOS Metadata, and the concept of global satellite data monitoring.

WIS Metadata Abstract template guidelines

The breakout group noted the need to understand the various use cases: e.g. high-level use case - searching in the GIS, looking to see if a product is available.

The group considered a categorisation based around product type, level of data (level 1 or level 2), product geometry, temporal coverage, instrument information and platform information.

It was decided to look at CMEMS parameter categorisation and to apply the same approach to the wider satellite data (Action on Guillaume and Sally).

The next steps agreed by the team were to:

- create a new draft of the Abstract by mid-March; and
- if feasible, apply the template in a test environment for beta-tester feedback

ACTION 2.7: S. Wannop and G. Aubert to look at CMEMS parameter categorisation and to apply the same approach to the wider satellite products; by 31 March 2016.

ACTION 2.8: S. English and M. Rattenborg to propose a high-level typology of level 1 products; by 31 March 2016.

ACTION 2.9: CGMS-WMO Task Force to provide a revised WIS Metadata abstract to the Team. By 15 April 2016

WIGOS Metadata

The group felt that the feedback already provided to the Task Team should be addressed in a new version of the document, for feedback by CGMS.

The review and further promotion with CGMS operators should be deferred to when an interim update of the Metadata Standard is available that takes into account earlier comments by the Team.

WIGOS Monitoring

ECMWF took the action to evaluate the effort and resources needed to provide information which could be used as basic alert information within WIGOS.

ACTION 2.10: Steve English to explore options at ECMWF to generate regular monitoring reports (on availability and quality), based on their routine monitoring of satellite data streams. By 30 April 2016.

Break-out Group 2 (SCOPE-Nowcasting Review)

Richard Eckman, Luiz Machado, Suman Goyal, Fang Xiang, Daisaku Uesawa, Ignatius Gitonga

General recommendations

- Tropical cyclones would be a topic of wide interest
 - Important to use new & different products beyond RGBs and precipitation products (from the initial 4 projects), ideally from different sensors and satellites (e.g., scatterometer winds, microwave products, polar orbiting satellites using DBNet)
 - Would require wide support of regions given its global importance: many agencies should be involved (less specific to one or two regions like the earlier projects)
- More explicit component for training would be welcome, particularly in regions that do not have satellite operators and are therefore less knowledgeable with interpreting these products.
- Official support to be better documented, through letters of explanation from WMO to the relevant participating agencies. Some smaller agencies and entities may not appreciate that this is a WMO-sponsored activity.
- Improve advertising of the products that are already available for use and validation by other end users.
- Promote collaboration with other WMO programmes, as appropriate.

RECOMMENDATION 2.11: SCOPE-Nowcasting partners to explore the possibility for a new pilot project on tropical cyclones.

Specific project recommendations

Project 1. Imagery and RGBs for SWFDP in RA III-IV

- Himawari is the only platform presently on orbit. FY-4A and GEO.KOMPSAT-2A to be launched in relatively near future. Intercomparisons should then be performed and unified products can be produced and compared.
- Problems with JMA website visibility in China should be solved.

- CMA would like to compare their RGB standards with JMA, but there are differing channel standards.
 - If there are small differences, who should do something about it? This would make merging of the products more difficult. Would it be accomplished by a 3rd party service? Or, could JMA and CMA collaboratively interact?
- FY-4A scheduled launch is November 2016. It is not too early to begin planning for consistent, combined products. This would be an activity that the providers could potentially generate.
- Potential case study suggestion: Indonesia could be provided a processing package by JMA (or CMA). They could then in turn re-distribute the products to nations with less able services. This intermediate agency data redistribution model could be explored for more widespread applicability.

RECOMMENDATION 2.12: Include RGBs and Himawari-8 AHI-related adjustments to the WMO/EUMETSAT RGB standard as subject of a training event at AOMSUC-7

RECOMMENDATION 2.13: WMO, together EUMETSAT, NOAA, CMA and JMA, to organize a RGB best practices workshop in late 2017.

Project 2. Volcanic ash intercomparison

- The results of the first intercomparison revealed a broad spectrum with many differences in algorithms and their ability to detect volcanic ash. This really points to the need for additional analysis. Further analysis of the initial results is warranted for more in-depth analysis. This should be the next priority.
- It was noted that Himawari data was not available at the time of the first intercomparison. Ideally, a second intercomparison would be beneficial to bring in any new data sources.

Project 3. Precipitation estimates

- The team recognized the excellent progress. Other countries are also interested in analyzing products (e.g., India). This could require further validation by end-users.

Project 4. Sand & Dust Monitoring in RA II

- There should be additional inter-agency participation with additional satellite products used.
- There may be a need to help users with data product use.
- Consideration of other/additional data products beyond AOD might be warranted. It is also important to understand user requirements.

Break-out Group 3 (TT-SAT Report on Ocean Requirements)

Jean-Louis Fellous, Rainer Hollmann, Anthony Rea

The group reviewed the Requirements document and made a number of recommendations:

- Recommendations to TT-SAT
 - Refer the document back to the original scope – focus on forecasting services
 - Consider publishing the document (no more than 25 pages) as a review paper in a scientific journal for higher visibility/impact
 - Refer to relevant work by CEOS Virtual Constellations
- Recommendations to JCOMM, WMO and IOC
 - Demonstrate the usefulness and added value of such a document: how influential is it with respect to decision-making processes in WMO Member states and space agencies
 - Provide adequate Secretariat support for the TT

- Engage a consultant to accelerate and make the process more efficient (most information is readily available on the internet)

Break-out Group 4 (Essential Satellite Data)

Steve English, Anthony Rea, Sergei Uspensky, Richard Eckman, Luiz Machado, Mikael Rattenborg, Sally Wannop, Stephan Bojinski, Simon Keogh, Rainer Hollmann

The Group discussed mainly about how to frame and structure a position paper, and its title. It was suggested that the document should discuss critical data for nowcasting and NWP. It could be referred to as a guideline for procurement of satellite data generated by private operators.

The group considered the idea that “Any data contributing to the GOS should be considered essential.”

- There is concern about the word “essential” since it has a special meaning in the context of Resolution 40, and with respect to perceived user needs (free & open dissemination).
- Ideally, we should be using a different word than “essential”. Preferably, we should have a statement of need from the satellite user perspective and then move on to a data policy consideration, with no reference to Resolution 40.
- Note that Resolution 40 has a specific list of data types considered vital in Annex I. But, this Annex is less clear with respect to satellite products.
- It is noted that some satellite operators are not under the control of one state (e.g., EUMETSAT).
- There have been previous requests to WMO Members regarding the definition of what products were important to the GOS. This was last done in 2007 and there were replies at that time.
- With the forthcoming MTG, EUMETSAT may be revisiting its data policy. This would probably result in only small adjustments.
- The main reason for creating this paper is concern about future actions of commercial providers of meteorological satellite data, with considerably different dissemination models than what is current best practice.
- We could also note that the satellite user community finds that Annex I of Resolution 40 is dated and does not consider new satellite data types that are important in the protection of life and property.
- The group noted that there is no mechanism for engagement of the private sector within WMO teams and other consultative groups. Enhanced private sector engagement would be worthwhile.
- It was noted that the strongest mechanism that WMO has to influence matters is through Resolutions by its Congress.
- It was agreed that we should cite some of the economic returns that Barbara Ryan (GEO) noted on the added value of free distribution of Landsat data versus sales of these data.
- Do we focus on just satellite data or should it be broader? Based on earlier conversations with David Grimes and other senior people, this paper should be kept specific to satellites.
 - Are these regulations still “fit for purpose” in today’s environment where NWP has evolved significantly since the 1990s.
- What is the target audience? – All satellite operators? And, in what form should the recommendation take place? Perhaps as a WMO letter to satellite operators.
- The recommendations for producing FCDRs and ECV products (GCOS-143) can be used as a model for our own specific recommendations.
 - Getting deep into specific data types is counterproductive. It was agreed to remove the table from the draft position paper.
 - Do we use this FCDR production template as a prescription for the creation of critical data and the criteria that they must fulfill, with a view towards the actions of the commercial sector?

- Critical data should fulfill the following criteria for protection of life and property (nowcasting and NWP):
 - Transparency in instrument characteristics and processing steps
 - Documented algorithms and validation
 - Timely provision of pre-validated data to users
- It should further consider:
 - Anchor tenant considerations
 - Outsourcing vs. commercial activity
 - Access to NRT vs. archived data
- A quantitative maturity index, like the one used for CDRs, could serve as a model for fit for purpose of specific NRT data streams
- The breakout group has agreed to develop a paper based on above principles:
 - It was noted that this paper should be from a “user perspective”, rather than appearing to interfere with commercial sector.
 - We need to recognize that there may indeed be a role for the private sector in providing data.

It was suggested that the paper could be attached to a WMO letter to satellite providers, asking for reaffirmation of their commitment to the space-based WIGOS.

ACTION 2.11. A. Rea to consult with NOAA on the framing and content of this position paper. By 31 March 2016

ACTION 2.12. A. Rea to report on the discussion at the meeting of IPET-OSDE in April 2016. By 11 April 2016.

ACTION 2.13. Task team to prepare a new draft of the position paper. By 31 Mar 2016

The Task team consists of: Steve, Luiz, Anthony, Sally, Simon, Rainer.

Break-out Group 5 (Satellite Skills and Knowledge for Operational Meteorologists)

Daisaku Uesawa, Xiang Fang, Eduard Podgaiskii, Bernie Connell, Suman Goyal, Ignatius Gitonga

The group identified areas for clarification and provided related comments. Overall, the document captures the essence of identifying necessary satellite enabling skills. There was confusion with the wording associated with foundational knowledge vs. enabling skills and their linkage as well as whether the requirements that followed the performance components were prerequisites or what should have been gained as a skill. This should be better explained and the wording adjusted in appropriate places in the document. Comments were also provided on the arrangement of skills in brackets throughout the document. The breakout group recommends reviewing this and adjust wording accordingly.

The session endorsed the Satellite Skills, subject to these clarifications.

ACTION 2.14: VLab co-chairs to send IPET-SUP comments on the Satellite Skills document to the authors. By 15 March 2016.

RECOMMENDATION 2.14: Authors of the paper to provide update at VLMG-8.

Break-out Group 6 (OSCAR/Space V2.0)

Richard Eckman, Xiang Fang, Daisaku Uesawa, Steve English, Simon Keogh, Rainer Hollmann, Jean-Louis Fellous

The group discussed the future of OSCAR/Space V2.0:

The recommendations are that it is a critical resource and should be maintained, and that a full-time position is probably needed to maintain it.

RECOMMENDATION 2.15: The group recommended the establishment of a Scientific Management Team (to ensure maintenance of content and QC), possibly divided up e.g. by WMO Region.

The drafting of a letter from users to WMO was recommended, which would highlight and emphasise the importance of OSCAR/Space as a resource.

RECOMMENDATION 2.16: ISWG co-chair to consider writing a joint letter to WMO, emphasizing the importance of OSCAR/Space as a community resource.

ACTION 2.15: Secretariat to draft such a letter and invite the ISWG chairs to sign. By 30 April 2016.

The group also noted the role of ET-SAT in providing factual content and the complementary role of IPET-SUP in reviewing the information.

RECOMMENDATION 2.17: Maintenance of OSCAR/Space should be subject of a joint ET-SAT/IPET-SUP meeting.

Break-out Group 7 (User Readiness Project; Way Forward in RA III-IV)

Anthony Rea, Luiz Machado, Suman Goyal, Bernie Connell, Mikael Rattenborg, Eduard Podgaiskii, Sergei Uspensky, Sally Wannop, Ignatius Gitonga

The group discussed the survey conducted in RA III/RA IV and recommended that it be published on the SDR website.

ACTION 2.16: L. Machado to make available Survey draft report for comments in English, by 31 March 2016

The upcoming Satellite Data Requirements meeting was also discussed and it was recommended that this proceed as soon as possible. The group also recommended that, prior to the meeting, participating countries undertake a self-assessment of their readiness for GOES-R. The SDR Chair should organise a template for the gathering of this information.

ACTION 2.17: Prior to the SDR, undertake an investigation of the level of readiness of users in RA III/IV for GOES-R and JPSS, through analysis of survey results and existing information (Roadmap, User Readiness Project), to develop suggested solutions for every country (Machado). By 30 June 2016.

The group also provided comments on the Reference User Readiness Project that will be taken into account in the final document.

ACTION 2.18: Team to provide final comments on the Reference User Readiness Project document. By 15 March 2016.

ACTION 2.19: WMO to publish the final version of the Reference User Readiness Project, and to translate it into French, Spanish, and Russian. By 31 July 2016.

Break-out Group 8 (Vision 2040)

The Team welcomed the draft Vision as being comprehensive, however, Team members noted that the Vision was partly conservative and should be more user-focussed (e.g., requirements for high timeliness).

Participants commented that “Categories of missions” rather than “Tiers” should be used. The wording “Tiers” could suggest that these are dependent of, or building on, each other, or that one Tier is more important than the others. By 2040 it is likely that a broader range of missions will be considered core missions.

ACTION 2.20: Team to provide comments on the draft Vision for the WIGOS space-based components in 2040, by 24 March 2016.

Break-out Group 9 (IPET-SUP Work Plan 2016-2019)

The Team reviewed the proposed work plan, which is provided in Appendix I.

17 REVIEW AND ADOPTION OF THE DRAFT REPORT

The Secretariat provided a draft report of the session, for initial feedback by participants.

18 MEMBERSHIP

The Secretariat provided information on the state of IPET-SUP membership and its expected evolution, given the upcoming regular session of CBS in November 2016 where all expert teams are subject to review. Members were encouraged to reaffirm their interest in the Team, through their PRs and Directors.

19 ANY OTHER BUSINESS

S. Wannop informed on main outcomes of a EUMETSAT workshop on a Future Data Delivery Services Roadmap held in January 2016. The workshop looked at current data services and pathfinder candidates for future data dissemination:

- Pathfinder 1: Online access – bridge gap between NRT (EUMETCast) and archive data
- Pathfinder 2: EUMETCast Terrestrial – starting this year as a demonstration service; used for Sentinel-3A
- Pathfinder 3: Webmapping services; EUMETPilot, explore licensing conditions
- Pathfinder 4: Format conversion toolbox: BUFR, GRIB into netCDF, TIFF
- Pathfinder 5: Hosted processing – bringing the user to the data

In closing, W. Zhang commended the Team for its achievements. As priorities for its work, he stressed (i) to explore new capabilities in space through pilot projects, (ii) to ensure user readiness, with the suggestion of a CBS-16 side event on the Reference User Readiness Project, (iii) the long-term view on the WIGOS space-based components, including GHG information systems. He mentioned the Guideline for the Long-term Sustainability for the Peaceful Use of Outer Space (UNOOSA).

20 DATE AND PLACE OF NEXT MEETING

The meeting agreed to organize its next session in the week of 3-7 April 2017 in Geneva, if possible in conjunction with ET-SAT.

ADJOURN

The session closed at 13.00 on Friday, 26 February 2016.

DOCUMENTS FOR INFORMATION

I.1 SATELLITE APPLICATIONS

Provided an update on the development led by the Global Atmosphere Watch Programme of observation requirements for the three new WMO application areas related to atmospheric composition: monitoring atmospheric composition, forecasting atmospheric composition, and urban applications related to atmospheric composition.

I.2 INTERNATIONAL SCIENTIFIC WORKING GROUPS

Presented results arising from the 20th ITOVS Study Conference held in October 2015.

I.3 ARCHITECTURE FOR CLIMATE MONITORING FROM SPACE

Presented the final report "Satellites for Climate Services: Case Studies for Establishing an Architecture for Climate Monitoring from Space" (WMO-No. 1162), developed under IPET-SUP auspices and demonstrating the link of satellites to the GFCS.

I.4 WMO SPACE PROGRAMME ONLINE RESOURCES

Updated on the online resources made available on the WMO website to facilitate access to satellite information and data, with focus on user statistics (OSCAR/Space (see item 11); Product Access Guide; Data Access page; Tools page).

I.5 USER SURVEYS

Presented the online questionnaire used for the 2016 WMO Survey on the Use of Satellite Data.

I.6 TRAINING AND EDUCATION

NOAA presented their approach to training NWS staff in view of the upcoming GOES-R satellite. The Committee on Space Research (COSPAR) plans for training workshops are provided in document IPET-SUP-2/INF.6. Training on space weather was covered in item 15.

I.7 UPDATE ON EVENTS

Reported on results from the 6th Asia-Oceania Meteorological Satellite Users Conference (AOMSUC) and plans for the 7th and 8th session in 2016 and 2017, respectively (INF.7.1); to inform on the EUMETSAT Conference 2015 (INF.7.2) and other community events.

I.7 IPET-SUP WORK PLAN

Included the current work plan of IPET-SUP.

MEETING URL: <http://www.wmo.int/pages/prog/sat/meetings/IPET-SUP-2.php>

**PROPOSED IPET-SUP WORK PROGRAMME FOR THE PERIOD 2016-2019
(LAST UPDATE: 26 FEB 2016)**

(this work plan is to be presented to the OPAG-IOS Chair, then updated by the Team to assign responsibilities, deadlines, and indicate status)

No.	Task (ToR)	Deliverable/Activity	Due	Responsible	Status	Comment
1	Monitor the progress of satellite data availability and use by WMO Members, related issues and expectations, with the aim to publish findings and recommendations in a WMO document	Quadrennial survey Analysis of responses Findings and recommendations Advice to Regional Associations on follow-up actions WMO document for publication Next survey	Feb 2016 Apr 2016 Apr 2016 Sep 2016 Jan 2017 2020	WMO SP Secretariat and IPET-SUP	Survey carried out in the period 8 Feb – 15 Mar 2016; More than 400 responses received	
2	Provide advice and support to the development and implementation of WIGOS, from a satellite user's perspective and coordinate with ET-SAT and IPET-OSDE on the evolution of the space-based component of Global Observing Systems;	Contribute to the evolving EGOS IP, the Manual on the GOS, WIGOS Regulatory Material, the Vision for the WIGOS component systems 2040, and the WIGOS IP Support WMO Programmes (both operational and research) in their satellite data and product-related needs, with focus on marine meteorology and oceanography, climate, hydrology, and atmospheric composition	As required Continuous	IPET - SUP and WMO SP Secretariat	IPET-SUP provided input to the initial Vision for the WIGOS space-based components in 2040	

3	Initiate and promote activities to improve the availability of operational and R&D satellite data according to user needs, monitor these activities in close coordination with the relevant working groups, regional associations and with WIS activities	<p>Promote the development and maintenance of Regional Satellite Data Requirements Groups and satellite data requirements in all Regions, as appropriate</p> <p>Promote activities to advance the Satellite Data Dissemination Strategy:</p> <ul style="list-style-type: none"> - Information and guidance - Data requirements - Enhancing data availability - Description and Registration - Dissemination and User Access <p>Encourage and assist Regional Satellite Data Requirements Coordination Groups in carrying out Region-based user surveys</p>	2016 onwards	<p>IPET - SUP and WMO SP Secretariat, with assistance from Int'l WGs</p> <p>IGDDS and RARS implementation groups</p>	<p>Regional Groups active in RA I, II, III/IV</p> <p>Development of progress indicators ongoing, including for DBNet</p> <p>Ongoing</p>	
4	Review present and future R&D satellite data and products including their availability and potential applications, and provide advice with a view of increased utilization by WMO Members;	<p>Review of relevance and availability of R&D satellite data, based on global/regional requirements;</p> <p>Strengthen interaction with R&D agencies in the area of altimetry, soil moisture, precipitation, and climate</p> <p>Make recommendations for improved availability, information and training, especially for developing countries</p> <p>Collect case studies to demonstrate the value of satellite data for hydrological applications</p>	<p>Ongoing</p> <p>2017</p>	IPET - SUP and WMO SP Secretariat	Participation in relevant fora, focus WMO survey on these topics and interaction with CEOS as appropriate	
5	Review, and assist in addressing, the needs of WMO Members and regional associations for information regarding satellite capabilities and in particular access to and utilization of satellite data and products;	<p>Maintain OSCAR/Space and a list of satellite data access points, processing and analysis software tools on WMO webpage</p> <p>Support activities to achieve user readiness for the new generation of meteorological satellites, including the development of guidelines for users and satellite operators</p>	2016/2 (continued yearly)	IPET - SUP and WMO SP Secretariat	Best practices for achieving user readiness (Reference User Readiness Project) published; Next-generation of OSCAR/Space, Product Access Guide and SATURN online	

6	<p>Promote development and harmonization of satellite data and products responding to WMO Members' needs, and develop and update relevant elements of the WIGOS regulatory and guidance materials, including the Manual and the Guide to the GOS and the WIGOS quality data monitoring system</p>	<p>Provide guidance to Sustained Co-ordinated Processing of Environmental Satellite Data (SCOPE) for Climate Monitoring as a key contribution to the architecture for climate monitoring from space.</p> <p>Continue to develop and promote the SCOPE-Now casting, initiative and support the work of the coordinating group.</p> <p>Collaborate with WIGOS, WIS and CGMS on developing data format and metadata standards, as well as procedures for monitoring satellite data availability and quality</p> <p>Promote the exploitation of commonalities of instruments on the new meteorological satellites in generation of product and training material</p>	2016-2018	<p>IPET - SUP and WMO SP Secretariat, SCOPE-CM Executive Panel, and SCOPE-Now casting Coordination Group</p>	<p>SCOPE-CM IP under review</p> <p>Four Pilot Projects in progress</p>	
7	<p>Keep under review the needs of WMO Members for training in satellite meteorology and related fields, and engage with the Management Group of the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) to address these needs, towards full utilization of satellite data from operational and R&D satellites, in accordance with the 2015–2019 Virtual Laboratory Training Strategy;</p>	<p>Regular reviews of the VLab status, activities and plans (training resources, courses, meetings, newsletters);</p> <p>Support existing VLab CoEs and the establishment of new ones;</p> <p>Provide guidance to meet users' needs, especially from less developed Members and for the next generation of satellites;</p> <p>Explore training partnerships</p> <p>Contribution to training resource development</p>	Continuous activity	<p>VLMG, WMO SP Office and IPET-SUP</p>	<p>VLab 2015-2019 strategy updated</p> <p>Events on user preparedness planned</p> <p>Joint COSPAR/VLab training event on space weather planned for August 2016</p>	
8	<p>Holding joint and/or overlapping meetings with ET-SAT as appropriate, to facilitate interaction between users and providers of satellite systems, data and products</p>	<p>Plan for joint session of ET-SAT and IPET-SUP in 2017</p>	2017/4	<p>WMO SP Office</p>		

9	Coordinate with ET-SAT with a view to making recommendations and receiving input on matters, such as the exchange, management, and archiving of satellite data and products, radio frequency utilization, as well as education and training and other appropriate capacity-building measures related to the use of satellite data in all WMO Programmes, including support to resource mobilization activities;	As above Exchange meeting reports Engage with ET-SAT on specific issues as required, such as developing the Vision for WIGOS space-based component systems in 2040	Ongoing	WMO SP Office, IPET-SUP Chair		
10	Coordinate with WMO Technical Commissions and Programmes, including co-sponsored Programmes, activities related to satellite utilization and products, through ex-officio membership on the Team	Increase engagement with WMO Technical Commissions, including JCOMM, CCI and CHy Develop and implement communications strategy	Ongoing 2015/4	IPET-SUP Chair and WMO SP Office IPET-SUP Chair		

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AGENDA AND WORK SCHEDULE

WORLD METEOROLOGICAL ORGANIZATION

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

 SECOND SESSION
 GENEVA, SWITZERLAND, 23-26 FEBRUARY 2016

IPET-SUP-2/Doc. 1.2(1) REV.1
 (17.II.2016)

 Original: ENGLISH

PROVISIONAL AGENDA

TUESDAY, 23 February 2016		<i>Approx. Time incl. Discussion</i>
8:30	Registration (Salle 7 LAKE)	
9:00	1. ORGANIZATION OF THE SESSION 1.1 Opening of the session (<i>Chair</i>); Welcoming Remarks (<i>WMO</i>) 1.2 Adoption of the agenda 1.3 Working arrangements for the session	15'
9:15	2. CHAIRMAN's REPORT, WORK PLAN (<i>Rea</i>)	15'
9:20	3. GUIDANCE FROM THE CHAIRPERSON OF OPAG IOS (<i>Rea, Dibbern</i>)	5'
9:40	4. ACTION REVIEW AND RELEVANT MEETINGS (<i>Secretariat</i>)	20'
10:00	5. DATA EXCHANGE AND DISSEMINATION 5.1 Satellite Data Dissemination Strategy: Performance Indicators (<i>Rattenborg</i>)	15'
10:15	5.2 Status in Regions 5.2.1 RA I (<i>Wannop, Gitonga</i>)	20'
10:35	<i>Break</i>	20'
10:55	5.2.2 RA II (<i>Uesawa</i>) 5.2.3 RA III/IV (<i>Machado</i>) 5.2.4 RA V (<i>Rea</i>) 5.2.5 RA VI (<i>Wannop</i>) 5.3 Guide to the Direct Broadcast Network (DBNet) (<i>Rattenborg</i>)	20' 20' 15' 10' 30'
12:30	<i>Lunch Break</i>	60'
13:30	5.4 GODEX-NWP Data Exchange Mechanism (<i>Rea</i>) 5.5 Essential Satellite Data: Position Paper (<i>English, Machado, Wannop, Rea</i>)	10' 20'
14:00	6. PREPARING USERS TO NEW GENERATION SATELLITES 6.1 SATURN Status: Adding LEO Satellites, User Feedback (<i>Rattenborg</i>) 6.2 Himawari-8: Experiences and Lessons from AOMSUC-6 (<i>Uesawa</i>) 6.3 Himawari-8: User Feedback I (<i>Rea, with input from ECMWF</i>) 6.4 Himawari-8: User Feedback II (<i>Connell</i>) 6.5 Reference User Readiness Project (<i>Rattenborg</i>)	15' 20' 15' 15' 20'

15:25	Break	20'
15:45	7. SCOPE PROJECTS: NOWCASTING AND CLIMATE MONITORING	
15:45	7.1 SCOPE-Nowcasting: Pilot Project Updates	
	7.1.1 Imagery and RGBs for SWFDP in RA II/V (PP 1) (<i>Uesawa, Rea</i>)	20'
	7.1.2 Volcanic Ash Algorithm Intercomparison (PP 2) (<i>Pavlonis, webex</i>)	20'
	7.1.3 Global Quantitative Precipitation Estimates (PP 3) (<i>Machado</i>)	20'
	7.1.4 Sand and Dust Monitoring in RA II (PP 4) (<i>Fang</i>)	20'
	7.1.5 Review of work plan and potential new activities (<i>Rea</i>)	10'
17:15	7.2 SCOPE-Climate Monitoring: Status, Implementation Plan (<i>Doutriaux-Boucher, Secretariat; Keams, Chair of Executive Panel</i>)	30'
17:45	Adjourn for Day 1	

WEDNESDAY, 24 February 2016

		<i>Approx. Time incl. Discussion</i>
9:00	8. VISION FOR THE WIGOS COMPONENT SYSTEMS IN 2040 (<i>Secretariat</i>)	30'
9:30	9. SATELLITE APPLICATIONS	
	9.1 Report by Commission for Climatology Task Team on the Use of Remote Sensing Data for Climate Monitoring (<i>Hollmann</i>)	20'
	9.2 JCOMM Needs for Satellite Data (<i>Fellous; Dorandeu, Mercator-Océan</i>)	15'
	9.3 Satellite data needs of the hydrological community (<i>Secretariat</i>)	20'
	9.4 Validation of INSAT-3D derived rainfall (<i>Goyal</i>)	20'
	9.5 Proposed Integrated Global Greenhouse Gas Information System (<i>Tarasova</i>)	20'
10:45	Break	15'
11:00	10. METADATA, DATA FORMATS AND TOOLS	
	10.1 WIS Metadata: Report by CGMS-WMO Task Force (<i>Rattenborg; Aubert, EUMETSAT, webex</i>)	15'
	10.2 WIGOS Metadata Standard: Satellite Community Update (<i>Secretariat</i>)	15'
	10.3 Update on ecCodes and community building (<i>Fucile, ECMWF, webex</i>)	15'
11:45	11. OSCAR/SPACE V2.0 (<i>Secretariat</i>)	25'
12:10	12. USER SURVEYS	
	12.1 Results of Regional survey in RA III/IV (<i>Machado</i>)	20'
12:30	Lunch Break	90'
13:45	13. TRAINING AND EDUCATION	
	13.1 VLab update and plans (<i>Podgaiskii, VLab Co-Chair Representative</i>)	30'
	13.2 Conceptual models for the southern Hemisphere (CM4SH): Results and way forward (<i>Podgaiskii, VLab Co-Chair Representative</i>)	15'
14:45	14. COMMUNICATION PLAN (<i>Rea</i>)	15'
15:00	15. SPACE WEATHER	
	15.1 WMO Coordination and 2016-2019 Plan (<i>Onsager, Co-Chair, Inter-Programme Coordination Team on Space Weather, webex</i>)	30'
	15.2 COSPAR Training Event on Space Weather (<i>Fellous</i>)	10'
15:40	Break	20'

16:00	MATTERS ARISING FROM INFORMATION DOCUMENTS	20'
16:20	ORGANIZATION OF BREAK-OUT GROUPS	20'
16:40	BREAK-OUT GROUPS ON TOPICS ARISING IN SESSION (IN ROOMS 7 LAKE, 7 JURA, 6 LAKE)	60'
17:40	<i>Adjourn for Day 2</i>	
19:00	<i>Group Dinner</i>	

THURSDAY, 25 February 2016

		<i>Approx. Time incl. Discussion</i>
9:00	ALL DAY : WORK IN BREAK-OUT GROUPS (7 LAKE, 7 JURA, 6 LAKE)	
11:45	INTERIM REPORTS TO PLENARY (7 LAKE)	45'
12:30	<i>Lunch Break</i>	70'
13:30	ALL DAY : WORK IN BREAK-OUT GROUPS (7 LAKE, 7 JURA, 6 LAKE)	
16:30	INTERIM REPORTS AND DISCUSSION IN PLENARY	90'
17:30	<i>Adjourn for Day 3</i>	

FRIDAY, 26 February 2016

		<i>Approx. Time incl. Discussion</i>
9:00	16. REVIEW AND ADOPTION OF THE DRAFT REPORT	90'
10:30	<i>Break</i>	20'
10:50	16. REVIEW AND ADOPTION OF THE DRAFT REPORT (cont'd)	90'
12:20	17. MEMBERSHIP (Secretariat)	20'
12:40	18. ANY OTHER BUSINESS	10'
12:50	19. DATE AND PLACE OF NEXT MEETING	10'
13:00	<i>Adjourn Session</i>	

DOCUMENTS FOR INFORMATION (see overleaf)

DOCUMENTS FOR INFORMATION

(NO PRESENTATION; AT CHAIR'S REQUEST, SHORT VERBAL INTRODUCTION ONLY)

- I.1 **SATELLITE APPLICATIONS**
Atmospheric composition: Update of observation requirements (*WMO GAW Secretariat*)
Use of satellite-derived data in minimizing adverse weather impacts in Kenya (*Gitonga*)
- I.2 **INTERNATIONAL SCIENTIFIC WORKING GROUPS**
Sounding – 20th ITOVS Study Conference Oct 2015 (*English*)
- I.3 **ARCHITECTURE FOR CLIMATE MONITORING FROM SPACE:**
Report on Case Studies (*Secretariat*)
- I.4 **WMO SPACE PROGRAMME ONLINE RESOURCES**
Product Access Guide, Data Access, Tools (*Secretariat*)
- I.5 **USER SURVEYS**
WMO Survey 2016 (*Keogh, Wannop, Eckman, Uspensky*)
- I.6 **TRAINING AND EDUCATION**
COSPAR Plans for Training Events 2016-2018 (*Fellous*)
NOAA/NWS training plan 2016 to prepare for GOES-R (*Mostek*)
- I.7 **UPDATE ON EVENTS**
INF.7.1. AOMSUC-6 Report, Plans for AOMSUC-7 and AOMSUC-8 (*Uesawa*)
INF.7.2 EUMETSAT Conference 2016 (*Wannop*)
- I.8 **IPET-SUP Work Plan**

MEETING URL: <http://www.wmo.int/pages/prog/sat/meetings/IPET-SUP-2.php>

ACTIONS OF IPET-SUP

ACTIONS	DEADLINE
ACTION 2.1: Secretariat to screen WMO 2016 survey responses for any major geographic or user community gaps prior to closure, for remedial action.	10 March 2016
ACTION 2.2: Secretariat to draft a letter to EUMETSAT indicating the needs of the global NWP centres for accessing near real-time Sentinel-3 data, with a request to explore options for distribution of such data. High-level requirements of the centres for such data should be included in the letter.	31 May 2016
ACTION 2.3: Secretariat to add, in coordination with NOAA, the RA III-IV Roadmap for Satellite Data Distribution to the GOES-R content on SATURN.	15 March 2016
ACTION 2.4: Secretariat to make available an interim version of the WIGOS Metadata Standard, for further discussion by the satellite community (CGMS operators, other providers of satellite data and products).	1 May 2016
ACTION 2.5: INPE to finalize the report on the Regional Survey in RA III/IV in English, Spanish, and Portuguese; the report should be published on the RA III/IV SDR Group website and on the WMO Space Programme website.	30 April 2016
ACTION 2.6: VLMG should develop a process for quality management of the CoEs, including self-assessment, using the review of the WMO Regional Training Centres as a model. By: VLMG-8.	9 May 2016
ACTION 2.7: S. Wannop and G. Aubert to look at CMEMS parameter categorisation and to apply the same approach to the wider satellite products.	31 March 2016
ACTION 2.8: S. English and M. Rattenborg to propose a high-level typology of level 1 products.	31 March 2016
ACTION 2.9: CGMS-WMO Task Force to provide a revised WIS Metadata abstract to the Team.	15 April 2016
ACTION 2.10: S. English to explore options at ECMWF to generate regular monitoring reports (on availability and quality), based on their routine monitoring of satellite data streams.	30 April 2016

ACTION 2.11. A. Rea to consult with NOAA on the framing and content of this position paper.	31 March 2016
ACTION 2.12. A. Rea to report on the discussion at the meeting of IPET-OSDE in April 2016	11 April 2016
ACTION 2.13. Task team to prepare a new draft of the position paper. By 31 Mar 2016	31 March 2016
ACTION 2.14: VLab co-chairs to send IPET-SUP comments on the Satellite Skills document to the authors.	15 March 2016
ACTION 2.15: Secretariat to draft a letter by the joint ISWGs on support for OSCAR/Space, and invite the ISWG chairs to sign.	30 April 2016
ACTION 2.16: L. Machado to make available Survey draft report for comments in English.	31 March 2016
ACTION 2.17: Prior to the SDR, undertake an investigation of the level of readiness of users in RA III/IV for GOES-R and JPSS, through analysis of survey results and existing information (Roadmap, User Readiness Project), to develop suggested solutions for every country (Machado).	30 June 2016
ACTION 2.18: Team to provide final comments on the Reference User Readiness Project document.	15 March 2016
ACTION 2.19: WMO to publish the final version of the Reference User Readiness Project, and to translate it into French, Spanish, and Russian.	31 July 2016
ACTION 2.20: Team to provide comments on the draft Vision for the WIGOS space-based components in 2040.	24 March 2016
RECOMMENDATIONS	
RECOMMENDATION 2.1: The session suggested that Secretariat should systematically report at sessions of the Team on usage statistics of its online resources (SATURN, OSCAR/Space, PAG – see IPET-SUP-2/INF.4).	
RECOMMENDATION 2.2: JMA and BOM to provide a report on the Himawari-8 rapid scan study in support of the RA II/V WIGOS satellite project to the next session.	
RECOMMENDATION 2.3: The RA II WIGOS Project Coordination Group should pay due	

attention to the needs of Members in the western part of RAll in its deliberations; the report to the next session should reflect this.	
RECOMMENDATION 2.4: The Secretariat to ensure continuous provision of the DBNet data load modelling tool.	
RECOMMENDATION 2.5: The session endorsed the final version of the DBNet Guide, and recommended the document for endorsement by CBS as best practices for DBNet.	
RECOMMENDATION 2.6: The Team commended the effort undertaken on volcanic ash algorithm intercomparison under SCOPE-Nowcasting Pilot Project 3, congratulated the group for its achievements so far, supported future collaboration with the modelling community and recommended that opportunities be explored to fund the continuation of analysing the results of the intercomparison.	
RECOMMENDATION 2.7: SCOPE-Nowcasting Pilot Project 4 should seek collaboration with the SDS-WAS Asian node and potentially other SDS-WAS centres; consideration of lidar data should also considered when comparison AOD results from various sources.	
RECOMMENDATION 2.8: The session recommended that the project self-assessment of maturity be discussed at the next meeting of the SCOPE-CM Executive Panel. A review of open Actions (including identification of potential ICDRs) as well as a clear specification of SCOPE-CM plans over the next 3 years in the context of the Climate Architecture should be developed at this meeting.	
RECOMMENDATION 2.9: Future funding of CM4SH should be considered in the broader context of the VLab Trust Fund, rather than being treated as a separate issue.	
RECOMMENDATION 2.10: The Team noted the opportunity presented by the COSPAR workshop for capacity building in space weather, and recommended that the WMO Secretariat provide financial support, advertise the workshop and contribute to orienting the workshop to respond to operational user as well as research needs.	
RECOMMENDATION 2.11: SCOPE-Nowcasting partners to explore the possibility for a new pilot project on tropical cyclones.	
RECOMMENDATION 2.12: Include RGBs and Himawari-8 AHI-related adjustments to the WMO/EUMETSAT RGB standard as subject of a training event at AOMSUC-7	
RECOMMENDATION 2.13: WMO, together EUMETSAT, NOAA, CMA and JMA, to organize a	

RGB best practices workshop in late 2017.	
RECOMMENDATION 2.14: Authors of the paper to provide update at VLMG-8.	
RECOMMENDATION 2.15: The group recommended the establishment of a Scientific Management Team (to ensure maintenance of content and QC), possibly divided up e.g. by WMO Region.	
RECOMMENDATION 2.16: ISWG co-chair to consider writing a joint letter to WMO, emphasizing the importance of OSCAR/Space as a community resource.	
RECOMMENDATION 2.17: Maintenance of OSCAR/Space should be subject of a joint ET-SAT/IPET-SUP meeting.	

Task Teams established within IPET-SUP

CGMS-WMO Task Force on Metadata Implementation (participants from IPET-SUP)

Mikael Rattenborg
Daniele Biron

WIGOS Metadata Standard (participants from IPET-SUP)

Guillaume Aubert (nominated through Sally Wannop)
Leon Majewski (nominated through Anthony Rea)

PAG management task team

Sally Wannop
Daniele Biron
Anthony Mostek
Xiang Fang
Hidehiko Murata

Task Team on Position paper on essential satellite data

Stephen English
Sally Wannop
Luiz Machado
Anthony Rea
Rainer Hollmann