WCRP
World Climate Research Programme

Report of the 6th Session of the WCRP Data Advisory Council

22-23 March 2017, ESA/ESRIN, Frascati, Italy

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Disclaimer

Executive Summary

The WDAC6 session was held at ESRIN/ESA in Frascati, Italy on 22-23 March 2017. The objective of the meeting was to review progress on the different WDAC Task Teams, data set assessments and intercomparison efforts within core projects, to improve the modalities of the WCRP-GCOS cooperation and to explore synergies with other major initiatives such as the Copernicus Climate Change Service (C3S).

The present report is meant to complement the detailed PowerPoint Presentations available on the meeting web site and to synthesize discussions and actions agreed at the end of the session.

Participants of the WDAC6 session in Frascati, Italy, 22-23 March 2017

Contents

PRESENT: Otis Brown (co-chair), Dorothee Bakker, Mike Bosilovich (remotely), Ben Galton-Fenzi (remotely), Peter Gleckler, Pascal Lecomte, Pierre-Philippe Mathieu (host), Remy Rocca, Joerg Schulz, Bernadette Sloyan, Caterina Tassone, Susann Tegtmeier, Jean-Noël Thépaut (co-chair), Wolfgang Wagner, Brian Ward

EXCUSED: Kenneth Holmlund, Philip Jones, Walt Meier, John Wilkin

WCRP JPS: Michel Rixen

1. Introduction

a. Introduction

WDAC co-chairs Otis Brown and Jean-Noël Thépaut welcomed all participants and thanked them for attending this important meeting leading the preparation of the WCRP Joint Scientific Committee meeting in Paris in April and in the context of the WCRP review. They expressed their gratitude to ESA and Pierre-Philippe Mathieu for hosting the session in such a relevant location for WDAC. The agenda was approved without further adjustments.

b. Welcome address – ESRIN

Nicolaus Hanowski wished a warm welcome to all participants on behalf of ESA. He recalled the general mission of the Agency and ESRIN in particular, which manages Earth Observations missions but also leverages a portfolio of third party missions. Copernicus missions play an important role in this context.

He provided some details on the Science Operations Development Department. The Department focuses on data management, data literacy, the Climate Change Initiative, analysis ready data the data cube.

He kindly organized a visit of the ESA Earth Observation Room.

c. WCRP update

Michel Rixen provided a short update on WCRP and emphasized in particular:

1) the importance of the Earth System Grid Federation to support science across all elements of the programme
2) the two new Grand Challenges on Near Term Climate Predictions and on Carbon Feedbacks, respectively
3) the recently released Data Policy
4) the WCRP/GCOS International Data Prize
5) the on-going WCRP sponsors' review, the development of the new WCRP strategy and upcoming JSC session to be held in Paris
6) the strong budget pressure on the programme

d. GCOS update

Caterina Tassone updated the Council on the latest GCOS developments, in particular the review of Essential Climate Variables and the new GCOS Implementation Plan (IP), which has built on inputs from the joint GCOS-WCRP panels and well as from a wider community consultation. A new feature of the IP is to improve the monitoring of Global Climate Cycles of energy, water and carbon.

It was emphasized that the next IP is scheduled for 2021. It will be important to engage with the community to collect inputs and update requirements prior to this deadline.. The planned GEWEX conference in 2018 was cited as an opportunity to present the needs for lower troposphere water vapour measurements.

e. Review of WDAC5 actions

Otis Brown reviewed the WDAC5 actions. Actions 10 and 11 related to gaps in observing systems have been addressed via the GCOS IP but not through letters to WG CLIM and the WCRP JSC, as it is unclear whether WDAC should play an advocacy role on those.

It was recalled that WCRP entities, which are represented on the Council with the exception of the Grand Challenges are the appropriate channels to forward any emerging observing gap. WG CLIM complements such process with its own gap analysis cycle.

2. WDAC Task Teams

a. Obs4MIPS – P. Gleckler

Peter Gleckler noted obs4MIPs strives to improve the use of observational data for the evaluation of climate models in WCRP model intercomparisons, with the international Coupled Model Intercomparison Project (CMIP) being the emphasis. obs4MIPs began in 2011 as a pilot project between the U.S. DOE and NASA to make satellite data more accessible, but soon thereafter was recognized by the WDAC as an excellent approach to internationalize and work towards including a more diverse suite of observations. obs4MIPs is now actioned by a WDAC Task Team (TT) which communicates via regular telecons.

Four tenets have served as criterion for introducing new datasets to obs4MIPs: 1) Use the CMIP Standard Model Output as guideline for identifying relevant observations, 2) Observations to be structured in coordination with the CMIP output (e.g. NetCDF, CF Convention, common vocabularies), 3) host data side by side on the ESGF with CMIP model output, and 4) Include a Technical Note for each variable describing the observations and utility for model evaluation (at graduate student level).

In obs4MIPs there are currently nearly 90 gridded satellite datasets spread across 6 ESGF nodes. A year ago the TT distributed a data call to identify new datasets to obs4MIPs, for the

first time including gridded in-situ data. Nearly 100 new datasets were proposed, all of which have now been reviewed by the WDAC TT. During this review process the TT worked to find a solution to a difficulty that had challenged the effort since the beginning: how should the wide range in data quality, maturity and y/uncertainty - as relevant to climate model evaluation - be dealt with in obs4MIPs? After considerable thought, the TT has developed a suite of "readiness indicators" that will be applied to all new datasets. As a result, obs4MIPs is now positioned to broaden its scope considerably. Rather than attempting stringent gate keeping to control what gets contributed to obs4MIPs, the TT will emphasize greater inclusiveness while assigning readiness indicators to each new dataset. An additional accomplishment of the TT during the past year is that it has devised a mechanism for including supplemental information along with new datasets, such as estimates of uncertainty or codes that provide forward operators to make it easier to compare models and observations. These advancements (readiness indicators and the ability to include supplemental information) are being prototyped, and will be used to help advance the project during the coming year.

The process of including datasets has to be more efficiently implemented for obs4MIPs to continue successfully. There have been several challenges to this: first, a key utility used for CMIP and obs4MIPs (notably CMOR, the Climate Model Output Rewriter) was originally designed to handle model output and has been very cumbersome to use in obs4MIPs for observational data sets. Second, while the CMIP6 data standards have been under development during the past year, advancing obs4MIPs was effectively put on hold. Fortunately, CMOR has been substantially enhanced (CMOR3) and now can handle most types of observations, and the CMIP6 data standards have recently been released and are currently being adopted to apply for obs4MIPs. While infrastructure investment has been the emphasis of the past year, in the coming year obs4MIPs is well positioned to deliver a substantially expanded collection of observational data for WCRP model intercomparisons via the same integrated and distributed environment used to make model simulations available to the research community. For the next phase, planning is underway to include a broader community of in-situ data providers into obs4MIPs.

It was noted that there is still some risk associated with the sustainability of the ESGF, which has relied primarily on research funding. However, entities such as C3S are adopting it as an operational infrastructure supporting their climate service architecture. Previous work on maturity indices from Bates et al and Schulz et al is inspirational but could not be readily applied to the obs4MIPs framework having a specific focus on Model Intercomparison. Tools will have to be enabled for data sets being updated on a regular basis. ESGF usage is being tracked.

b. Fluxes Task Team and SOLAS update

Brian Ward recalled the SOLAS aims to understand the key biogeochemical-physical processes, interactions, and feedbacks between the ocean and atmosphere. Amongst the four SOLAS core themes, the one most relevant to WCRP is "Air-sea interface and fluxes of mass and energy". The Workshop on 'Frontiers in ocean-atmosphere exchange: Air sea interface and fluxes of mass and energy', May 15-19, 2017 Cargese, France, was highlighted. The Flux Task Team is making progress with a web presence, the development of a white paper and wider useful connections to the community. Air-sea fluxes in the Southern Ocean are extremely sparse and this is a major aim of the SOOS working group on Air-Sea fluxes.

It was suggested that the Flux TT could contribute significantly in leading a specific activity to get flux data sets published on obs4MIPs.

c. Reanalyses and TIRA

Mike Bosilovich (remotely) provided an update on the TIRA Task Team and reanalysis activities within WCRP. The primary aim of the Task Team for the Intercomparison of ReAnalyses (TIRA) is to develop a reanalysis intercomparison project plan that will attain the following objectives.

- To foster understanding and estimation of uncertainties in reanalysis data by intercomparison and other means
- To communicate new developments and best practices among the reanalyses producing centers
- To enhance the understanding of data and assimilation issues and their impact on uncertainties, leading to improved reanalyses for climate assessment
- To communicate the strengths and weaknesses of reanalyses, their fitness for purpose, and best practices in the use of reanalysis datasets by the scientific community

The TIRA membership reflects the diversity of interest and possible contributions across WCRP. Several conferences have been held already to review the reanalysis landscape and identify common issues where community efforts can be developed. One such example could be to investigate the Clausius-Clapeyron relationship in the various reanalyses.

An update on recent progress at NASA, JMA, ERA and NCEP was provided. The general trend seems to go towards fully coupled Earth System Reanalysis for most of them.

It was commented that the ESGF and associated ana4MIPs and CREATE-IP should become the preferential repositories supporting TIRA projects. These could be foundational for the GEWEX work on energy budgets and it could useful to ensure necessary outputs on native grid are saved accordingly. TIRA was encouraged to advertise the 5th International Conference on Reanalysis, co-organised by ECMWF-C3S and WCRP, which will be held later this year in Rome.

3. Observations and data initiatives

The focus of this session was on data requirements and intercomparison efforts.

a. CLIVAR and GSOP update

Pierre-Philippe Matthieu noted the new CLIVAR Science Plan and highlighted relevant WDAC initiatives such as:

- the Ocean Reanalysis Intercomparison Project (ORA-IP) coordinated effort between CLIVAR/GSOP & GODAE OceanView with interaction with OMDP,
- the COST/CLIVAR Workshop on ocean reanalyses and inter-comparisons
- the CLIVAR research focus on the “Consistency between planetary energy balance and ocean heat storage (CONCEPT-HEAT)”

- the International Quality-Controlled Ocean Database (IQuOD) which aims at maximizing the quality, consistency and completeness of the long-term global subsurface ocean temperature database (EOV/ECV)
- the GC Regional Sea Level Change and Coastal Impacts leading the organization of the "WCRP/IOC International Conference on Sea Level Change: Columbia University New York, City, July. 10 – 15, 2017

In closing, he presented the *ESA Earth System Data Cube* (earthsystemdatacube.org), an initiative which could help understanding interactions within the Earth System through big data mining and a demonstration of the Ocean virtual lab (ovl.oceandatalab.com).

b. GEWEX and GDAP update

Remy Rocca and Joerg Schulz provided an update on GEWEX and GDAP, which has 3 main objectives: data records, in-situ networks (such as BSRN and GPCC) and data quality assessments. Progress on GEWEX data products and their integration covered:

- Clouds and radiation ISCCP (Bill Rossow and NOAA NCEI)
- Aerocom MAC (Stefan Kinne)
- Surface Radiation Budget (Paul Stackhouse)
- Precipitation GPCP (Bob Adler et al.)
- Evaporation SEAFLUX (Carol Anne Clayson)
- LandFlux (Matt Mc Cabe, Carlos Jimenez)
- Soil Moisture (Wouter Dorigo)
- GEWEX Merged and Integrated Product (Paula Brown and Chris Kummerow)

The GEWEX Merged products puts these into a common file with common grids. The GEWEX Integrated product ensures full physical consistency between inputs. They contain:

- Global Precipitation Climatology Project (GPCP)
- Int'l Satellite Cloud Climatology Project (ISCCP)
- Surface Radiation Budget (SRB)
- Sea Flux
- Land Flux (currently 3 potential products for LH)

GEWEX Data Quality Assessments currently include:

- Clouds (Claudia Stubenrauch, Andrew Heidinger)
- Water Vapor (Marc Schröder, Lei Shi)
- Aerosol (Jeff Reid, Stefan Kinne, et al.)
- Precipitation (Hiro Masunaga, Chris Kummerow)
- Soil Moisture (Wouter Dorigo)

The discussion highlighted the need for a strong coordination on surface flux issues (Land, ocean, ice, biogeochemical, heat, moisture, momentum, turbulent, radiative, in situ, remote). GEWEX/GDAP is moving into 'merged' products to improve the consistency of its water+energy cycle assessments. As reanalyses provide a strong input into such process, it was suggested to coordinate closely between GDAP and TIRA (identify requirements such as specific model outputs, characterization of uncertainties, etc.).

c. SPARC and S-RIP update

Susann Tegtmeier noted that SPARC has a well-established history of assessing the quality and utility of long-term climate records. These data assessments are published in form of comprehensive SPARC reports, which are strictly peer-reviewed and of high scientific quality. The SPARC reports have been widely cited and have provided important contributions to the WMO/UNEP Ozone and IPCC Assessments.

The SPARC assessments include the creation, analysis, and interpretation of climate data from observations, reanalysis and modeling efforts. In most cases, climatologies are compiled from existing data in a common and simple-to-use data format and are provided to the end user via the SPARC Data Center. Detailed comparisons of the climatologies with each other and with independent observations yield basic information on quality and consistency of the various data products. Biases in particular climatologies can be isolated and guidelines for the use of the data sets in merging exercises, trend evaluations, and model-measurement comparisons are given accordingly. These assessments also provide feedback to the agencies and modelling centers about required improvements in existing data sets and the need for future activities. The role of SPARC in these data assessments is to promote, coordinate, and guide all related international activities and cooperation.

Initial SPARC reports assessed the knowledge and understanding of middle atmosphere ozone (SPARC, 1998), water vapour (SPARC, 2000), temperatures, zonal winds, and eddy flux statistics (SPARC, 2002) as well as aerosols (SPARC, 2006). These reports highlighted differences and uncertainties in the climatological data sets used in the research community at that time. The systematic inter-comparisons of the middle atmosphere data sets provided the basic information required to analyze long-term composition and temperature changes.

The most recent SPARC assessment focused on vertically-resolved chemical trace gas climatologies derived from limb-viewing satellite instruments (SPARC, 2017). Here, a variety of long- and short-lived trace gas species underwent detailed comparisons, which identified strengths and shortcomings of all data sets. The motivation for this activity stemmed from the SPARC CCMVal report (SPARC, 2010), an assessment of the performance of stratosphere-resolving chemistry-climate models. CCMVal noted that for some species, satellite products appear to contradict each other and recommendation an assessment of the various data products to support future model evaluations.

Currently ongoing data SPARC inter-comparison activities are focused on water vapour (WAVAS-II), long-term ozone trends (LOTUS), and reanalysis data sets (S-RIP). WAVAS-II will provide a quality assessment of satellite water vapour records and validation against ground-truth instruments. The LOTUS activity aims to quantify ozone trends during the recovery phase with a focus on propagating uncertainties of merged datasets and is a follow up of the SI^2N activity. The S-RIP activity coordinates the assessment of all middle atmosphere reanalysis datasets. The data sets are compared for various "key" diagnostics in order to understand the causes of the differences and to provide guidance on appropriate usage in scientific studies. S-RIP is a co-operation between analysis centres and scientists from SPARC and other groups.

SPARC Report N°1, 1998: Trends in the Vertical Distribution of Ozone.
SPARC Report N°2, 2000: Upper Tropospheric and Stratospheric Water Vapour
SPARC Report N°3, 2002: Intercomparison of Middle Atmosphere Climatologies
SPARC Report N°4, 2006: Stratospheric Aerosol Properties
SPARC Report N°5, 2010: Chemistry-Climate Model Validation
SPARC Report N°8, 2017: Stratospheric composition climatologies (in print)
SPARC Report N°9, 2017: Interim report by SPARC Reanalysis Intercomparison Project (in preparation, to appear in the Autumn).
SPARC Report N°10, 2018: Water vapour report (in preparation)

Members strongly recommended TIRA engage closely with all core projects to coordinate reanalysis intercomparisons efforts via the ESGF. Caution was noted on the use of reanalysis for trend identification. There was also a question raised about the availability of BUFR data at higher pressure levels.

d. CliC

Ben Galton-Fenzi, Walt Meier and Lawrence Hislop provided a CliC overview presentation for the Council. Data issues concerned by CliC cover multiple domains across both observations and modelling (Sea Ice, Ice Sheets, Glaciers, Permafrost, Snow cover and interactions with freshwater and the oceans, including sea level).

CliC modelling work for CMIP6 and support for the Grand Challenge on Melting Ice & Global Consequences includes:

- ESM-SnowMIP - Earth System Model-Snow Model Intercomparison Project
- SIMIP - Sea Ice Model Intercomparison Project
- ISMIP6 - Ice Sheet Model Intercomparison Project
- GlacierMIP - Glacier Model Intercomparison Project
- PCN – Permafrost Carbon Network

All require access to the best cryospheric observations with special emphasis on the consolidation and standardization of various crysopheric-related data streams, multi-national/institutional data portals, including management, of derived data products (e.g. from MIPs), big data curation on new observational products and model outputs, in addition to CMIP6 to facilitate model evaluations.

The CliC Arctic Sea Ice Working Group (CASIWG) aims at Integrate surface-based observations with remote sensing and modelling efforts.

The Antarctic Sea Ice Processes and Climate (ASPeCt) delivered an updated software and automatic cameras to supplement visual observations which are being used for quality control and training of ice observers.

e. AOPC update

Caterina Tassone, on behalf of AOPC co-chairs Kenneth Holmlund and Phil Jones provided a summary on the current AOPC work plan that focuses on the following:

- Establish and monitor ECV requirements
- Review of ECV Observation networks
- Coordinate GCOS networks (GSN, GUAN,GRUAN)
- Establish a GCOS Global Reference Surface Network (GRSN)
- Promote the use of weather radar data for climate needs
- Promote cross-cutting issues with other science panels

The next AOPC session will address the following topics on ECV requirements:

- Radiosondes launches
- Atmospheric composition: consistency between GCOS IP and GAW inputs
- Clouds and water vapour: current capabilities and emerging requirements (in particular on the vertical in the lower troposphere)

AOPC has established the following task teams:

- A task team of experts to suggest a way forward in Using Radar Data for Climate Monitoring
- A task team to instigate of a GCOS Surface Reference Network
- A task team on the GCOS Upper Air Network (GUAN) for reviewing the network requirements, assessing and documenting the benefits of meeting stated requirements.

Results of these initial studies will be presented at the next AOPC meeting.

It was noted that GEWEX is already investigating the use of weather radars, which could be useful to the Grand Challenge on Extremes. Members advised AOPC and GEWEX to consider consolidating their efforts on these issues. It was also noted that there is a CGMS Working Group on Clouds.

f. TOPC update

Wolfgang Wagner, after a brief introduction about TOPC, highlighted the relevance of the panel for adaptation needs, where the focus is at local/regional scale, requires high-resolution data and puts climate change in context with other on-going pressures (population growth, land degradation, etc.).

A proposal for Evaporation/Latent Heat Flux as an ECV will be made at the upcoming TOPC-19 session. There is a strong need for those data but it remains unclear to what extent this is technically and economically viable. λE cannot be measured directly from space, requires multiple observations (solar radiation, humidity, air temperature, wind speed, soil moisture, vegetation cover, stress and phenology in particular).

The Carbon Budget is stated as a goal in the GCOS IP and aims at quantifying fluxes of carbon-related greenhouse gases to +/- 10% on annual timescales and quantifying changes in carbon stocks to +/- 10% on decadal timescales in the ocean and on land, and to +/- 2.5 % in the atmosphere on annual timescales.

Members advised TOPC to consider conducting a thorough assessment on the feasibility for Evaporation/Latent Heat Flux to become an ECV. Carbon budget estimates rely even more on modeling than evapotranspiration. The discussion closed on the need to acknowledge and cite the work of data providers.

g. OOPC

Bernadette Sloyan highlighted the contribution of ocean observations (carbon, sea level, heat content, salinity) for climate assessments and initialization of decadal predictions. The Ocean Observing System includes multiple satellite segments and in-situ elements (drifters, buoys, morrings, research cruises, volunteer observing ships, etc.). Essential Ocean Variables (EOV) observing systems and data products are meeting reasonable readiness levels in the physics and bio-geo-chemistry realm, much less so on the biology and ecosystems.

Amongst the issues raised for WDAC, it was highlighted that:

- the WRCP Grand Challenges all require observational data, particularly ocean data (surface and subsurface), however, the documentation on many of the Grand Challenges doesn't highlight the connection to observational data or actively engage with OOPC.
- OOPC is working toward more active engagement with the range of modeling communities, from NWP to climate, to high resolution local/regional
- OOPC is seeking clarification on how to engage with WDAC, including connections to other WRCP project/programs (e.g., WDAC air-sea flux group, obs4MIPS, and Grand Challenges).

It was recalled that from WCRP's perspective, the WDAC plays the switchboard role between the programme and GCOS. With regard to specific flux-related questions, the recommended channel would be the newly established Flux Task Team. Some members suggested a possible stronger role of the Council in advocating for the Observing Systems, especially on the ocean side, as those networks rely more heavily on research/soft funding and some are clearly at risk. It was agreed that this should be brought up at JSC level.

i. CEOS-CGMS WG Climate update, including ECV inventory

Pascal Lecomte and Joerg Schulz recalled the major objectives of the CEOS-CGMS Working Group Climate (WG CLIM):

- Provision of a structured, comprehensive and accessible view as to which Climate Data Records (CDR) are currently available and planned from satellite missions of CEOS and CGMS members or their combination;
- Assist in promotion of a common understanding of the implementation implications of meeting the various space-related climate monitoring requirements (e.g. from GCOS);
- Creation of the conditions for delivering further Climate Data Records;
- Optimization of the planning of future satellite missions and constellations to expand existing and planned Climate Data Records addressing possible gaps with respect to GCOS requirements.

The joint CEOS/CGMS WG Climate is working in parallel on providing structured response to the GCOS-IP and finishing cycle#2 of the ECV Inventory, gap analysis and action plan. The inventory of ECV Climate Data Records is a verified source of information allowing the analysis of gaps and formulation of coordinated action by assessing content against GCOS principles, guidelines and requirements. The ECV Inventory will also offer a public source of verified information on CDRs for anybody and should be useful for selection of satellite data records for activities such as climate services and obs4mips. For cycle#3 extension of the inventory towards FCDR and CDR Interim are planned. This shall optimize the planning of future missions and constellations to expand Climate Data Records and close gaps with respect to GCOS requirements. The ECV Inventory is updated in 2-year cycles.

4. Way ahead and partnerships

a. UNFCCC Global Stocktake and JSC Proposal for a Data Intercomparison Project

Michel Rixen provided an update on the recent UNFCCC developments on the Global Stocktake, to which the IPCC cycle may align and contribute, highlighting the importance of reanalysis and data set assessments in this context.

The JSC interest in the development of a Data Intercomparison Project under the WDAC was conveyed to the Council.

It was commented that data intercomparison efforts and assessments are on-going in several WCRP core projects and appear to be similar to CMIP but for observational or reanalysis data sets. Additional resources would need to be identified for a broader effort beyond these existing initiatives. The WDAC has developed and published best practices on this topic. In Core Projects, current assessment efforts should be made more visible within WCRP.

There are issues with deriving an ensemble average of data sets. What is crucially missing is the associated uncertainty with each data set. Data intercomparison efforts should avoid becoming a 'beauty contest' and rather build on community approaches. It was noted that C3S is operational and not research focused, hence attributes of a CDIP need to be better defined against something like C3S. C3S is aiming at providing routine access to high "climate quality" ECV datasets, and an eventual CDIP would have another purpose, while building upon the C3S infrastructure.

There are a number of other CDIP efforts beyond those within WCRP. For example, the International Precipitation Working Group is co-sponsored by CGMS and the World Meteorological Organization (WMO) and provides a forum for operational and research users of satellite precipitation measurements to exchange information on methods for measuring precipitation and the impact of space borne precipitation measurements in numerical weather and hydrometeorological prediction and climate studies.

b. GCOS Climate indicators

Caterina Tassone outlined the recent development of GCOS Climate Indicators to describe the ongoing impacts of climate change in a holistic way and meeting the criteria of relevance, representativeness, traceability, timelines and limited in number.

The current tentative list includes Temperature/Energy, Atmospheric composition, Oceans, Cryosphere, Extremes, Land use/vegetation.

It was noted that for indicators to be an effective way to communicate climate change they should avoid complex science which would need to be communicated to a wide audience. For example, atmospheric composition may need to be reframed. Deforestation is a societal indicator rather directly linked to climate change and might be misleading. Existing indicators would need to be mapped against those proposed by GCOS and C3S.

c. Copernicus Climate Change Service

Jean-Noël Thépaut updated the Council on the Copernicus Climate Change Service (C3S), which at a high level consists of a climate data store (CDS), a sectoral information system, an evaluation and quality control component and outreach and dissemination activities. C3S data can be any satellite and in-situ observation as well as model simulation (reanalyses, seasonal forecasts and global and regional climate projections). Essential Climate Variables (ECVs) are the reference 'currency' for CDS observational and reanalysis products. The ERA5 production has started and looks extremely promising for the troposphere, but there are some issues with the stratosphere (trend) and the mesosphere (tropical jets). Reanalysis data access tools include a "Observation Feedback Archive" to explore, select, plot and download observations used in ERA5 and a "Climate Monitoring Facility" to explore, compare, plot ECV estimates from multiple sources.

A common data model is used within the CDS. The Sectoral Information System (SIS) addresses about O(100) different indicators. The QA ensures consistent indicators when different sources are available. The QC could be used to formulate requirements towards GCOS panels. The Observations Feedback Archive will provide a lot of very valuable information back to producing centers.

d. Bio-geochemistry data initiatives: SOCAT and GLODAP

Dorothee Bakker provided an update on ocean bio-geochemistry observing and data assessment efforts, in particular SOCAT and GLODAP. A particular challenge is to move from sparse to gridded data to infer global flux quantities. This is the main purpose of SOCOM which aims at inter-comparing various mapping methods to assess uncertainties in global ocean carbon sink estimates. These ocean bio-geochemistry data sets represent fundamental references for evaluating ocean carbon models and hence deserve a Global Data Assembly Center.

It was commented that the Copernicus Marine Service could support this effort. An assembly effort of ocean bio-geochemical data sets aligned with ESGF could provide an important glue between all data sets useful to CMIP.

e. OSCAR and Rolling Review of Requirements

Caterina Tassone summarized the current WMO process to collect and update observing requirements.

The Rolling Review of Requirements (RRR) is the process used by WMO to collect, vet and record user requirements for all WMO application areas and match them against observational capabilities. A gap analysis results in a Statement of Guidance, one per application area, that provides a narrative of how well a given application area is supported by WIGOS.

A WMO Application Area describes a homogeneous activity for which it is possible to compile a consistent set of observational user requirements agreed by community experts working operationally in this area.

This process is supported by the OSCAR data base. Requirements are listed (separately for each of the 14 application areas and for all relevant variables): spatial (horizontal and vertical) and temporal resolution, uncertainty, data latency, required coverage area, source, and level of confidence.

Each requirement is expressed in terms of three separate values:
- Threshold (observations not useful unless this is met)
- Break-through (optimum cost-benefit ratio)
- Goal (exceeding this provides no additional benefit)

GCOS has proposed the following Application Areas, which are agreed on by the AOPC/OOPC/TOPC panel and are now being introduced into the OSCAR DB.
1) “Climate Monitoring” – long-term, global, observations of ECVs monitoring climate and climate change to underpin assessments such as those of the IPCC and providing a baseline understanding of climate change. Nearly all of the requirements in the GCOS implementation plan fit into this category;
2) “Climate Services” – monitoring to support climate services such as adaptation and mitigation.

These may be global, regional or national and will depend on national priorities, aims and objectives. There are currently a few terrestrial requirements in this category, GCOS expects to develop additional climate service requirements in the near future;

Michel Rixen then briefly explained the current structure of OSCAR entries for WCRP, divided in 6 Application Areas, with some inputs as old as 1998. A possible way forward proposed was to create a “Climate Science” Application Area where all entries of WCRP already in OSCAR would be integrated.

It was recalled that RRR inputs are used on a regular basis to design specifications for new satellite missions or in-situ observing systems. Specifying these values needs to be done carefully (this is quite a challenge for soil moisture for example) and signal to noise ratio is another important dimension beyond accuracy, etc. The discussion then proceeded on how to deal with a similar approach with regard to WCRP requirements. Two options emerged, one which would fold the current WCRP entries into the GCOS ones by using the ‘goal’ value (not used by GCOS), another one by streamlining WCRP inputs and collecting them under a single ‘Climate Science’ Application Area. Members indicated their preference for the first option.

Post-meeting note: during the AOPC 22 (GCOS 207), it was recommended to start with a single application area, climate monitoring, and upon discussion with the WCRP secretariat, it was suggested that this application area would include the needs of WCRP. Having discussed the practicalities this approach with the WMO Secretariat responsible for OSCAR, it appeared that keeping climate monitoring and climate research requirements in separate records would be more appropriate.

f. International Reanalysis Conference Update

Jean-Noël Thépaut reviewed the status of the preparation of the 5th International Conference on Reanalysis to be held in Rome, Italy, 13-17 November 2017 and which will have a greater focus on Users and Earth-system reanalysis. The programme will be structured along five sub-topics:

1. Status and plans for reanalysis production
2. Observations for reanalysis
3. Methods for reanalysis
4. Evaluation of reanalyses
5. Applications of reanalyses

A high priority now is to mobilize additional resources to secure the budget and to provide financial support to a number of selected individuals. Members of the Council were invited to activate their contacts in their respective agencies to that effect.

5. WDAC Business

a. Inputs to WCRP Strategic Plan

Michel Rixen recalled the on-going development of the WCRP strategic plan, the on-going WCRP sponsors' review and broader restructuring of research and WMO Technical Commissions. He invited all members of the Councils to actively engage and contribute to this process with regard to observations and data issues.

b. Memberships and Terms of Reference

The Council currently lacks appropriate balance with no representation from Asia. It was suggested that the WDAC consider various experts from Asia as potential nominees. Given the strategic importance of ESGF and obs4MIPs/ana4MIPs, it was further recommended to maintain a corresponding expertise on the Council for the upcoming future.

The Council has far more stakeholders now (CCi, C3S, etc.) than when it was created, and it may be useful to revisit the Terms of Reference.

c. Next WDAC Meeting

Joerg Schulz offered to investigate the possibility to host WDAC7 in Geneva during the traditional Climate Space Week in spring 2018. Susanne Tegtmeier also offered to host the meeting in Kiel, Germany.

d. AOB

It was suggested to have a more detailed discussion of the Flux Task Team and its interaction with existing relevant efforts in GEWEX, CLIVAR, SOLAS. A potential focus on publication of flux data sets on obs4MIPs could represent a nice niche for the Task Team, otherwise not emerging elsewhere.

The need to review the practical modalities of the GCOS-WCRP interaction was also highlighted and will be taken up to the JSC38 session and also at the WMO secretariat level.

The need for WDAC to engage more actively in advocating for observing systems was expressed, given their importance for reanalyses and model initialization. As this is currently not part of the Council's mandate, the JSC will be consulted on this issue at their upcoming session. This issue could also be taken up at some major event (COP25, a WCRP Open Science Conference, etc).

e. Review of Draft actions list

Draft actions were reviewed and are summarized in Annex A.

ANNEX A: Action list

Data policy and Prize

1. Members to suggest any adjustments to Data Policy (inputs to be sent to Michel, June)

2. Members to suggest adjustments to Data Prize call and rules (inputs to be sent to Michel, June)

WCRP Strategy

3. Recirculate WCRP Ahead doc for comments, members to provide inputs by June (Michel, asap)

Reanalysis

4. GDAP-TIRA collaboration on energy budget (GDAP to convey reanalysis requirements to TIRA) - Mike

5. Promote 5th International Conference – Jean-Noel, Michel

6. Seek additional sponsors for the 5th International Conference (Jean-Noel, Michel)

ESGF, obs4MIPs, ana4MIPs

7. Encourage all projects to use ESGF/ana4MIPs/obs4MIPs as baseline infrastructure and data standards (co-chairs)

8. Send obs4MIPs info/table to panel co-chairs and keep them informed on progress (Peter)

9. Further develop strategy for in-situ ingestion into obs4MIPs (Peter, Jean-Noel, Dorothee, Matthias)

Data intercomparison

10. CDIP: make current assessments efforts in core projects more visible, each core projects to prepare inputs for WDAC brief to JSC38 brief (core projects, co-chairs, Michel)

Fluxes

11. Assess progress on Surface flux Task Team (Otis to discuss with Carol Ann)

GCOS-WCRP interface

12. Recall role of GCOS-WCRP panels at WDAC report to JSC38 (WDAC co-chairs)

13. Reorganize WCRP OSCAR inputs into the 'Climate Monitoring' application area in close coordination with GCOS via panels (panel co-chairs, Michel)

Core projects

14. Check availability of High vertical resolution radiosonde data (Jean-Noël)

Memberships

15. Identify and propose relevant WCRP rep on GCOS panels (core projects and SOLAS)

16. Explore Asia, Africa, South-America representation on WDAC (Co-Chairs)

Next session

17. Explore Climate week at WMO for hosting WDAC7 (Joerg)

ANNEX B: Contact list

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