WCRP REPORT

World Climate Research Programme

Meeting Report

Eight Session of Global Synthesis and Observations Panel

28th September 2015/Exeter, UK

15th December 2015

WCRP Report No.20/2015

ICPO Report No.204

CLIVAR is a component of the World Climate Research Programme (WCRP). WCRP is sponsored by the World Meterorological Organisation, the International Council for Science and the Intergovernmental Oceanographic Commission of UNESCO. The scientific planning and development of CLIVAR is under the guidance of the JSC Scientific Steering Group for CLIVAR assisted by the CLIVAR International Project Office. The Joint Scientific Committee (JSC) is the main body of WMO-ICSU-IOC formulating overall WCRP scientific concepts.

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Action items

ACTION: GSOP to provide comments on the deep Argo strategy when available (GSOP co-chairs, ICPO)

ACTION: GSOP to coordinate comments on behalf of CLIVAR on the TPOS2020 Backbone Task team report when available (GSOP co-chairs, ICPO)

ACTION: GSOP to discuss with GODAE OceanView about a strategy to develop OSE experiments to help the refinement of the tropical array observing system (T. Lee, M. Balmaseda, K. Ando)

ACTION: GSOP to provide CLIVAR's input to OceanSITES on key products and indices for model validation (co-chairs, U. Send, ICPO)

ACTION: Discuss with University of Hamburg if they agree to host ORA-IP datasets (Magdalena Balmaseda)

ACTION: Request permission from ORA-IP data producers to make their data publicly available (Magdalena Balmaseda)

ACTION: Send letter of support to JMA/MRI's contribution to Real-Time Multi-ORA project (co-chairs)

Welcome and introductions

Matt Palmer and Tony Lee, GSOP co-chairs, welcomed all panel members and invited guests (Appendix 1). Apologies were received from Pierre-Philippe Mathieu, Masafumi Kamachi, Are Olsen, and Dean Roemmich. Yan Xue and Ken Ando joined the meeting remotely. Co-chairs introduced the objectives of the meeting, which would focus on

- Updates of observing systems and how GSOP can assist in the design/development of observing systems and the evaluation of the related products.
- Data products and quality.
- The strategy in interacting with efforts within CLIVAR and WCRP, particularly with the groups participating in the ocean heat content workshop during that week

Observing systems

Brian King, member of the Argo Steering Team, presented an overview of the status of the array, with a focus on developments of deep Argo floats. Report on the Deep Argo Implementation

Workshop that took place in Hobart, Australia on 5-7 May 2015, is now available from the Argo website (http://www.argo.ucsd.edu). A strategy needs to be developed for a global array for the deep ocean, with deployments starting in high latitude regions. Instruments for deep Argo are still being developed but profiles from the initial deployments of two deep Argo floats have been retrieved.

ACTION: GSOP to provide comments on the deep Argo strategy when available (GSOP co-chairs, ICPO)

Ken Ando, vice-chair of the Tropical Moored Buoy Implementation Panel, gave a remote presentation on the tropical arrays in the Pacific, Atlantic and Indian Oceans. Data return for the TAO array is back to historical levels after 2 years of unusually low return rates. The number of TRITON sites in the western equatorial Pacific has been reduced from 12 to 8 and will decrease further in 2017. TPOS2020 will provide an opportunity to refine the tropical Pacific observing system to reflect new technologies and research goals. However, any fundamental changes need to be done with some level of caution since the Pacific array has provided invaluable data to the ocean and climate research and forecasting communities. The TPOS2020 Backbone Task team is finalising its report and will be submitting to the TPOS2020 SSC, and after that will be opened for comments from the community.

ACTION: GSOP to coordinate comments on behalf of CLIVAR on the TPOS2020 Backbone Task team report when available (GSOP co-chairs, ICPO)

The PIRATA array is well maintained and is providing expected amounts and quality of data to the community. New and enhanced observations are being introduced. In the Indian Ocean, the implementation of the RAMA array is steadily moving forward. KIOST will provide some ship time for deployment of the moorings part of the RAMA array. Threats of piracy have decreased, allowing the possibility of implementation in the western tropical Indian Ocean. Limited availability of research vessels impacts timely maintenance of some established sites and the implementation of new sites. Overall, new technologies provide high-resolution real-time data in TAO, PIRATA and RAMA.

During the discussion, following GSOP's involvement in developing OSEs for TPOS2020, it was pointed out that a strategy could be defined, together with GODAE OceanView, for these experiments to be expanded to the other ocean basins. However, it is necessary that the community define which sites are important to maintain for verification.

ACTION: GSOP to discuss with GODAE OceanView about a strategy to develop OSE experiments to help the refinement of the tropical array observing system (T. Lee, M. Balmaseda, K. Ando)

Uwe Send, co-chair of OceanSITES Steering Team, updated the panel with recent OceanSITES activities. The project is developing a new structure for documents of their website, which will increase visibility of their activities. OceanSITES also need continued request from CLIVAR panels

and the biogeochemistry community on new sites for mooring deployment. Also, CLIVAR should be proactive in providing the necessary requirements for plans of the Deep Ocean Observing System. In the Atlantic basin, SAMOC will be added as “planned” in the OceanSITES system. OSNAP is still seen as a process study and will not be added. OceanSITES planned activities are to generate a set of products and indices from the network, and CLIVAR’s involvement would be key in determining what are the best suited from model validation. There is also a lot of momentum in the community to discuss and measure boundary current regions, with the Ocean Observations Panel for Climate (OOPC) leading it. OceanSITES will make sure to be part of that discussion.

ACTION: GSOP to provide CLIVAR’s input to OceanSITES on key products and indices for model validation (co-chairs, U. Send, ICPO)

Elaine McDonagh, member of GO-SHIP’s Executive Group, provided an update on the GO-SHIP decadal surveys, showing sections that have already been occupied and those in planning stages (funded or not). GO-SHIP is part of the Global Climate Observing System (GCOS) / Global Ocean Observing System (GOOS). Some lines, mainly at boundary current regions, are labeled as “associated lines’ since they do not fulfill the criteria of coast-to-coast, coast-to-sea-ice.

Tony Lee provided an update on changes of status for NASA ocean-related missions. Aquarius has provided nearly 4 years of global SSS measurements that are widely used in research and operational applications, from ocean dynamics, climate variability, water cycle, and biogeochemistry. Unfortunately Aquarius/SAC-D ended its operation in June 2015 due to hardware failure that precluded the control of the spacecraft. Salinity is being retrieval from NASDA’s Soil Moisture Active-Passive (SMAP) mission to provide continuity of NASA’s satellite-derived salinity products. A community effort is being made to formulate the science requirements for future ocean salinity missions as an input to the US National Academy’s National Research Council Decadal Survey for future missions (2017-2027), including the exploration of international partnership. The NASA ISS-RapidScat was launched in September 2014 to the International Space Station (ISS). It is a two-year mission, a speedy and cost-effective replacement of NASA’s QuikSCAT to provide ocean vector wind measurements.

Data quality and ocean synthesis

Catia Domingues gave a talk on the latest activities of the International Quality-Controlled Ocean Database (IQuOD). The main goal of the project is to construct the most complete, consistent and high quality subsurface ocean temperature (EOV/ECV) 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 and services of societal benefit. In the past few months, IQuOD has submitted a proposal to SCOR for a Working Group. IQuOD has also requested endorsement from the WCRP Data Advisory Council (WDAC), which has requested a proposal for that effort. Both proposals are still under consideration by SCOR and WDAC, respectively. For the long term, the project expects that it will take around three years to achieve the minimum requirement. The next planned activities are the 3rd IQuOD workshop, which will take place in Hamburg, Germany, focusing on Uncertainty, Intelligent metadata, towards delivery interim product v1.0 and planning

v2.0. There will also be an IQuOD session at the 2016 Ocean Sciences Meeting, in New Orleans, USA. The release of IQuOD v1.0 is planned for June 2016.

Magdalena Balmaseda provided an update on the GSOP/GODAEOceanView Ocean Reanalysis Intercomparison Project (ORA-IP). Several papers have been published with the latest comparison of the synthesis products. The next step will be to develop a strategy/metrics to gauge the improvement of the synthesis products as a whole. For that, it is essential that all datasets, with version control, can be archived in a single repository, ideally with the same format. It was suggested that all datasets could be sent to the University of Hamburg. Data producers would have to agree that their data can be made available through that server.

ACTION: Discuss with University of Hamburg if they agree to host ORA-IP datasets (Magdalena Balmaseda)

ACTION: Request permission from ORA-IP data producers to make their data publicly available (Magdalena Balmaseda)

However, in order to measure progress, some metrics need to be identified. A suggestion made was to discuss with GODAE OceanView Metrics Panel, and perhaps develop a document that would set best practices for this. Furthermore, it would be ideal to develop a pilot project for this assessment. Velocity measurements made by OceanSITES stations would be a good candidate for this initial assessment.

Yan Xue provided a summary of realtime ORA-IP effort. An ensemble of nine (seven) operational ORAs for 1993-present (1979-present) has been collected to assess signal (ensemble mean) and noise (ensemble spread) in upper ocean temperature analysis in real-time. The real-time ensemble ocean monitoring products have been used in support of ENSO monitoring and prediction. TAO/TRITON array is found to significantly reduce analysis uncertainty in the equatorial Pacific while Argo data reduces analysis uncertainty in off-equatorial regions. In particular, TAO/TRITON data helps reduce the analysis spread in the equatorial zone. When there was a significant TAO data loss in 2012-2013, the spread among analyses increased significantly. Despite uncertainties in ocean reanalyses, the ensemble mean of multiple ocean reanalyses provides the best estimation of the state of the ocean and can be used to derive climate indicators. The ensemble spread provides uncertainties in our estimation. The analysis and monitoring will be expanded beyond the tropical Pacific in the future.

Yosuke Fujii gave a presentation on the contribution of JMA and MRI for the Real-Time Multi-ORA project. JMA has been participating in the real-time multi-ORA project since March 2014 as a data provider. It currently provides monthly means of the 3-dimensional temperature, the ocean heat content, and the depth of 20°C isotherms in the operational global ocean data assimilation system every month, which is a real-time extension of the ORA-IP project. The system was replaced by a new version in June 2015, with these datasets already available. JMA will serve other variables if it will definitely bring benefits to the operation of seasonal forecasting. However, due to limited resources, JMA has decided to withdraw their official contribution to the Real-Time Multi-ORA project, although Yosuke Fujii can still participate on the basis as a PI for his funded project during

the period of his funded project (ending in 2018). GSOP's view is that it is important to have JMA's contribution to the project, and it was suggested that a letter from panel co-chair should be sent to JMA/MRI leadership stating the importance of continued involvement in the project.

ACTION: Send letter of support to JMA/MRI's contribution to Real-Time Multi-ORA project (co-chairs)

GSOP and CONCEPT-HEAT Interactions

Karina von Schuckmann, co-chair of the CLIVAR CONCEPT-HEAT Research Focus (RF), gave an overview of the activities and plans of the RF and led the discussion on how GSOP could collaborate. CONCEPT-HEAT's main objective to build up a multi-disciplinary synergy community for climate research aiming to work on two different issues: (a) Quantify Earth's energy imbalance, the ocean heat budget, and atmosphere-ocean turbulent and radiative heat fluxes, their observational uncertainty, and their variability for a range of time and space scales using different observing strategies (e.g., in-situ ocean, satellite), reanalysis systems, and climate models; and, (b) Analyze the consistency between the satellite-based planetary heat balance and ocean heat storage estimates, using data sets and information products from global observing systems (remote sensing and in situ) and ocean reanalysis, and compare these results to outputs from climate models to obtain validation requirements (for model and observations).

Potential main common objectives:

- Develop an overview on recommendations for global climate observing systems and climate tools
- Develop an overview on recommendations for future coordinated research through dedicated initiatives, well defined key questions and key challenges for climate research on the Earth's energy budget
- Improve accessibility and information content of products to evaluate the different components of EEI for use by wider community.
- Continue performance of multi-analysis reanalysis ensemble approach to study the uncertainties
- Complement the GSOP inventory of surface flux products with "assessment"- type information
- Evaluate OHC changes from the ensemble of current ocean reanalyses and work with the OHC community to identify and understand differences, coming from different observations such as gap filling, data assimilation
- To achieve advancements in commonly agreed data quality control issues and management of data and metadata archeology (IQuOD)
- Evaluate the relative importance of the ice-covered ocean, marginal seas and deep ocean (> 2000m) of ocean heat content change and to understand how heat is transferred vertically, with the objective to develop recommendations for observing system design.
- To increase the exchange between in situ and remote sensing communities for the further cross-validation.
- Cross cutting reanalysis / in situ:
    - Evaluation of OHC structure and redistribution of heat during the hiatus period
    - Develop diagnostics for heat transport estimates

One item discussed was the need for a central data, or data access information, repository for ocean reanalysis, which perhaps could be extended to other initiatives, and raise interest and facilitate access to the scientific community. This should be made available, at least, as a data portal to existing products, through both GSOP and CONCEPT-HEAT website (the latter is under development). The panel agreed with these proposed topics and further decisions will be made after the CONCEPT-HEAT workshop.

Membership

Nico Caltabiano explained to the panel that CLIVAR will have an open call for membership in September. Any applications will be sent to co-chairs who will make a proposal to the CLIVAR SSG.

Appendix 1

Participants

Name	Country	Role
Tony Lee	USA	Panel Co-Chair
Matt Palmer	UK	Panel Co-Chair
Lisan Yu	USA	Panel Member
Keith Haines	UK	Panel Member
Magdalena Balmaseda	UK	Panel Member
Catia Domingues	Australia	Panel Member
Yan Xue (remotely)	USA	Panel Member
Uwe Send	USA	Ex-officio
Ken Ando (remotely)	Japan	Ex-officio
Yosuke Fujii	Japan	Invited Expert
Brian King	UK	Invited Expert
Elaine McDonagh	UK	Invited Expert
Karina von Schuckmann	France	Invited Expert
Kevin Trenberth	USA	Invited Expert
Nico Caltabiano	China	ICPO

Appendix 2

Agenda

- Argo (Brian King)
- OceanSITES (Uwe Send)
- GO-SHIP (Elaine McDonagh)
- Tropical moored arrays and TPOS2020 (Ken Ando, remotely)
- Updates of satellite observing systems (Tony Lee lead with contribution from Pierre-Philippe Mathieu)
- Discussion of how GSOP can help with the development of these observing systems and utility of the data (Tony Lee leads)
- IQuOD (Catia Domingues)
- ORA-IP update (Magdalena Balmaseda)
- Update for realtime comparison of operational ocean analysis products (Yan Xue, remotely)
- JMA/MRI efforts update (Yosuke Fujii)
- Discussions
- Strategy to systematically assess improvement of ocean synthesis products (Magdalena leads)
- OOPC (report of GSOP participation of the OOPC meeting and follow-up actions by Keith Haines)
- Ocean Modeling Development Panel (OMDP) (e.g., AMOC comparison, Keith and Magdalena lead)
- Discussion related to observing systems
- Discussion on joint efforts between GSOP and CONCEPT-HEAT