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Executive Summary of the Second Meeting of the CLIVAR Working Group on Ocean Model Development (WGOMD)

Santa Fe, USA
5-7 March 2001

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Working Group on Ocean Model Development (WGOMD)

2.Meeting, Santa Fe, USA, 5-7 March 2001

Executive Summary

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The WGOMD meeting in Santa Fe brought together 17 experts from major climate and ocean modelling groups, including representatives from the WG on Seasonal to Interannual Prediction (WGSIP) and the IGBP/GAIM Ocean Carbon-cycle Modelling Intercomparison Project (OCMIP), to discuss the status and ongoing efforts in ocean model development, identify outstanding questions, and define necessary activities.

The meeting was kindly hosted by the ocean modelling group of the Los Alamos National Laboratory, upon an invitation by WGOMD member A.M. Treguier, currently spending a sabbatical at LANL. WGOMD wishes to express sincere thanks for the organizational assistance provided by the US WOCE Office, especially the excellent local arrangements organized by Ms. Maureen Reap.

A main discussion item of the meeting was the effect of higher resolution in the ocean component of global, coupled models. The group noted a clear tendency towards oceanic resolutions of about 0.5 - 1 degree for the new generation of climate models, motivated by a consensus view of the need for a more realistic representation of topographic features such as passages, equatorial ocean dynamics, and aspects of high latitude water mass formation. A particular question that needs attention in this regard is that of the behavior of various ice models (see also [2]) at this resolution; WGOMD will invite reports for discussion at its next meeting (see [4]).

A few groups (at Hadley Centre, LODYC, SOC/CSIRO and the Frontier Research system for Global Change in Japan) have begun or are considering coupled model integrations with higher resolution (typically, 1/3 - 1/4-degree) ocean components to assess the impact of improved representations of western boundary currents, narrow channels, convection sites, and mesoscale eddy fluxes. Among the important questions that will be addressed in these efforts is that of the sensitivity of the Atlantic's thermohaline circulation to climate change. It is planned to further the discussion of first results, but also lingering questions with respect, e.g., to coupling techniques and parameterizations, at next years meeting [4].

The meeting's discussion of outstanding issues in ocean model development and assessment, led to the following,

Major conclusions and action items:

(1) Model Intercomparison Projects

a. Pilot OMIP

WGOMD launches a 'Pilot Phase' for an Ocean Model Intercomparison Project (Pilot OMIP) that is to demonstrate the feasibility and merit of a coordinated investigation of global ocean-ice model performance. At this stage, there are 7 groups participating (from CSIRO, CCSR, GFDL, LANL, LODYC, MPI, NCAR and RSMAS), coordinated by F. Bryan (NCAR).

The meeting agreed on the main elements of a common integration protocol that, for this stage, will basically follow the example of the German 'mini-OMIP' (MOM/HOPE intercomparison, Report of German OMIP group, AWI Bremerhaven and MPI Hamburg), involving a 100-year integration period and forcing by a global flux dataset based on refined ECMWF re-analysis products (see also item [3] below). However, individual groups will also test alternatives in the choices of initial data, integration time and air-sea fluxes; and a key part of the effort will be directed at an assessment of the impact of different ocean model resolution.

Results from the pilot phase will be reported and discussed at the next meeting of the WGOMD (May 2002; see also [2] [4]), upon which the committee will decide on recommendations for a fully fledged OMIP. An important prerequisite for launching that effort would be the clarification of organisational and technical service functions. WGOMD therefore asks the JSC to help allocating necessary resources, especially by identifying a center that will take over these responsibilities.

While common output datasets and diagnostics for the pilot phase are targeted to prime aspects of large-scale ocean circulation, i.e., fields that can be tested against WOCE climatologies and derived products such as overturning rates and meridional fluxes of heat and freshwater, it has to be noted that the OMIP configuration offers a potential for add-on tracer experiments. Participating groups are particularly encouraged to consider a simulation of CFC-uptake, following the protocols established by the IGBP/GAIM OCMIP, to aid understanding the effects of ocean model formulation on trace gas inventories.

b. Dynamics of Overflow Mixing and Entrainment (DOME)

The quality of ocean model representation of the thermohaline circulation is known to be very dependent on how well they represent overflows from the Nordic seas into the North Atlantic. The committee believes that such overflows are important in the prediction of changes in the thermohaline circulation.

For this reason it strongly supports the initiative on "Dynamics of Overflow Mixing and Entrainment" (DOME), <http://www.rsmas.miami.edu/personal/tamay/DOME/dome.html>. DOME seeks to provide a comprehensive, thorough examination of treatments of overflows

and mixing by a variety of intercomparison and sensitivity experiments, and is joined already, even without a dedicated funding, by no less than 14 participating ocean modelling groups.

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WGOMD takes a keen interest in DOME developments and will be asking for a report on progress at its next meeting.

c. CMIP analyses

WGOMD notes that very few of the CMIP diagnostic sub-projects concerned the role of the ocean. This was of particular concern because of the IPCC predictions showed that global warming may lead to a significant reduction in the thermohaline circulation.

The committee strongly supports the continuation and extension of the current CMIP diagnostic sub-projects involving the ocean. The committee also believes that new projects involving the role of the ocean in the CMIP runs (especially CMIP2+) needed to be encouraged. Progress with this issue will be discussed at the next meeting of the WGOMD.

(2) Sea Ice

WGOMD notes a general movement towards routine use of coupled ocean-ice models in global ocean (climate) model development, because of the difficulties in specifying under-ice ocean conditions in stand-alone ocean models.

Although one may recognize a tendency towards a consensus in the ocean-ice modelling community regarding choices of basic features like visco-elastic ice dynamics, simple thermodynamics, and multiple ice categories, the specific ice models chosen by the various centers differ in many details. In order to increase the transparency and feedback between ongoing model developments, and as a prerequisite for a comprehensive assessment and intercomparison of ocean-ice model behaviors, there is an urgent need for a comparative documentation and discussion of these different options. The committee therefore encourages the ACSYS/CLiC NEG to follow the example set by the Griffies et al. (2000) review on ocean model developments.

The committee believes that the output fields eventually produced by a global OMIP will offer a potential for assessing the performance of various sea ice models, coupled to global ocean models of various resolution, but identical forcing. While for the first, pilot phase of OMIP as discussed above, there has been some need to confine the range of intercomparison data sets, the committee is anxious to ensure a representation of the ACSYS/CLiC NEG at next years' meeting, to help define requirements for a main Ocean (or, Ocean-Ice) Model Intercomparison Project.

(3) Air-sea fluxes

A global flux dataset, including budgets of heat flux in ice covered regions and runoff, has been developed for use in running global ocean and sea ice, as part of the model intercomparison effort of MPI and AWI (see also [1]). This dataset represent a refinement of the ECMWF ReAnalysis products, involving a tuning process aimed at reducing model drifts which would inevitably occur when using the raw ReAnalysis fluxes.

OMIPs are now becoming feasible only because of the significant efforts needed to produce this global forcing dataset. WGOMD points out a need for, and encourages efforts to further

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refine the ECMWF-based analyses, as well as flux datasets based on other re-analysis products, as a necessary pre-requisite for improved ocean simulations.

(4) WGOMD Meeting 2002

Upon the kind invitation of M. Latif (MPI), WGOMD plans to hold its next meeting in Hamburg, probably in May 2002; exact dates need to be determined.

The format of the meeting should be similar as the last one in Santa Fe: i.e., WGOMD committee members plus invited representatives from various modelling centers, other numerical experimentation groups of WCRP and IGBP, and in particular, the groups participating in the Pilot OMIP; the total number of participants should not exceed 25.

This plan deviates from the previous one outlined in the last WGOMD reports to the WGCM, WOCE SSG, and JSC, which called for a larger Workshop in spring 2002: WGOMD believes it most important at this stage, to ensure a focussed discussion of its key activities, particularly the lessons from the Pilot OMIP and their consequences with regard to the launch of a larger scale Ocean (or, Ocean-Ice) Model Intercomparison Project.

Apart from the OMIP issue, the agenda will also include a discussion of first experiences with the various eddy-permitting coupled model experiments currently underway, and a discussion of how different ice models have worked in the new generation of coupled models, at resolutions better than 1 degreee.

Appendix: Meeting Participants

a) WGOMD members:

- C. Böning (chair; IfM Kiel, Germany)
- F. Bryan (NCAR, Boulder, USA)
- H. Hasumi (CCSR, Tokyo, Japan)
- E. Chassignet (RSMAS, Miami, USA)
- S. Griffies (GFDL, Princeton, USA)
- A. Hirst (CSIRO, Aspendale, Australia)
- A. M. Treguier (Local organiz.; LANL, USA; IFREMER, France)
- D. Webb (SOC, Southampton, UK)

unable to attend:

- R. Gerdes (AWI, Bremerhaven, Germany)

b) Invited experts and guests:

R. Bleck (LANL)
M. Latif (MPI) - WGSIP ENSIP/STOIC
G. Madec (LODYC)
M. Maltrud (LANL)
T. McDougall (CSIRO)
J. Orr (IPSL) - IGBP/GAIM OCMIP
M. Roberts (Hadley C.)
R. Smith (LANL)
S. Wacogne (FSU)

unable to attend:

A. Beckmann (AWI) - ACSYS/CLiC NEG