Workshop Announcement and Call for Abstracts
Ocean Heat and Freshwater Storage and Transports in Observations and Climate Models

October 26-30 2020
UK Met Office
Exeter, UK

In the light of the COVID-19 pandemic, remote facilities will be made available to participate in case of travel restrictions.

The UK Met Office, the GCOS-GOOS-WCRP Ocean Observations Physics and Climate Panel (OOPC), and the WCRP Climate and Ocean Variability, Predictability, and Change (CLIVAR) Project invite you to participate in a workshop that will:

1. Explore the use of observation-based estimates of large-scale ocean heat and freshwater transport and storage in model evaluation, assessment and development.

2. Assess the current capability of the ocean observing system to measure ocean heat and freshwater transport and storage changes, including budget constraints at global and regional scales to identify priority areas for new observations.

3. Assess CMIP6 models fitness-for-purpose in diagnosing forced heat and freshwater changes, including global and regional conservation of ocean heat and freshwater, systematic model biases, and model representation of regional heat/freshwater budgets.

Call for Abstracts
The call for abstracts for talks and posters will open on 20th April 2020 and close on 22nd May 2020. Participation is limited to 70 people. The agenda will be finalized in late June and general registration will be open in July. Please note that priority for attendance will be given to participants who have submitted an abstract. Participants are expected to be self-funded. A limited amount of funding is available. See the call for abstracts opening on 20 April for more details.

Organizing Committee
Matt Palmer (OOPC/Met Office Hadley Centre)
Karina von Schuckmann (Mercator Ocean International)
Till Kuhlbrodt (NCAS, University of Reading)
Lijing Cheng (IAP, Chinese Academy of Sciences)
Paul Durack (PCMDI / Lawrence Livermore)
Gokhan Danabasoglu (NCAR)
Maria Hood (OOPC/WMO)
Tristan L’Ecuyer (U. Wisconsin-Madison)
Adele Morrison (Australian National University)
Bernadette Sloyan (CSIRO)
Neil Swart (Environment Canada / CliC)
Amy Solomon (CU/NOAA/NORP)
**Workshop Overview**

This workshop will explore the use of observation-based estimates of large-scale ocean heat and freshwater transport and storage in the evaluation of climate model simulations by bringing together expertise from both the observational and modelling communities. A central aim is to develop a suite of metrics for routine use in climate model assessment and development to promote increased fidelity in simulations of the energy and water cycles and to help address long-standing climate model biases.

A second element of the workshop will explore the use of model simulations as a test-bed for the current and future ocean observing system through “synthetic observations” and similar approaches, focusing on our ability to monitor ocean heat and freshwater storage/transport changes and to close regional heat and freshwater budgets. These approaches will be used to assess the capability and limitations of the current ocean observing system for quantifying observed climate variability and change, and to develop recommendations for the future evolution of an extended and sustained ocean observing system.

The workshop represents a unique multi-disciplinary opportunity to jointly assess the current status and challenges of representing the heat and freshwater transports and storage in state-of-the-art climate models, as well as to foster and improve quality targets and recommendations for the global ocean observing system. We therefore encourage participation from diverse scientific backgrounds, including those with experience in ocean observations, heat and freshwater budget analysis and ocean/climate modelling.

**Workshop Sessions**

**Theme 1: Estimates of large-scale ocean heat and freshwater storage and transports from observations and models**

- Heat and freshwater transport and storage in Earth System models, reanalyses and observations: assessment and priority areas for improvement
- Large-scale regional budgets of heat and freshwater - how can we improve closure?
- The role of climate variability in regional budgets and changes in heat/freshwater transport and storage
- Developing a community-led set of priority model metrics for large-scale heat and freshwater storage/transport and observational targets based on the current ocean observing system

This theme will focus on estimates of large-scale heat and freshwater storage/transport changes from observations, data assimilation efforts and climate models. Heat and freshwater budget analyses are particularly encouraged as well as studies that provide insights into processes or drivers of simulated or observed changes. We will review current observational estimates of large-scale heat/freshwater transports and explore their use in the evaluation of climate model simulations. An outcome of this session is a set of priority metrics for use in future climate model evaluation and development based on the current ocean observing system.
Theme 2: Assessment of the global ocean observing system – approaches, results and recommendations

- Models/reanalysis as test beds for the observing system, using “synthetic observations” and other approaches.
- Developing a community view on priorities for future ocean observations that would reduce uncertainties in key process understanding and aid climate model evaluation and development.
- Towards “case study” papers on the use of synthetic observations for observing system assessment and estimating uncertainties in global and regional indicators of climate change and implications for future observing system design.

This theme focuses on assessment of the ocean observing system and to inform its future development using both observations and models. A key element is the use of model simulations as test beds for observing system assessment through use of synthetic observations and other approaches. Various methods will be assessed to determine the capability and limitations of the current ocean observing system for monitoring heat/freshwater storage/transport changes, and the regions and processes where the largest uncertainties remain. We will develop community-led recommendations for the priorities of future ocean observations that would reduce uncertainties in key regions and/or process understanding and aid climate model evaluation and development. An outcome of this session is the identification of “case studies” that will quantify the likely improvement in the accuracy (reduce the uncertainty) of current global and regional heat and freshwater budget estimates using models and recommendations for an improved ocean observing system.

Theme 3: CMIP6 models fitness-for-purpose in diagnosing forced heat and freshwater changes in a global and regional context

- Heat and freshwater conservation in CMIP6: where are we now and what are the outstanding challenges?
- Regional heat/freshwater budget studies and observational comparisons to better understand and address long-standing model biases in climate models.
- Development of model metrics for heat/freshwater conservation, budgets and storage to inform CMIP7 protocol.

Ocean drift is ubiquitous in coupled climate models, arising from inadequacies both in the simulated physics and in the conservation of energy and freshwater moving between different model components. This drift leads to long-standing biases in climate models. In this session we aim to address the fitness-for-purpose of CMIP6 models for diagnosing forced changes in ocean heat and freshwater transport and storage. We welcome CMIP6 studies focused on conservation issues, mechanistic understanding of model biases and observational comparisons, both in global and regional contexts. An outcome of this session is to identify outstanding challenges and to develop model metrics of heat and freshwater conservation, budgets and storage to inform the CMIP7 protocol.

For more information, visit the workshop website at:
https://www.goosocean.org/HFworkshop or contact Maria Hood at mhood@wmo.int