



# PROJECT REPORT

Report of the fourth session of the WCRP  
Data Advisory Council (WDAC)

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**PRESENT:** Otis Brown (Co-chair), Toshio Koike (Co-chair), Magdalena Balmaseda, John Bates (remotely), Michael Bosilovich, Mark Bourassa, Peter Gleckler, Michaela Hegglin, Erland Kallen, Albert Klein-Tank, Pascal Lecomte, Walt Meier (remotely), Joerg Schulz, Carolin Richter, Koni Steffen, Jean-Noel Thepaut, Brian Ward

**WCRP JPS:** David Carlson, Michel Rixen

## 1. Introduction

### a. Introduction

WDAC Co-chairs welcomed all participants and thanked Jean-Noel Thepaut for hosting the meeting in conjunction with the Copernicus Workshop on Climate Observations Requirements. A quick round table allowed all participants to introduce themselves. The agenda was approved without changes.

### b. Welcome address

Erland Kallen, Director of the Research Department at ECMWF, welcomed all participants on behalf of ECMWF, and recalled the main mandate of the Center to deliver operational medium range weather forecast. Its mission very much depends on reanalysis for model development, initialization and evaluation. Reanalyses have become an intrinsic tool for climate research and monitoring and are now updated frequently over time. Whilst the initial focus was on the atmosphere, reanalyses are now expanding in the other Earth system components, including the ocean, land surface, atmospheric composition towards Earth system modeling and a fully coupled approach, currently being an intensive research exercise. He stressed the importance of addressing observations issues, as they are an integral and fundamental component of model initialization and was looking forward to see the outcomes of the Council's discussions.

### c. Copernicus workshop summary

Jean-Noel Thepaut noted this WDAC meeting was preceded by a "Copernicus Workshop on Climate Observations Requirements". The aim of the workshop was to help shape the observation-based content of the Copernicus Climate Change Service (C3S) Climate Data Store (CDS). A major goal for the CDS is to provide open and full access to observations and derived data products spanning the entire instrumental record available for climate applications and services. This includes:

- Climate data records from satellites
- Collections of in-situ climate observations
- Gridded ECV products derived from observations
- Input observations for model-based reanalyses

- Reference datasets for evaluation of models and climate data products

Topics discussed included:

- Data rescue activities for in-situ and satellite observations
- Best practices in homogenization and data reprocessing
- Metadata, traceability and transparency of climate data products
- Best practices for uncertainty characterization of climate data products

The workshop was lively and active, outcomes and recommendations from the workshop were many and will be used to guide the development of the observational component of the Climate Data Store catalogue, and to help specify scientific and technical service requirements in this area, including priorities on data rescue, metadata, traceability, uncertainty characterization and best practices.

*D/GCOS recommended to clearly link C3S to global programmes such as GCOS, WCRP and GFCS. C3S started on 11 Nov 2014 and will run to mid 2021. The service will be assessed in 2019 and renegotiated for a possible next term and updated form.*

#### **d. Review of WDAC3 actions**

Otis Brown reviewed the WDAC3 actions, noting that all had been completed except for a few whose status and progress would be reviewed at the present meeting and are addressed in this report.

#### **e. JSC36 update and proposal for an Open Data Policy**

David Carlson summarized the main outcomes of the JSC36 session held in Geneva in April 2015 noting several opportunities for intersections for collaborations between WCRP and GCOS. He highlighted the core of the session presentations focusing on typical modeling issues, whilst observations and data matters triggered interesting new discussions on the following matters:

- the establishment of a Data Prize following the successful launch of the joint WCRP-WWRP International Model Development Prize
- the organization of an informal Task Force on observational issues
- the investigation of a potential Earth System Reanalysis
- the development of a WCRP-wide open data policy.

*This last item monopolized the major part of the discussion. D/WCRP is the founder of ESSD, a major open access data journal, amongst other such as within Nature. The driver is to serve the needs of data producers, vetted by different entities not always well defined. It was noted the IPY data policy was developed from the prior CLIVAR data policy. Whilst there might be separate WCRP core project data policies, there is currently no pan-WCRP policy which could further support quality science through open data publication and DOIs. A recommendation from WDAC is needed in order to adopt such approach across the Programme.*

*Peter Gleckler remarked that developing a policy also requires details on the procedure and steps and that obs4MIPs will also address data policy issues. Koni Steffen noted the importance of DOIs for citations and appropriate credit.*

*Carolin Richter recalled that GFCS was tasked to develop a global data policy with due consideration of other stakeholders policies (WMO, IOC, UNFCCC, etc).*

*Toshio Koike noted that sharing data can lead to unexpected issues, such as bandwidth limitations, for example.*

*Members suggested to start with the CLIVAR policy and modify it so that it applies across the Programme and GCOS, covering all observations, reanalysis and model simulations but avoiding tighten it to other stakeholders such as GEO or WMO.*

## **f. GCOS update**

D/GCOS recalled the scope of GCOS: GCOS encompasses the climate observing components of:

- the WMO observing systems (WIGOS: GOS, GAW, WHYCOS, ...)
- the IOC-led co-sponsored Global Ocean Observing System (GOOS)
- the terrestrial observing networks, FAO co-sponsored Global Terrestrial Observing System (GTOS)
- observational elements of research programmes (WCRP, IGBP, ...)
- other systems contributing to climate observations, data management or products

She outlined the joint panels as an important mechanism for GCOS-WCRP cross-collaboration and highlighted the on-going development of:

- the GCOS Status Report: a 2015 report on the progress and status of climate observation, submitted to COP21/SBSTA in November 2015.
- a new "Implementation Plan" in 2016, reinforcing the Energy, Carbon and Water Cycles and discussing Essential Climate Variables to be used across UN conventions for climate change, biological diversity and to combat desertification: UNFCCC, CBD, UNCCD

Upcoming events include the GCOS Steering Committee 29 Sep – 1 Oct, Cape Town, RZA and the "GCOS International Science Conference –The Road to the Future", 2 – 4 March 2016, Royal Academy of Arts and Sciences, Amsterdam, The Netherlands.

*Members recommended circulating the draft GCOS status report within WCRP for review and feedback to GCOS.*

## **g. GCOS panel reports**

The GCOS/GOOS/WCRP Ocean Observation Panel for Climate (OOPC) has been interacting with the WCRP through participation in the WDAC meetings and through CLIVAR and GSOP participation at OOPC meetings. The interactions with WCRP provide input to the goals for observing system design and provide feedback on strengths and weaknesses of the existing observing system. Discussion with CLIVAR groups has supported the processes and interactions modeled with the Framework for Ocean Observations. These interactions help inform OOPC of observing system needs as OOPC contributes to the next GCOS Implementation Plan. OOPC will continue to foster these interactions.



Consistent with recent WDAC activities, OOPC finds that surface flux accuracy and the lack of observations below 2000m are limitations in the use of observations. Modeling studies have also found that the deep ocean and boundary current regions are focus areas. OOPC is trying to work with GSOP to improve the use of modeling to access the needs for an observing system. One area of discussion for improved interaction is the observation and modeling of how short term and/or mesoscale variability links to the large scale state of the ocean and the climate.

*Two on-going DEEP ARGO pilot projects aim at complementing the current observing system. Current profilers and bio-chemical sensors are being fitted to the floats. The possible involvement of WDAC in advocating for the tropical Pacific Ocean arrays was unclear as this was seen mainly as a national resourcing problem despite its benefit for the international community. It was suggested to turn a subset of Essential Ocean Variables (EOV) into Essential Climate Variables (ECV) as part of the new implementation plan, as the later have a stronger standing. Any such transition needs to fulfill GCOS ECV requirements. The lack of flux ECVs was noted. Flux data and collocated measurements within the boundary layer are fundamental to develop coupled models and require high quality interfacial data for their inference. ARGO itself would probably not meet the resolution requirements for such flux data. Advocacy for any specific observing system calls for a strong coordination between GCOS and WCRP and could point to ARGO as an outstanding community achievement.*

#### AOPC:

Kenneth Holmlund highlighted the joint AOPC/TOPC session held in Zurich in April 2015 and the upcoming GCOS Status Report, currently under development. The coordination of in situ observing network remains a major resourcing challenge. GRUAN currently has about 8-10 stations and is aiming for 40-50 stations in the future. Reference station is key to the development of Climate Services, and this has been brought to the attention of C3S.

*Koni Steffen noted that the overarching question is how to describe the climate system with a suitable set of variables and how to engage the community to sustain such observations. Task teams between panels have been established in the past to develop white papers on specific interfacial variables to address these issues for the GCOS Steering Committee's consideration.*

*The 2014 paper in BAMS was highlighted as a reference publication dealing with the ECV concept (<http://journals.ametsoc.org/doi/abs/10.1175/BAMS-D-13-00047.1>).*

#### TOPC

Koni Steffen noted that fluxes were addressed as a specific topic at the joint AOPC/TOPC session earlier in 2015. ECVs were developed using a bottom-up PI-driven approach, which may require a new view, with potentially a retirement of some ECVs if activity stalls and the re-definition of some ECVs (e.g. ice-sheet, surface radiation). This suggests maybe a new TOPC structure, in light of the GTOS issues.

## **2. Data sets assessments and intercomparisons**

Briefers were invited to focus their presentations specifically on climate data set open access, assessments and intercomparison efforts, including fluxes, reanalyses and interfaces with other efforts.

#### a. CLIVAR – GSOP

The summary of CLIVAR GSOP activities was given by Magdalena Balmaseda as Pierre-Philippe Mathieu was not available. The talk summarized the following activities of CLIVAR with a focus on GSOP:

- Ocean Reanalysis Intercomparison project (ORA-IP) led by Magdalena Balmaseda at ECMWF. This initiative aims to perform joint intercomparison of ocean synthesis & forward model simulations to better quantify Signal/Noise from Ensemble, gain insight into the ocean variability and trends, identify current deficiencies, measure progress and exploit existing multi-ORA ensemble (e.g. climate indicators, validation, monitoring). See paper Balmaseda, M.A. *et al.*, The Ocean Reanalysis Intercomparison project (ORA-IP) *J. Op. Oceanogr.* Volume 8, supplement 1, 9 June 2015.

- COST action on Evaluating Ocean Synthesis (EOS) [www.eos-cost.eu](http://www.eos-cost.eu) led by University of Liege. This initiative aims to improve the coordination of European efforts in the evaluation of ocean syntheses by making an inventory of existing activities and harmonizing data and protocols for intercomparison.

- CLIVAR Research Focus on the Consistency Between Planetary Energy Balance and Ocean Heat Storage (CONCEPT-HEAT) led by Karina von Schuckmann. This initiative aims to bring together the research communities concerned with the energy flows in the Earth's System to advance the understanding of the uncertainties through budget constraints and consistency studies.

- ESA Ocean Heat Flux project led by Abderrahim Bentamy (IFREMER) [www.oceanheatflux.org](http://www.oceanheatflux.org) to generate a multi-ensemble turbulent fluxes derived from satellite data and the latest algorithms.

- International Quality Controlled Ocean Database (IQuOD) Led by Catia Domingues and Matt Palmer. This initiative aims to construct the most complete, consistent and high quality subsurface ocean temperature long-term database, with intelligent metadata and assigned uncertainty to each observation, and to freely distribute for use in ocean, climate and Earth system research science and applications of societal benefit.

- Multi-ORA real time ocean monitoring. Led by Yan Xue.

- Observing System Evaluation (in collaboration with GODAE/Ocean View) GSOP priorities.

The following meetings are foreseen: (i) a Focus Workshop on Energy Flow through the Climate System, UK MetOffice, Exeter, UK; Dates: 28 Sep - 02 October 2015, (ii) the IQuOD Session at Ocean Sciences, 21-26 Feb 2016, New Orleans, and (iii) the IQuOD Workshop, 03-05 December 2015, Hamburg, Germany.

The main GSOP priorities are:



- Improve usability/accessibility of Ocean Reanalysis products
- Development of Coupled (Ocean-Atmosphere) Data Assimilation (and Reanalysis) methods
- Understanding and Estimating long-term sea level, ocean heat uptake and surface temperature rise
- Focus for IQuOD project in developing "intelligent meta-data" - basically an educated-guess, based on other existing meta-data
- Tropical Pacific Observing System (TPOS2020)
- Deep Ocean Observing Network
- Ocean Climate Indicators

*The discussion highlighted the comprehensive Grand Challenge on Sea Level which pulls many inter-disciplinary elements together to address the issue also at regional/local level. An endorsement of IQuod and ORA-IP by WDAC seems natural but would require more details so that WDAC can make an informed decision. Toshio Koike noted that QC activities are important to support quality research within WCRP and encouraged such endorsement.*

## **b. GEWEX – GDAP**

Jörg Schulz provided a presentation on GDAP activities which addressed Data Products, Product Quality Assessments, and Radiative Transfer Code Assessments. The product quality assessments commonly bring together a variety of in-situ measurements. Some of these are well coordinated and quality controlled while others exist largely in their own regional domains. The panel, therefore, sees a role as identifying such networks of in-situ observations and fostering the development of integrated global datasets that can be used to both construct and/or validate the global climate products.

The individual and the integrated GEWEX data products enable research related to Grand Challenges on changes in water availability, clouds, circulation and climate sensitivity and potentially for climate extremes. A specific objective within GEWEX is to provide a better understanding of variability and change of the water and energy cycles and individual state variables mainly derived from satellite observations.

Major objectives of the product quality assessments are to provide independent and transparent quality assurance for existing data records, to endorse the use and the credibility of data records to a broader community not necessarily familiar with the data sources and methods used to generate the data records, to identify key limitations in data records to stimulate improvements, and to allow objective selections of appropriate data records, e.g., for evaluating climate models in Climate Model Intercomparison Projects (CMIP).

Radiative transfer code assessments performed as GEWEX projects had the objectives to provide a new standard for assessing the performance and potentially certifying GCM-style SW and LW RT codes, to compare performance of 3D radiative transfer codes and comparison of canopy radiative transfer models under controlled experimental conditions.

The production of GEWEX individual products for Clouds (ISCCP), Aerosols (GACP, MAC), Radiation Fluxes (SRB), Turbulent Fluxes (SeaFlux and LandFlux) as well as Precipitation (GPCP) continues with reasonable support from agencies except for

GACP which remains unfunded. The Max Planck Institute für Meteorologie continues the production of an Aerosol Climatology that is being adopted by GDAP. GDAP still pursues the generation of an integrated GEWEX product employing the standard products designed to ensure that geophysical signals and their covariance are tied to the data and products themselves rather than inconsistencies in their assumptions. However, the panel has encountered significant issues, of the scientific rather programmatic nature, as it has forged ahead to create this product. In that sense the integrated product is an important step forward in that the very interdependence of the products makes it difficult to produce, but is also a very strict QC procedure.

GDAP has begun to explore the expansion of GEWEX standard products to include terrestrial water budget terms. Two experts on these topics, Wouter Dorigo (Soil Moisture) and Felix Landerer (GRACE Observations of water storage), joined the Panel advising on best ways to incorporate potential data sets.

A future longer term issue is to better characterize the uncertainty of products that includes the provision of uncertainty estimates with the products and their evaluation. GDAP needs to follow up the uncertainty characterization more systematically for all products to resolve random, systematic, and so-called structural (situation and magnitude dependent) components of uncertainty. The provision of uncertainty measures with the products will certainly trigger needs for new reprocessing activities.

In terms of applications, GDAP will make an attempt to bring the integrated product and also a more complete set of GEWEX products to the CMIP-6 activities by interrogating with the obs4mips activity. It is expected that such a usage will create valuable feedback for further developments of the products.

Jörg Schulz reported that GDAP has two ongoing data set quality assessments on water vapor and aerosol optical depth. Both are crucial elements of the integrated product and were originally designed to provide information on different existing data sets derived from satellite data.

Whereas the progress with the aerosol assessment is a concern, the water vapor assessment ([www.gewex-vap.org](http://www.gewex-vap.org)) has continued to make significant progress. Trend analysis was used as a tool to compare total column water vapor (TCWV) and water vapor profiles on global scale. The TCWV trends were found to be significantly different, in particular in tropical land regions which led to the recommendation to the Global Reference Upper Air Network (GRUAN) co-chairs to consider a tropical land surface station during GRUAN network expansion ([www.gruan.org](http://www.gruan.org)). Using homogeneity tests these differences in TCWV were found to be caused by break points in the time series which temporally coincide in almost all cases with changes in the observing system. The 4th G-VAP workshop was hosted by the Institute of Space Sciences at FU Berlin, Berlin, Germany on 09+10 October 2014. More than 30 scientists from all over the world participated and nearly everybody contributed with a presentation. The willingness of the participants to take over responsibility in WCRP report drafting is noteworthy and highly acknowledged.

The GDAP meeting in The Hague (July 2014) decided to embark on two new product quality assessments that will cover precipitation and soil moisture data sets. The soil moisture assessment may also consider consistency between soil moisture, precipitation and evaporation at the surface. A third topic for an assessment might be groundwater related products. Both assessments will be further discussed at the next GDAP meeting in late September 2015.

*The discussion highlighted the upcoming changes in GDAP leadership requiring the update of WDAC web pages and mailing lists, the availability of many soil moisture products, and the strategy to ask for white papers outlining planned steps ahead of future assessment efforts.*

### **c. SPARC – S-RIP**

Michaela Hegglin (for Susann Tegtmeier) updated WDAC on SPARC activities. SPARC historically concentrated on the role of the stratosphere in climate, but now also includes science foci throughout the atmosphere. Identified SPARC themes for the new (post 2015) implementation plan are: 1) Atmospheric Dynamics and Predictability, 2) Chemistry and Climate, and 3) Long-term Records for Climate Understanding. Theme 3) is the most pertinent to WDAC. SPARC has been particularly successful in guiding the construction, quality control, analysis, and interpretation of climate data records (CDRs) that require international cooperation. SPARC also promotes establishing traceability and uncertainties of measurements, as well as the collection and archiving of CDR metadata.

A key example given was the revision of the SSU temperature CDR within the SPARC temperature trends activity. Discrepancies between existing SSU products from two different institutions were largely resolved. SPARC research within the ESA SPIN project further developed a new merging method between the SSU and AMSU records using vertically higher resolved limb-sounder observations as a transfer function. The newly merged temperature time series and trends also now agree with those from CMIP5 models. Note that knowledge of middle atmosphere temperatures is key to accurate predictions in weather forecast systems.

Two further SPARC activities were highlighted. The SPARC Data Initiative is about to finish a comprehensive quality assessment of zonal monthly mean climatologies of 25 chemical trace gases and aerosol from international satellite limb observations. It introduced a new ‘top-down’ approach to data validation for climate purposes. Key to success was a mixed team of data analysts and data providers, regular team meetings, and data archiving for easy access in a data centre. The SPARC Reanalysis Intercomparison Project (SRIP) successfully established collaborative links between the reanalysis centres and the SPARC community with the common work goal to evaluate the performance and quality of different currently available stratospheric reanalyses. It also noted the usefulness of ana4MIPs for its work. The SRIP assessment (with the first part to be finalized by the end of 2015) will provide guidance on the appropriate use of reanalysis products.

Finally, SPARC summarized its data needs, which are the continued improvement of meteorological analyses and past records, as well as the continuation of existing core measurements. SPARC brought to the attention of WDAC that funding pressure is threatening the closure of many ground-based observation sites and also has led to a lack of planned limb satellite sounders. It was noted that the latter, in particular, would make it difficult for SPARC to support WMO in observing the state of the ozone layer, a mandate given to WMO by the signatories of the Montreal Protocol.

*Koni steffen and other members noted the current lack of cooperation to advocate for limb sounders for the UTS composition. The group recommended SPARC to articulate such need which could then be forwarded to various WMO and other channels.*

#### d. CliC

CliC has particularly focused on modelling in the past year, noted Walt Meier (remotely). Several model intercomparison projects have started or are proposed. The most notable is the Ice Sheet Model Intercomparison Project for CMIP6. Led by Sophie Nowickie at NASA Goddard, it has been approved by CMIP and planning is underway. A snow MIP is in the planning stages and will likely fully develop after CMIP6. A sea ice MIP has also started, though this will only be diagnostic in nature – requesting output variables from the models for comparison. The Sea Ice Prediction Network has begun its annual Sea Ice Outlook and a record number of contributions (32) were submitted in June. Observational activities include continued planning for MOSAiC, the drifting ice station planned for 2017 or 2018, and approval by the WMO of the Global Cryosphere Watch. The Permafrost Carbon Network has been initiated to synthesis permafrost research.<sup>1</sup>

*W. Meier acknowledged Jenny Baeseman's strong contribution to CliC, as she is leaving the Project Office to become the new Director for SCAR.*

*ana4MIPs was suggested as a suitable platform for hosting SIRTa data. D/WCRP recalled the importance of developing and promoting permafrost data sets. Snow Model Intercomparison Project (SnowMIP) will aim at comparing various data sets.*

*Global Cryosphere Watch mainly provides access to existing data sets and is still in its infancy, with some components further along than others.*

*Post-meeting note: the MOSAiC experiment will be postponed to 2020, as announced during the Year of Polar Prediction (YOPP) Summit held in Geneva 13-15 July 2015.*

#### e. IGBP

N/A

#### f. SOLAS

Brian Ward noted that IGBP is winding down and will come to an end by 2015, but Future Earth has been recently established, and SOLAS decided that it will transition

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<sup>1</sup> Permafrost Carbon Network (PCN):  
<http://www.permafrostcarbon.org>

Permafrost presentation at CliC SSG (scroll to T Schuur presentation):  
[http://www.climate-cryosphere.org/media-gallery/1397-tedschuur-permafrost?album\\_id=64](http://www.climate-cryosphere.org/media-gallery/1397-tedschuur-permafrost?album_id=64)

Snow inter-comparison workshop last year:  
<http://www.climate-cryosphere.org/news/clic-news/855-snowpex2014>

from IGBP to Future Earth. In this new landscape, SOLAS 2015-2025 will have more emphasis on the human relevance of SOLAS science (e.g. geo-engineering and environmental services).

SOLAS has produced a Transition Statement addressed to Future Earth in November 2014 from which a response was provided in April. SOLAS responded to referees comments in May.

SOLAS has produced a new Science Plan for the period 2015-2025, which encompasses six core themes: (i) Greenhouse gases and the oceans (ii) Air-sea interface and fluxes of mass and energy (iii) Atmospheric deposition and ocean biogeochemistry (iv) Aerosols, clouds, and ecosystems (v) Ocean biogeochemical controls on atmospheric chemistry, as well as three Integrated Topics: (i) Regional process studies in high sensitivity systems (ii) SOLAS and Geo-engineering (iii) SOLAS and Society.

An overview of the Surface Ocean CO<sub>2</sub> Atlas (SOCAT) was provided. SOCAT's version 2 dataset spans the period 1968-2011, contains 10.1 million fCO<sub>2</sub> measurements, derived from 2660 data sets. SOCAT has been used as a dataset to estimate the oceanic uptake of CO<sub>2</sub>, and shows significant deviation from model estimates. Further applications of SOCAT include: assessments of ocean acidification and validation of ocean biogeochemical models.

The SOLAS Open Science Conference will be held in Kiel from September 7-11, 2015.

*The discussion noted that SOCAT data have been gridded using a.o. neural networks. fCO<sub>2</sub> measurements are available on some moorings besides ship of opportunity and remain a challenge, even more so in the presence of sea-ice. ice-tethered platforms still require significant maintenance and systems onboard ships need close monitoring. Members again encouraged the use of DOI to publish such data. The publication of SOCAT data in the open data access literature was highlighted, and issues about contributors' agreement and signature noted.*

## **g. Data set assessments, best practices**

*Jörg Schulz updated the Council on the latest draft of the document. It was decided to circulate the current version to WCRP core projects for comments by the end of the summer.*

## **3. Data dissemination and reanalysis**

### **a. obs4MIPs**

Peter Gleckler, representing the WDAC Observations for Model Evaluation Task Team, provided a brief status report on obs4MIPs and related efforts. Both challenges and opportunities were discussed.

obs4MIPs has received considerable attention within the CMIP community by making selected data more accessible in support of modeling research. It has also attracted

broader interest in a wide range of observational communities (in-situ included) because of the potential of what it represents - carefully organized and described observationally data retrievable via the Earth System Grid Federation (ESGF). The Climate-Forecast data conventions (CF) are what makes this possible, and the task team and members of WDAC strongly support further adoption and refinement of these conventions. In fact, several members noted that for in-situ data the small data volumes meant that data could be made available via a variety of mechanisms, but that the CF conventions still had a centralizing role to play and that the task team should find ways to support this. Key among the opportunities discussed by the WDAC members was how to respond to the broad interest and further expand the obs4MIPs repository beyond satellite data.

A current priority for the task team is to define protocols for how datasets are selected for inclusion into obs4MIPs as well as developing solutions to streamline the technical tasks of preparing data for publication into ESGF. Possible enhancements discussed included DOIs for data and documentation as well as the possible advancement of a “maturity matrix” adopted to meet the purposes of obs4MIPs. At the time of WDAC4, a queue of dataset proposals needed to be reviewed by the task team. A clearly defined process is expected to rectify this.

Once the task team clearly defines a recipe for how datasets are included into obs4MIPs, this documented process will be promoted to a broader community of dataset providers in hopes of providing them opportunities to publish their products on ESGF. It remains to be determined if this will require broadening the scope of obs4MIPs or if the process developed for obs4MIPs is leveraged to enable other ESGF projects. In brief, the task team hopes obs4MIPs and related efforts can provide some coordination of disparate observational communities.

The latest obs4MIPs information is now hosted on the “CoG” (Community Governance) which includes direct access to obs4MIPs datasets hosted on ESGF. Many other climate community projects are already hosted on the CoG (e.g., the sister obs4MIPs project for selected atmospheric reanalysis fields - see ana4MIPs discussed below), and it is anticipated that soon CMIP5 and later CMIP6 data will also be accessible via the CoG.

*The discussion noted the current governance and IT security issues with the ESGF, which will be unavailable for some months to firewall the system against potential threats. A number of agencies (ESA, EUMETSAT, NASA, NOAA) are currently producing CDR towards obs4MIPs but there is a backlog in the ingestion because of the amount of requests.*

*The CF convention was developed for (satellite) gridded data sets. One Member remarked that gridded data (including reanalysis) are not observations. The netCDF construct could support sparse data too, with dedicated attributes to clarify such distinction. An “Observation operator” capability to extract data at specific times and locations should be considered.*

*D/GCOS remarked that obs4MIPs can help making the connection between climate research and reference observing networks. The SOCAT data set was cited as an example to set a standard for in-situ data in obs4MIPs and raised the question of the usefulness of such data, as the original parameter of fugacity may be of lower interest to climate modelers than partial pressure.*



*Joerg Schulz cited the example of the H2020 GAIA-CLIM project which includes an effort to collocate in-situ with satellite, reanalysis and forecast model data towards a virtual laboratory in preparation for CMIP6. Peter Gleckler also recalled that the CMIP DECK is aiming for some diagnostic capabilities. Magdalena Balmaseda noted that the H2020 atlantOS project is working towards ocean metadata standards and that marine core services are CF compliant. Michaela Hegglin highlighted the importance to entrain the observational community in the MIPs efforts, as using the data helps advocating for observing systems.*

*The ambition of obs4MIPs to become a selected pool of observations is limited by compliance (CF convention, technical note) and quality, for which a threshold has yet to be determined, but also resources (funding, manpower), as the Task Team is now facing a growing number of requests.*

*D/WCRP recalled that for in-situ – e.g. big high-resolution - data sets, other publication avenues exist, such as the open data literature, whose use should be encouraged too.*

*It was suggested to add the WCRP logo on the obs4MIPs CoG.*

## **b. ana4MIPs**

Michael Bosilovich noted the progress made in the evolution of ana4MIPs. It has become a subset of a larger effort to coordinate broad reanalysis data for the ESGF, called the Collaborative REAnalysis Technical Environment – Intercomparison Project (CREATE-IP). CREATE-IP will have the flexibility to incorporate model-generated data and data assimilation output from the reanalyses systems into ESGF. ana4MIPs will be a subset of reanalysis data classified as suitable for CMIP model intercomparison and validation. CREATE-IP will facilitate the intercomparison of reanalyses data products and comparison with observations in ESGF, There are also plans to provide visualization and analytics tools for wider use of reanalyses. Currently, this is supported by NASA, but all the reanalyses centers have approved their data for inclusion in the ESGF.

*The Copernicus Climate Change Service (C3S) could build on and contribute to CREATE-IP including its analysis increment component. Magdalena Balmaseda noted that the ocean community is developing something similar, suggesting a stronger coordination between both efforts. Some CMOR-like processing could facilitate the ingestion of data. The use of DOIs was encouraged to give credit to reanalysis providers. Gerald Potter currently supports the ana4MIPs helpdesk role. CREATE-IP will help quantifying uncertainties, but this requires some clever communication strategy, as reanalysis are a mix of observations and models.*

## **c. Reanalysis Task Team update**

Michael Bosilovich presented the status of the white paper outlining the WDAC Task Team for Intercomparison of ReAnalyses (TIRA). See WDAC4 document records for a copy of this paper. Over the past year, the first draft of the whitepaper was finalized with input from the reanalysis developing centers. The draft was then circulated among WDAC members, and other interested communities (e.g. WGNE). Following WDAC4, the TIRA white paper is being circulated across WCRP activities.

The white paper outlines the status of reanalyses and the community need for information on the reanalyses. Presently, there is no existing international coordinating body dedicated to reanalyses data. Yet, intercomparison activities are developing on their own (e.g. CREATE and S-RIP). The task team would be comprised of both representatives from developing centers and the community of users. It would represent a central body to coordinate reanalyses information and understanding within WCRP and its partners. In addition, it would be charged with developing a long term project for the intercomparison of reanalyses. While there are tremendous possibilities and opportunities for collaboration, the task team would also need to develop a reasonable plan to move forward on these objectives.

*Members endorsed the TIRA draft provided consistent scope and resources, welcomed additional members as required and suggested to also liaise with the WWRP DAOS group.*

#### d. Earth System Reanalysis

*David Carlson recalled that this topic emerged from the IPCC-WCRP Bern workshop in 2014. A main question remains the scope of such effort, as activities and contributions can range from specific coupling to broader bio-geochemistry. Some dialogue, thinking and preparation could start so that a framework could emerge when tools (e.g. SOCAT in obs4MIPs, conventions in bio-geochemical data, etc.) get more mature. Otis Brown recalled that WDAC became the owner of reanalysis and suggested TIRA and the place to host this activity. Magdalena Balmaseda cited ocean reanalysis as an example of successful bottom-up activity which started without any formal pathway. Members suggested a close coordination between ORA-IP and ana4MIPs and to circulate the TIRA concept note to core projects. Peter Gleckler recalled that ocean-atmosphere coupling remains an important challenge to address ahead of full Earth System Models. The next International Conference on Reanalysis will currently planned for 2017, maybe in Brussels.*

### 4. Observations, inventory, fluxes

#### a. WG Climate

John Bates presented a proposal for an Obs4ECV Dataset and OpenSearch Capability for ESGF to address the intersection between ESGF, obs4MIPs and ECVs with the idea to make the ESGF OpenSearch capable.

The overarching goal of the CEOS/CGMS Working Group on Climate (WGClimate) will be to improve the systematic availability of Climate Data Records through the coordinated implementation, and further development of the architecture for climate monitoring from space.

The Major Activity of WGClimate is the Collection, Analysis, and Action Plan using an ECV inventory which is currently challenged:

- it must be an exact match with ECV/CDR name
- it must be available from an EO data service
- it must provide documentation

- the data call is not effective and does not reach entire ECV community

obs4MIPs is suggested as the right framework to address these issues as part of a new paradigm for Earth observation discovery and metadata harvesting

OpenSearch (see [opensearch.org](http://opensearch.org)) is a collection of simple formats for the sharing of search results. The OpenSearch description document format can be used to describe a search engine so that it can be used by search client applications. The OpenSearch response elements can be used to extend existing syndication formats, such as RSS and Atom, with the extra metadata needed to return search results.

*Members welcomed the idea. The naming of ECV variables could pose a slight technical issue as different levels of granularity (generic names, processes) are used. The problem of portal proliferation was raised. obs4ECV could be folded into obs4MIPs to solve this point pending technical feasibility, and to advocate benefits for CMIP and from a GCOS perspective.*

## b. GEO update and GCI

Toshio Koike introduced the draft Strategic Plan for the GEO activities from 2016 to 2025. It outlines the strategy and framework for the intergovernmental Group on Earth Observations (GEO) to fulfill its vision, define its objectives, and produce key deliverables while determining structures and resources needed to accomplish these goals. The Plan will be implemented through a set of activities within specific timeframes as defined in Work Programmes. The draft defines action areas in which GEO will actively advocate the value of Earth observations as a fundamental component of timely information regarding the state of the Earth, engage with stakeholder communities to address societal challenges, and deliver critical data, information and knowledge to inform decision-making. In the draft, GEO is positioned to contribute to actions that address urgent societal challenges, including climate change and its impacts, by leading national, regional and global efforts to enhance global Earth observation systems. GEO will advocate the value of Earth observations, engage communities and deliver data and information to support the management of disaster resilience and water resources as its targeting societal benefit areas as well as the other six ones. He also reported on the update of the GEOSS Common Infrastructure (GCI), including Web Portal, Discovery and Access Broker(DAB), Centralized EO Inventory Clients and Component & Service Registry (CSR).

*Jean-Noel Thepaut highlighted that Copernicus is a contribution to GEO. In-situ data are an integral part of GEO. Some concerns were expressed as to the benefit for contributors to invest in GEO, the perceived disconnect to tangible activities and the strategy to aggregate existing activities. Toshio Koike commented that GEO is most effective as seeking high level agreements, promoting EO missions, data sharing principles, and influencing agencies' funding agenda.*

## c. ECV inventory

Otis Brown provided a brief update to the Council on the joint activity with WGClimate (sponsored by CEOS and CGMS) to develop an inventory for in situ climate observations. This effort is being supported by NOAA / NCEI through GOSIC

and NASA / LARC. A preliminary survey form has been drafted and reviewed by the WGClimate Chair John Bates and a WDAC co-chair. This form is architecturally similar to the MIM tool to facilitate linking of remotely sensed and in situ data sets. Eventually the in situ inventory tool would be hosted by GOSIC. There are a number of challenges, not the least being the lack of GCOS specificity for ECV observation linkages with traditional in situ parameters. This has necessitated additional background efforts and forced consideration of alternative approaches such as harvesting appropriate metadata from dataset descriptions, such as the obs4MIPs documentation. Progress is currently constrained by resource availability, however EU resources have been identified for inventory activities, which may necessitate an alternative partnering arrangement.

*John Bates recalled that the GCOS Satellite Supplement aim is to match Earth Observations with ECVs. obs4mips was highlighted as a potential resource to hold the ECV inventory. The WG Climate and the obs4MIPs Task Team should explore this possibility more in details, with due consideration of the fact that obs4MIPs may not host all ECV. Jörg Schulz mentioned that the satellite ECV inventory will most likely move from NASA to EUMETSAT. The opportunity to expand this opportunity to in-situ data sets could be explored. Koni Steffen highlighted the need for consultations between GCOS/WCRP panels to clarify names of some of the ECVs.*

#### **d. Flux Task Team update**

B. Ward recalled that fluxes remain a major modeling challenge and noted the opportunities for new and exciting research which could integrate efforts from CLIVAR, SPARC, SOLAS, IMBER amongst others, as highlighted by G. Brasseur in the recent Flux Newsletter produced by CLIVAR. He then presented the draft Terms of Reference and proposed membership to the Council.

There is little doubt that there are large errors associated with flux estimates from models, which results in large errors in our predictive capabilities for weather and climate.

As a result, it was decided at WDAC3 to establish a Surface Flux Task Team, whose terms of reference are described below.

The current membership of the task team comprises of the following scientists:

- Carol Anne Clayson, Woods Hole Oceanographic Institution, USA
- Brian Ward, National University of Ireland, Galway, Ireland
- Peter Gleckler, Lawrence Livermore National Laboratory, USA
- Joerg Schulz, EUMETSAT, Germany
- Pierre Phillippe Mathieu, European Space Agency, Italy
- Anton Beljaars, ECMWF, UK
- Carlos Jimenez, LERMA, Observatoire de Paris, France
- James Edson, University of Connecticut, USA
- Paul Stackhouse, NASA, USA
- Hape Schmid, Karlsruhe Institute of technology, Germany
- Saigusa Nobuko, National Institute for Environmental Studies, Japan

The upcoming workshop "Air-Sea Fluxes for the Southern Ocean: Strategies and Requirements for Detecting Physical and Biogeochemical Exchanges" (Frascati, Italy,

September 21-23, 2015) will be an opportunity to present this task team to the air-sea flux community and possibly expand the team membership.

#### Terms of Reference

1. Provide a single point-of-contact for surface flux observations and analysis in the WCRP.
2. Establish and encourage the use of data, metadata, and documentation standards for global surface flux data (ocean-atmosphere-land) data sets that are consistent with standards used in major climate model intercomparison efforts (e.g., CMIP), thereby facilitating intercomparison of the data sets and their use in evaluation of Earth System models and their components. Recommendations and improvements to CMIP and reanalysis standard model output and documentation for improved capability for comparison with observed flux datasets.
3. Establish conventions for intercomparisons of global datasets, and for assessment of the global datasets with available in situ data.
4. Encourage continued acquisition of eddy covariance flux measurements, particularly in extreme locations and conditions as well as the expansion of flux observations to include all of the heat (turbulent and radiative), momentum, gas, aerosols, and freshwater fluxes. Support continued acquisition of key input parameters for bulk flux estimation and radiative fluxes at existing and planned long-term sites.
5. Oversee a website containing available direct and indirect flux estimates in a common format, along the lines of the GEWEX SeaFlux site. In addition, provide hosting for global flux data sets in agreed standards, a repository of results of comparisons, and an inventory of the literature published using these data sets for the benefit of the larger community.
6. Support activities from other non-air-sea-flux communities, such as the ocean heat content and the atmospheric radiation communities, to work with constraining and understanding uncertainties in the air-sea fluxes.
7. Encourage support for groups attempting to evaluate bulk flux parameters from non-research sources, such as ships of opportunity.
8. Encourage research into and support for satellite missions that provide enhanced air-surface flux capabilities.
9. Provide support for having surface fluxes named as Essential Climate Variables.
10. Report to the WDAC and brief other relevant WCRP committees and panels (e.g., GEWEX/GDAP and CLIVAR) on progress, status, and plans for activities overseen by the Task Team.

*Otis Brown recommended avoiding reference to earth components in the ToRs but suggested the addition of a polar expert as bulk formulae have issues in high latitudes. Jörg Schulz noted some duplication of GDAP representation on the proposed Task Team. D/WCRP indicated the upcoming SOOS workshop in September. The programmatic link to Future Earth was address but not deemed essential as this is already endorsed by WCRP from a science point of view but*

*Michaela Hegglin recommended making some connection to the carbon/biogeochemistry via IGAC for example. Michel Rixen suggested to add a co-chair (Brian Ward) to connect directly with the Council, to revised the ToRs for final approval and to kick-off the activities of the group with a first conference call soon.*

## **5. WDAC Business**

### **a. Development of a WCRP-GCOS Data Prize**

Dave Carlson summarized the discussions at the JSC36 suggesting the establishment of a data prize, possibly joint between WCRP and GCOS and building on the WCRP/WWRP International Model Development Prize model. The council recommended setting up a small team involving Sonia Seneviratne, Anny Cazenave and some GCOS representation to develop such idea with due consideration of similar initiative such as the “International Data Rescue Award” sponsored by IEDA and Elsevier and presented at the EGU Assembly.

### **b. Memberships**

Otis Brown noted that the terms of 9 members are coming to an end. He enquired about the possibility to maintain a good level of corporate memory within the group so as to see a well-managed group, whilst staggering the changes progressively. D/WCRP confirmed it should be easy to get the JSC approval on this approach.

### **c. Next WDAC Meeting**

Otis Brown offered to host the WDAC5 session at NCEI in Asheville the week of 4-8 April 2016, in conjunction with the next AOPC session the same week, hence prior to the JSC37 session. The next OOPC session will be held during week 11-15 April 2015, whilst the TOPC dates are still to be determined.

### **d. AOB**

Attendees highlighted the benefit of having held WDAC4 back to back with the Copernicus workshop. C3S is currently establishing a board which could involve WCRP and GCOS affiliated people. Conversely, it was also suggested to maintain some form of liaison in the other direction, by inviting Copernicus affiliated people at future WDAC sessions. The opportunity WDAC sessions offers for WCRP-GCOS panel chairs to meet in person was also noted as useful. D/GCOS raised the unresolved issue with GTOS and noted the on-going effort to resource and host this activity somewhere.

### **e. Review of Draft actions list**



The draft action list was reviewed and can be found in Annex B. WDAC Co-chairs thanked all participants, including Jean-Noel and ECMWF staff for hosting the session and the logistics support.

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## **ANNEX B: WDAC4 ACTIONS**

### **Open Data policy**

ACTION 1: take CLIVAR policy as a template, consult with other core projects and adjust so that it can apply across WCRP and GCOS (data definition == observations + reanalysis + models) (WDAC Co-chairs and GCOS Chair)

### **GCOS**

ACTION 2: WCRP to review GCOS draft status report and provide feedback to GCOS (Michel Rixen, Carolin Richter, end of August)

### **CLIVAR**

ACTION 3: IQuod to provide additional details so that WDAC can make informed decision about potential endorsement (Pierre-Philippe Matthieu, Magdalena Balmaseda)

### **CLiC**

ACTION 4: CLIC to consider using ana4MIPS for SIRTA (Walt Meier)

### **SPARC**

ACTION 5: SPARC to articulate need for new missions to address current "Lack of planned satellite observations (esp. limb) of UTS composition" and forward to WGClimate (Susann Tegtmeier, Michaela Hegglin)

### **Data set assessment**

ACTION 6: circulate draft document to WCRP project offices for review and publication (Michel Rixen, end of August 2015)

### **obs4MIPs**

ACTION 7: follow-up on tractable work: maturity matrix, data set call, xml technical note, completeness table (obs4MIPs Task Team, end 2015)

ACTION: use SOCAT and other data sets as case studies for obs4MIPs in situ protocol and standards (JPS)

### **ana4MIPs**

ACTION 8: circulate TIRA concept note to WCRP core projects and DAOS (Michael Bosilovich)

ACTION 9: TIRA to engage core project reanalysis efforts (Michael Bosilovich)

### **Inventory**

ACTION 10: WGClimate to update WDAC on (satellite component of) ECV inventory (WGClimate Co-chairs, WDAC5)

### **Fluxes**

ACTION 11: revise ToR, add Brian as vice-chair, address high latitude and biogeochemistry representation, and circulate to JSC for approval (Brian Ward)

### **Data Prize**

ACTION 12: drafting tiger team (Sonia, Martin, Anny + GCOS rep(s) via Carolin) to scan 'Prize' landscape and get back to WDAC with final proposal, consider data availability as part of the criteria, revisit career criteria (WDAC Co-chairs)

### **BUSINESS**

ACTION 13: update WDAC pages and mailing list (GDAP and WGClimate co-chairs, etc) (Michel Rixen)

ACTION 14: address WDAC membership expirations with a 1/3, 1/3, 1/3 rotation arrangement and submit to WCRP JSC (WDAC Co-Chairs, Michel Rixen)

ACTION 15: WDAC5 session, Asheville, ideally 2 days during week 4-8 April 2016, in conjunction with the AOPC session