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# **11<sup>TH</sup> SESSION OF THE COMMISSION ON ATMOSPHERIC SCIENCES (CAS) MANAGEMENT GROUP**

## **FINAL REPORT**

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

#### **1.1 Welcome and Introduction**

The President of the Commission for Atmospheric Sciences (CAS), Dr Øystein Hov, opened the meeting at 09:00 on 1 June 2016, and welcomed the CAS Management Group members participating in the meeting, see Annex 1.

#### **1.2 Adoption of the Agenda**

The Management Group approved the agenda. The President provided guidance on the purpose and scheduling of the various agenda items during the three days planned. The purpose of the meeting was to review the programmes, to discuss relevant scientific issues, to review the resource situation, and plan how to mobilize additional resources, and to plan what to address during the 2017 CAS session and related TECO, planned to be held in Djakarta, Indonesia, during July 2017.

### **2. PROGRESS REPORTING**

#### **2.1 Report by the President of CAS**

The President reminded the members of the terms of reference of the CAS Management Group and of the WMO strategic priorities, of seven expected results and need for better connection between research and services, as well as the six CAS priorities. He stressed that "science for services" is judged by the quality, relevance and impact. Research and development represent an important part of the value delivery chain. He reminded that implementation plans of two programmes in CAS were written with this picture in mind. He stressed that post-processing, for individual users and specific sectors, is becoming an important part of the value chain, and that the collective capacity is what matters for the final user rather than the capability of a single met service, and in this way the visibility of individual met services is decreasing.

The President of CAS highlighted some strategic elements:

- The strong link between for instance Numerical Weather Prediction (NWP) and Climate Services, calling for the value chain to be driven by R&D and users, and for a merge of R&D and forecasters' cultures.
- In order to be influential in the mosaic of environmental policies, there is the need of bridging science and policy and adding economic modelling to the chain following three main phases: basic science discovery phase, mature science results consensus, integrated assessment modelling and policy
- Key partners for CAS and challenges in working with them:
  - WCRP and its integration with WWRP and GAW activities;
  - GCOS, the challenge for CAS, can be formulated as: "How to grow together with those which feed on us?" It is important to make sure that CAS + GCOS is a sustainable value creating structure.
  - WIGOS, WMO foundational activity addressing the observational needs of weather, climate, water and environmental services of its members.
- The UN International Law Commission (ILC) is working on a draft legislation: "The Law of the Atmosphere" and has discussed with WMO and CAS relevant technical aspects like Advertent climate engineering (Geo-engineering), for further details see Lenton and Vaughan (2009, ACP). ILC asks important questions: legislation mosaic, geoenvironment (Would it work? Is it feasible? Who is responsible for?, etc.). The WMO Congress or EC has been reluctant to address the geoenvironment issue.

The President noticed that we are facing a turning point for weather/climate services, and he specifically detailed some important trends:

- Services are becoming more and more sophisticated, internet based and without a clear institutional brand, and are moving from forecasting to impact assessment;
- There is a notion of value chain in the service delivery and a need for interaction with user community to be relevant;
- Resource mobilization is strongly required for science innovation and new services development;
- WMO and NMHS role in the global weather enterprise, can WMO and NMHS expect to continue to push the future global data processing and forecast products? User interactions forces exploration of what works, which can be quite different from what the World Meteorological Congress or NMHS push; big data vs the traditional WMO controlled observational data flows; WIGOS and WIS do they succeed in becoming the generic way of global data management for research and operational data?

The President's report was noted with appreciation. The presentation followed up by a discussion on the need for better connection between the work of CAS and policy making, visibility of CAS activities in Copernicus Atmospheric Monitoring Services (such as the separation of the work of European Commission and the National Met Service's deliveries in weather services). The discussion covered a question of visibility of WMO services in a new business and information world where a lot of information is available through Internet without attribution to original sources. CAS MG members expressed concerns that WMO has little flexibility as there are many more players in the area at the moment than it was 20 years ago. To be responsive WMO needs to improve its responsive capabilities.

## 2.2 Action item progress

The President invited Oksana Tarasova and Paolo Ruti to provide a short overview on progress related to previous CAS Management Group action items and recommendation, as presented in more details in the table below:

<b>CAS MG-10 Action Items</b>	
<b>Action Item</b>	<b>Progress</b>
<p><b>ACTION ITEM 1:</b></p> <p>The CAS Management Group members were requested to familiarize themselves with IG3IS and to ensure that their respective PRs' are well informed and supportive to this initiative, including at the discussions during Congress in May 2015.</p>	<p>The web page for IG3IS initiative was created (<a href="http://www.wmo.int/pages/prog/arep/gaw/ghg/IG3IS-info.html">http://www.wmo.int/pages/prog/arep/gaw/ghg/IG3IS-info.html</a>). It contains presentations and background materials to explain the tool. The concept paper is also uploaded to the GAW web page and it will be further discussed at the EC-68. Round table in support of the document will take place on 17 June 2016.</p>
<p><b>ACTION ITEM 2:</b></p> <p>The CAS Management Group members were requested to familiarize themselves with the role of (the observational component of) GAW within WIGOS and use the opportunities presented by WIGOS in support of CAS initiatives, including IG3IS. In this regard, members were requested to ensure that their respective PRs' are well informed and supportive of WIGOS-GAW links, including at the discussions during Congress in May 2015.</p>	<p>Role of WIGOS and its underlying processes is specified in the GAW Implementation plan, though further actions in the countries are required to foster implementation of WIGOS. Mutual benefits should be sought between upgrades of meteorological observing networks and enhancement of atmospheric composition measurements.</p>

<p><b>ACTION ITEM 3:</b></p> <p>A well-coordinated effort is required to ensure sustainable resources to the activities of the WMO Research Department (WCRP, WWRP and GAW) and to ensure that global, regional and national funding organizations are aware of the research opportunities presented. In this regard CAS MG requested for:</p> <p>i. A holistic funding strategy to be developed with contributions from the CAS MG and two SSCs and the secretariat.</p> <p>ii. The CAS Management Group members to ensure that their respective PRs' are reminded of the priorities agreed to by CAS and to be supportive to these initiatives, including the discussions during Congress in May 2015.</p> <p>iii. (Deon Terblanche) Will develop an action list on the funding of projects for Cg-17.</p>	<p>See resource mobilization session under CAS MG 11 agenda.</p>
<p><b>ACTION ITEM 4:</b></p> <p>The Chief WWRP has to establish what is being done already in other commissions (CIMO and CBS) and departments of WMO. If a clear gap exists, the WWRP SSC should consider how the Working Group on Nowcasting and Mesoscale Weather Forecasting Research and the Working Group on Data Assimilation and Observing Systems could assist.</p>	<p>CIMO has developed a WMO guidance on weather radar/ wind turbine siting (see Annex (page 28) of ch. 9 in Part II of the current CIMO Guide edition ( <a href="http://www.wmo.int/pages/prog/www/IMOP/CIMO-Guide.html">http://www.wmo.int/pages/prog/www/IMOP/CIMO-Guide.html</a> ).</p> <p>This topic has been also considered at the last WMO Congress under the item 4.2.2.65 (Standardization of Weather Radar Practices and Procedures). "CIMO is requested to coordinate scientific studies and work on more specific recommendations on the separation between wind turbines and weather radar systems."</p> <p>The nowcasting and mesoscale numerical weather prediction WG has been established last year with a first meeting held in Geneva (December 2015). It has been requested to put this agenda item for their first meeting in Hong Kong, July 2016.</p>

The members were satisfied with the progress made, and provided additional comments to be considered for the final list of actions from CAS MG-11.

There was a discussion on the interaction of wind farms with radars. The impact is quite substantial in Europe. It was noted that WMO regulation are not taken as “hard” legal regulation on the country level.

Action Item: Impact of wind farms on radar systems, and subsequent impact on the forecasting uncertainty and risk should be followed up with CIMO.

### 2.3 Report on Cg-17, the presidents of technical commissions meeting and a joint meeting with the presidents of the regional associations

The President reported on the Congress 17, the meeting of the presidents of technical commissions (PTC), which was held from 19 to 20 January 2016, and a joint meeting with the presidents of the regional associations (PRA) held on 21 January 2016 in Geneva. He noted that, although atmospheric science cuts across most of the other commissions, there is a need to substantially improve the integration of research activities in the other commissions.

He reviewed the main resolutions of Cg-17 which impact on CAS: Res 44 (Aviation RDP), Res 45 (WWRP), Res 46 (IG3IS), Res 47 (GAW), Res 48 (Polar Prediction) and Res 49 (the Year of Polar Prediction). Other relevant resolutions are on GFCS related aspects (Res 60-63).

The main issues from PTC and PRA-PTC meetings can be summarized as follows:

- Collaboration between GFCS and CAS; what is the role of CAS in the products and services’ values chains. There are four elements under objective 3 of GFCS which address CAS mandate. Draft document for GFCS and a financial plan caused a lot of discussions, especially concerning the role of nine global production centers for GFCS.
- How to ensure visibility and partnership with UNFCCC and UNEP to promote and sustain the IG<sup>3</sup>IS initiative. There are several initiatives relevant for IG<sup>3</sup>IS development and implementation, including European ICOS (Integrated Carbon Observing System) and CAMS (Copernicus Atmospheric Monitoring Service) which also cover/promote global inverse modelling. An important limitation in inverse modelling systems derives from the inadequacies in transport modelling. Issues related to IG<sup>3</sup>IS implementation:
  - diversity of inverse modelling techniques /data assimilation;
  - need for advancements in atmospheric transport modelling (relevant not only to GHG, but to Sand and Dust Storms, Biomass Burning, volcanic ash transport, atmospheric deposition to land and ocean surfaces including heavy metals, etc.);
  - role of multi-tracer observations for inversions.

Big Data context: the value chain in meteorology is rapidly being diversified. From mainly providing weather forecasts to the general public, the NMHSs and the weather enterprise progressively develop and apply downstream models/postprocessing of NWP and other forecasts or reanalysis for a range of applications in specific societal sectors.

## 3. PROGRAMME ACTIVITIES, CLOSE PARTNERS AND GUIDANCE

### 3.1 WWRP highlights and discussions

Sarah Jones and Paolo Ruti reported on the recent outcomes and events of the World Weather Research Programme. The main elements can be summarized as follows:

- Since the last SSC, the Polar Prediction Project (PPP) published a status report of the project, updated the Year of Polar Prediction Project (YOPP) Implementation Plan.
- The Sub-seasonal to Seasonal (S2S) Project established the S2S Database (Data Portals at the European Centre for Medium-Range Weather Forecasts (ECMWF) and China Meteorological Administration (CMA)), and it promoted a new subproject on "Teleconnections".
- In the High-Impact Weather Project (HIWeather), a Steering Group and 5 teams were formed. The HIWeather kick-off workshop, held from 25 to 27 April 2016 at the Met Office headquarters in Exeter, UK, attracted 84 scientists from 21 countries around the world.
- SERA working group is advancing the science of the social and economic application of weather-related information and services. Involvement with the 3 major WWRP Projects: Brian Mills, former Chairperson of the WGSERA, is currently a member of the SERA sub-committee of the PPP which had its inaugural organizing meeting in Ottawa, Canada, from 12 to 13 March 2016.
- Joint Working Group on Forecast Verification Research (JWGFVR) in 2015, contributed to the verification plans of PPP, S2S, HIWeather and several WWRP FDP's and RDP's, and its work on spatial methods intercomparison using a rich dataset from previous research projects (MAP D-PHASE/COPS).
- Predictability, Dynamics and Ensemble Forecasting (PDEF) Working Group initial meeting was organized in May 2015 in Karlsruhe, Germany (within the Progress and Future Directions of Research on Predictability and Dynamics of midlatitude Weather Systems (PANDOWAE) symposium).
- Following the 66th Executive Council Resolution 13, SDS-WAS established the SDS-WAS Steering Committee (SC) in October 2015. The SC is formed to coordinate global research coordination of regional activities. An SDS-WAS trust fund has been established to secure funding of the SDS-WAS activities.
- Aviation RDP: A kick-off meeting was held from 24 to 25 June 2015 in Shanghai, China.

*Action Item:*

- *The Chairperson of the WWRP SSC and the Chief of WWRD to improve the presence of African Monsoon experts in the WGs, specifically in the Tropical Meteorology Research WG.*

*[Michel Béland: there is redundancy between quite parallel groups in CBS and CAS related to Weather Modelling – AI: CAS to discuss complementarity of CBS and CAS groups related to weather and environmental research and predictions].*

### 3.2 GAW highlights and discussions

Greg Carmichael provided a short review of the main activities in GAW during the last year.

He indicated the main GAW objectives and implementation elements:

- Increased efforts enhancing observational systems and broadening the use of GAW related observations
- Enhancement of the modelling efforts
- Improved information management infrastructure
- Stronger efforts towards building collaborations, capacity and communications

GAW has carried out the SSC decisions approved also by Cg-17:

- The scope of the SAG precipitation chemistry was extended to cover total deposition

Expert Team on NRT-Chemical Data Transfer was developed into SAG on NRT applications (initial focus of the group is on biomass burning, sand and dust storms, volcanic ash plume forecasting, global and regional scale modelling) with the task to develop research based applications and products relevant to users

Main action items for the near-future:

- Develop a strategy on reactive nitrogen; the cycle of ammonia was identified as a critical gap in the GAW programme;
- Plan a workshop on low cost-sensors with UNEP/WHO/WMO
- Work on UNEP/WHO/GAW joint data coordination, perhaps starting with a request to members nations for AQ observation and submission, and also explore use of GAWSIS as a front end;
- Develop concepts/business models for resource mobilization;
- The collaboration with GCOS should include a mechanism that supports GAW observations and analysis;
- Complete establishment of the Rolling Review of Requirements process;
- Develop a strategy to further engage young scientists into GAW;
- Enhance GAW communications;
- Develop an integrated strategy within GAW for aerosols (with WWRP and WCRP).

The Chairperson of EPAC SSC highlighted recent developments in the observational network and quality assurance related activities. The outcome of the workshop on Coupled Chemistry models was mentioned, as well as the further development of the Integrated Global Greenhouse Gas Information System (IG<sup>3</sup>IS), and joint activities with the Commission on Agricultural Meteorology related to:

Air Pollution and Agriculture and the workshop on the Health impact of airborne dust.

He also described the collaboration with UNEP, especially in several joint side events at recent meetings. The activities of GAW related to capacity development were mentioned.

*Action Item:*

- *The Chairperson of EPAC SSC and C/AER to discuss how to initiate work to improve the methods to derive CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and other surface-atmosphere fluxes in an optimal way, based on chemistry observations and boundary layer meteorology data.*
- *C/AER to prepare a document on urgent issue in the relationship between GCOS and GAW, for the President of CAS and the CAS MG to follow up with GCOS.*
- *The Chairperson of EPAC SSC and the Secretariat to study the SWISS Space weather project and find synergies and opportunities for WMO where possible.*

### 3.3 WIGOS update (Sandro Fuzzi)

Sandro Fuzzi, CAS representative in the Inter-Commission Coordination Group on WIGOS, gave an update (by Webex) on the recent development in the system. WIGOS is an integrated system that is comprised of all the present WMO global observing systems and includes the GAW observational Programme. WIGOS provides the framework for the existing observing systems to provide more efficiently and effectively the data required for delivery of services across WMO's application areas. The first phase of WIGOS terminated last year with the 17th Congress. In 2016, the implementation phase is initiated and the Manual on the WMO Integrated Global Observing System has been approved by Cg-17.

Sandro Fuzzi highlighted some benefits WIGOS bring to CAS/GAW :

- improved visibility,
- the potential for an extension of the network,
- an harmonized approach to quality assurance,

- the promotion of data exchange between different programmes
- Representatives of CAS have actively been involved in the first phase of WIGOS.

The table below summarizes WIGOS groups.

<b><u>Pre-operational phase of WIGOS</u></b>	<b><u>Operational phase of WIGOS</u></b>
<b>ICG (Inter-Commission Coordination Group)</b>	<b>Same</b>
TT-WRM (Regulatory material)	WIGOS Editorial Board (three members) Russ Stringer (CBS) and Volker Kurz (CIMO) + 1 other one focal point from each Commission should be nominated as interface to the Editorial Board
TT-WQM (Quality management)	TT-WDQMS (Data Quality Monitoring System) New, to be formed ( <b>CAS should plan its nominee</b> )
TT-WMD (Metadata)	TT-OD (OSCAR Development) The present TT-WMD will form in the near future the new TT-OD (CAS has already Joerg Klausen as representative)
	TT-WDP (Data and partnership) TT-WDP (Data and partnership) Composition already agreed: Mike Manore (RA-IV) (Co-Chair) Matteo Dell'Aqua (CBS-ISS/RA-VI) (Co-Chair); Simon Gilbert (RA-VI); Joel Fisler (RA-VI); Jose Arimatea de Sousa Brito (CBS/RA-III); Anthony Rea or alternate (CBS-IOS/RA-V); William Wright (CCI/RA-V) (Since partnership is a key issue within GAW, where most partners are not NMHS, <b>propose to appoint a CAS member would be important</b> )

One important priority is to enable the Members to benefit from WIGOS via their national implementation efforts. Support for the national WIGOS implementations will be provided by the Regional WIGOS Centers (RWCs) that are being established with the initial mandate to provide support to the Members for the use of the WIGOS technical tools.

Concerns were raised by CAS about the possibility of unnecessary duplication of effort with respect to the existing GAW infrastructures. The WIGOS office assured that the plan is to integrate existing facilities into the overall WDQMS system architecture and not to establish new entities for those functions that are already taken care of.



Another achievement of WIGOS, is the launch of OSCAR/Surface on 2 May 2016. This data base replaced WMO No. 9, Volume A, Observing Stations and WMO Catalogue of Radiosondes. Since OSCAR/Surface has been developed around the second generation of GAWSIS, the integration of GAW into WIGOS at the metadata level is straightforward.

Sandro Fuzzi stressed that proper attention should be given to the involvement of non-NMHSs in WIGOS as the NMHS contribution to GAW is often quite limited.

Networking still remains an issue for GAW with respect to WIGOS, since NMHSs are generally not ready (possibly not willing) to take responsibility for atmospheric composition stations established in the frameworks of time-limited projects.

*Action Item:*

- *CAS to nominate the representatives for the new WIGOS task teams in the operational phase.*

### 3.4 WCRP highlights and discussions

David Carlson described the CMIP6 experiment. More than 1500 researches involved in the experiment. A new element is the inclusion of the carbon feedback in near-term prediction; the evolution of the land and ocean sources and sinks are investigated in this way.

David Carlson showed how:

- the Carbon cycle and its intra-seasonal variability peak at higher than 400 ppm.
- new issues arise from continuous monitoring of the North Atlantic ocean
- climate and hydrological communities are linked (the water availability programme in GEWEX). GEWEX is an obvious intersection with WWRP
- The model development Price WWRP-WCRP to be highlighted and promoted.

The President of CAS expressed a concern over the very large number of experts that are involved in CMIP experiments, taking time away from the development of the models and other pressing research challenges. David Carlson agreed that there is a lead of 5-7 years to analyze CMIP runs already made, and research runs often have to wait in the computing infrastructures in favor of operational runs. There are 20 different models involved in CMIP6 experiments and there is a need to foster some convergence.

### 3.5 WGNE highlights and discussions

Keith Williams, WGNE co-chair, presented the main outcomes of the WGNE annual meeting.

He firstly mentioned the main WGNE activities:

- MJO task force,
- Surface Drag project
- Seamless activities bridging between Climate and Weather communities (AMIP transpose, new AMIP methodologies)
- Aerosols' impact in weather forecasting
- The grey zone through GASS modelling initiatives
- Evaluation and verification

The WGNE MJO task force facilitates improvements in the representation of the MJO in weather and climate models to increase the predictive skill of the MJO and related

weather and climate phenomena. The Maritime continent project contributes as a joint effort with S2S.

Concerning verification and evaluation, WGNE encourages more interaction between the climate metrics and diagnostics panel, and the joint working group for forecast verification research.

The main actions were decided during the recent WGNE meeting in Pretoria, South Africa, from 26 to 29 April 2016:

- WGNE suggested that the next CAS TECO (July 2017), could provide an opportunity to engage Panasonic and other private sector modelling groups to work with WGNE
- EPAC SSC Chairperson to be invited as an ex-officio member of WGNE
- Build stronger links with GASS and GLASS
- Continue to develop the understanding of systematic model errors and work with GEWEX groups to address these
- WGNE systematic errors workshop, 19-23 June 2017
- WGNE 32 will be a joint meeting with the other WCRP modelling groups (Exeter, UK)

The discussion was focusing on which activities that are of particular importance for modelling development and improvement. To meet the objectives of WWRP/GAW/WCRP, there is a need for continued research to improve numerical models in climate/weather/environmental research and prediction. An important step is the improvement in the representation of key physical processes in the atmosphere (convection, clouds and precipitation, boundary layer processes, radiation, etc.), the land/ocean/cryosphere and the exchange of water, energy and momentum between the atmosphere and the underlying surface, as well as atmospheric composition.

Within WCRP, the main communities supporting model development with expertise on detailed atmosphere and land processes have been in the GEWEX panels GASS and GLASS. Those two panels, in particular, have maintained strong weather links and they both report to the WGNE meeting each year. Given the trend towards using the same numerical models for NWP and climate research, the model improvement work in WWRP and WCRP is quite similar. Thus, it would make sense to link WWRP and WCRP activities in this area rather than try to recruit contributions from the same research community to overlapping but separate activities.

Based on the discussion, there seem to be three options:

- Using WGNE as the focal point for this research. This would require changes in the way WGNE addresses these issues and a significant improvement in the high level interaction between WGNE and WWRP. This could make the work of WGNE and/or the interactions between WWRP/WGNE too broad and cumbersome;
- Initiating a joint WWRP / WCRP working group to cover this (but this would duplicate what is happening in GASS/GLASS);
- Making GASS and GLASS a joint activity between WWRP and WCRP that is closely coordinated with WGNE. This would need to have enough high level support to enable it to priorities and tackle the key issues for WWRP.

CAS MG raised the question about inclusion of atmospheric composition in the work of WGNE. Inclusion of atmospheric composition can improve collaboration between the programmes under CAS and reduce systematic uncertainties in the models. The SAG on NRT applications is important here. There is also a need to set up the requirements for observing system that can support model development and improve predictions.

*Action Items:*

- *The C/AER and C/WWR to set up appropriate communication channels to foster the interaction between the chairpersons of WCRP JSC, WWRP SSC, EPAC SSC, and WGNE, regular teleconferences for example.*
- *All co-chairs (WGNE, WCRP JSC, EPAC SSC, WWRP SSC) to find the best solution for integrating GASS/GLASS (two GEWEX panels on Global Atmospheric System and Global Land/Atmosphere System Studies) into a WMO modelling improvement perspective.*

### 3.6 IG<sup>3</sup>IS

Phil De Cola reported on IG<sup>3</sup>IS development and evolution. The initial formulations of IG<sup>3</sup>IS has been developed further based on input from several initiatives and stakeholders, National Academy of Science, GEO, IPCC, and UNFCCC. Carbon trackers could help bolster climate vows: projects lay groundwork for a global greenhouse information system.

IG<sup>3</sup>IS will support the bottom-up process of calculating national GHG emissions as an obligation to IPCC by providing an independent top-down approach, following up actions of nations recommended by COP21, sub-national governments, and the private sector to reduce GHG emissions through a sound scientific, measurement based approach that:

- Reduces uncertainty of national emission inventory reporting
- Can identify additional emission reduction opportunities
- Provides nations with timely and quantified guidance on progress towards their emission reduction strategies and pledges

It has been noted that estimating megacity emissions can provide important benchmarking examples for IG<sup>3</sup>IS. Key partnerships should be further developed and implemented (UNEP, UNFCCC, ICLAI), including financial mechanisms (Global Environment Facility, Green Climate Fund).

The President of CAS stressed that we need to have a system, that includes flux measurements, atmospheric concentration measurements, transport modelling. To be successful, IG<sup>3</sup>IS needs to develop all the components.

Implementation of the CAS activities requires involvement in international initiatives like Future Earth and Belmont Forum, though the opinion was expressed that CAS needs to be selective in the choice of partner initiatives.

CAS MG members should work towards better presentation of research at global, regional and national funding fora.

## 4. SETTING THE STAGE FOR CAS-17 AND ITS TECO

### 4.1 An overview of the WMO priorities

Oksana Tarasova reported on WMO priorities and the broad international agenda:

- 2030 Agenda for sustainable development, 17 goals
- Sendai framework for disaster risk reduction
- COP21 Paris agreement

She reminded the CAS MG members that WMO is a technical agency however relevant work in many countries and international funds are driven by the 2030 Agenda. She reported on the strategic partnership WMO is working on.

## 4.2 Emerging issues, including strategy to resource mobilization

Paolo Ruti presented elements of a resource mobilization strategy for research activities at WMO. Resource mobilization is the process by which an organization acquires and manages the financial, human and logistical resources it needs to fulfill its mission. It cannot be limited to the fund-raising component. It means that we are not just applying for funding, we need to create long-term partnerships with donors and international institutions in order to influence the alignment of their scientific objectives with ours.

### A global strategy

Large international research projects have been important for the development of new services. Ensemble forecasting, now widely used in weather and climate forecasting, evolved in THORPEX. Involvement with organizations and individuals planning and funding large-scale research initiatives is important in order to bring the outcome of research to use worldwide and not only in developed countries. A unique voice for WMO research representing all programmes (GAW, WWRP, WCRP and research components in other technical commissions) would be an advantage.

### Regional to local scale

Members need to be supported at regional and local level for leveraging their RTD capacity. In this context, important contributors can be international funds and national agencies that are working to improve local developments. These are often not research funders, however, ensuring a development component when observational and computational facilities are installed, can facilitate the establishment of national and regional research programmes.

### Branding for funding

Promoting WMO leadership in key sectors can really help in engaging relevant stakeholders in resource mobilization. An important element is focusing on an integrated communication strategy to sustain long-term resource mobilization actions and to promote WMO research activities with a unique voice. Research WMO activities can be seen also as facilitating mechanisms for the Sustainable Developing Goals.

#### Action Items:

- *The CAS President to propose to SG to raise WMO profile in research funding circles (Belmont Forum, <http://www.belmontforum.org/>) proposing a focal-point (possible from Executive Council), in order to maintain and build momentum in atmospheric research and model development across timescales.*
- *The CAS and Research Department to interact with GFCS (GCS ORP Task Team) in order to improve the support to existing projects.*

## 4.3 The continued relevance of CAS-16 priorities including Implementation Plans

Greg Carmichael and Sarah Jones provided an overview of the implementation plans for GAW and WWRP, respectively.

### GAW Implementation Plan

It follows the concept “research enabling services”, the activities are around application areas rather than focused on specific GAW parameters, and with more focus on modelling tools and value added products. The plan also describes the networking and resource mobilization required for the programme implementation.

The vision for the next decade of GAW is to expand the international network on air monitoring to meet the need for atmospheric composition information and related services. This requires:

- Increased efforts to enhance the observational systems
- Enhanced modelling efforts
- Improved information management infrastructure
- Stronger efforts towards building collaborations, capacity and communications

Three broad atmospheric chemistry application areas have been identified:

- Atmospheric composition forecasting
- Atmospheric composition analysis and monitoring
- Urban services

An overarching goal of GAW research is to understand better the atmospheric processes which underpin science based products and services. The emission inventories for many locations are not of a sufficient quality to obtain reliable air quality forecasts.

Examples of applications in GAW:

- IG<sup>3</sup>IS, support of climate emission estimation (mitigation)
- Ecosystem services, analysis of total deposition, the reactive nitrogen cycle, deposition to the oceans
- Health, sand and dust storms, urban air quality, biomass burning
- Food security, atmospheric composition and agriculture

Additional elements mentioned:

- Observations to support the integration of surface and upper air measurements, minimize gaps in data-poor regions
- Key element: enhance metadata based data management to facilitate data search, retrieval and use, and to facilitate the near-real time delivery of data. Station metadata and standardization of the metadata vocabulary are important elements and requires resources. Public-private partnerships a possibility?
- Expand the predictive capabilities through the developing of further urban air quality forecasting capabilities.

Greg Carmichael pointed out that in the implementation of the GAW IP, it is needed to agree the split of labour and responsibility with the emission inventory community and the modelling community doing inverse modelling based on atmospheric observations.

#### [WWRP implementation plan](#)

The plan relies on the key scientific achievements of the WWRP community since its start in 1998. Recently, WMO took the lead and co-organized the World Weather Open Science Conference (Montréal, Canada, from 16 to 21 August 2014), a first-of-its kind event which brought together a diverse community to foster the science needed to make society less vulnerable to weather-related impacts. This conference has brought together the entire weather science and user communities for the first time to review the state-of-the-art and map out the scientific frontiers for the next decade and more. The outcomes of the debates and discussions have been synthesized in the book: "Seamless prediction of the Earth-System: from minutes to months".

The new Implementation Plan has been developed along four main societal challenges proposed by CAS: (a) High-impact Weather and its socio-economic effect in the context of global change; (b) Water, modelling and predicting the water cycle for improved disaster risk reduction and resource management; (c) Urbanization, research and services for megacities and large urban complexes; (d) Evolving Technologies, their impact on science and their use.

Per each societal challenge, the WWRP scientific community (Scientific Steering Committee, Working Groups, Expert Teams, Projects) has identified: key scientific challenges, key implementation challenges, International Coordination needs, Resulting Benefits for WMO Members, Action Areas.

The proposed structure of the implementation plan consists of two booklets. The first booklet describes the major societal challenges and action areas that WWRP will promote and undertake during the next 8 years. The first booklet provides a complete and synthetic overview of the WWRP Implementation Plan and promotes activities for external stakeholders and donors. The second booklet will contain a detailed description of the Action Areas and the associated tasks for working groups and projects. A further level of the details will be added in a detailed two-year plan which will be used to monitor the WGs and projects activities.

**The CAS MG endorsed** the GAW and WWRP implementation plans.

The President of CAS stressed that the plans should be inspirational for the community, provide a flexible framework for participation and provide recognition of contributions made. Redundancy should be avoided between WWRP and WCRP activities.

Recommendation: CAS should capitalize on interest in atmospheric composition from climate and air quality communities and this point should be brought to CAS TECO.

EPAC SSC stressed that we need to improve collaboration between GAW and WCRP and WWRP. "Atmospheric composition matters" offers a new perspective for sponsors .

The satellite community can offer optimization of observing networks, although the contribution of satellite observation to the current knowledge of atmospheric composition in the boundary layer has been quite limited so far.

In the process of implementation of both plans, there is a need to include social aspects into application areas, hence the products produced by GAW should include their economic value. This value should be communicated.

The CAS MG raised a concern that atmospheric transport is an overarching issue for many applications and should be better addressed in CAS. The proposal was made that HIWeather can serve as a framework for the atmospheric transport modelling.

It was noted that CBS has six working groups and many task teams that discuss issues similar to WWRP. The President of CAS noted that this is probably dysfunctional and should be discussed further between the relevant commissions.

*Action Items:*

- *The EPAC SSC and WWRP SSC chairpersons, and C/AER and C/WWR, to continue to work on the respective implementation plans after EC-68, in order to improve the link with other technical commission and key external partners (including consultations with these partners).*
- *The President of CAS to ask the question on dysfunctionality of WGs creation in WMO to SG, requesting a higher level of coordination between the departments (and technical commissions)*

## **5. PLANNING OF CAS-17 AND ITS TECO**

5.1 Detailed planning of TECO with objectives, roles and responsibilities, short presentation and open discussions

5.2 Detailed planning of CAS-17 session, short presentation and open discussions

The Secretariat gave a short presentation of a possible structure of the TECO and CAS sessions. Most of the time was spent to discuss the priorities.

The TECO key priorities were agreed as:

- Overarching Topic: WMO science serving society/Science supporting decisions
- stakeholder oriented talks;
- funder oriented;
- technology oriented;
- regional oriented.
- The three main sessions with the following topics:
  - Catalyzing Science Development
  - The Evolving Atmosphere ...
  - The Future Modelling Technology
- Main principles:
  - Attract key speakers from the region, India, China, etc.
  - Involve users' communities as much as possible
- Round Table on Urban issues involving regional stakeholders and donors
- Allocate appropriate time for the poster sessions

Stakeholders should be involved in TECO.

Resource mobilization should be a component of TECO and CAS sessions. The CAS MG members agreed that there is a need to make research more visible, fostering research funding as an element in capacity building. Private, economic and cities fora are potential sources. There is a need to develop 2-3 high profile projects across GFCS areas and WMO priorities (water, CHAMPS, IG<sup>3</sup>IS, HIW).

The EPAC SSC stressed that resource mobilization is critical.

- 1) to succeed, dedicated personnel and resources are required;
- 2) and we should search in several directions, including the private sector and the big data community.

Urbanization was highlighted as one of the important global concerns. There are several groups that are working on the issue, including C40, Urban Climate Research Network and many others (as CCAC – Climate and Clean Air Coalition). Urbanization can be one of the topics for the TECO.

The general discussion was on the ways of shaping science in order to deliver services. It will require visualization, production, integration and expression of impact in a seamless way.

The main purpose of the CAS session is to review CAS components and excellence, and the impact of the delivery of the research results, techniques and information. A specific focus will be on the integration with CBS, WCRP and early career scientists.

There was a recommendation to develop a paper that covers concrete collaboration points between CAS and CBS.

*Action Items:*

- *The WMO Secretariat to finalize the TECO and CAS session programmes based on CAS MG11 recommendations and EC68 outcomes. The main theme will be "science supporting decision making", and a specific focus will be on the integration with CBS, WCRP and early career scientists. The programme to be circulated within the CAS MG for comments and approval.*

## 6. MEMBERSHIP OF CAS STRUCTURES AND OVERSIGHT OF WWRP MAIN PROJECT RESOURCES

### 6.1 WGNE and SSC membership

Keith Williams, Greg Carmichael and Sarah Jones provided an overview of the membership status with specific requests. The CAS MG endorsed the following membership: Nowcasting and Mesoscale Forecasting Research, Rita Roberts from NCAR, US, as co-chair; EPAC SSC to include a UNEP representative (initially Valentin Voltescu - to be confirmed by UNEP) as ex officio member; Ariane Frassoni from CPTEC, Brazil, and Gunther Zangl from DWD, Germany as WGNE members.

#### *Action Items:*

- *The Secretariat to inform the CAS MG annually on WG membership.*
- *Recirculate the letter for nomination of OPAG members.*
- *The CAS proposes that WMO requests PRs to nominate CAS focal points representative on the country level (representing the research community in a broad sense).*

### 6.2 WWRP Core Project resources

Paolo Ruti briefed the CAS MG on the status of the trust funds of the following projects: Polar Prediction Project, Sub-seasonal to Seasonal Prediction Project, High Impact Weather Project, and Sand and Dust Storm Advisory Warning System.

#### *Action Item:*

- *The President of CAS to discuss with WMO Executive Management the financial situation of the trust funds of S2S, HIW and SDS.*

## 7. ANY OTHER BUSINESS

### 7.1 Young Scientist Initiative

Julia Keller introduced the CAS MG to the current status and activities of the Young Earth System Scientists (YESS) Community. YESS unifies Early Career Researchers from the earth system sciences in an influential worldwide network. It provides them with a voice and leverage and with options for networking and career development within and across regions and disciplines. YESS got endorsed by the last WWRP SSC and WCRP JSC.

#### *Action Item:*

- *The CAS MG members to familiarize themselves with the Early Career Scientists initiative and promote it in their own institutions and regions.*

### 7.2 Potential reorganization of WMO programmes and commissions

Michel Béland presented two important topics for future CAS development.

Potential reorganization of programmes and commissions:



- CAS and its programmes (WWRP and GAW) should prepare a set of positions on this initiative for the SG and EC.
- This position should describe some of the past successes (excellence, relevance and impact) of CAS,
- Defines its views of the role of research in WMO,
- Describes and positions its future activities (using the GAW and WWRP implementation plans) vis-à-vis the WMO strategic plan, again looking at excellence, relevance and impacts
- Presents its own perception of the potential impacts of the rapidly accelerating changes in the S&T and IT environment in which WMO operates on the long term
- Proposes options on the reorganization initiative, including resources reallocation through elimination of duplications and inefficiencies.

The Future Seamless Global Data Processing and Forecasting System:

- Notes the information document and related documents on this issue in the EC-68 documentation plan
- Defines a strategy or position on the involvement of CAS in this initiative, with a view to position its programmes as key components of a successful evolution of the GDPFS .

Other two topics have been proposed by Sarah Jones and discussed:

- Forum of research directors, WMO to request PRs to nominate contact person (focal points)
- Best practice in research. Set up best practice guidelines and collect guidelines from different countries and propose to EC69

*Action Items:*

- *The CAS MG members to brief PRs attending EC-68 on the risk of overlap in the structures of GDPFS and WWRP. Chairpersons of GAW SSC, WWRP SSC and WGNE to review the GDPFS document and suggesting way forwards to the President of CAS to better integrate existing WGs for the success of GDPFS. First inputs before EC-68.*
- *The President of CAS, in collaboration with the CAS MG and the Secretariat, to prepare a document to SG between EC-68 and EC-69, in order to propose the role and evolution of CAS in the future WMO.*

## **8. SUMMARY OF THE MEETING**

### **8.1 List of Action Items, Discussions and Closure**

The CAS MG discussed in-depth the proposed actions and approved the final list available in Annex 3.

The President concluded the meeting at 12:00 on Friday, 3 June 2016, after thanking all the participants for their input and advice.

## Annex 1 - Participants

First Name/NAME	COUNTRY	POSITION
<b>Mr Øystein HOV</b>	Norway	President of CAS
<b>Mr Shiv Dev ATTRI</b>	India	Member
<b>Mr Michel BELAND</b>	Canada	Member
<b>Ms Sarah JONES</b>	Germany	Member
<b>Mr Philippe BOUGEAULT</b>	France	Member
<b>Mr James BUTLER</b>	USA	Member
<b>Ms Shanna PITTER</b>	USA	Observer
<b>Mr Gregory CARMICHAEL</b>	USA	Member
<b>Ms Marianne DIOP-KANE</b>	Senegal	Member
<b>Mr Yihong DUAN</b>	China	Member
<b>Mr Peter MAY</b>	Australia	Member
<b>Ms Alice GRIMM</b>	Brazil	Member
<b>Mr Keith WILLIAMS</b>	UK	Member

## Annex 2

### Approved agenda

Opening Session: 1 June 2016 at 9h00  
Closing Session: 3 June 2016 at 12h00

#### Wednesday, 1 June 2016

START TIME	EVENT NAME
	<b>1. ORGANIZATION OF THE SESSION</b>
09h00 to 09h10	1.1 Welcome and Introduction
09h10 to 09h20	1.2 Adoption of the Agenda
	<b>2. PROGRESS REPORTING</b>
09h20 to 09h45	2.1 Report by the President of CAS (Oystein Hov)
09h45 to 10h10	2.2 Action item progress (Oksana Tarasova & Paolo Ruti)
10h10 to 10h35	2.3 Cg-17, PTC and PRA+PTC meetings (Oystein Hov)
10h35 to 11h00	Coffee Break
	<b>3 PROGRAMME ACTIVITIES, CLOSE PARTNERS AND GUIDANCE</b>
11h00 to 11h30	3.1 WWRP highlights and discussion (Sarah Jones & Paolo Ruti)
11h30 to 12h00	3.2 GAW highlights and discussion (Greg Carmichael & Oksana Tarasova)
12h00 to 12h30	3.3 WIGOS update (Sandro Fuzzi)
12h30 to 14h00	Lunch Time
14h00 to 14h30	3.4 WCRP highlights and discussion (David Carlson)
14h30 to 15h00	3.5 WGNE highlights and discussion (Keith Williams)
15h00 to 15h30	3.6 IG3IS (Phil De Cola)
15h30 to 16h00	Coffee Break
	<b>4. SETTING THE STAGE FOR CAS-17 AND ITS TECO</b>
16h00 to 16h30	4.1 An overview of the WMO priorities (Oksana Tarasova & Paolo Ruti)
16h30 to 17h30	4.2 Emerging issues, including strategy to resource mobilization (Paolo Ruti)
17h30 to 18h00	Final Discussion

## **DINNER TO BE ORGANIZED**

### **Thursday, 2 June 2016**

<b>START TIME</b>	<b>EVENT NAME</b>
	<b>4. SETTING THE STAGE FOR CAS-17 AND ITS TECO</b>
09h00 to 10h00	4.3 The continued relevance of CAS-16 priorities including Implementation Plans (Sarah Jones, Gregory Carmichael, Oksana Tarasova & Paolo Ruti)
10h00 to 10h30	Coffee Break
	<b>5. PLANNING OF CAS-17 AND ITS TECO</b>
10h30 to 12h00	5.1 Detailed planning of TECO with objectives, roles and responsibilities Short presentation and open discussion (Sarah Jones, Gregory Carmichael, Oksana Tarasova & Paolo Ruti)
12h00 to 14h00	Lunch Time
14h00 to 15h30	5.2 Detailed planning of CAS-17 session, short presentation and open discussion (Oystein Hov, Oksana Tarasova & Paolo Ruti)
15h30 to 16h00	Coffee Break
	<b>6. MEMBERSHIP OF CAS STRUCTURES AND OVERSIGHT OF WWRP MAIN PROJECT RESOURCES</b>
16h00 to 17h30	6.1 WGNE, and SSC membership (All)
17h30 to 18h00	6.2 WWRP Core Project resources (Paolo Ruti)

### **Friday, 3 June 2016**

<b>START TIME</b>	<b>EVENT NAME</b>
	<b>7. ANY OTHER BUSINESS</b>
09h00 to 09h30	7.1 Young Scientist Initiative (Julia Keller)
09h30 to 10h00	7.2 Potential reorganization of WMO programs and Commissions (Michel Béland)
10h00 to 10h30	Discussion
10h30 to 11h00	Coffee Break
	<b>8. SUMMARY OF THE MEETING</b>
11h00 to 12h00	8.1 List of Action Items and Discussion
12h00	<b>9. CLOSURE OF MEETING</b>

## **Annex 3 - Action Items**

### **ACTION ITEM 1**

The chairpersons of WWRP SSC and the Chief of WWRD to improve the presence of African Monsoon experts in the WGs, specifically in the Tropical Meteorology Research WG.

### **ACTION ITEM 2**

The C/AER and C/WWR to set up appropriate communication channels to foster the interaction between the chairpersons of WCRP JSC, WWRP SSC, EPAC SSC, and WGNE, regular teleconferences for example.

### **ACTION ITEM 3**

The President of CAS to propose to SG to raise WMO profile in research funding circles (Belmont Forum, <http://www.belmontforum.org/>) proposing a focal-point (possible from Executive Council), in order to maintain and build momentum in atmospheric research and model development across timescales.

### **ACTION ITEM 4**

The CAS and Research Department to interact with GFCS (GCS ORP Task Team ) in order to improve the support to existing projects.

### **ACTION ITEM 5**

The Chairperson of EPAC SSC and the Secretariat to study the SWISS Space weather project and find synergies and opportunities for WMO where possible.

### **ACTION ITEM 6**

The EPAC SSC and WWRP SSC chairpersons, and C/AER and C/WWR, to continue to work on the respective implementation plans after EC-68, in order to improve the link with other technical commission and key external partners (including consultations with these partners).

### **ACTION ITEM 7**

The President of CAS to ask the question on dysfunctionality of WGs creation in WMO to SG, requesting a higher level of coordination between the departments (and technical commissions).

### **ACTION ITEM 8**

The WMO Secretariat to finalize the TECO and CAS session programmes based on CAS-MG11 recommendations and EC-68 outcomes. The main theme will be "science supporting decision making", and a specific focus will be on the integration with CBS, WCRP and early career scientists. The programme to be circulated within the CAS MG for comments and approval.

### **ACTION ITEM 9**

All co-chairs (WGNE, WCRP JSC, EPAC SSC, WWRP SSC) to find the best solution for integrating GASS/GLASS (two GEWEX panels on Global Atmospheric System and Global Land/Atmosphere System Studies) into a WMO modelling improvement perspective.

### **ACTION ITEM 10**

The impact of wind farms on radar systems and subsequent impact on the forecasting uncertainty and risk should be followed up with CIMO by C/WWR.

### **ACTION ITEM 11**

The EPAC SSC Chairperson and C/AER to discuss how to initiate work to improve the methods to derive CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and other surface-atmosphere fluxes in an optimal way, based on chemistry observations and boundary layer meteorology data.

#### **ACTION ITEM 12**

The CAS to nominate the representatives for the new WIGOS task teams in the operational phase.

#### **ACTION ITEM 13**

The Secretariat to inform CAS MG annually on WG membership.

#### **ACTION ITEM 14**

Recirculate the letter for nomination of OPAG/EPAC membership.

#### **ACTION ITEM 15**

The President of CAS to discuss with WMO Executive Management the financial situation of the trust funds of S2S, HIW and SDS.

#### **ACTION ITEM 16**

The CAS proposes that WMO requests PRs to nominate CAS focal points representative on the country level (representing the research community in a broad sense).

#### **ACTION ITEM 17**

The CAS MG members to familiarize themselves with the Early Career Scientists' initiative and promote it in their own institutions and regions.

#### **ACTION ITEM 18**

The CAS MG members to brief PRs attending EC-68 on the risk of overlap in the structures of GDPFS and WWRP. Chairpersons of GAW SSC, WWRP SSC and WGNE to review the GDPFS document and suggesting way forwards to the President of CAS to better integrate existing WGs for the success of GDPFS. First inputs before EC-68.

#### **ACTION ITEM 19**

The President of CAS, in collaboration with the CAS MG and the Secretariat, to prepare a document to SG between EC-68 and EC-69 in order to propose the role and evolution of the CAS in the future WMO.

#### **ACTION ITEM 20**

The C/AER to prepare a document on urgent issues in order the relationship between GCOS and GAW, for the President of CAS and the CAS MG to follow up with GCOS.

### **DECISIONS**

**DECISION 1** on the general endorsement by CAS MG11 of the GAW and WWRP implementation plans.

**DECISION 2** on WG's membership: Nowcasting and Mesoscale Forecasting Research, Rita Roberts from NCAR, US, as co-chair; EPAC SSC to include a UNEP representative (initially Valentin Voltescu - to be confirmed by UNEP) as ex officio member; Ariane Frassoni from CPTEC, Brazil, and Gunther Zangl from DWD, Germany as WGNE members.

## RECOMMENDATIONS

### RECOMMENDATION 1

The President of CAS and the Secretariat to discuss with other technical commissions and GFCS the development of 2-3 high profile projects that raise the WMO visibility and impact, involving CAS programmes. An initial set could comprise IG<sup>3</sup>IS, HIWeather, CHAMP, S2S.

**RECOMMENDATION 2** for CAS session a paper to be prepared on how to strengthen collaboration between CAS and CBS with concrete actions

### RECOMMENDATION 3

The Secretariat to prepare a document for EC-69 on the Early Career Scientist Initiative.

### RECOMMENDATION 4

CAS to collect best practice guidelines on research from different countries before EC-69 and to consider to propose a document on that to EC-69.

### RECOMMENDATION 5

The President of CAS, in collaboration with the Secretariat, to propose SG to allocate specialized resource to attract new funds.