

**Eighth WGOMD Panel Meeting**  
**UK Met Office Hadley Centre, Exeter, UK**  
**30April-01May 2009**

**WGOMD active members**

Helene Banks (co-chair): Met Office Hadley Centre, UK  
Helge Drange (co-chair): University of Bergen, Norway  
Stephen Griffies (co-chair): NOAA/Geophysical Fluid Dynamics Laboratory, USA  
Gokhan Danabasoglu: National Center for Atmospheric Research, USA  
Matthew England: University of New South Wales, Australia  
Richard Greatbatch: Leibniz-Institut für Meereswissenschaften, Kiel, Germany  
Gurvan Madec: LODYC, Institute Pierre Simon Laplace, France  
Anna Pirani: CLIVAR Project Office, Southampton, UK, and Princeton University AOS Program  
Hiroyuki Tsujino: Meteorological Research Institute, Japan Meteorological Agency, Japan

**WGOMD emiratus members**

Claus Böning: Leibniz-Institut für Meereswissenschaften, Kiel, Germany  
Eric Chassignet: Florida State University, USA  
Rüdiger Gerdes: Alfred Wegener Institut für Polar- und Meeresforschung, Germany  
Anne Marie Treguier: Laboratoire de Physique de Océans, IFREMER, France

**ABSTRACT**

This document summarizes plans for the Exeter WGOMD panel meeting. It also serves as a means to help streamline and focus discussions during the meeting, and to anticipate certain of the action items. This document is evolving, with input from panel members solicited to fine tune the details.

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## 1 Introduction

The eighth WGOMD panel meeting will occur on 30April-01May 2009 at the Hadley Centre in Exeter, UK. The Exeter meeting follows a three day scientific workshop, also at the Hadley Centre, discussing ocean mesoscale eddies. Since 2004, each WGOMD panel meeting has been associated with a science-based workshop aimed at stimulating discourse and understanding on a particular aspect of oceanography. The mesoscale workshop will be the fourth organized by WGOMD.

This document summarizes plans for the Exeter WGOMD panel meeting. It also serves as a means to help streamline and focus discussions during the meeting, and to anticipate certain of the action items. This document is evolving, with input from panel members solicited to fine tune the details.

## 2 Tentative Agenda and Guests

The following represents a tentative agenda for the panel meeting. Your input is solicited to help fine tune details.

- 29April evening: quasi-working dinner together (after completion of mesoscale eddy workshop)
- 30April (9am start)
  - CORE presentations and discussions (bulk of day)
    - \* Goal: develop detailed strawman protocol for CORE-II, and initiate a comparison project amongst panel members and interested others.
  - REOS website
    - \* Goal: scrutinize the REOS website, anticipating public release soon after Exeter.
- 01May (9am start):
  - Decadal prediction presentations and discussion
    - \* Goal: articulate WGOMD's role in helping to address the research needs of decadal climate prediction.
  - WGOMD business:
    - \* membership
    - \* member presentations (time allowing).

We have invited the following guests to participate in our discussions. The agenda will be adjusted depending on whether these guests can attend.

- Detlef Stammer: University of Hamburg and CLIVAR GSOP (ocean reanalysis)–unlikely
- Magdalena Balmaseda (ECMWF and CLIVAR GSOP: (interannual and decadal prediction)–confirmed
- Wilco Hazeleger: KNMI and CLIVAR Atlantic panel (decadal variability and prediction)–likely
- Malcolm Roberts: Hadley Centre (coupled modelling)–confirmed
- Doug Smith: Hadley Centre (decadal prediction)–likely

The following sections detail the aims and needs for the above agenda items. Specific requests from panel members are also noted.

## 3 CORE-II

CORE has been the focus of WGOMD activities for years. We now have something specific to show for our efforts, with publication of the Normal Year Forcing CORE-I paper Griffies et al. (2009b). This paper provides the community with an example of how WGOMD can address projects of use and interest to the broader ocean modelling community, where cross-institutional collaboration is required for success. There remains a future for CORE-I simulations, with various groups around the world now routinely using it to evaluate their ocean-ice models. Nonetheless, CORE-II remains of primary interest to many on the panel, and it will touch upon a broader group of the CLIVAR basin panels.

### 3.1 Panel goals related to CORE-II

With the release of version 2 for the Large and Yeager forcing (Large and Yeager, 2008), there has been interest in testing this dataset, and examining experimental protocols for CORE-II. The central focus of WGOMD CORE discussions in Exeter will concern the needs for CORE-II. In particular, we envision the following goals for these discussions:

- Develop an agreed upon experimental protocol for global ocean-ice simulations using version 2 of the interannual dataset from Large and Yeager.
- Garner commitments from a large part of the WGOMD panel to coordinate their CORE-II simulations and analysis during 2009, running suites of experiments examining issues such as boundary forcing, initialization, spin-up, analysis metrics and methods, etc.

In our discussions, we must address all details of the experimental design and scientific use of the experiments. Any prejudice, experiences, and counsel on particular details should be expressed and discussed. We also must recognize that the final experimental design will likely represent a consensus, that will not satisfy all. The goal is to design a baseline protocol that is both of scientific interest and can be readily implemented, even if that protocol has certain (hopefully minor) shortcomings.

### 3.2 Specific questions to address

Specific questions to be addressed in our panel discussions include the following:

1. What are the key scientific uses for interannually forced global ocean-ice simulations?
2. How does CORE-II fit into the spectrum of coupled climate modelling (e.g., IPCC “historical experiments”) and reanalysis projects such as those addressed in GSOP?
3. Can we identify interesting scientific questions that will make a CORE-II project of scientific interest to the panel?
4. What are the baseline metrics required to assess the simulation integrity?
5. What further metrics and diagnostics are of scientific interest for CORE-II simulations?
6. What observational datasets and reanalysis products should be used to evaluate the CORE-II simulations?
7. Should Large and Yeager (2008), using NCAR bulk formula (as in CORE-I), form the basis of the CORE-II benchmark simulation? What are the problems with this dataset that make certain groups use reanalysis products, or alternative approaches?
8. Would it be possible to construct key atmospheric forcing fields for the first half of the 20th century and merge this (constructed) forcing with CORE-II to generate a continuous, albeit not fully consistent, data set from year 1900 (or 1880)?

9. What about the salinity boundary conditions? Should this remain a choice for each group, much as in CORE-I? Can we instead provide more specific guidance, and perhaps make another effort to unify the approaches?
10. How should the ocean and sea ice models be initialized? What about spin-up time prior to the focused analysis period? What portion of the simulation should be analyzed, and what should be ignored (due to initialization shock)?
11. Are there any un-spoken issues that may handicap the goal of producing a common benchmark simulation (besides the magnitude of the effort)?
12. How can we make the CORE-II simulation output more accessible to the broader community?
13. Is it feasible, and of interest, to aim towards a comparison paper to be written during 2010?
14. How can we coordinate simulations leading up to a CORE-II paper (e.g., password protected Wiki page monitored by Anna)?

### **3.3 Tasks for individual panel members**

To help address the above questions, we ask for the following specific input from panel members in the form of a prepared presentation (15-30 minutes). The order of requests roughly represents the order of presentations during the meeting. Please design your presentations to directly address the above questions, in addition to the questions listed below.

#### **3.3.1 Gokhan**

- Status of CORE forcing fields. Are there any known problems or planned updates beyond Large and Yeager (2008)?
- Summarize the efforts of CORE-II at NCAR, including POP and HYCOM.
- What papers have been published using the interannual forcing?
- Propose a protocol for baseline CORE-II simulations, based on the experiences at NCAR.
- What concerns and recommendations do you have for a comparison project based around CORE-II?

#### **3.3.2 Matthew**

- Summarize some of the key scientific uses of a global ocean-ice model that complement the fully coupled climate models.
- Identify analysis metrics and diagnostics of use for CORE-II.
- How can a CORE-II dataset be of use for others outside of the modelers actually running the simulations?
- Present general advice for CORE-II.

### 3.3.3 Ruediger and/or Richard

- Discuss the issues related to surface boundary forcing with CORE-II, and compare to the situation with CORE-I.
- What are the possible symptoms of a problem with the boundary conditions (e.g., MOC weakening; large oscillations; drift)?
- Propose a method to force the surface salinity that may be of use for all models participating in CORE-II.
- Status of long-time reconstruction of atmospheric forcing fields.

### 3.3.4 Helge

- Experiences using NCEP, ECMWF and CORE-II in Bergen.
- Recommendations for CORE-II protocol, including discussion of initialization, forcing, and spin-up.
- Status of long-time SST reconstructions.

### 3.3.5 Gurvan and/or Anne Marie

- Summarize use of interannually forced simulations in France, and detail experimental design.
- Discuss reasons for developing an alternative to Large and Yeager, and whether the French will be interested in participating in a CORE-II comparison if based on Large and Yeager.
- Provide recommendations for CORE-II experimental design.

### 3.3.6 Hiroyuki

- Summarize use of interannually forced simulations in Japan, and detail experimental design.
- Provide recommendations for CORE-II experimental design.

### 3.3.7 Claus and/or Richard

- Summarize use of interannually forced simulations in Kiel, and detail experimental design.
- Provide recommendations for CORE-II experimental design.

## 4 Repository for Evaluating Ocean Simulations (REOS)

Anna has made significant progress since Bergen on the development of a website of use for cataloging various ways to analyze ocean model simulations

[www.clivar.org/organization/wgond/reos/reos.php](http://www.clivar.org/organization/wgond/reos/reos.php)

REOS needs your specific input now, prior to full community release planned for just after the Exeter workshop. We thus ask that each panel member present Anna with specific input and comments for this website. We expect that most of these requests can be addressed prior to the panel meeting, so that Anna can make the necessary changes in time for our discussions in Exeter. Please take some time to address the needs of this website, and provide specific input.

The following identifies some specific requests that will be of use for REOS.

- Provide links to relevant published papers and reports that help to further methods of analysis and model evaluation.
- Identify further datasets that should be linked on REOS.

The following presents some specific requests from individuals in an attempt to assign ownership to various portions of the website, and to ensure that we all participate in contributing content and giving specific feedback to Anna. Please send input directly to Anna, preferably prior to Exeter.

- Helge
  - Scrutinize the transports portion of REOS.
  - Identify further North Atlantic and Arctic datasets to be linked from REOS.
- Gokhan
  - Give REOS a general overview, and solicit input from NCAR colleagues.
- Matthew
  - Identify further Southern Ocean specific datasets and analysis products to be linked from REOS.
  - Provide links to various mixed layer products.
- Richard
  - Identify papers of interest that describe analysis methodologies of use for the broader ocean modeling community.
- Gurvan and Anne-Marie
  - Provide links to websites and papers that present novel and innovative analysis methods (e.g., water mass properties; Lagrangian trajectories; eddy statistics; development of metrics and analysis for eddying simulations)
- Hiroyuki
  - Links to methods used in Japan for evaluating ocean simulations
  - Are the Indian and Pacific ocean sectors well represented in REOS?
- Rüdiger
  - Arctic methods for evaluating simulations
  - AOMIP relevant links
- Eric
  - Means used in forecasting community to evaluate and validate simulations
  - Make GODAE/MERSEA tools and scripts available for REOS.

## 5 Decadal Variability

CLIVAR has a keen interest in identifying the physical mechanisms associated with decadal variability, and facilitating the modelling tools to develop prediction systems. Many WGOMD panel members are key players in ongoing projects related to decadal variability and prediction. Given the long time scales, decadal variability questions intimately involve the ocean. Many efforts have focused on the Atlantic sector, with the meridional overturning circulation a key player, though the Pacific basin contains intriguing variability on the decadal time scales (i.e., the PDO).

There are significant difficulties with the decadal problem associated with a paucity of observational data, the long time scales involved, and model limitations. Indeed, it is unclear whether there is any predictable signal to be uncovered. Nonetheless, there is variability in the system, and the ocean's role appears to be nontrivial, if only in setting the long time scale via red noise damping processes (e.g., as in Hasselmann, 1976).

The planned discussion of decadal variability during the panel meeting is somewhat open-ended, largely because the questions remain fundamentally of a research nature. With these points in mind, part of day 2 in the WGOMD panel meeting will be focused on discussing our role in the decadal problem. We will focus on addressing the following question:

- How should the WGOMD, as CLIVAR's primary ocean modelling panel, play a role in guiding rational efforts towards understanding, and possibly predicting, decadal variability?

### 5.1 Discussion questions

To help guide our discussions, we pose the following topics for consideration.

1. WGOMD, as presently constituted, is not ideally suited to making statements about decadal prediction, which is a problem requiring fully coupled models with initialization and assimilation systems. Instead, a more useful role is to help identify key scientific questions related to the ocean, and designing/performing community-wide experiments to robustly understand oceanic relevant aspects of decadal variability.
2. There is no consensus regarding the mechanisms for decadal variability appearing in the models, much less in the real world. To capture variability that is not tainted by boundary conditions typically requires a coupled climate model. Many members of WGOMD run coupled models, but it seems prudent to also consider the potential contributions of ocean-ice models that have been the focus of CORE efforts thus far. What role can ocean-ice models play in developing an understanding of decadal variability?
3. Can we identify variability mechanisms active within the CORE-II simulations. Is there a means to stratify the models into various classes of variability? This research may involve a focused analysis on certain features (e.g., density structure; convection patterns; pathways of currents; formation, propagation and decay of large-scale thermal and/or saline anomalies). It may also, as a complement, involve developing perturbation experiments (e.g., changes to the forcing; fresh water melt expts such as CORE-III) to test the response of the models to perturbations.
4. By considering the recent observed period, CORE-II will present the community with a baseline means to identify robust features of the simulations. In what specific ways can CORE-II directly impact research aimed at understanding decadal variability? What features/diagnostics would be of interest to analyze across a suite of models run with the same forcing for the observed period?
5. How can CORE-II complement the efforts ongoing with the reanalysis of recent decades? Should the reanalysis ocean-ice models be run under CORE-II forcing as a benchmark to evaluate the integrity of the forward models used for the reanalyses?

6. How can CORE-II systematically explore sensitivity of the simulated variability to various horizontal and vertical grid resolutions, and/or to key parameterizations (for instance related to overflows and gyre circulation)?

## 6 Status of action items from Bergen panel meeting

During the August 2007 panel meeting in Bergen, we identified a list of *Action Items and Recommendations*. This section provides an updated version of this list. Some items remain to be acted upon during or after the Exeter meeting.

- CORE ISSUES

1. ACTION: Inform WGOMD when updated Large & Yeager dataset is available
  - STATUS: Updated data has been available from the GFDL webpage

<http://data1.gfdl.noaa.gov/nomads/forms/mom4/COREv2.html>

since the middle of 2008. Note that the updated data is provided only for the interannual forcing, with the Normal Year Forcing unchanged from the Large and Yeager (2004).

2. ACTION: WGOMD has agreed to continue working with the Large & Yeager CORE forcing (Large and Yeager, 2004, 2008), maintaining a close relationship with, and providing feedback to W. Large and colleagues at NCAR.
  - STATUS: This task is ongoing, with the need to re-affirm this decision amongst the panel members during the Exeter panel meeting.
3. ACTION: CORE-related references should be placed on the WGOMD CORE webpage, including annotations (give references and comments to A. Pirani).
  - STATUS: The following webpage aims to keep the community updated with regards to the CORE simulations.

<http://www.clivar.org/organization/wgomd/core/core.php>

4. ACTION: Prepare references and information relevant to the CORE-III experiment for the WGOMD webpage (R. Gerdes).
  - STATUS: The following webpage details the CORE-III protocol, with references

[http://www.clivar.org/organization/wgomd/core/core\\_III.php](http://www.clivar.org/organization/wgomd/core/core_III.php)

5. ACTION: WGOMD needs to emphasize the limitations of CORE, such as the caution needed when interpreting the interior ocean. Metrics should be proposed to quantify errors due to drift.
  - STATUS: Some discussion is provided in the CORE paper Griffies et al. (2009b). More discussion of drift will need to be provided when documenting the CORE-II simulations.
6. ACTION: CORE-II participants should provide details on the boundary conditions being applied, initialisation and the complexity of the ice model being used so that these details can be included on the WGOMD CORE webpage together with a table of participants, planned experiments and status.
  - STATUS: This work remains largely incomplete. We need to fully enable a website for CORE-II simulations, facilitating the ongoing work both to realize an agreeable protocol, and to analyze the simulations. This website will be maintained by Anna Pirani, and will be an essential element in developing CORE-II. Work towards enabling this website will commence prior to the Exeter workshop.



7. ACTION: Provide a paragraph on the alternatives to salinity restoring (H. Drange).
  - STATUS: With the Bergen version of MICOM, cyclic spin-up with reanalysis forcing for at least 200 years is required to avoid strong (unaccented) drift in surface salinity. Initially, typically for the first 150-200 years, the model is integrated with strong Newtonian relaxation (30 days relaxation time scale for a 50m deep mixed layer). Thereafter, weak relaxation is introduced (180-360 days relaxation time scale for a 50m deep mixed layer) for another 50-100 years. The applied relaxation fluxes from the last integration with weak Newtonian relaxation are then stored on a weekly basis. Finally, the model is then integrated with the stored relaxation fluxes (the production run). For the Newtonian relaxation, the relaxation scheme is limited in the way that the scheme does not see anomalies exceeding 1.5 psu-units, implying that large salinity anomalies are allowed in, e.g., western boundary currents. In addition, relaxation is never applied at high northern and southern latitudes covered by sea ice.
8. ACTION: Each CLIVAR basin panel should be requested to produce a list of questions and metrics to be tested in a CORE-II type experiment, including a view on the timescales of the processes that could be addressed by a 50-year experiment timeframe. Each panel should also be asked to name a panel member for liaison.
  - STATUS: WGOMD has solicited input from GSOP, CLIVAR Pacific panel, and CLIVAR Atlantic panel for the Exeter meeting. This item will continually be revisited as CORE-II matures.
9. ACTION: Preliminary CORE-II results will be shown at the next Pacific Implementation Panel meeting on 29-30 November 2007, Guangzhou, China (C. Böning)
  - STATUS: Claus had the flu so could not attend the panel meeting. Magdalena presented discussion of Kontiki.
10. ACTION: Recommend that NCAR intialisation code should use a more realistic sea-ice distribution, and should correct for unrealistic ice volume off the coast of Siberia.
  - STATUS: Sea ice initialisation will be part of the discussions in Exeter.
11. ACTION: Provide details of Arctic reconstruction project (R. Gerdes and H. Drange).
  - STATUS: WGOMD should continue with its ongoing discussion of reconstructed data for use in running models longer. However, for the purposes of CORE-II, we should focus on the forcing provided by Large and Yeager (2004) and Large and Yeager (2008).

- EVALUATION OF OCEAN CLIMATE MODELS

1. ACTION: WGOMD should be making recommendations on data that should be saved, data format etc. for the climate modelling community, by advising WGCM. For example, in eddy-permitting/resolving simulations, should correlations be saved?
  - STATUS: A report (Griffies et al., 2009a) has been submitted to WGCM and PCMDI which details a recommended list of fields to be archived for the CMIP5 model comparison project. This report is available from the WGOMD webpage

<http://www.clivar.org/organization/wgomd/wgomd.php>

and will be also available from the PCMDI website in the near future. Many members of WGOMD are co-authors of this report, and all are encouraged to scrutinize this report to ensure that the requested fields are sensible, and properly documented. Notably, this report does not make recommendations for eddying simulations. The topic of recommending how to save eddy correlations is beyond the scope of this report, and must form the basis for future discussions of model comparison projects.

2. ACTION: WGOMD needs to input to WGCM an ocean-ice model view of how climate models are assessed (WGOMD)
  - STATUS: The report Griffies et al. (2009a) provides details for the ocean model fields to be saved for CMIP5. A separate report is being prepared by the cryosphere community for the sea ice requirements.
3. ACTION: WGOMD needs to recommend what ocean data needs to be saved in the next IPCC assessment process (all), and work towards formulating what should constitute the basis for the assessment of climate models (S. Griffies, H. Banks) and regional models (E. Chassignet).
  - STATUS: The report Griffies et al. (2009a) provides details for the ocean climate model fields to be saved for CMIP5. A separate report is being prepared by the cryosphere community for the sea ice requirements. The GODAE metrics are detailed in the report MERCATOR (2006), with focus on operational models.
4. ACTION: WGOMD strongly recommends to PCMDI that native ocean grids be supported.
  - STATUS: The report Griffies et al. (2009a) details that native grid ocean model fields should be saved for CMIP5. This recommendation has been accepted by the CMIP5 panel, and PCMDI.
5. ACTION: Tools for converting between grids (eg those available at NCAR) should be shared.
  - STATUS: A community effort, known as Mosaics, is maturing for the purpose of making all model grids share a common structure. Details of Mosaics are available at
 

<http://www.gfdl.noaa.gov/~vb/gridstd/gridstd.html>.

Mosaic grids are presently being incorporated into the requirements that PCMDI has for the CMIP5 model output. Software has been written to remap the native grid scalar fields to the sphere, with this software accessible via a web based interactive visualization tool.
6. ACTION: WGOMD recommends that participants to a future AR5 submit a 500 year CORE-I simulation as well as CORE-II, depending on progress.
  - STATUS: It is unclear that PCMDI will house this model output, without more formal requests from WGOMD. Is there a strong sense from WGOMD that we should make this request?
7. ACTION: Identify what data sets are being used by the Met Office Hadley Centre to assess the ocean and sea-ice components of HadGEM3 and how the metrics proposed by the Met Office Hadley Centre compare with the metrics GSOP is considering (H. Banks)
  - STATUS: unknown.
8. ACTION: Provide input to GSOP (D. Stammer) on the above issues for the synthesis evaluation document that is in preparation (S. Griffies)
  - STATUS: unknown
9. ACTION: Circulate GSOP draft synthesis evaluation document to WGOMD (A. Pirani).
  - STATUS: Awaiting final version from Detlef Stammer.
10. ACTION: Summarize observational data quality control activities at the Met Office Hadley Centre (H. Banks).
  - STATUS: Brief discussion on REOS website.
11. ACTION: What are the official GODAE metrics? Have class I-IV metrics with all the data on the same grid for all the models for the Atlantic. This needs to be extended globally (E. Chassignet).
  - STATUS: The GODAE metrics are detailed in the report MERCATOR (2006). This report is a valuable resource for model comparisons, with focus on operational modeling. It is available on the REOS website.

12. ACTION: Feedback and input on ideas for developing a webpage for evaluating ocean models, making recommendations for data saving and a classification of metrics (All to A. Pirani and S. Griffies).

- STATUS: Ongoing, with further discussions in Exeter, with REOS website release soon afterwards.

- MESOSCALE EDDY WORKSHOP

- ACTION: Start planning content and invited talks, logistics and sources of funding for the proposed workshop (H. Banks, S. Griffies, A. Pirani).

- \* STATUS: The mesoscale eddy workshop has been fully organized, with funding opportunities identified for young scientists. Details can be found at

[http://www.metoffice.gov.uk/conference/mesoscale\\_workshop/](http://www.metoffice.gov.uk/conference/mesoscale_workshop/).

## 7 Summary of research and development

In the past, we started WGOMD panel meetings with each person summarizing ocean modelling work originating from their geographical region. For the Exeter panel meeting, such presentations will occur at the end. The reason for lowering the priority of these discussions is simple: we have little time together and must focus on the main WGOMD agenda items.

Nonetheless, we still ask that each panel member present Anna with a written summary of the WGOMD-relevant work ongoing in your sphere of influence (i.e., your home institution and those nearby geographically). This written summary will enter into the WGOMD panel meeting report. These summaries provide the panel and CLIVAR with an outline of what is happening with ocean modelling around the world, and such information forms one of the terms of reference for WGOMD. So please send your reports to Anna when requested, and take some time to advertise activities occurring in your geographical region, even if you are unable to present the material during the meeting.

## References

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