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

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CONSULTATIVE MEETINGS ON HIGH-LEVEL POLICY

ON SATELLITE MATTERS

TWELFTH SESSION

GENEVA, SWITZERLAND, 21 JUNE 2014

FINAL REPORT

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1. ORGANIZATION OF THE SESSION

1.1 Opening of the session

The 12th session of WMO Consultative Meetings on High-level Policy on Satellite Matters (CM) was opened on Saturday 21 June 2014, at WMO Headquarters by Dr D. Grimes, President of WMO, chairing the session. CM-12 was held in conjunction with the 66th session of WMO Executive Council (EC-66). The Chairman welcomed the participants (See list in Annex).

The President recalled the role of the Consultative Meetings to support a dialogue between high-level representatives of the environmental satellite community and WMO, and to elaborate the strategic directions that WMO programmes take in relation to space. The President recalled the establishment and 50 years of success of the World Weather Watch with strong involvement of the satellite community. Strong relationships with space agencies have been established to reap the socio-economic benefits of satellite missions in the context of the global observing system. He indicated that CM has had regular meetings since 2001. This twelfth session would focus on two topics: (i) Climate monitoring from space and related data policy considerations in the context of the Architecture for Climate Monitoring from Space; and (ii) Socio-economic benefits of satellite programmes. The President pointed out the importance of mainstreaming climate services in all nations, and stressed the importance of satellite observations. The session should provide an opportunity to discuss status and future challenges related to effective coordination and use of satellite observing systems in support of weather and climate applications.

The Secretary-General of WMO, M. Jarraud, recalled the early mechanisms for the dialogue between satellite agencies and satellite data users. Today the value of satellite observations to all WMO Programmes and Members is undisputed, and therefore the CM is of crucial importance to WMO. He noted that the role of CM was unique in that it informs space agency about WMO initiatives and allows for high-level dialogue with Members and agencies; in the past it has provided important strategic advice. For example, the WMO Space Programme, which has an essential role for coordinating and building bridges between satellite operators and users, was established as an outcome of CM. The sixteenth World Meteorological Congress (Cg-16, 2011) called for the development of an Architecture for Climate Monitoring from Space, in recognition of the relevance of satellites for climate monitoring and the generation of climate data records. A well-coordinated, end-to-end Architecture is fundamental in the context of the emerging Global Framework for Climate Services (GFCS).

Moreover, the Secretary-General underlined that many Members face budget challenges and the benefits of meteorological activities in general and satellites in particular need to be demonstrated. Numerical Weather Prediction (NWP) has powerful tools to assess the impact of individual observing systems (current and future), leading to higher return on investment as soon as the satellite has been launched. He cited the World Food Programme as a beneficiary of satellites directly and indirectly (through NWP forecasts). In the area of disaster risk reduction support, the usefulness of satellite programmes is invaluable and visible. In this case, as well as for climate monitoring, it might be easier to communicate to decision makers in terms of “cost avoided to the society” rather than “benefits” only. Finally, the Secretary-General ensured the CM participants that the outcome of CM would be brought to the attention of the Executive Council (EC-66), and the seventeenth World Meteorological Congress (Cg-17) sessions and taken into account by the WMO Space Programme in its activities.

1.2 Adoption of the agenda

The session adopted the provisional agenda contained in Document 1.2 (1). All working documents, reference documents and presentations are posted on the CM-12 document web page: http://www.wmo.int/pages/prog/sat/meetings/CM-12.php .

2. PROGRESS ON THE SPACE-BASED ARCHITECTURE FOR CLIMATE MONITORING, AND ASSOCIATED DATA POLICIES

2.1 Update on Global Framework for Climate Services (GFCS) and preliminary outcome of the WMO EC Task Team on the WMO Policy for International Exchange of Climate Data and Products to support the implementation of GFCS

2.1.1 The Director of the GFCS Office, F. Lucio, provided an update on GFCS. He reported that as an outcome of the first Intergovernmental Board on Climate Services (IBCS-1) the Partners Advisory Committee had been established and institutional partnerships were in place (e.g., with IFRC, IUCN, ICID, UNECA, UNITAR) or under discussions (e.g., with the European Commission, UNDP, World Bank, UNFCCC). GFCS has now entered an implementation phase. National and regional consultations are being conducted to identify gaps in the various components of the GFCS in the four priority areas. Guidelines for frameworks for climate services at the national level are in preparation. Key gaps are related to inadequate gathering of high quality climate data, either from surface or space-based observations, such as ocean salinity, sea ice, soil moisture, leaf area index or air quality. Early efforts to showcase partnerships in the development and application of climate services are taking place through specific activities. The Director mentioned the status of several of these projects initiated to support GFCS implementation addressing the Observation & Monitoring, User interface platform, and Research/modelling pillars. He invited space agencies to contribute to this endeavour in different ways, e.g., by contributing resources to the GFCS Trust Fund, selecting activities of their interest from the implementation plan and the compendium of initial GFCS projects, or designating activities they are implementing as contributing to the GFCS. He indicated that a call for “GFCS projects” or “Contributing projects” would be issued shortly.

2.1.2 D. Grimes, in his capacity as chair of the Executive Council Task Team (ECTT) on the WMO Policy for International Exchange of Climate Data and Products to Support the Implementation of the GFCS, summarized the findings of this Team. He pointed out that at IBCS-1 and other meetings, emphasis was placed on the need for availability of climate-relevant data to support climate services, while respecting national policies. Three particular principles were stressed, out of the eight principles for establishing the GFCS: public data and products should be seen as a public good; climate services are necessary to address the safety of population; climate data are also important for their impact on economic growth. Common understanding of terminology (data, products, tools, methods) is a prerequisite in this discussion. It was recalled that an underlying principle of Resolutions 40 and 25 is that the data necessary to support safety and security are to be exchanged as “essential” data. This has direct implications on climate data, as the extent to which public data is available and can be used determines the ability to monitor and forecast climate including anomalies that affect the safety of population (Greater Horn of Africa drought is a case in point, for example).

The ECTT Chair drew attention to the draft Resolution for Cg-17 in document CM-12/Doc.02-01-02 (EC-66/Doc.3.2.(1)) and to its annex which lists particular climate relevant “essential data”, some inspired by impacts and adaptation applications (e.g. coastal areas), the last one being very broad and addressing also socio-economic data. The words “All

available" imply that nations should share what they have, but does not mean an obligation to generate data sets that do not exist. Furthermore, certain data may not be made available, for example data relevant to national security. He invited the session to provide feedback on the proposals put forward by this EC Task Team, from a satellite operators' perspective. He asked in particular whether the proposal would help satellite operators and Members to address climate challenges.

G. Adrian (P.R., Germany) pointed out the importance of data assimilation systems for making effective use of satellite data. He acknowledged the importance of the ECV concept but noted that the concept should not be misused (e.g., by introducing ill-defined products). Availability of well-characterized level 1 and higher-level products will always be essential.

C. Richter (Director, GCOS) emphasized that the ECV list is being carefully reviewed.

M. Jarraud enquired on the contribution of GEO to the provision of data beyond the physical climate system.

B. Ryan (GEO) noted the success of ECV concept at strategic and technical level; it has been a marshalling force to developing climate data records, certainly from a space agency perspective. Other communities are developing similar concepts (Essential Biological Variables - EBVs, Essential Ocean Variables - EOVs) and these need to be seen in context.

M. Paese (NOAA/NESDIS) highlighted the U.S. contribution to climate dataset generation and supported the international policy on data sharing drafted by WMO.

P. Lecomte (ESA) stressed that the concept of "Essential Climate Variables" is important to focus satellite agency action on essentials.

A. Frolov (P.R., Russian Federation) supported the view of ESA that the ECVs are providing a useful focus for observing systems and data processing and generation. He also stressed that it is critical that processing algorithms be well defined and validated, and instruments be rigorously characterized, to ensure that datasets are comparable for the generation of climate data records in accordance with global standards.

G. Zheng (P.R., China) pointed out the importance of national space plans to ensure the continuity of the space-based monitoring system. He mentioned the China Meteorological Administration (CMA) plans to move a geostationary FY-2 spacecraft to the Indian Ocean to provide continuity of coverage and highlighted the importance of inter-calibration of the various satellites, as promoted by the WMO Space Programme, to ensure seamless transition and to enable consistent data series over time for climate monitoring.

W. Zhang (Director, Space Programme) recalled the questions in the working document submitted to the meeting, and T. Mohr (Special Advisor of the Secretary General of WMO on satellite matters) suggested that Members should get an opportunity to review the draft resolution and provide detailed comments.

In summarizing this discussion, the Chair highlighted the following points:

- There is broad recognition of the need for international exchange of observation data required for climate monitoring and services;

- The WMO should take an action to officially inform the space agencies of the EC draft resolution (EC-66/Doc.3.2.(1)) and invite feedback by October 2014, in order to inform the upcoming Congress deliberations from the perspective of the Architecture

for Climate Monitoring from Space, taking into account the data policy practices of space agencies for climate data;

- There is a need for seamless continuity of satellite programmes to support climate monitoring and climate applications; this should be advocated in reference to the socio-economic benefit of climate applications (See item 3 below);

- The climate data policy should not only focus on ECVs, which are related to climate relevant geophysical products, but also on the preservation and sharing of Level 1 (instrument-level) data, to secure the possibility of further reprocessing.

2.2 Progress report on development of the Architecture for Climate Monitoring from Space, data preservation and data policy

2.2.1 Space-based observation is playing an increasing role in climate monitoring, thanks to the length of historical satellite data records, improvement of satellite observation capabilities, improved calibration, increased maturity of satellite data processing and re-processing, and improved use of satellite data in model analysis and reanalysis. Since the WMO Congress has adopted Resolution 19 (Cg-16) on the development of an Architecture for Climate Monitoring from Space, a report on “Strategy towards an Architecture for Climate Monitoring from Space” has been jointly developed by the initial group composed of representatives of the Committee on Earth Observation Satellites (CEOS), the Coordination Group for Meteorological Satellites (CGMS) and the WMO.

W. Zhang, on behalf of the CEOS/CGMS/WMO group chair Mr M. Dowell (European Commission, JRC), presented the rationale behind the Architecture, the elements foreseen in the Strategy, and currently planned activities. The Architecture is an effort aiming to provide a structured and comprehensive view of what Climate Data Records are available from Earth Observation satellites, to create the conditions for delivering further Climate Data Records through best use of existing data holdings, and to optimize the planning of future satellite missions and constellations in order to expand existing and planned Climate Data Records, addressing possible gaps of coverage or record length. He recalled that the Architecture is an end-to-end approach which spans over several “pillars”, from remote sensing, to climate data record creation and preservation, and to climate applications in support of decision making. The challenges associated with constructing the physical architecture were addressed, including some critical technical challenges as well as utilization/application challenges.

Whilst recalling the importance of long-term climate information preservation supporting climate change and adaption, he highlighted that the Architecture also provides the foundation for implementing the Observations and Monitoring pillar of GFCS, thus sustaining the provision of near real time monitoring for climate services at the global, regional and national scales. Furthermore, he pointed out that it is a responsibility of governments to strengthen and sustain their long-term national space programmes to meet global, regional and national climate monitoring and service needs. Additional investments by governments would be needed in space programmes to complete, enhance and sustain the Architecture. The role of international organizations like WMO is to further enhance international collaboration towards the development of a physical space architecture, facilitate free and open data and products access and exchange from satellites, and to promote collaboration of space agencies with user communities for realizing economical and societal benefits through climate services. In this regard, WMO through its Space Programme plays an important role as a bridge between users and satellite operators.

2.2.2 The Chair of the CEOS-CGMS Working Group on Climate, John Bates (NOAA), presented his views on the progress and future plans for the Architecture. He recognized the

focus of the current work on sensing and climate data record generation (the two left most pillars), and attention needs to be paid over time on the application and further downstream use of climate data records. He explained the connection between climate data latency and their application, highlighting the distinction between near-real time application of satellite data (e.g., to infer on precipitation and crop indices, ENSO) and long-term application (e.g, for climate trend detection). He described the Group's work plan which includes:

- Developing an inventory of ECV climate data records held by agencies, as part of the "physical" Architecture and to allow for analysing gaps and developing actions to mitigate the gaps;
- Case studies linking climate data records to societal applications and policy decisions; examples of climate services in the GFCS priority areas;
- Reporting and engaging with GCOS and UNFCCC, and proposed use of the ECV inventory approach to incorporate in-situ data holdings as well.

T. Mohr questioned the assumption that the physical architecture could be captured in the ECV inventory. He expressed the view that the Architecture, in order to respond to the request from Congress, should not be limited to an inventory of datasets, but should rather build on such an inventory to develop a full-scale "virtual climate constellation". J. Bates responded that the work plan was addressing this concern. P. Counet (EUMETSAT) noted that the building blocks of the Architecture needed to be solid, and therefore the Group's three-year work plan was focussing on the ECV data record analysis, and not on building an entire system.

J. Lafeuille (WMO) highlighted the risk that, if space segment considerations are postponed after completion of the three-year work plan, the Working Group would not be in a position to deliver solid outcomes by the time of the 17th World Meteorological Congress (Cg 17).

B. Ryan commended CEOS, CGMS, and WMO for working together on an important subject such as climate. She pointed out that a successful development of the Architecture for Climate Monitoring could serve as a useful model for the development of similar mechanisms for other societal applications pertinent to GEO.

M. Dowell encouraged a systematic discussion between data providers and users to capture the whole range of user requirements, through GCOS and potentially other communities.

M. Paese commended the work of the joint Working Group Climate and supported its continuing work.

The Chair recognized the importance of an effective collaboration between CEOS, CGMS and WMO and the particular role of WMO to support the user-provider dialogue.

2.3 Presentations by Satellite Operators and Space Agencies on responses to the Architecture and associated data policies

2.3.1 The Director of the European Space Agency (ESA) Climate Office, P. Lecomte, described the ESA Climate Change Initiative (CCI) focussing on the generation of climate data records using archived data from ESA Earth Observation instruments over thirty years. The CCI is based on GCOS requirements within the context of GEOSS. The ESA Ministerial Council in 2008 approved the CCI programme for the period 2009-2014 with a 75.5M€ funding envelope. Collaboration with other space agencies within CEOS (and now the joint Working Group) has been important for implementing this programme, since raw data (level 1) from several partners are needed in the various CCI projects (e.g., from EUMETSAT, NASA, JAXA). The ECV datasets serve climate data users, and these provide feedback to reprocessing level 1 datasets. Interaction among the CCI projects, partly through the Climate Modelling User Group, has led to community-building in Europe and spurred the

development of new collaborations, e.g. a SST/Sea Ice project. A CCI Phase 2 will start in July 2014 for three years, at a comparable level of funding, and will address new ECVs. Nine projects have completed Phase 1 and are entering Phase 2; four other projects should enter Phase 2 by January 2015. He underscored the value of interdisciplinary exchanges within a Climate Modelling User Group (CMUG).

P. Lecomte also presented the Copernicus Sentinel data policy. Apart from data designated as security-relevant, all Sentinel data will be made openly available. ESA proposes the development of thematic exploitation platforms, a concept of virtual workspace whereby "the users are moved to the data" instead of moving the data to the users. More specifically, the exploitation platform is a collaborative environment delivering the resources and capabilities required for users' work in a thematic domain, it includes a comprehensive work environment with remote sensing and in-situ data from several sources, data discovery and processing capabilities, software tools and scalable resources.

M.L. Bah (President of RA I) asked whether carbon measurements are included in the CCI. It was clarified that atmospheric CO_2 is addressed but not biomass. The advisor to Dr Kilya asked about ground water, river and lake levels. It was clarified that this was not addressed either since the ESA CCI focuses on those ECVs which are measurable from ESA instruments and for which there is a recognized competence in the ESA community.

2.3.2 M. Crowe (Environment Canada) presented the Polar Communications and Weather (PCW) mission, its status and potential contribution to the space-based architecture for climate monitoring. Canada had issued a Request for Information to the space industry and received more than 20 respondents which confirm the feasibility of high-level requirements. He described the potential contribution by PCW to climate monitoring and ECV dataset generation as well as its possible support to inter-calibration other satellite instruments in the context of the Global Space-based Inter-calibration System (GSICS).

P. Taalas (P.R. Finland) noted the importance of Arctic monitoring for services and expressed interest from Finland and possibly other Nordic countries, in contributing to the mission. He invited M. Crowe, however, to explain why a mission on Highly Elliptical Orbit would be necessary in addition to polar orbiting satellites which already provide frequent overpasses of high latitude areas.

M. Crowe responded that a polar satellite overpass only covers part of the Arctic, therefore even three LEO satellites cannot provide permanent coverage of the whole Arctic with 15-minute repeat cycle (and this would be of unique value to weather applications. An additional value of PCW is the permanent telecommunication capability enhancing broadband communications over the Arctic, e.g. for shipping operations.

The session noted the significant potential of the proposed PCW mission to contribute to the WIGOS, Global Cryosphere Watch, and the Architecture for Climate Monitoring from Space, through quasi-permanent observation of the Arctic area.

3. SOCIO-ECONOMIC BENEFITS OF SPACE PROGRAMMES

3.1 Progress report from the Tiger Team on socio-economic benefits from space programmes

The Chair of the CGMS Socio-Economic Benefit Tiger Team (SETT), C. Wooldridge, reported on the progress of this team since its inception in 2013 and its short- and medium-term plans. The Team's objectives are (i) to develop a credible methodology for articulating

the socio-economic benefit of satellite observing systems, and (ii) to explore most effective ways to communicate this information to desired stakeholders. He reflected on the origins of this activity at the 40th session of CGMS, inspired by a presentation on the impact of various observing systems on NWP. An underlying motivation for better justifying the investments in satellite programmes was an increasingly resource-constrained environment, as well as higher demands on communicating the benefits of these programmes.

The first workshop of SETT on 24-25 April 2014 recognized the importance of context, methods, existing practices, approaches (quantitative versus qualitative) and costs of implementation when carrying out socio-economic benefit studies. When framing such studies, one should bear in mind the intended audience, as well as the decision-making structure on the part of the audience. For the success of socio-economic studies, interdisciplinary expertise and socio-economic data (sometimes commercially restricted) was generally required. He discussed the plans for SETT and advocated the need for a continuous process of assessing the benefits of satellite programmes, since assessing progress over time was needed.

The President suggested that, in addition to estimating benefits, opportunity costs and cost avoidances should be included in socio-economic benefit studies. S. Barrell (BOM, CBS Vice-President) highlighted the importance of estimated benefits and the difficulties to differentiate the benefits of observations from those due to services. She suggested that users of satellite data (NMHS) as well as users of users should be involved in such studies. She further recommended that the workshops on the impact of various observing systems on NWP held under the auspices of WMO should be extended to other application areas such as climate. T. Mohr reinforced the latter point.

G. Adrian emphasized the importance of estimating avoided costs (e.g., arising from a meteorological hazard) as a result of operating observing systems. Such estimates would assist NMHS in justifying their operations within government. He shared the observation that the German aviation industry as a major customer of German NMS (DWD) services was not in a position to estimate the monetary value of meteorological information that they receive from DWD, since this information was an integral part of a larger aviation management system and its value could therefore not be disaggregated.

3.2 Presentations by Satellite Operators and Space Agencies on socio-economic benefit studies

CMA, EUMETSAT, JMA and NOAA/NESDIS reported on studies they have performed on socio-economic benefits of satellite programmes and shared their experience in this area.

3.2 (1) EUMETSAT: Cost-benefit analysis of EPS Second Generation

P. Counet (EUMETSAT) reported on a study to assess the benefit/cost ratio for the EPS/Metop-Second Generation programme, to inform EUMETSAT member states. The study scope covered Europe (EU27) in areas directly benefiting from improved accuracy of forecast information, where quantitative assessments of benefit were possible (e.g., protection of property and infrastructure (avoided costs), transport and energy management, the value of private use for European citizens). The study did not consider areas where quantitative assessments of the impact of satellite observations were more complex or not feasible (e.g., climate monitoring, safety of life) and its results should therefore be considered conservative estimates. The study consisted of two parts (i) estimating the socio-economic benefits of forecasts (led by the World Bank and MétéoFrance), and (ii) the impact of satellites on forecasts supported by the ECMWF, UKMO, DWD, and MétéoFrance. The relative contribution of various satellites showed the value of investing in new technology (e.g., Metop-A vs NOAA-19) and of international collaboration (a loss of Metop-A and NOAA-

19 would have higher negative impact, than the sum of the impacts of either system removed separately). The benefit/cost ratio of the EPS/Metop-SG programme was estimated at 5 (minimum) to 20 (likely).

M.L. Bah thanked EUMETSAT for their contribution to providing meteorological information to RA I and re-emphasized the importance of satellite coverage of the Indian Ocean region, echoing the discussion in EC-66. A collaborative effort by RA II satellite operators to address continuing coverage of this part of the world is encouraged.

G. Zheng emphasized the value of assessing impacts of observing systems.

I. Čačić (President of RA VI) stressed the need for guidance on how to communicate cost-benefit studies.

3.2 (2) CMA: Preliminary assessment of socio-economic benefits from CMA Meteorological Satellite Programmes

J. Yang (CMA) presented a preliminary assessment of socio-economic benefits of the CMA meteorological satellite programme. He described the significant impact of meteorological disasters on China. Relative reduction in losses of lives and properties over the past twenty years is partly due to improvement of meteorological services. Typhoon route forecasts have significantly increased. Satellite-based fire monitoring has significantly reduced loss of life and property due to forest and grassland fires. There has been a significant investment by government in satellite meteorological infrastructure (7.5b CNY in 2001-2012) including space and ground segments, and operational maintenance. He described the use of the Delphi method to establish benefit estimates and reported on an estimated benefit/cost ratio of 40 for satellite systems. In explaining this high ratio, he offered the long-term satellite development plan pursued by China, a good balance between satellite and ground segments, an open data policy, and significant effort in application development. He acknowledged the challenges associated with estimating the socio-economic benefit of satellites.

S. Barrell noted the benefit of open data sharing, estimated to have a benefit of 1.3% of the annual GDP of OECD countries.

3.2(3) NOAA: NOAA's JPSS Economic Benefit Analysis

C. Wooldridge (NOAA) briefed on the NOAA's JPSS economic benefits analysis which is in a formative stage. However, in shaping the study, NOAA has already benefited from discussions in the CGMS SETT. The methodology of the analysis will include prior studies carried out by other agencies, as well as the WMO OSCAR database for evaluating the value of individual instruments for measuring variables that are needed for applications. He said that OSCAR should be maintained at a best level possible. He pointed at some of the challenges expected in the analysis.

B. Ryan asked to what extent cost-benefit analyses were truly independent and not biased by the commissioning institution.

3.2(4) JMA: Himawari-8 and -9 from a Disaster Risk Reduction Perspective

T. Kimura (JMA) discussed how Himawari-8/9 will be used for reducing the risk of disasters in Japan. He stressed the importance of this new geostationary satellite system for monitoring tropical cyclones, volcanic activity and heavy rainfall. He discussed the role of the Regional Specialized Meteorological Centre (RSMC)-Typhoon Centre (TC) Tokyo and the likely benefits of high-resolution satellite imagery for nowcasting and numerical weather

prediction. The Advanced Himawari Imager on Himawari-8 will allow improved monitoring of tropical cyclones and volcanic eruptions, at 10 minute intervals by default and at 2.5 minute intervals over Japan and target areas.

In the discussion, the value of combined radar-satellite nowcasting products, for example on rainfall, was recognized. The integration of various observing system data streams required in generally more attention. G. Adrian pointed out that in Germany, alternatives to radar networks needed to be found since in some areas, the quality of radar observations were increasingly compromised by the presence of wind turbines.

J. Lengoasa (Deputy Secretary-General) raised the possibility to estimate the cost/benefit of the entire global observing system since most studies shown here were directed at national decision-makers. The President of the Commission for Agriculture pointed out the criticality of satellite remote sensing for agriculture (e.g., soil moisture products). He noted that satellite operators would not sufficiently engage in sustaining in-situ ground networks (e.g., soil moisture), and WMO should stress this need more strongly. He also noted the significant IT infrastructure needed to process satellite data, for analysis and service provision.

D. Grimes suggested that at the next session of the CM, one of the application-oriented WMO Technical Commissions should provide a perspective on socio-economic benefits.

The session recommended that WMO should broaden its assessment of the impact of observing systems on user applications to areas other than numerical weather prediction. Such assessments would underpin socio-economic benefit studies of observing systems. They could be done either by broadening the scope of the highly successful series of WMO Impact Workshops (e.g., Sedona 2012), or by arranging similar but separate events for other application areas.

4. ANY OTHER BUSINESS AND CONCLUSIONS

Suggestions for the agenda of future CM sessions

With regard to the agenda of the next session of CM, the President encouraged participants to express their views on what are the emerging issues of strategic nature that should be discussed in CM and WMO Congress. One of these issues could be the evolving context of space programme funding and management, with potential opportunities and issues raised by different models for the respective engagement of governmental and non-governmental parties with respect to data sharing and global coordination.

T. Mohr raised two challenges: (i) the Architecture for Climate Monitoring from Space, and (ii) ensuring the preparedness of users to the new generation of satellites. On the latter, a strategic discussion is required which would also be addressed in the IMO Lecture on 25 June 2014.

M. Paese expressed interest on the issue of emerging commercial providers in the development and operations of satellite observations, and possible implications on partnerships, data exchange and WMO Resolution 40. He suggested that a task team be formed to scope and discuss this issue, and to present its results to Cg-17. D. Grimes endorsed this idea, noting concerns by EC Members about the role of commercial infrastructure providers more generally. S. Barrell commented that such work had been identified by CBS Implementation-Coordination Team on Integrated Observing System (ICT-IOS) and should be part of WIGOS efforts. J. Lengoasa noted the role of the NWP and the World Weather Open Science Conference.

The Chair further noted that holding the CM session during the EC timeframe had some advantages but also posed some organizational challenges and did not enable to report the outcome of CM sessions in advance of EC discussions.

Summary recommendations from the session

Recommendation 1
The session expresses strong support to the general approach to international exchange of climate data and products contained in the WMO Executive Council Draft Resolution on climate data policy and its Annex. It underlines however the specific challenges of the generation and long-term preservation of satellite-based climate data records. There is thus general agreement that CEOS and CGMS space agencies should be given an opportunity to provide comments on the Draft Resolution including agencies' views regarding the data policy both for sensor data (e.g., radiances) and for derived, higher-level products. It is thus recommended that the WMO Secretary-General inform the space agencies of the draft Resolution adopted by the Executive Council and invite them to provide feedback by 31 Oct 2014, so that this feedback can be taken into account by WMO Members at the seventeenth Congress.

Recommendation 2
WMO is strongly encouraged to broaden its regular assessment of the impact of observing systems on user applications in considering areas beyond numerical weather prediction. This could be done either by broadening the scope of the highly successful series of WMO impact workshops (e.g. Sedona 2012), or by arranging similar but separate events for other application areas.

Recommendation 3
In the context of the Architecture for Climate Monitoring from Space, WMO should take a leading role in developing user case studies showing the relevance of satellites in support of GFCS priorities.

Recommendation 4
The session recommended that a task team be formed under the ICT-IOS to elaborate the issue of emerging commercial providers in the development and operations of satellite observations, and possible implications on global coordination and on data exchange (implementation of WMO Resolution 40). Input from the NWP community and the World Weather Open Science Conference should be considered. The task team should present its results to Cg-17.

Recommendation 5
The Secretary General is encouraged to host the CM in conjunction with meetings of the WMO Bureau or other events as appropriate to facilitate strong participation of Agency Executives from the satellite operators in the CM. The outcome of CM meetings should also inform the Space Programme reports to the EC or Congress.

The Session agreed that EC-66 should be informed about the outcome of the session.

5. CLOSURE OF THE SESSION

The session closed at 17:00.

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ANNEX:

LIST OF PARTICIPANTS

GRIMES	David	Chair CM-12 WMO President Permanent Representative of Canada
MOURA	José Antonio	WMO First Vice-President Permanent Representative of Brazil
MOKSSIT	Abdalah	WMO Third Vice-President Permanent Representative of Morocco
BAH	Mamadou Lamine	RA I President Permanent Representative of Guinea
ABDULLA MOHAMMED	Ahmed	RA II President Permanent Representative of Qatar
BAEZ	Julián	RAIII President Permanent Representative of Paraguay
FALLAS SOJO	Juan Carlos	RA IV President Permanent Representative of Costa Rica
ČAČIĆ	Ivan	RA VI President Permanent Representative of Croatia
LEE	Byong-lyol	CAgM President National Center for AgroMeteorology (NCAM) Republic of Korea
BRANSKI	Frederick	CBS President U.S. National Weather Service
STANDER	Johan	JCOMM Co-President South African Weather Service
BARRELL	Sue	ICG-WIGOS Chair Bureau of Meteorology, Australia
CIAPPESONI	Héctor Horacio	Permanent Representative of Argentina Servicio Meteorológico Nacional, Argentina
MARINO	Monica	Servicio Meteorológico Nacional, Argentina
MATSCHINSKE	Emma Giada	Brazil
ARAVEQUIA	José Antonio	National Institute for Space Research, Brazil

KORTCHEV	Georgi	National Institute of Meteorology and Hydrology, Bulgaria
CROWE	Michael	Environment Canada
ZHENG	Guoguang	Permanent Representative of China China Meteorological Administration (CMA)
SHEN	Xiaonong	China Meteorological Administration (CMA)
YANG	Jun	China Meteorological Administration (CMA)
ZHOU	Heng	China Meteorological Administration (CMA)
LOUMOUAMOU	Camille	Permanent Representative of Congo
DINGA	Paul	Hydrological Adviser DGRST, Congo
NARANJO JÁCOME	Carlos	Permanent Representative of Ecuador
ADRIAN	Gerhard	Permanent Representative of Germany Deutscher Wetterdienst
WAQAICELUA	Alipate	Permanent Representative of Fiji
FUNAKI	Misaeli	Fiji Meteorological Service
HURTOLA	Maria	Finnish Meteorological Institute
RATHORE	Laxman Singh	Permanent Representative of India India Meteorological Department (IMD)
ATTRI	Shiv Dev	India Meteorological Department (IMD)
ROSCI	Paolo	Italian Air force, MetService, Italy
NISHIDE	Noritake	Permanent Representative of Japan Japan Meteorological Agency (JMA)
KIMURA	Tatsuya	Japan Meteorological Agency (JMA)
HIRANO	Yoshiaki	Japan Meteorological Agency (JMA)
HASEGAWA	Jitsuko	Japan Meteorological Agency (JMA)
MATSUDA	Kohei	Japan Meteorological Agency (JMA)
WON	Jaegwang	Korea Meteorological Administration (KMA)
STRAUSS	Bernard	METEO-FRANCE

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