COMMISSION FOR BASIC SYSTEMS

OPEN PROGRAMME AREA GROUP ON INTEGRATED OBSERVING SYSTEMS

INTER-PROGRAMME EXPERT TEAM ON SATELLITE UTILIZATION AND PRODUCTS

FOURTH SESSION

GENEVA, SWITZERLAND

26 FEBRUARY – 1 MARCH 2018

FINAL REPORT
Regulation 42

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

Regulation 43

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

The fourth session of the Inter-Programme Expert Team on Satellite Utilization and Products (IPET-SUP) was convened in Geneva, Switzerland from 26 February – 1 March 2018.

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.

The session focussed on user preparation for the new-generation meteorological satellites GOES-16 and FY-4A, as well as NOAA-20 and FY-3D. In this context, participants discussed early availability of instrument characteristics to users, such as on the SATURN portal, continuity of product lines, and exchange, dissemination and monitoring of datasets at global and regional levels. The session discussed ways to monitor global satellite data availability and quality in support of the WIGOS Data Quality and Monitoring System (WDQMS).

Advancing the use of WMO metadata standards (WIGOS and WIS) by satellite operators, and interfacing these with the OSCAR/Space resource were further items of consideration by the Team. Coordinated and where appropriate standardized product development for nowcasting and climate monitoring was subject of discussions, as well as progress with education and training in the WMO-CGMS Virtual Laboratory (VLab).

The Team strives to reach out to satellite data user communities in climate, oceanography and marine meteorology, hydrology, and in the area of land surface modelling for NWP, and fosters community building, the definition of user requirements, and linkage to satellite operators in CGMS.

A major item for discussion was finalization of a position paper on critical satellite data for WMO applications, and implications of a possible revision of WMO Resolution 40 Annex 1.

The Team furthermore reviewed its communication strategy with the various stakeholders within and outside WMO, and gave guidance on the development of WMO Space Programme online resources, such as SATURN and OSCAR/Space.
From left to right (front rows): Simon Keogh, Mikae Rattenborg, Sally Wannop, Stephen English, Werner Balogh, Xiang Fang, Natalia Donoho, Riris Adiyanto, Stephan Bojinski

From left to right (back row): Richard Eckman, Jae-dong Jang, Rainer Hollmann, Mariane Diop Kane, Luiz Machado
1. ORGANIZATION OF THE SESSION

1.1 Opening of the session

The session opened at 9.00 on Monday 26 February 2018 in room 7 LAKE in WMO Headquarters, Geneva, Switzerland. The meeting was chaired by Stephen English (European Centre for Medium-Range Weather Forecasts - ECMWF).

The objective of this third session was to organize the Team's activities around the 2016-2019 IPET-SUP work programme defined by the WMO Commission for Basic Systems (CBS), in particular: global and regional satellite data exchange issues; technical and programmatic aspects of satellite data distribution and access; consistent use of metadata for discovering and describing satellite data; Sustained Coordinated Processing of Environmental Satellite Data (SCOPE) mechanisms to foster consistent satellite product generation; preparing users to the new generation of satellites; training and education.

Fernando Belda (D/OBS) opened the meeting and recalled the CBS Technical Conference in March 2018 which prepares CBS-related documents for WMO EC and Cg-18 in 2019. WMO is planning to adopt a new governance structure; IPET-SUP is invited to provide comments on its future work programme.

He reminded the Team of its important role in three areas:

- Transfer of knowledge to Members
- Standards in generation of satellite-based datasets and products
- Facilitate satellite distribution and exchange, based on user requirements

This session should be aware of the following five objectives:

1. Assess the status of user preparedness in all WMO Regions, and advice on further enhancements of technical assistance and capacity building
2. Assess gaps and develop technical guidance to improve satellite data exchange over the WIS
3. Discuss a prototype for monitoring global satellite data quality, in support of the WIGOS Data Quality Monitoring System (WDQMS)
4. Assess progress in engaging international user communities in the use of satellite data, including in the air quality, met-ocean and hydrology domains
5. And, very importantly, consider its work on defining critical satellite data principles in light of the possibility of revising the Annex to WMO Resolution 40, as discussed at the recent 10th session of the ICT-IOS

F. Belda outlined the proposed new governance structure of WMO, consisting of a commission for infrastructure, and a commission for applications.

1.2 Adoption of the agenda

A provisional agenda was developed by the IPET-SUP Chair and the Secretariat. The agenda, as contained in IPET-SUP-4/Doc. 1.2(1), was submitted to the session for adoption.

1.3 Working arrangements for the session

The work of the session was conducted in Plenary and in break-out groups. Working documents are available through the IPET-SUP-4 web page: http://www.wmo.int/pages/prog/sat/meetings/IPET-SUP-4.php.
2. **CHAIRMAN’S REPORT AND HANDOVER OF DUTIES**

The IPET-SUP Chairman provided his views and strategic priorities in advancing the Team's work programme, and specific guidance for the session.

S. English recalled that there have probably never been data from so many new satellites being made available in a short period of time, which makes the role of the Team more important than ever.

Following the success of the Fiduceo and GAIA-CLIM European Commission Horizon2020 projects, it is natural to consider the questions of reference standards, especially in a future where we may have many poorly calibrated but potentially useful observations (e.g. from constellations of cubesats). IPET-SUP users have quite different requirements on calibration and validation standards. This item should be considered in the future Work Programme of the Team.

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

The Chairperson of the CBS Open Programme Area Group on Integrated Observing Systems (OPAG IOS), Anthony Rea, in coordination with the Chair, informed the Expert Team on his expectations from IPET-SUP in the context of OPAG IOS. He also provided an overview of the WMO governance in which the Team operates. IPET-SUP should develop ideas for its work programme in the period 2020-2023.

A. Rea recalled the governance structure of World Weather Watch, consisting of CBS and CIMO. CBS has four Open Programme Area Groups (OPAGs), on IOS, ISS, DPFS, and PWS. The OPAG IOS looks at all components of the observing systems in the WIGOS sense, with expert teams on aircraft-based, surface-based observations, and satellite observations.

Recognition that definition of essential data in WMO Resolution 40 is largely framed around the use of satellite data for nowcasting, rather than reflecting today's broad use of satellite data for example in NWP and climate.

A WIGOS team led by Sue Barrell on emerging data issues reflected on public-private partnerships (Ref: IPET-SUP-4/Doc.3); another team under leadership of Mike Manore looked at WIGOS data partnerships for surface-based data (draft 1.9 of the report is available at [https://www.wmo.int/pages/prog/www/WIGOS-WIS/meetings/ICG-WIGOS-7/WDP%20Guidance%20Document%20V19%2020180112%20clean.docx](https://www.wmo.int/pages/prog/www/WIGOS-WIS/meetings/ICG-WIGOS-7/WDP%20Guidance%20Document%20V19%2020180112%20clean.docx)).

Strong direction was received from CBS and WMO management to review the Annex 1 to WMO Resolution 40. A break-out group is planned during the CBS Technical Conference (TECO) meeting 26-29 March 2018 in Geneva, Switzerland, which will consider input from the various CBS expert teams and compile a revised Annex to Resolution 40, for submission to EC-70 in June. Participation by an IPET-SUP representative in the CBS TECO is recommended.

**ACTION 4.1: A representative from IPET-SUP to participate in the CBS Technical Conference held 26-29 March 2018 in Geneva, Switzerland. Identify a representative by 15 March 2018.**

In the output from IPET-SUP-4, the principles should be there, supplemented by a list of datasets to which the principles should be applied. The supplemental list would provide a basis for discussion.

He suggested two more items for discussion:

- Can some of the approaches taken in IPET-SUP in collecting user requirements and identify gaps be adopted in other expert teams (e.g., marine)?
How does “New Space” and other trends in technology shape WMO, the meteorological community, and IPET-SUP in particular? (This item was discussed in break-out group 6.)

4. ACTION REVIEW AND RELEVANT MEETINGS

The Chair and Secretariat provided a review of IPET-SUP Actions.

Some comments:

Action 3.6: Follow-up with operators and CGMS-WMO task force; delay until end of 2018
Action 3.7: covered in a CGMS-WMO task force paper to CGMS-46
Action 3.10: ongoing; to be closed since firm intention to provide S-3 data over GTS; a high-level agreement between WMO and the European Commission on Copernicus is recommended, to frame provision of Sentinel data to the global community
Action 3.22: DPFS monitoring webpage needs updating (no response from WMO internally)

5. PREPARING USERS TO NEW GENERATION SATELLITES

This item introduced an overarching theme for the session, with focus on user readiness and updates with regard to the new-generation geostationary (GOES-16, FY-4A) and low-Earth orbiting (NOAA-20, FY-3D) satellite systems. The session looked specifically at the air quality community and efforts to improve its preparedness to the novel data types.

5.1 GOES-16 and GOES-S

N. Donoho briefed on the status of the GOES-R series, with GOES-S set for launch on 1 March 2018 at 23.00 CET. NOAA published a process for international users to request Mesoscale Domain Sectors (which was forwarded to the RA-3-4-SDR group). She showed the GOES-16 and GOES-S post-launch science product validation schedule. NOAA organized a workshop and provided trainers and organizational support to 3 other workshops this past year for the international community. Training support continues through COMET, the International Desk, and a newly-formed GOES International Training Working Group (GITWG) to assess, coordinate, and plan for training activities in response to increasing user requests. Eric Madsen (NOAA Int’l Affairs) is the liaison between the GITWG and RA-3-4-SDR.

INPE and NOAA organized a successful testbed for the MDS service during a field campaign in Brazil. The Team enquired on who would be authorized to request the service from NOAA. WMO sent a letter to Members of RA II and RA V informing about the HimawariRequest service.

ACTION 4.2: N. Donoho to clarify who the authorized users of the MDS international request services are.

In 2019, a joint NOAA, AMS and EUMETSAT Satellite User Conference is planned at the Westin Plaza Hotel in Boston (MA), USA.

The Team asked about the plan for overlap between GOES-15 and GOES-S products, since there are issues in this transition from GOES-13 and GOES-16. Operational GOES-16 AMV and CSR data are not available to ECMWF. There are also issues encountered by the MetOffice Space Weather prediction centre in using GOES-16 space weather mission data.
ACTION 4.3: N. Donoho to enquire on the transition plans from GOES-15 to GOES-S, in particular regarding products (AMV, CSR, space weather data, for example).

RECOMMENDATION 4.1: NOAA should communicate information about the transition from GOES-15 to GOES-S to both the RA-3-4-SDR Group and the RA-V Task Team on Satellite Utilization.

ACTION 4.4: Secretariat to send information about RA-V TT-SU and the recent WMO nomination letter to N. Donoho.

5.2 FY-4A

X. Fang briefed on the FY-4A payload, in comparison to other GEO new-generation satellites. In-orbit testing has been finished, and FY-4A will be operational in March 2018. Details on the acquisition patterns are provided. He showed calibration results for AGRI and GIIRS in terms of geolocation accuracy, and spectral bias and random uncertainty. Comparison of FY-4A products is done with other products, such as from Himawari-8, NOAA satellites. There are products on tropopause folding, quantitative precipitation, and a comparison of these with lightning events. CMA also looked at lightning events during typhoon NESAT. Two types of GIIRS products: temperature and humidity profiles, in comparison with IASI showing small systematic uncertainty (bias). He showed some air quality products (PM2.5, dust index), as well as fire and snow products.

In support of user readiness, CMA looks into create a national and provincial application architecture, inspired by the EUMETSAT SAFs. 30 application demonstration projects were set up, based on key application fields. Upgrades were made to 34+29 HRIT stations (for provincial and int'l users), CMACast user stations (for int'l and city-level users), DCP (for users in remote areas). Training is delivered through the WMO Regional Training Centre Beijing (onsite and through VLab).

R. Adriyanto enquired on CMA plans to enable special user requests for rapid scan from FY-2 and FY-4A. CMA does its best to respond to these needs. On the future FY-4 satellites, a dedicated rapid scanning imager is planned.

5.3 NOAA-20

N. Donoho provided an update on NOAA-20 including the data release plan and product availability. User readiness and training material is provided through SATURN and through training workshops on CSPP. NOAA established the High Rate Data Users Group to address direct readout issues, with participation by station manufacturers.

R. Adriyanto enquired on contacts in the S-NPP and JPSS teams to provide information on data services and training.

ACTION 4.5: NOAA to update SATURN with updated JPSS content, particularly regarding data services and training.

S. English appreciated that the SRFs of ATMS were published in advance.

5.4 FY-3D

X. Fang informed about FY-3D payloads and products, including MERSI-II, HIRAS, MWRI, MWTS, and MWHS. Data services consist of direct readout, CMACast, GTS, and through the website. There are plans for the satellite to go operational soon.
S. Keogh enquired on availability of preprocessing software to use FY-3D data; such software will be made available soon (and followed up through DBNet).

S. English stressed the need for the SRFs from the MW instruments to be made available publicly (on SATURN). A large array of atmospheric composition products is planned.

WMO congratulated CMA that MWHS data are now being made available over the GTS.

5.5 Readiness of user communities

5.5.1 Air quality

R. Eckman provided an overview of the air quality missions (TEMPO, GEMS, Sentinel-4; Sentinel-5p) which will provide unprecedented resolution and precision on air quality parameters. The TEMPO mission is engaging diverse user communities to prepare for the rapid uptake and utilization of these datasets for air quality forecasting, health, wildfire, and other impacts.

End user communities for air quality measurements include:
- Air quality forecasters
- Public health practitioners
- Wildfire forecasters
- Agricultural practitioners
- Disaster risk reduction practitioners

Considering the coverage areas of TEMPO, Sentinel-4 and GEMS, there is a lack of Southern Hemisphere coverage. He gave a summary on the focus of Sentinel-4 and Sentinel-5 and Sentinel-5p (short-lived constituents vs long-lived gases).

Operational air quality users:
- Are primarily forecasters, state/local air quality forecasters
- Require simple tools and data formats

TEMPO core engagement areas have been on:
- Air quality forecasting
- Planning and assessment
- Emissions
- Health, agricultural and environmental impacts

Coordination across agencies is effective through the CEOS Atmospheric Composition Constellation.

Product dissemination now includes provisions for near real-time access to TEMPO products, through websites of EPA and NOAA.

The Applied Remote Sensing Training (ARSET) group at University of Maryland (led by Ana Prados) has produced webinars on data analysis tools for high-resolution air quality satellite dataset. ([http://arset.gsfc.nasa.gov](http://arset.gsfc.nasa.gov)).

R. Eckman distributed the Guideline on Best Practices to User Readiness to the TEMPO team, further follow-up is required.

The air quality and GHG user communities are overlapping, but distinct; some missions address both (pollution events vs emissions of long-lived constituents; long-lived vs short-lived GHGs/constituents). The GEOCarb mission aims at GEO-based GHG monitoring.

Lack of SH coverage is a technological limitation.
Have user communities been requesting 3MI data outside Europe? – There does not seem to be a lack of interest, but possibly a lack of information.

The CEOS ACC itself does not invite users, but science teams organize user workshops.

6. DATA EXCHANGE, DISSEMINATION, AND MONITORING

This agenda item addressed both strategic and technical aspects of satellite data exchange and dissemination, at global and regional levels. Progress and plans of the WMO Region-based satellite data user groups were reviewed, in particular with regard to the readiness of users for next-generation satellite data. The session looked at status and impediments to the use of the WIS for distribution and exchange of satellite data. It was informed on the implementation status of the Direct Broadcast network for near-real time relay of low-Earth orbit satellite data (DBNet). The session considered evolving needs of the global NWP community organized in the GODEX-NWP mechanism (Global Data Exchange for NWP).

Further, the Team reviewed progress in developing a position paper on critical satellite for WMO applications in light of the changing landscape of public and private satellite data providers.

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.

6.1 Regional Satellite Data Requirements and Exchange

6.1.1 RA-I

M. Diop-Kane recalled purpose, composition and recent activities of RAIDEG. She reported on the 8th meeting of RAIDEG held on 1-2 Nov 2018 in Geneva, Switzerland, with a focus on climate-related matters and with participation by the chair of the RA-I Working Group on Climate Service and Adaptation. EUMETCast-Africa will start a new service on 1 May 2018. EUMETSAT provided an update on its services to African users; reports from sub-regional groups emphasized issues with the PUMA upgrade, and needs for training and train the trainers. NWP production centres and C3S updates were also provided. There is high need for raising user awareness of new products. The GMES EU-AUC project started last year as a successor to MESA.

There is a definite need for training in RA-I related to the C3S Climate Data Store.

A decoupler can be installed in a visualization system to de-couple model resolution from resolution of the visualizer (S. Keogh). The SYNERGIE software does not have this.

6.1.2 RA-II

JMA launched the HimawariRequest service, in collaboration with BoM in Jan. 2018, allowing NMHS users in Himawari8/9 coverage area to request Target Area observation. Details on the HimawariRequest service are provided in IPET-SUP-4/INF.2. A response time to user request of 3-6h is envisaged by JMA.

The RAII WIGOS Project plans to develop and conduct a regional user survey in 2018 in coordination with the RA-V Task Team on Satellite Utilization. The Project coordinators and the Task Team lead are looking into adopting the user requirements template used in RA III-IV for collecting satellite data needs with the cooperation of CMA, JMA and KMA.
6.1.3 RA-III/IV

L. Machado briefed on the status of the RA-3-4-SDR group and its work, in particular its 3rd meeting held in July 2017 in New York City, NY, USA. The GEONETCast-Americas community has 78 operational stations in 19 countries. He noted the recommendation to add data from the remaining CMI bands of ABI to GNC-A. NOAA currently does not accept new international applications to access the PDA.

N. Donoho raised an interest to brief the RA-3-4-SDR group on latest developments with GOES-16 and NOAA-20 products.

The dates for a next teleconference of the RA-3-4-SDR need to be decided.

**ACTION 4.6: RA-3-4-SDR Chairs and Secretariat to agree on a new meeting date for the Group.**

S. English asked whether the training needs of the Region were all being addressed. This is being worked on through VLab and further iterations in the Group.

6.1.4 RA-V

R. Adiyanto reported on the status of regional satellite data reception in the South-West Pacific region. Himawari-8 is used as primary meteorological satellite. Himawari data reception is enabled through the HimawariCloud and HimawariCast (JMA-WMO project helped install reception system in 7 countries).

Satellite data is mostly used for short-range weather forecasting. Only few countries have been implementing in-house satellite data processing capabilities. Some advanced products are used in a few countries, such as IR-enhanced, WV-enhanced, natural colour/true colour, RGBs, convective cloud detection, cloud types, rainfall potential, and hotspot detection.

Web-based satellite product dissemination has been mostly implemented by NMHSs in SW Pacific.

He provided a list of weblinks to satellite product webpages maintained by NHMS in the Region. Most NMHSs still use geostationary data only. GSMaP satellite-based QPE from JAXA have also being used operationally in several member countries for rainfall monitoring – Indonesia, Tonga, Solomon Islands.

The HimawariRequest protocol information has been received, and there is great hope to put it to good use in the Region.

There are plans to undertake a regional satellite user survey in 2018, under coordination by JMA, KMA and BoM.

The WMO Space-based Weather and Climate Extremes Monitoring Demonstration Project (SEMDP) pilot project for SE Asia and SW Pacific was noted.

6.1.5 RA-VI

S. Keogh briefed on new developments in Region VI. There are many users of Himawari-8 products on EUMETCast, currently provided at 2km resolution every 30 minutes. The transition to GOES-16 is ongoing. Transition from Meteosat-10 to Meteosat-11 has occurred earlier this month. Meteosat-IODC has significant impact on RGB icing potential products as well as on global NWP (CSR).
The “triple Metop” opportunity is coming up. The MTGUP! Preparation project has started at EUMETSAT, with a first user workshop in November 2017.

He foreshadowed the increase of data rates to be transmitted over EUMETCast; each horizontal grey line means adding a transponder to the service. Some EUMETSAT Member states face issues in using the planned EUMETCast-Terrestrial service (due to legal problems in using research networks for non-research reasons). To receive the full range of data, users will have to purchase additional DVB-S2 receivers, one per transponder. The bandwidth limit per transponder is 75Mbit/s.

S. Wannop shared information about training events held by EUMETSAT in RA VI; a new VLab training calendar is hosted by EUMETSAT.

S. Keogh informed about the revamped NWPSAF website as a global resource, used for DBNet data monitoring.

6.2 WIS and Satellite Data

6.2.1 WIGOS Metadata Standard and OSCAR/Space

G. Aubert briefed on both items. The CGMS-WMO TFMI has contributed to the creation of the official WMO Core Profile 1.3 metadata creation document. WIGOS Metadata implementation by satellite operators is yet to happen.

The WIGOS Metadata Standard (WMDS) is to provide information on the observation as opposed to the WIS metadata which is discovery metadata. The initial version of the WMDS was approved by Cg-17 (2015), as part of WMO Technical Regulations (attachment to the Manual on WIGOS, WMO-No.1160) and an updated version has been published in 2017 as a stand-alone document, WMO-No 1192. The implementation of the WIGOS metadata via OSCAR/Space should ultimately replace the WMO-No.9, Vol. A. A WIGOS metadata representation (wmdr) model has been developed for the exchange of metadata.

The corresponding xml schema and schematron rules are available for automatically validating created metadata records.

There is a need to identify satellite operators that volunteer to validate the wmdr for satellite observations, to prepare for the uptake of the WMDS by satellite operators.

Currently no xml feed into OSCAR/Space is possible; G. Aubert asked whether there is a roadmap to modify OSCAR/Space to be able to accept WIGOS MD-compatible metadata records, and whether there are there provisions to create an API to OSCAR/Space (currently no).

Wmdr testing in 2018 could include: (i) create Wmdr observation capabilities metadata records, and to report issues to the TT-WMD team by August 2018; (ii) EUMETSAT is committed to create some observation metadata records by May/June 2018 (covering GEO and LEO missions).

He suggested to organize the uptake of the WIGOS MD standard for CGMS operators, and to define a roadmap for the evolution of OSCAR/Space to use the Standard.

Enabling the ingestion of satellite metadata into OSCAR/Space according to the WIGOS MD standard would provide strong support by operators to WIGOS.

Carrying forward the history of observations should be simpler in OSCAR/Space as compared to OSCAR/Surface, since changes to satellite orbit, status are rare compared to surface-based stations.
ACTION 4.7: Secretariat to develop a plan for OSCAR/Space to serve as a repository for the WIGOS MD Standard, and to develop an API that would enable ingestion and exporting of metadata according to the Standard.

6.3 GODEX-NWP

Secretariat briefed a summary of the 1st Global Data Exchange for NWP (GODEX-NWP) meeting, 16-19 May 2017 in Lannion (France), which saw participation from ECMWF, NCEP, NESDIS (part-time webex), JAXA (part-time WebEx), MS Canada, UK MetOffice, DWD, Meteo France, JMA, KMA, BoM, NCMRWF (India), EUMETSAT and WMO. ROSHYDROMET and INMET (Brazil) were invited to complete the list of global NWP centres, but did not participate.

Status report from NWP centres and data providers were provided:

CMA: NWP centres noted with concern that AMV and CSR are not in the product list for FY-4A AGRI. Also they raised questions about the release of GIIRS data for validation. Regarding the GPS RO data from FY-3 GNOS, which have been brought to very good level of quality thanks to cooperation between ECMWF and CMA, it was stated that it was planned to provide these on the GTS, but no details provided.

JMA: It is planned to keep Himawari-9 in cold standby, which will mean a 24-h gap in products in case of severe problems with H-8.

JAXA: Access to AMSR-2 data is still subject to bilateral arrangements with JAXA, hindering a global redistribution.

KMA: CSR will be provided for COMS later in 2017. For the new LEO satellite programme, the launch planning is 2022; development work to start (subject to funding) in 2018 and payload will be ATMS, plus possibly small ancillary payload.

NESDIS: CSR has (unintentionally) been left out of the initial product baseline for GOES-16. Development is now starting, availability expected for 2018. The NESDIS PDA (Production Distribution and Access) system is now operational and will be the prime data source for GOES-16, JPSS and other satellite data in the future.

NCEP: Reported on issues encountered with the early migration to the PDA.

EUMETSAT: Working to improve the global timeliness of HY-2 ocean data (Scat, Altimeter) through cooperation with NSOAS in China. Also EUMETSAT has requested authorization from European Commission to provide Copernicus Data for the GTS/WIS in the future, including Sentinel-3.

The body of the meeting concerns the consolidation and review of the global list of data requirements. The requirements document is an Excel workbook with separate sheet for requirements for different satellite data types.

ACTION 4.8: Secretariat should check whether the requirements for ocean satellite data in GODEX-NWP are consistent with the results from the WMO survey among GPCs for ocean satellite data needs (Ref. IPET-SUP-3/Doc.6.8).

GODEX-NWP provided feedback on the Critical Satellite Data paper:

- It is not entirely clear which principles should apply to the data provider and which should apply to the user.
Concretely, the NWP centres did not understand how a data provider can demonstrate the impact of a dataset. This can only be accomplished by an NWP centre. Maybe in this context the word “impact” should be avoided, as it has a very specific meaning in the NWP community.

- GODEX-NWP felt that the formulation of such principles should also apply to in-situ data. For example experience was described from the privatisation of the GPSmet system, providing ground-based GPS RO data covering the US to NOAA. Here the provider has been doing very badly, when it comes to issues like transparency, quality control and validation, and the data have on several occasions been blacklisted by NCEP.

- In this context, the WIGOS 2040 vision was mentioned, and several members of GODEX-NWP would appreciate visibility of the vision

**DBNet and telecommunications issues:**

GODEX-NWP was happy with the DBNet progress. GODEX-NWP did not feel it could address the telecommunications issues from the new satellite data from both global sources and DBNet. Dialogue with WIS needs to be strengthened in this regard.

It is not clear whether there is any capacity planning occurring under the WIS.

**GTS access to data for NWP:**

Due to EUMETCast, the European Centres are not very strongly requiring GTS access, but GTS is vital to NWP centres outside Europe. Also to be noted is the increasing dependence on internet portals for the provision of data (e.g. NESDIS PDA, CMA satellite data portal), and the limited commitment of operators (not just operators of R&D satellites) to provide products for NWP on. For the R&D operators this relates to policy issues affecting global re-distribution. EUMETSAT expressed the willingness to proactively work for ensuring GTS distribution for products vital to global NWP centres.

The next GODEX-NWP meeting is planned to be held in India in autumn 2018.

### 6.4 DBNet

P. Brunel (MétéoFrance, Chair of DBNet Coordination Group) summarized the status of DBNet. He stressed that the main requirement of DBNet to reduce delay of NOAA, Metop and FY-3 ATOVS global data to 20 minutes. He recalled the sub-regional networks and their management, the Guide to DBNet (WMO-No. 1185), the DBNet services implementation status, and DBNet coverage status August 2016. Recent additions are stations on Guam (NOAA) and Papeete, Tahiti (MétéoFrance). He exposed the plans to extend DBNet coverage in South America, Western Pacific, Southeast Pacific, and Southwest Indian Ocean.

He showed an example for a DBNet data timeliness (latency) plot provided by NCEP, and DWD data delay statistics for AMSU-A, showing the differences between DBNet data and global data, and the positive impact of DBNet. Roughly 50% of the data used by the NCEP system is delivered by DBNet.

He showed the list of DBNet high priority activities in the coming years, to be discussed at the DBNet coordination meeting in 2018.

At ITSC-21, the DBNet sub-group made recommendations related to DBNet processing software, priorities (e.g., MWHS-2).

The set of channels from hyperspectral IR sounders has been extended to about 500.

**ACTION 4.9: Secretariat to convene a meeting between the PR of Chile, MétéoFrance, CLS to advance the issue of using the Isla de Pascua location for DBNet.**
6.5 Critical Satellite Data

Comments on the IPET-SUP-3 draft were received from GODEX-NWP, ECMWF, and the ITSC-21 International issues and future systems Working Group. S. English recommended that these comments be adopted and worked into a revised draft. The principles should also apply to surface-based data.

A break-out was formed on this topic, to (i) finalize the paper, and (ii) decide on which elements to extract for the discussion at CBS TECO.

7. CGMS SATELLITE MISSION CONTINGENCY PLANNING

The Team was invited to take note of the current CGMS contingency planning practices, and to provide user perspectives on a draft 2007 contingency plan (e.g., are users satisfied with a ring of geostationary satellites spaced at 70° latitude, or is more or less spacing needed? Are three orbital planes (e-am, am, pm) of low-Earth orbiting MW sounders sufficient?). Such input is required for a WMO-CGMS workshop on contingency planning on 30 April – 2 May 2018, where the respective roles of WMO and CGMS in contingency planning and gap analysis of the space-based WIGOS will be reviewed.

Secretariat (M. Rattenborg) briefed the Team on this item.

CGMS baseline was last agreed in 2011, and a draft contingency plan dates from 2007 (which was never formally adopted by CGMS). In view of the new WIGOS 2040 Vision, the emergence of the Space Weather theme, a review of (i) the CGMS baseline, and (ii) the CGMS contingency planning, to be adopted at CGMS-46 in 2018.

The baseline is based on a differentiation between core (backed up internally by operators) and critical capabilities (mutual back-up arrangements).

In the CGMS Contingency planning working group (WG III), draft outlines of the CGMS contingency plan and the CGMS baseline are being prepared. A dedicated workshop is planned on 30 April – 2 May 2018 at WMO HQ in Geneva, Switzerland.

ACTION 4.10: A representative from IPET-SUP to participate in the CGMS-WMO workshop on contingency planning 30 April – 2 May 2018. Identify a representative by 20 March 2018.

S. English pointed out the importance of engaging users when defining critical capabilities. Agencies are driving the process, but a user perspective on criticality, and on e.g. how to deal with degraded systems (Still useful? Not useful anymore?), would be valuable.

IPET-SUP members could form a view on the draft documents being prepared for the workshop by early April 2018; the IPET-SUP representative would then represent this view at the workshop.

8. DATA MONITORING

The Team was informed about the status of developing a WMO Data Quality Monitoring System (WDQMS) and discussed a satellite data monitoring prototype that eventually should be part of that System.

8.1 WMO Data Quality Monitoring System (WDQMS)

L. Nunes (Secretariat) informed the Team on WDQMS, which is one of the priorities identified in the WIGOS pre-operational phase 2016-2019. WDQMS should provide real-time monitoring of performance (availability and quality), and include an incident management component for mitigation of issues. Three main functions of WDQMS are (i) quality monitoring, (ii) evaluation and
reporting, (iii) incident management. The evaluation and reporting function should identify issues and determine those that justify being formally raised as an incident with the observing system owner or data provider.

A demonstration project has been done in RA-I to test the concept for GOS surface-based observations. Quality monitoring results from four NWP centres are being produced (ECMWF, NCEP, JMA, DWD) and a web-based display prototype has been developed by the Secretariat allowing to access those experimental results. Regional WIGOS Centres are being set up to assist Members in the implementation of WIGOS activities. Two mandatory functions of the Centres are (i) regional WIGOS metadata management, in support of OSCAR/Surface, and (ii) regional WIGOS performance monitoring and incident management. The status of these Centres is mostly in planning stage, except in RA VI where the EUMETNET Observations Programme has been running quality monitoring functions like a RWC and part of their operations are to be extended to the whole RA VI.

He described the main challenges: integration of monitoring activities from other surface components of the GOS; integrate (in whatever form) the monitoring of space-based observations; integrate the monitoring of surface observations, from other components of WIGOS (GAW, WHOS, GCW).

There is the issue of monitoring at global versus regional level of networks under GAW and JCOMM. For the observations under these and other Programmes some of the monitoring functions are likely to be done at global level, while for the surface land stations of the GOS, it will be up to the RWCs.

Question is whether existing monitoring of satellite data by global NWP centres is addressing the three functions identified by WDQMS. Monitoring functions do exist, it is harder to work out what qualifies as an incident. The global NWP centres have direct links to satellite operators; WMO is not involved in this dialogue; WMO requires a high-level view on the health of the space-based WIGOS.

8.2 Satellite Data Monitoring Prototype

Secretariat (M. Rattenborg) presented ideas for discussion, on what should be monitored. This could include: (i) timeliness, (ii) completeness, (iii) quality, (iv) availability of data.

Existing resources do not cover all requirements (see http://www.wmo.int/pages/prog/www/DPS/Monitoring-home/mon-participating-centres.htm). There is no uniform definition of completeness (availability at cut-off, availability). He summarized what existing satellite data monitoring resources provide; ECMWF provides long-term trends in comparison to reanalysis; other centres only maintain a rolling archive (past 14 days, e.g.).

NCEP central operations performed since 2001, a long-term data repository is available; limited resources available to do anything extra. Degradation of the COSMIC data received can be deduced.

ECMWF perform monitoring as well, distinguished by received data (available).

ECMWF operational plan is to implement a prototype monitoring tool producing monthly aggregates.

The NOAA NCEP role as a designated WMO centre for monitoring satellite data should be verified.

**ACTION 4.11: Secretariat to verify the NOAA NCEP role as designated WMO Centre for monitoring satellite data.** (see http://www.wmo.int/pages/prog/www/DPS/Monitoring-home/mon-leadcentre.htm)
WMO maintains the Regional user groups to ensure flow of information between operators and Members.

A break-out group was formed on this topic.

9. COMMUNICATION PLAN

Building on initial ideas developed at its third session, the Team further developed the communication plan and outreach strategy specific to IPET-SUP, in order to position itself in the wider WMO landscape, and to appropriately address key stakeholders.

It was suggested to have a 2-year action plan, and suggestions for input to the 2020- work programme.

A break-out group consisting of the Task Team on Communication Plan was organized.

10. SCOPE PROJECTS: NOWCASTING AND CLIMATE MONITORING

A report on results from the first session of the Sustained Coordinated Processing of Environmental Satellite Data (SCOPE) Nowcasting executive panel was provided, including progress against the four pilot activities, and the ideas for new pilots. The session also reviewed the concept of a generic nowcasting system for meteorological services (see http://www.wmo.int/pages/prog/sat/scope-nowcasting_en.php).

As for SCOPE-Climate Monitoring (CM), the Team reviewed progress in assessing maturity of climate data records generated in the nine current projects, and took note of the status of discussion on the planned update of its implementation plan in the context of the Architecture for Climate Monitoring from Space (see http://www.scope-cm.org for details).

10.1 SCOPE-Nowcasting

M. Pavolonis briefed on the status of SCOPE-Nowcasting. He provided background to the initiative, including the first meeting of the SCOPE-Nowcasting executive panel in September 2017. He reviewed progress made in the first four Pilot Projects. PP1 led, among other, to much improved RGB availability for NMHSs within Region II and V, and improved inter-sensor product consistency. PP2 has focussed on the inter-comparison and validation of satellite-derived volcanic ash products in support of growing demand for high-quality products. PP2 has focussed on the inter-comparison and validation of satellite-derived volcanic ash products in support of growing demand for high-quality products. A consensus volcanic ash product suite has been established: ash detection flag, ash cloud top height, ash mass loading, ash effective radius. Completion of the volcanic ash inter-comparison is planned in 2018. PP3 has leveraged on the NOAA HydroEstimator and the NASA IMERGE product in a web-based GIS tool. PP4 helped JMA, KMA and CMA in generating improved dust monitoring products from satellite, and to enhance inter-sensor consistency. More focus on comparing and validating products, and integration into forecast models is required.

Three new Pilot Projects are proposed: (A) multi-sensor feature-based nowcasting; a survey is being used to collect information on relevant products from the international community; there are less standards available, as opposed to other product lines such as SST, clouds; the European Convection Working Group is supportive of the effort; outreach should also be done to the SCOPE-Nowcasting participating agencies, and the International Cloud Working Group; (B) facilitate uptake of geostationary hyperspectral measurements; (C) improve exploitation of MW sensors in nowcasting.
R. Adiaryanto enquired about the best techniques to detect and differentiate volcanic ash; this is of high importance to BMKG. The intercomparison study pointed at possibilities and limitations of various sensors and techniques; the second phase should provide further insight. The new geostationary satellites will help in this regard.

The Team supported the proposed three new Pilot Projects.

10.2 Nowcasting System Concept

L. Machado briefed on a generic nowcasting system concept that would integrated nowcasting information from distributed sources. Weather services are more and more requested to provide a nowcasting service. There is a strong potential of the new satellite generation to support nowcasting, however, the key products are only produced by the Space Agencies. In addition, nowcasting products need to be available with very small delay and need to be combined with local geographical layers. This document presents a new innovative procedure to help weather services to have their own nowcasting service. This document proposes the development of a nowcasting system, only based on satellite data, that can be easily implemented in weather services by using the concept of web services and geographical information system.

The system would run on the user’s computer; consisting of four phases (pre-convective, convective initiation, severity, nowcasting), and sourcing nowcasting products hosted on the web by the various providers (web service rather than webpage). This does away with collecting (and merging) links to different data streams, and thus facilitates nowcasting. INPE are running a prototype for this concept.

ACTION 4.12: Luiz Machado to seek the formation of a Task Team composed of IPET-SUP and SCOPE-Nowcasting, the EUMETSAT Convective Working Group, and Nowcasting Working Group representatives to further discuss and test the concept.

S. Keogh recognized the value of the concept, since users would not need to pre-process data. M. Pavolonis commended the potential added value of the idea to leverage various nowcasting sources. S. Bojinski commented that overlaying different sources in a web-GIS environment would add value. L. Machado stressed the perceived use of the prototype in Brazil. S. Keogh mentioned the webmapping service pathfinder pursued by EUMETSAT. ePort was also mentioned as a useful resource.

10.3 SCOPE-CM

J. Privette (remote) briefed on purpose and background of SCOPE-CM. He provided highlights from the 2017 SCOPE-CM executive panel, with participation by 20 members and project representatives. ISRO and KMA are new members. All 9 project leads were asked questions about the perceived value, and it brings credibility, visibility, stability to some projects. The relationship between SCOPE-CM and the CEOS-CGMS Working Group Climate is evolving. For example, a possible SCOPE-CM role could be to coordinate solutions to known gaps in climate data records, and to coordinate sustainment of existing key climate data records. SCOPE-CM is also a mechanism for building capacity in agencies with less experience.

The special issue of the Remote Sensing journal has an open call for papers on ECV generation and applications, deadline is 30 June 2018.

R. Eckman asked about the types of gaps that WGClimate and SCOPE-CM are concerned with. Absence of flight hardware is one type; processing has stopped due to funding reasons; no plans for continuity; compliance with GCOS monitoring and generating principles (low maturity).
11. SATELLITE APPLICATIONS

As an Inter-Programme Team, the session reaches out to collect views by application-related WMO user communities, represented by Technical Commissions, regarding their satellite data utilization needs. This is currently through the Commission for Climatology (CCl), while representatives for the WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) and the Commission for Hydrology (CHy) are yet to be determined.

The CCI representative provided an overview presentation on the international coordination mechanisms in the field of climate, with a focus on satellites. Progress in re-establishing the JCOMM Task Team on Satellites was assessed, as well as the status of international community building in the area of remote sensing of the Earth’s surface for NWP and soil moisture applications. A user perspective on the use of satellite data in hydrological forecasting was provided, with a view to improve linkages of the Team to that community. ITWG have discussed the idea of a common user notification procedure that should guide the operators of satellites in case of changes to level-1 data that are within specification but still have significant (adverse) impact on NWP systems. A status report on the Space-based Monitoring of Weather and Climate Extremes (SEMDP) Demonstration Project in RA II/V was provided as well, for comments by the Team.

11.1 Climate: international coordination mechanisms

R. Hollmann provided an overview of international coordination mechanisms in the area of climate observation, research, applications and services. He described the WMO Commission on Climatology, and the Global Energy and Water Exchange project (GEWEX) of the World Climate Research Programme. GEWEX consists of various topical Panels (GDAP, GASS, GHP, …). The CEOS-CGMS Working Group on Climate, established in 2010, supports implementation of the Architecture for Climate Monitoring from Space. The Group recently compiled the ECV Inventory with metadata on over 1000 satellite-based climate data records (http://climatemonitoring.info/ecvinventory). He described GCOS and SCOPE-CM.

He described the respective roles of the coordination bodies (e.g., WMO CCI – last mile to NMHSs, focussing on operational aspects).

Question was asked on the French proposal for a Global Climate Observatory, brought forth at COPUOS (Committee on the Peaceful Use of Outer Space). More information will be provided and discussed at the upcoming session of the CEOS-CGMS Working Group Climate in March 2018.

11.2 JCOMM Satellite Data Requirements: Status

Secretariat (Champika Gallage) updated on the status of the JCOMM Task Team on Satellites. Considering the importance of satellite observations for marine and oceanographic applications and services. JCOMM-5 in October 2017 established the position of a Coordinator on Satellite Data Requirements; authorized the establishment of a new Task Team, with the task of continuing and completing the satellite-specific statement of requirement of the marine and oceanographic community, by 2019; urged Members to nominate experts to the Coordinator position.

**ACTION 4.13:** IPET-SUP members were invited to identify experts, and send suggestions to the Secretariat Grimes (sgrimes@wmo.int, sbojinski@wmo.int) by 30 April 2018.

11.3 Surface Remote Sensing / Soil Moisture International Community Building

S. English reported:
Dr. Gianpaolo Balsamo and Dr. Benjamin Ruston organised a Land Surface Working Group meeting at Monterey 19-20 July 2017. Outcomes were reported to the ITSC-21 meeting and a follow up meeting is being planned for Lisbon 26-28th June 2018 (2.5 days). More information about this group can be found at http://cimss.ssec.wisc.edu/iswg/meetings/2017/.

The 2017 meeting had sessions on land surface modelling, soil moisture, snow applications and land surface classification. Speakers came from North America, Europe and Asia. The group aims to engage a broader cross section of the community and plans to continue to have short but frequent meetings to try and gain wide acceptance as an international science group for land surface.

The group builds on an effort of a sub-group (Remote Sensing and Modelling of Surface Properties) of the ITWG which has organised four workshops over the past decade. The ITWG has hosted a website (http://cimss.ssec.wisc.edu/itwg/groups/rtwg/meetings/sfcem/2016/) where more information on the activities of this subgroup can be found. The group reports directly to the ITWG, and thus indirectly to CGMS via ITWG. However the new group has a much clearer focus on the land surface, not just fixing the land surface to enable atmospheric sounding.

The group will put forward recommendations and actions to ensure EO surface application continuity and direct development of techniques for their utilization. Noting that CGMS has no International Science Working Group with a surface focus it is the longer term ambition of this group to eventually become a CGMS International Science Working Group and Drs. Balsamo and Ruston are open to advice.

The Team noted that an international surface working group needs to be clear on its scope: Land surface remote sensing to improve weather forecasting vs land surface remote sensing for other applications (agriculture, hydrological, flood forecasting, etc.).

11.4 Hydrology

Christel Prud’homme (remote) presented. Satellite data cannot be directly used by many of the tools used in the hydrological community. EFAS contributes to the Copernicus Emergency Management Service. EFAS uses in-situ gauge data, model data, and static assumptions about land surface etc. It currently does not use satellite data.

Hydrological forecasting would improve by better land surface initial states (current water storages in the catchment), for drought monitoring, flood monitoring. Atmospheric forcing could also be informed by satellites (where/when precipitation, ...). Hydrological modelling in general mostly uses static information, but could be regularly or dynamically updated: vegetation phenology (proxy for irrigated area, water resources), river networks (<10m), lakes and wetland extent, reservoir levels (regular information on these would be very useful), urban area information (runoff, infiltration), land use and crop vegetation cycles (currently static maps are used), impacts on water use due to mass-migration of people.

Better initialization of EFAS hydrological forecasts could be enabled by RT information e.g., on precipitation and soil moisture between the last water storage measurement, and the start of the forecast.

Flash flood indicators and verification may be able to use convective activities, lightning as proxy?

S. Keogh noted the absence of snow in the presentation. There are simple snow models in the hydrological models; importance of the snow water equivalent at higher resolution than 10x10km2 or 5x5km2.
D. Berod (Secretariat, CLW Dept) informed about the importance of combining surface-based and satellite-based information, and hydrological models. He noted the WMO Global Data Centre on Lake and Reservoirs (HYDROLARE, hosted by the Russian Institute of Hydrology in St Petersburg) that benefits a lot from satellite observations provided by the French CNES, the latter using in-situ data hosted by HYDROLARE for validation. Regarding soil moisture, satellites can only provide information about the top few centimetres, which needs to be combined with in-situ observations and models, as many hydrological processes occur in the first 50 cm – 1 metre, without mentioning groundwater. The WMO HydroHub focuses on innovative collection, management and use of observations for improving Regional and national hydrological measuring networks (WMO WHYCOS program). He shortly briefed on the new WMO project HydroSOS (hydrological Status and Outlook System, aiming at producing information on the current and next future state of hydrological situation, with a view to better prevent Floods and Droughts). This project will combine multiple sources of information, including from satellite, and models. A meeting in Entebbe in September 2017 was the starting point of this project.

Team to further discuss the way forward in a break-out group.

11.5 CGMS Radiance Processing Change Notification Procedure proposal

S. English briefed that the 21st International TOVS Study Conference of the ITWG noted that at a past meeting (ITSC-10 in 1999), it recommended to NOAA/NESDIS thresholds on the size and type of changes that users would like to be notified about. This was used by NOAA/NESDIS for many years and was useful, but is out of date. In general data providers are using the original instrument specification to decide when to notify users about changes. However users are sensitive to changes much smaller than the original instrument specification, in part because they bias correct data, but they need time to adjust bias corrections to changes in input data. It is also the case that often instrument performance is much better than specification, and use of the data exploits this. Therefore the requirement with respect to changes in bias is different to the absolute requirement. Therefore the NWP WG of ITWG made a specific proposal to data providers (ITSC-21 Recommendation DA/NWP-12 to Data Providers). This paper reports on this proposal and seeks the IPET-SUP view.

The guiding principle proposed by the ITWG is if the expected maximum change (temporally, geographically) in the observed brightness temperature of any channel of the instrument exceeds 0.1K or 20% of NEdT (whichever is smaller) this should be made clear in notifications to users. Users need these notifications to be made no later than 8 weeks before the change and with test data (at least a few orbits, ideally more) provided if possible. Users also require smaller changes to be communicated as now, but without the need for extended advanced warning and test data.

Questions were raised on how to implement the proposed guidance principle. A “change” is referred to as a maximum change in the systematic error over any part of the orbit (bar minimal deviations that may be corrected for). The principle would apply to polar-orbiting and geostationary instruments.

Earlier guidance by ITWG was used successfully by NOAA. EUMETSAT and NOAA intend to discuss the proposal before CGMS-46.

11.6 Space-based Weather and Climate Extremes Monitoring Demonstration Project

The outline of the initial steps and the key elements of the Space-based Weather and Climate Extremes Monitoring Demonstration Project (SEMDP) were presented. The 2-year SEMDP in 2018-19 will focus on Region II and V, and concentrate on products at national and regional levels. Items to be worked on include:
(i) monitoring persistent heavy/little precipitation and droughts;
(ii) making best use of existing and newly developed satellite derived products and time series of measurements;
(iii) making best use of products that combine satellite information with in-situ and/or model reanalysis data;
(iv) recommendations as to which products should be transitioned from research to operations, including an assessment of those products.

A final report of the SEMDP will be compiled and reviewed. The next steps will then be based on the outcome of the demonstration phase.

UN ESCAP has a regional drought monitoring mechanism, without strong involvement of satellite operators. This is why they are involved in this initiative.

The Team inquired on the linkage of the initiative with SCOPE-Nowcasting precipitation pilot project.

12. TRAINING AND EDUCATION

The Team discussed the status of VLab and future collaboration of VLab with the Committee on Space Research (COSPAR) in the area of capacity building.

12.1 VLab update and plans

M. Higgins (VLab co-chair, remote) briefed on the status of VLab.

He reported on activities within the WMO-CGMS Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) along with future plans. Since IPET-SUP-3, VLab members have offered a variety of training opportunities, with highlight to training efforts addressing the new generation of satellites, as this proved to be the major training need identified by VLab members. Furthermore, a comprehensive review and update of the Guidelines on Satellite Skills and Knowledge for Operational Meteorologists was conducted.

Bridges into Competency frameworks are important to link training with the needs of operational meteorologists. The “living” Skills and Knowledge document is discussed with academia in Europe.

The training calendar is now available in an xml format and an API, and any user can connect and customize it for their own purposes.

S. English commended VLab for looking into the question of assessing the impact of training activities. The Team appreciated the reflections from all VLab Centres on this issue.

12.2 COSPAR Update

J.-L. Fellous (COSPAR executive director, remote) gave an update on the WMO-COSPAR joint training partnership. He mentioned two capacity building events on space weather; WMO has committed to support the planned 2018 event to be held in Brazil. The COSPAR-WMO agreement has proven useful and mutually beneficial over its 6 years, and extension of the agreement is recommended.

ACTION 4.14: Secretariat to initiate renewal the WMO-COSPAR MoU on capacity building for another 3 years.

The Team noted the possibility of entities that would be willing to potentially host a COSPAR fellow, typically for a 2-4 week period. Country of origin usually supports travel; host institution
would if possible provide lodging and office space. COSPAR grants usually do not exceed 2000 €. A concrete example could be the Brazil 2018 workshop, if a student is identified to continue his or her work in a host institution. The institution would then be added to the list of hosting institutions by COSPAR.

13. WMO ONLINE RESOURCES

13.1 OSCAR/Space V2.0

Version 2.0 of the WMO Observing Systems Analysis and Review Tool / Space (OSCAR/Space) was released in September 2016. Setting up a maintenance and management structure to ensure sustained operations of the resource is a priority. Setting up a Support team and a Scientific and Technical Advisory Team for OSCAR/Space is underway. Engagement of satellite operators in CGMS as well as key user communities such as International Science Working Groups is critical in this regard. CBS-Ext. (2014) assigned responsibility to IPET-SUP for the user assessment of space-based observing system capabilities in OSCAR (excluding space weather). (https://www.wmo-sat.info/oscar/spacecapabilities).

The Team reiterated its strong support to OSCAR/Space and its maintenance. It noted the currently 1200 page visits/day. NOAA has set up an information chain in support of monthly updates of OSCAR/Space.

13.2 SATURN

The Satellite User Readiness Navigator (SATURN) portal has been maintained by WMO and CGMS operators since 2015 to support user readiness activities with structured information on upcoming next-generation meteorological satellites, initially focussing on geostationary satellites (Himawari-8/9, GOES-16, FY-4A, INSAT-3DR, Elektro-L N2, GEO-KOMPSAT-2A, MTG). More recently, information on polar-orbiting satellites has been added (JPSS, FY-3E), as well as a user feedback mechanism. (https://www.wmo-sat.info/satellite-user-readiness/)

The Team noted the low visibility of SATURN in search engines and suggested that its visibility be increased. It noted that the number of page visits was not a good measure for the impact of the site.

13.3 Product Access Guide

The Product Access Guide (PAG) website has been set up to facilitate discovery of satellite-based products that are documented online and fulfil minimum documentation and access criteria. Currently more than 110 product collections, related training resources and international science groups are linked from the PAG, including in the space weather domain. (https://www.wmo-sat.info/product-access-guide/)

The Team noted a number of broken URLs in the current PAG. The Team noted low visibility of the site; should be an item discussed by the Communications Task Team.

ACTION 4.15: Secretariat to fix broken URLs in the PAG, and send PAG template to NOAA, NASA, EUMETSAT, for updating the PAG.

ACTION 4.16: Secretariat to send summary slide on SP online resources to N. Donoho, M. Rattenborg.

13.4 Data Access, and Data Processing Tools Webpages
The Data Access pages are entirely sourced from OSCAR/Space and are maintained to provide facilitated access to basic satellite data (typically level 1) from a range of satellites: http://www.wmo.int/pages/prog/sat/data-access_en.php

The Data Processing Tools page is maintained to provide an overview of common tools to process, visualize and analyse satellite data, including both commercial and open source tools: http://www.wmo.int/pages/prog/sat/processingtools_en.php

Team recommended to: remove the “Version” column, to add a disclaimer to the Open Source listing (“non-exhaustive”), to add a statement “if you wish your package to be added, please contact WMO Secretariat”.

ACTION 4.17: Secretariat to modify the “Tools” webpage as follows: “remove the “Version” column, to add a disclaimer to the Open Source listing (“non-exhaustive”), to add a statement “if you wish your package to be added, please contact WMO Secretariat”.

ACTION 4.18: Team to provide updates to the list of Tools (to include e.g. SNAP).

MATTERS ARISING FROM INFORMATION DOCUMENTS

The Team is invited to raise any issues or questions regarding the documents submitted for information only. The Team is invited to raise any points that may need further discussion in the break-out session.

INF.1.2: M. Rattenborg suggested collecting comments from GODEX-NWP on the proposed notification procedure (IPET-SUP-4/Doc.11.5).

INF.5.2: Re AOMSUC-9 invited participants, interaction between WMO and BMKG is requested to finalize the list; this should be used in fundraising for the Conference

INF.6: Secretariat noted the CBS fast track process to update Guidelines; alignment of the WMO Statements of Guidance on global and regional NWP with the Guide to the DBNet should be verified; the Statements are maintained by user communities and reviewed at meetings of IPET-OSDE.

INF.7: Pay attention to lessons learned, for designing a next Survey for 2020; should be discussed at IPET-SUP in 2019.

BREAK-OUT GROUPS

The Team discussed in separate groups topics that require particular attention and group discussion, such as writing assignments.
The Team finalized the Paper, taking into account comments from the Chair of ICT-IOS (Anthony Rea), the Chair of IPET-OSDE (Erik Andersson), and GODEX-NWP.

The Team provided comments on a potential revision of WMO Resolution 40 and its Annex 1.

Both drafts will be circulated with the Team. The output will be sent to the Chair of ICT-IOS, for use in discussions within the CBS Technical Conference. The final Position Paper should be published as a WMO SP document.

**ACTION 4.19:** Team to provide final comments on the draft Critical Satellite Data Position Paper, and the comments on revising WMO Res 40 Annex I. By 9 March 2018.

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### Break-out group 2 – Communication strategy and action plan

**Communications Grid**

The group reviewed the Communications grid since the last meeting with the following modifications:
<table>
<thead>
<tr>
<th>High Influence on IPET-SUP objectives</th>
<th>Low Interest in IPET-SUP activities</th>
<th>High Interest in IPET-SUP activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMHS Organisational leaders</td>
<td>(involve/consult/sell)</td>
<td>(collaborate/empower/delegate)</td>
</tr>
<tr>
<td>Individual Satellite Operators</td>
<td>WIS</td>
<td>GODEX-NWP</td>
</tr>
<tr>
<td>Commission for Hydrology</td>
<td>Commission for Agricultural Meteorology</td>
<td>Regional Requirements Groups</td>
</tr>
<tr>
<td>JCOMM</td>
<td>Copernicus User Fora</td>
<td>CGMS (incl. Working Groups (ITSC, IPWG, IROWG, ICWG)</td>
</tr>
<tr>
<td>National User Organisations?</td>
<td>CEOS</td>
<td>ET-SAT</td>
</tr>
<tr>
<td>Atmospheric Composition GAW</td>
<td>Individual Satellite Operators</td>
<td>IPET-SWeISS</td>
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<td></td>
<td>SWFDP</td>
<td>Commission for Climatology</td>
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<td>VLMG</td>
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<td>WIGOS</td>
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<table>
<thead>
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<th>Low Influence on IPET-SUP objectives</th>
<th>Low Interest in IPET-SUP activities</th>
<th>High Interest in IPET-SUP activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual users</td>
<td>(inform/tell)</td>
<td>(consult/listen/support)</td>
</tr>
<tr>
<td>Other Expert Teams within WMO</td>
<td>Commercial data providers</td>
<td>Groups of Users</td>
</tr>
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<td></td>
<td></td>
<td>Met Service users</td>
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<td>SWFDP</td>
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</tbody>
</table>

The above changes reflect the already improved exchanges between IPET-SUP and some of the communities listed in the grid. Two new communities were added atmospheric composition and commercial data providers.

Given the good representation at IPET-SUP from the Regional Associations it is proposed that at future IPET-SUP meetings the status reports are provided as information papers.

It was agreed that focus in communication efforts should be focused on communities within the High-Influence and Low-interest sector:

- **Promoting the achievements and work of IPET-SUP with PRs**
  - continued efforts to ensure access to critical data
  - Training benefits and opportunities provided by the VLAB
  - Encourage participation of representatives in this group and the value of their participation.

- **New communities (Hydrology and Atmospheric Composition):**
  - These community may not be not aware of available satellite data and do not know how to access it we need to consider a dedicated information campaign to support them (e.g. check and update the PAG to cover these themes, participation in community meetings, encourage participation in training etc.).
These communities need to articulate and refine their needs for satellite data to allow IPET-SUP to map these onto existing satellite products future requirements.

- New communities (Agriculture):
  - No progress has been achieved in communicating with this community. It would be extremely beneficial to have a representative from this community within IPET-SUP group.

- JCOMM:
  - Ongoing TTSAT review to engage with communities and develop requirements/baseline for ocean applications with an action on IPET-SUP to provide representatives to support TT SAT activities.
  - There is an outstanding action on JCOMM to provide a representative to participate in IPET-SUP meetings

- EC Copernicus:
  - It is noted that there is strong European coordination between satellite operators and the Copernicus services. Without participation in the user forum there is little opportunity to influence future Copernicus satellite data services. Individual European Member States could act upon the interests of IPET-SUP. This could be one to watch.

Concerning general communication improvements:
There is a general need to continue to promote what we have already achieved as a group (Best practices, Tools, Training opportunities etc.) to the community of users:
- Are these activities covered in social media? Perhaps there is limited to what we can do here given the nature of the work the group does??
- Conferences - AMS, NOAA, EUM, AOMSUC (encourage members to provide an overview paper or poster presentation whenever the opportunity exists)
- Case studies on topics we would like to promote (e.g. new communities where we see gaps) - this would work for promotion on social media
- Who in the group could provide information on available case studies or be a source of new case studies?
- Generate a newsletter once per year based upon achievement (key work with specific communities)

For the 2yr plan the following priorities were identified:
• Complete JCOMM activities (2 actions)
• Develop a newsletter for general promotion purposes
• Start the communication with the new target communities (hydrology, atmospheric composition)
• Develop case studies set for the new communities
• Need a identify a representative from the agricultural community to join the group

Break-out group 3 – Air quality and atmospheric composition – user engagement

Engagement with GAW Secretariat (Oksana Tarasova, Geir Braathen, Alexander Baklanov and Lorenzo Labrador all in attendance)
- Oksana noted the significant coordination activities by CEOS Atmospheric Composition Virtual Constellation (AC-VC) already occurring across these communities which involve harmonized ozone products for long term records (CDRs), coordination of the next generation
geostationary air quality satellite missions, and the CEOS response to the GEO carbon strategy which involves the synergies between current and upcoming GHG monitoring missions.

• Geir noted that the GAW ozone bulletins already make extensive use of satellite data.

• Oksana described the recently modified WMO atmospheric composition application areas

  1. Monitoring/reanalysis: the goal is to look backwards and that requires high quality data and inverse modelling. Potentially, we can demonstrate the impact of environmental policies. Stratospheric ozone requires high precision measurements. Inverse modelling is, indeed, severely constrained by data accuracy.

  2. Forecasting: the end use is near-real time data for assimilation or other uses. These data are not necessarily the same quality as reanalysis quality. They can be less accurate. Spatial resolution spans from global to regional scales. Some applications are sand and dust storm forecasting, biomass burning, and volcanic ash monitoring.

  3. Urban: High-resolution data with fast delivery required. Up to 100m resolution, urban scales. A tiered approach could be used: a mixture of satellites, in-situ (towers), and mobile deployable observing systems IG3IS goal is the identification of sources using such a tiered approach of observations. Multiple tools are needed to elucidate the sources of GHGs. Oksana described an example using OCO-2 measurements over the Los Angeles area which were augmented by airborne radiometer measurements that identified the source as unexpected dairy emissions.

Oksana described GAW interaction with WHO to assess health impacts of air quality. Many end users/stakeholders do not think that satellites add much to urban AQ applications. Satellite observations are (currently) too coarse. Difficulties of converting from AOD to PM2.5 are not always appreciated.

Mikael asked about the difference between the AQ and GHG communities. Oksana stated that they are inter-related, but with different uses. For AQ: assimilation and forecasting. For GHG: inverse modelling and mapping of emissions for attribution.

Alexander noted that other trace gases are being used for user applications. For example, NH3 from satellites (AIRS, TES, and IASI) are being used. He also noted the SCOPE Nowcasting activities including dust forecasting and volcanic ash, which are already covered by IPET-SUP.

The overall conclusion was that the air quality, composition, and GHG communities are reasonably well engaged with satellite data providers and agencies through coordinating groups like CEOS AC-VC and WMO GAW. It was recommended that IPET-SUP continue to monitor the activities of these communities and the forthcoming launches of satellite missions relevant to these communities, recognizing the paradigm shift from LEO to GEO observation missions for air quality and GHGs (e.g., GEOCarb).

Secretariat asked to what extent atmospheric composition products are reflected in the Product Access Guide. Sentinel-5 will benefit from direct readout on Metop-SG. It was noted that NH3 is missing in OSCAR/Requirements.

**ACTION 4.20:** Secretariat to check the Product Access Guide for atmospheric composition products, and OSCAR/Requirements for NH3 and other trace gas species identified in the Atmospheric Composition Application Areas.

*Break-out group 4 – Global satellite data monitoring*

The group looked at the WIGOS Data Quality Monitoring System concept. The concept includes two distinct layers:

• Operational Quality Monitoring (QM), consisting of three components:
Production and collection of Monitoring data (Quality monitoring function)
Analysis of Monitoring Data and identification of Incidents (Evaluation function)
Incident management (IM function)

- High-level indicator reporting to stakeholders on health of Observing System

For the surface-based WIGOS a Quality Monitoring structure is being established where regional WIGOS centres are to implement the operational functions, supported by initially four NWP centres: NCEP, DWD, JMA and ECMWF, who are responsible for producing monitoring data. For other networks, like GAW, it has already been recognized that a regionalized structure cannot be implemented. Establishing the Operational QM capability should have first priority in the WDQMS implementation for space-based observations. Regarding high-level reporting, WQDMS will initially inject monthly aggregated numbers into OSCAR/Surface, but it remains to be seen how well this corresponds to stakeholder expectations.

The group agreed that the objective is to ensure that for the space-based system Data Quality Monitoring processes are implemented, fulfilling the essential WDQMS requirements in the WDQMS concept. This needs to be based as far as possible on existing capabilities and procedures.

In terms of existing operational QM processes, ECMWF and other NWP centres are producing monitoring data for satellite observations, monitoring significant changes in observational spread and bias. These data are provided automatically to other NWP users and to satellite operators. ECMWF are analysing their monitoring data, identifying satellite problems and communicating these to satellite operators. For EUMETSAT instrument issues ECMWF sometimes raise a User Feedback record, sometimes they call experts directly. This is already a very good basis for the QM system. What is missing in terms of WQDMS requirements is a more formal and structured Incident Management system as well as the participation of more NWP centres.

It was agreed that we should strive to document the QM processes and identify areas for improvement. The engagement of satellite operators is essential, so this should be addressed at CGMS (and maybe at GODEX-NWP?). Subsequently this could be presented to the TT-WDQMS, to discuss how this is integrated into the overall WQDMS.

Regarding high-level indicators, we should continue to develop the high-level indicators with ECMWF and synthesize this into high-level indicators. The group did not have time to discuss the details of this further. There are no clear requirements from the WIGOS coordination bodies on this item. Aggregated numbers could be produced by ECMWF, and converted to high-level indicators, such as # of satellite data streams assimilated, and # of satellite data streams with an anomaly (over a month, for example).

**ACTION 4.21:** Secretariat to draft a WMO working paper for CGMS on the topic of global satellite data monitoring, providing the status and proposal for formal incident management of satellite data.

**Break-out group 5 – Hydrology - user engagement**

- **Issue:** Lack of engagement of space community with hydrology community
- **In principle satellite observations are sensitive to parameters hydrologists are interested in**
  - However satellite data e.g. SMOS soil moisture not used by hydrology community
  - This is despite decreasing number of in situ measurements in many areas (water level, water discharge soil moisture, water quality, Groundwater, …)
  - Can satellite data provide additional information to in situ observations?
- **Different hydrological applications e.g. Flood forecasting, water management**
- Existing effort
  o CEOS has a water strategy
  o Regular ESA- Mapping Water Bodies from Space Conference in Frascati (next: March 27-28 2018)
  o Copernicus: natural disasters / floods forecasts / water management
  o Minimum 10-30m scale river – still not accurate and lack of data for smaller rivers (e.g., NASA effort)
- Requirements
  o Minimum: Want water level of river or lake
  o If possible: Flow and discharge (currently no satellite technology for this)
- Ideas
  o SCOPE project, looking at specific basin?
  o Compile case studies that demonstrate value
    ▪ E.g. ESA study to replace static soil moisture in hydrological model with SMOS estimate in Central America
    ▪ Model is weak link? Improving models and data assimilation is a priority
    ▪ Hydrological processes still mostly unknown at different space and time scales, many uncertainties
    ▪ Physically-based vs statistical models
    ▪ How to compute and communicate uncertainty
    ▪ Stochastic modelling to address model uncertainty
    ▪ Poor model makes satellite data interpretation difficult
    ▪ However EFAS and other global models making progress
    ▪ Demonstrate value through Hydro Status and Outlook System (possible pilots on Lake Victoria and Ganges-Brahmaputra basins); i.e. Congo use possibly GSMap

Cultural shift in hydrological community is required, to overcome fear of losing influence, funds to maintain surface-based networks; most NHS are seeing decrease in hydrological measuring network coverage, and a few have some increase.

Mechanisms for interaction: CHy Advisory Working Group meets in Sep/Oct 2018; presentation on IPET-SUP and potential role of satellites should be highlighted; CHy President Harry Lins should be involved.

ACTION 4.22: Secretariat to liaise with WMO CLW (Dominique Berod) to engage with the Commission for Hydrology Advisory Working Group in Sep/Oct 2018, to highlight the work of IPET-SUP and the potential value of satellite data.

ACTION 4.23: Secretariat to send CEOS Water Strategy document to Team.

The World Water Forum is held in March 2018 in Brazil. The WMO Hydrological conference will be in May 7-9 in Geneva, and there should be a WMO High Mountain Summit that should include Water themes late 2018 or early 2019 in Austria. At EC-70, a Water Day is planned on 23 June 2018.

Break-out group 6 – Future trends, “New Space” implications

S. English noted that ECWMF are starting to think on how engage with projects such as the MIT TROPICS and other cubesat providers, and what it means to data calibration and quality monitoring. Mass deployment of space-based observations that are less mature and less quality, but higher
S. Keogh reported on MetOffice being in dialogue with several private operators that have or plan cubesat constellations. Frequent observation of high spatial-scale air quality parameters could provide useful information, either for monitoring, analysis, or optimal positioning of surface-based systems.

L. Machado mentioned the possibility to derive vertical cloud velocity from cubesats.

N. Donoho mentioned the partnership between NOAA and major IT firms to test data distribution of NOAA satellite data via the Cloud. NOAA provides data quality assurance, or subject matter expertise. NOAA also undertook the Commercial Weather Data Pilot. She also highlighted the issue of cyber security and cost recovery.

S. Keogh mentioned the increasing role of NWP-based simulated products, and their comparison with satellite data and products has been beneficial to bring together modelling, radiative transfer, and satellite communities.

S. English noted the Earth system trend in modelling, and thus engagement with the atmospheric composition and hydrological communities is fully consistent. More engagement with cryospheric communities would be useful in the future since the importance of Polar Regions and the cryosphere is increasing.

S. Keogh noted that engagement with stakeholders that have high influence and low interest should be a priority.

S. English recognized the importance of measuring the impact of training, and expressed his support to assisting VLab in this regard.

**ACTION 4.24:** S. English and Secretariat to draft an IPET-SUP work programme 2020, based on input received at IPET-SUP-4.

**14. REVIEW AND ADOPTION OF THE DRAFT REPORT**

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

**15. ANY OTHER BUSINESS**

**16. DATE AND PLACE OF NEXT MEETING**

The meeting identified the week of 20 May 2019 as a possible date for its next session.

**ADJOURN**

The session closed at 12.00 on Thursday, 1 March 2018.

**DOCUMENTS FOR INFORMATION**

**I.1 INTERNATIONAL SCIENTIFIC WORKING GROUPS**

To present results arising from recent workshops of the International Science Working Groups on Radio Occultation, and Sounding.

**I.2 HIMAWARI-REQUEST EVENT-DRIVEN TARGET OBSERVATION PROTOCOL**

To present the HimawariRequest protocol for event-driven target observations of Himawari-8 AHI for Asia-Oceania in support of disaster risk reduction in RA II and RA V.
I.3 VISION FOR THE WIGOS COMPONENT SYSTEMS IN 2040

A new Vision for the WIGOS space-based component systems in 2040 is being developed under CBS auspices, as high-level guidance for the future development and coordination of global observing systems in support of WMO applications. The current draft of the Vision (space and surface-specific parts combined) is provided.

I.4 CGMS HIGH-LEVEL PRIORITY PLAN 2017-2021

To inform the session about the Plan, and the priorities identified by satellite operators in CGMS in particular regarding satellite data access and utilization. One item of particular interest to IPET-SUP is priority 3.4 “Maintain, enhance and improve the methods to describe the error characteristics of satellite data and products”.

I.5 UPDATE ON EVENTS

To report on results from the 8th Asia-Oceania Meteorological Satellite Users Conference (AOMSUC) and plans for the 9th session in in October 2018 in Jakarta, Indonesia; to inform about experiences from the NOAA Satellite Conference 2017; on the plans for the EUMETSAT Conference 2018.

I.6 WMO GUIDELINES WITH IPET-SUP INVOLVEMENT

To provide the reference to the WMO guidance documents accomplished by the Team in its 2013-2016 term:
- Best practices for Achieving User Readiness for New Meteorological Satellites – Reference User Readiness Project
- Satellite skills and knowledge for operational meteorologists
- Guide to the Direct Broadcast Network (DBNet)

I.7 WMO 2016 SURVEY ON THE USE OF SATELLITE DATA

To provide the final draft of the Survey report prior to its publication as a Space Programme document.

MEETING URL: http://www.wmo.int/pages/prog/sat/meetings/IPET-SUP-4.php

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### IPET-SUP WORK PROGRAMME FOR THE PERIOD 2016-2019
(LAST UPDATE: 21 APRIL 2016)

<table>
<thead>
<tr>
<th>No.</th>
<th>Task (ToR)</th>
<th>Deliverable/Activity</th>
<th>Due</th>
<th>Responsible</th>
<th>Status</th>
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<tbody>
<tr>
<td>1</td>
<td>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</td>
<td>Quadrennial survey</td>
<td>Feb 2016</td>
<td>WMO SP Secretariat and IPET-SUP</td>
<td>Survey carried out in the period 8 Feb – 15 Mar 2016; More than 400 responses received</td>
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<td></td>
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<td>Analysis of responses</td>
<td>Apr 2016</td>
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<td></td>
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<td>Findings and recommendations</td>
<td>Apr 2016</td>
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<td></td>
<td></td>
<td>Advice to Regional Associations on follow-up actions</td>
<td>Sep 2016</td>
<td></td>
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<td></td>
<td></td>
<td>WMO document for publication Next survey</td>
<td>Jan 2017</td>
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<td>2</td>
<td>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;</td>
<td>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</td>
<td>As required</td>
<td>IPET - SUP and WMO SP Secretariat</td>
<td>IPET-SUP provided input to the initial Vision for the WIGOS space-based components in 2040</td>
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<td></td>
<td>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</td>
<td>Continuous</td>
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<td></td>
<td>Initiate and promote activities to improve the availability of operational and R&amp;D satellite data according to user needs, monitor these activities in close coordination with the relevant working groups, regional associations and with WIS activities</td>
<td>Promote the development and maintenance of Regional Satellite Data Requirements Groups and satellite data requirements in all Regions, as appropriate</td>
<td>2016 onwards</td>
<td>Regional Groups active in RA I, II, III/IV</td>
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| 3 | Promote activities to advance the Satellite Data Dissemination Strategy:  
- Information and guidance  
- Data requirements  
- Enhancing data availability  
- Description and Registration  
- Dissemination and User Access | Encourage and assist Regional Satellite Data Requirements Coordination Groups in carrying out Region-based user surveys | | Development of progress indicators ongoing, including for DBNet Ongoing |
| 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; | Review of relevance and availability of R&D satellite data, based on global/regional requirements;  
- Strengthen interaction with R&D agencies in the area of altimetry, soil moisture, precipitation, and climate  
- Make recommendations for improved availability, information and training, especially for developing countries  
- Collect case studies to demonstrate the value of satellite data for hydrological applications | Ongoing | Participation in relevant fora, focus WMO survey on these topics and interaction with CEOS as appropriate |
<p>|   | | | 2017 |  |</p>
<table>
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<tr>
<th></th>
<th>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;</th>
<th>Maintain OSCAR/Space and a list of satellite data access points, processing and analysis software tools on WMO webpage</th>
<th>2016/2 (continued yearly)</th>
<th>Best practices for achieving user readiness (Reference User Readiness Project) published; Next-generation of OSCAR/Space, Product Access Guide and SATURN online</th>
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<td></td>
<td>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</td>
<td>Provide guidance to Sustained Coordinated Processing of Environmental Satellite Data (SCOPE) for Climate Monitoring as a key contribution to the architecture for climate monitoring from space. Continue to develop and promote the SCOPE-Nowcasting, initiative and support the work of the coordinating group. Collaborate with WIGOS, WIS and CGMS on developing data format and metadata standards, as well as procedures for monitoring satellite data availability and quality Promote the exploitation of commonalities of instruments on the new meteorological satellites in generation of product and training material</td>
<td>2016-2018</td>
<td>SCOPE-CM IP under review Four Pilot Projects in progress</td>
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<td>IPET - SUP and WMO SP Secretariat, SCOPE-CM Executive Panel, and SCOPE-Nowcasting Coordination Group</td>
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### APPENDIX I

<table>
<thead>
<tr>
<th></th>
<th>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&amp;D satellites, in accordance with the 2015–2019 Virtual Laboratory Training Strategy;</th>
<th>Regular reviews of the VLab status, activities and plans (training resources, courses, meetings, newsletters); Support existing VLab CoEs and the establishment of new ones; Provide guidance to meet users’ needs, especially from less developed Members and for the next generation of satellites; Explore training partnerships Contribution to training resource development</th>
<th>Continuous activity</th>
<th>VLab 2015-2019 strategy updated Events on user preparedness planned Joint COSPAR/VLab training event on space weather planned for August 2016</th>
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<tbody>
<tr>
<td>8</td>
<td>Holding joint and/or overlapping meetings with ET-SAT as appropriate, to facilitate interaction between users and providers of satellite systems, data and products</td>
<td>Plan for joint session of ET-SAT and IPET-SUP in 2017</td>
<td>2017/4</td>
<td>WMO SP Office</td>
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<td>9</td>
<td>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;</td>
<td>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</td>
<td>Ongoing</td>
<td>WMO SP Office, IPET-SUP Chair</td>
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<td>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</td>
<td>Increase engagement with WMO Technical Commissions, including JCOMM, CCI and CHy</td>
<td>Develop and implement communications strategy</td>
<td>Ongoing</td>
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2015/4
# List of Participants

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<thead>
<tr>
<th>Name</th>
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<th>Contact Information</th>
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<td>HOLLMANN, Rainer</td>
<td>Co-lead of WMO CCL TT on the Use of Remote Sensing Data for Climate Monitoring Satellite based Climate Monitoring / KU43 Deutscher Wetterdienst Frankfurterstr. 135 63067 Offenbach Germany Tel.: +49 69 8062 4923 Fax: +49 69 8062 2512 Email: <a href="mailto:rainer.hollmann@dwd.de">rainer.hollmann@dwd.de</a></td>
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<td>JANG, Jaedong</td>
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<td>MACHADO, Luiz Augusto Toledo</td>
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<td>PAVOLONIS, Mike</td>
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</tr>
<tr>
<td>BRUNEL, Pascal</td>
<td>Meteo France</td>
<td>73 Avenue de Paris</td>
</tr>
<tr>
<td>HIGGINS, Mark</td>
<td>EUMETSAT</td>
<td>Postfach 10 05 55</td>
</tr>
<tr>
<td>PRUD'HOMME, Christel</td>
<td>ECMWF</td>
<td>Environmental Forecasts Team Leader</td>
</tr>
<tr>
<td>FELLOUS, Jean-Louis</td>
<td>Committee on Space Research</td>
<td>c/o CNES 2 Place Maurice-Quentin</td>
</tr>
<tr>
<td>PRIVETTE, Jeff</td>
<td>Deputy Director, Center for</td>
<td>Deputy Director, Center for Weather and</td>
</tr>
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</table>
## WMO Representatives

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAKLANOV, Alexander</td>
<td>Scientific Officer, World Weather Research Division, Research Department</td>
<td><a href="mailto:abaklanov@wmo.int">abaklanov@wmo.int</a></td>
</tr>
<tr>
<td>BALOGH, Werner</td>
<td>Chief, Satellite Data Utilization, WMO Space Programme, Observing and Information Systems Department (OBS)</td>
<td><a href="mailto:wbalogh@wmo.int">wbalogh@wmo.int</a></td>
</tr>
<tr>
<td>BELDA, Fernando</td>
<td>Director, Observing and Information Systems Department (OBS)</td>
<td><a href="mailto:fbelda@wmo.int">fbelda@wmo.int</a></td>
</tr>
<tr>
<td>BEROD, Dominique</td>
<td>Chief, Basic Systems in Hydrology, Climate and Water Department (CLW)</td>
<td><a href="mailto:dberod@wmo.int">dberod@wmo.int</a></td>
</tr>
<tr>
<td>BOJINSKI, Stephan</td>
<td>Scientific Officer, Satellite Utilization and Products, WMO Space Programme, Observing and Information Systems Department (OBS)</td>
<td><a href="mailto:sbojinski@wmo.int">sbojinski@wmo.int</a></td>
</tr>
<tr>
<td>BRAATHEN, Geir</td>
<td>Scientific Officer, Atmospheric Environment Research Division, Research Department</td>
<td><a href="mailto:gbraathen@wmo.int">gbraathen@wmo.int</a></td>
</tr>
<tr>
<td>LABRADOR, Lorenzo</td>
<td>Scientific Officer, Atmospheric Environment Research Division, Research Department</td>
<td><a href="mailto:llabrador@wmo.int">llabrador@wmo.int</a></td>
</tr>
<tr>
<td>NUNES, Luis</td>
<td>WIGOS Scientific Officer, Observing and Information Systems Department (OBS)</td>
<td><a href="mailto:lfnunes@wmo.int">lfnunes@wmo.int</a></td>
</tr>
<tr>
<td>RATTENBORG, Mikael</td>
<td>Consultant WMO Space Programme, Observing and Information Systems Department (OBS)</td>
<td><a href="mailto:mikael@rattenborg.eu">mikael@rattenborg.eu</a></td>
</tr>
<tr>
<td>TARASOVA, Oksana</td>
<td>Chief, Atmospheric Environment Research Division, Research Department</td>
<td><a href="mailto:otarasova@wmo.int">otarasova@wmo.int</a></td>
</tr>
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</table>
# APPENDIX III

## AGENDA AND WORK SCHEDULE

<table>
<thead>
<tr>
<th>MONDAY, 26 February 2018</th>
<th>Approx. Time</th>
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<tbody>
<tr>
<td><strong>8:30</strong> Registration (Salle 7 LAKE)</td>
<td><strong>Discussion</strong></td>
</tr>
<tr>
<td><strong>9:00</strong> 1. ORGANIZATION OF THE SESSION</td>
<td><strong>15’</strong></td>
</tr>
<tr>
<td>1.1 Opening of the session (Chair); Welcoming Remarks (WMO)</td>
<td></td>
</tr>
<tr>
<td>1.2 Adoption of the agenda</td>
<td></td>
</tr>
<tr>
<td>1.3 Working arrangements for the session</td>
<td></td>
</tr>
<tr>
<td><strong>9:15</strong> 2. CHAIRMAN’s REPORT (English)</td>
<td><strong>10’ + 5’</strong></td>
</tr>
<tr>
<td><strong>9:30</strong> 3. GUIDANCE FROM THE CHAIRPERSON OF OPAG IOS (Rea, remote)</td>
<td><strong>10’ + 5’</strong></td>
</tr>
<tr>
<td><strong>9:45</strong> 4. ACTION REVIEW AND RELEVANT MEETINGS (Secretariat)</td>
<td><strong>15’ + 10’</strong></td>
</tr>
<tr>
<td><strong>10:10</strong> 5. PREPARING USERS TO NEW GENERATION SATELLITES</td>
<td></td>
</tr>
<tr>
<td>5.1 GOES-16 and GOES-S (Donoho)</td>
<td><strong>10’ + 5’</strong></td>
</tr>
<tr>
<td>5.2 FY-4A (Fang)</td>
<td><strong>10’ + 5’</strong></td>
</tr>
<tr>
<td><strong>10:40</strong> Break</td>
<td><strong>20’</strong></td>
</tr>
<tr>
<td><strong>11:00</strong> 5.3 NOAA-20 (JPSS-1) (Donoho)</td>
<td><strong>10’ + 5’</strong></td>
</tr>
<tr>
<td>5.4 FY-3D (Fang)</td>
<td><strong>10’ + 5’</strong></td>
</tr>
<tr>
<td>5.5 Readiness of user communities</td>
<td></td>
</tr>
<tr>
<td>5.5.1 Air quality (NRT data access, community description) (Eckman)</td>
<td><strong>15’ + 5’</strong></td>
</tr>
<tr>
<td><strong>11:50</strong> 6. DATA EXCHANGE AND DISSEMINATION</td>
<td></td>
</tr>
<tr>
<td>6.1 Regional Satellite Data Requirements and Data Exchange</td>
<td></td>
</tr>
<tr>
<td>6.1.1 RA I (RAIDEG-8, GFCS-specific needs) (Kane)</td>
<td><strong>10’ + 5’</strong></td>
</tr>
<tr>
<td>6.1.2 RA II (RA II WIGOS Project) (Omori, Jang)</td>
<td><strong>10’ + 5’</strong></td>
</tr>
<tr>
<td>6.1.3 RA III-IV (RA-3-4-SDR-3) (Machado)</td>
<td><strong>10’ + 5’</strong></td>
</tr>
<tr>
<td>6.1.4 RA V (TT-SU) (Adriyanto)</td>
<td><strong>10’ + 5’</strong></td>
</tr>
<tr>
<td><strong>12:50</strong> Break</td>
<td><strong>80’</strong></td>
</tr>
<tr>
<td><strong>14:00</strong> 6.1.5 RA VI (Keoghi, Wannop)</td>
<td><strong>10’ + 5’</strong></td>
</tr>
<tr>
<td><strong>14:15</strong> 6.2 WMS and Satellite Data</td>
<td></td>
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<tr>
<td>6.2.1 (item moved to Tuesday pm)</td>
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</tr>
<tr>
<td>6.2.2 Standard Metadata Abstract for WMS Metadata (Rattenborg)</td>
<td><strong>10’ + 5’</strong></td>
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</tbody>
</table>
### APPENDIX III

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:35</td>
<td>Break</td>
<td>15'</td>
</tr>
<tr>
<td>11:55</td>
<td>11. SATELLITE APPLICATIONS</td>
<td></td>
</tr>
<tr>
<td>14:00</td>
<td>11.5 CGMS Radiance Processing Change Notification Procedure proposal (English)</td>
<td>15' + 5'</td>
</tr>
<tr>
<td>14:20</td>
<td>11.6 Space-based Weather and Climate Extremes Monitoring Demonstration Project (Secretariat)</td>
<td>15' + 5'</td>
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<tr>
<td>14:40</td>
<td>6. DATA EXCHANGE AND DISSEMINATION (cont’d)</td>
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<tr>
<td>15:00</td>
<td>10. SCPE PROJECTS: NOWCASTING AND CLIMATE MONITORING</td>
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**TUESDAY, 27 February 2018**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Notes</th>
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<tbody>
<tr>
<td>9:00</td>
<td>9. COMMUNICATION PLAN (Task Team: Wannop, Keogh, Donoho, Eckman, Hollmann, Fang)</td>
<td>25'</td>
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<tr>
<td>9:25</td>
<td>13. WMO SPACE PROGRAMME ONLINE RESOURCES</td>
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<tr>
<td>10:50</td>
<td>11. SATELLITE APPLICATIONS</td>
<td></td>
</tr>
<tr>
<td>11:55</td>
<td>12. TRAINING AND EDUCATION</td>
<td></td>
</tr>
<tr>
<td>12:40</td>
<td>Lunch Break</td>
<td>80'</td>
</tr>
<tr>
<td>14:00</td>
<td>6.2.1 WIGOS Metadata Standard and OSCAR/Space (Guillaume Aubert, EUMETSAT; remote; Rattenborg)</td>
<td>15' + 5'</td>
</tr>
<tr>
<td>15:00</td>
<td>10.1 SCPE-Nowcasting Status Report (Mike Pavoloni, Chair of Executive)</td>
<td>20' + 10'</td>
</tr>
</tbody>
</table>
APPENDIX III

IPET-SUP-4/1.2(1) REV.1, p. 3

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>10:20</td>
<td>10.2 Nowcasting System Concept (Machado, Diop Kane) 10’ + 5’</td>
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<tr>
<td>15:45</td>
<td>10.3 SCOPE-Climate Monitoring: Status, Implementation Plan (Jeff Privette, Chair of Executive Panel, remote) 15’ + 5’</td>
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<tr>
<td>16:05</td>
<td>Break 20’</td>
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<tr>
<td>16:25</td>
<td>MATTERS ARISING FROM INFORMATION DOCUMENTS 15’</td>
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<tr>
<td>16:40</td>
<td>ORGANIZATION OF BREAK-OUT GROUPS 15’</td>
</tr>
<tr>
<td>16:55</td>
<td>BREAK-OUT GROUPS ON TOPICS ARISING IN SESSION (IN ROOMS 6 LAKE AND 8 JURA) 80’</td>
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<tr>
<td>17:55</td>
<td>Adjourn for Day 2</td>
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<td>19:00</td>
<td>Group Dinner</td>
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WEDNESDAY, 28 February 2018

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<tr>
<td>9:00</td>
<td>ALL DAY : WORK IN BREAK-OUT GROUPS (6 LAKE, 8 JURA)</td>
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<tr>
<td>11:45</td>
<td>INTERIM REPORTS TO PLENARY (7 LAKE) 45’</td>
</tr>
<tr>
<td>12:30</td>
<td>Lunch Break 70’</td>
</tr>
<tr>
<td>13:30</td>
<td>ALL DAY : WORK IN BREAK-OUT GROUPS (6 LAKE, 8 JURA)</td>
</tr>
<tr>
<td>16:30</td>
<td>INTERIM REPORTS AND DISCUSSION IN PLENARY 90’</td>
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<td>17:30</td>
<td>Adjourn for Day 3</td>
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THURSDAY, 1 March 2018

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<tr>
<td>9:00</td>
<td>14. REVIEW AND ADOPTION OF THE DRAFT REPORT 90’</td>
</tr>
<tr>
<td>10:30</td>
<td>Break 20’</td>
</tr>
<tr>
<td>10:50</td>
<td>14. REVIEW AND ADOPTION OF THE DRAFT REPORT (cont’d) 90’</td>
</tr>
<tr>
<td>12:40</td>
<td>15. ANY OTHER BUSINESS 10’</td>
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<tr>
<td>12:50</td>
<td>16. DATE AND PLACE OF NEXT MEETING 10’</td>
</tr>
<tr>
<td>13:00</td>
<td>Adjourn Session</td>
</tr>
</tbody>
</table>

DOCUMENTS FOR INFORMATION (see overleaf)
DOCUMENTS FOR INFORMATION
(NO PRESENTATION; AT CHAIR’s REQUEST, SHORT VERBAL INTRODUCTION ONLY)

1.1 INTERNATIONAL SCIENTIFIC WORKING GROUPS
   INF.1.1 Radio Occultation – IROWG-6 (Tony Mannucci)
   INF.1.2 Sounding – ITSC-21 (Mitch Goldberg, Steve English)

1.2 HIMAWARI-REQUEST EVENT-DRIVEN TARGET OBSERVATION PROTOCOL
   INF.2.1 JMA HimawariRequest Protocol (Omori)

1.3 VISION FOR THE WIGOS COMPONENT SYSTEMS IN 2040 (Secretariat)

1.4 CGMS HIGH-LEVEL PRIORITY PLAN 2017-2021 (Secretariat)

1.5 UPDATE ON EVENTS
   INF.5.1 ACMSUC-8 Report (Jang, Omori)
   INF.5.2 ACMSUC-9 Plans (Adriyanto)
   INF.5.3 NOAA Satellite Conference 2017 (Donoho)
   INF.5.4 EUMETSAT Conference 2018 (Wannop)

1.6 WMO GUIDELINES WITH IPET-SUP INVOLVEMENT (Secretariat)
   INF.6.1 Best Practices for User Readiness for New-Generation Satellites
   INF.6.2 Satellite Skills and Knowledge for Operational Meteorologists
   INF.6.3 Guide to DBNet

1.7 WMO 2016 SURVEY ON THE USE OF SATELLITE DATA (Secretariat)

MEETING URL: http://www.wmo.int/pages/prog/sat/meetings/IPET-SUP-4.php
## APPENDIX IV

### ACTIONS OF IPET-SUP

<table>
<thead>
<tr>
<th>Action</th>
<th>Deadline</th>
<th>Status</th>
<th>Last Update</th>
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<tr>
<td>Action 4.2: Select a scenario which is the authorized user of the ORS Environment Service</td>
<td>IPET-SUP-5</td>
<td>IPET-SUP-5</td>
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<tr>
<td>Action 4.3: Select technique on the transition plan from OLCI-5 (OLCI-6) to ORS-6.</td>
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<td>Action 4.4: Select situation regarding the user interface.</td>
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<td>DOER</td>
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<tr>
<td>Action 4.5: Select situation regarding the user interface.</td>
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<td>Action 4.9: Select situation regarding the user interface.</td>
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<td>Action 4.11: Select situation regarding the user interface.</td>
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</table>

**Recommendation:**

Recommen...
APPENDIX V

Task Teams established within IPET-SUP

CGMS-WMO Task Force on Metadata Implementation (participants from IPET-SUP)
Mikael Rattenborg
Guillaume Aubert (nominated through Sally Wannop)

PAG management task team
Sally Wannop
Natalia Donoho
Chu-Yong Chung and Jin Woo (for KMA)
Xiang Fang
Shiro Omori