

Conclusions of the DRAKKAR team meeting

Brest, September 26th-27th

1 - Plans for scientific analysis and publications

First we review the ongoing plans of each team for the analysis of existing ORCA025 experiments by the team members :

Where	Who	Topic
LEGI Grenoble	Julien Le sommer, Bernard Barnier	Variability of the circulation around the Zapiola
	Thierry Penduff, Melanie Juza	ARGO/SSH model data comparisons, global modes of variability
	Thierry Penduff, Albanne Lecointre	Atlantic MOC variability and basin scale modes of variability
LEGI/LPO/LOCEAN Grenoble/Brest/Paris	Anne Marie Treguier, Julien le Sommer, Gurvan Madec, Christophe Messenger (+ Sabrina Speich, Michel Arhan)	Variability of water masses in Southern Ocean, of eddy fluxes, relation to forcing, neutral density analysis, fronts...
IFM-Geomar Kiel/ LPO Brest	Camille Lique, Markus Scheinert	Variability of transports out of the Arctic
LPO Brest	Virginie Thierry	Analysis of Mode waters in the North Atlantic
IFM-Geomar Kiel	Arne Biastoch, Markus Scheinert	Indian/Atlantic exchanges, Agulhas eddies
NOCS Southampton	Adrian New	Variability of Atlantic MOC (Rapid Array), analysis of relation between surface fluxes and heat transport/oceanic variability (global).
KNMI	Sybren Drijfhout	Analysis of sinking branch of MOC - Analysis of MOC variability across 30S, relation with the E-P budget of the Atlantic
U Reading	Greg Smith	Data assimilation in ORCA025

Note that other groups are using results of the G70 experiment, some have been presented at the meeting (Alix Lombard for SSH variability, Karina Von Schuckmann, Fabienne Gaillard, Cecile Cabanes and Thierry Huck for variability of water mass properties and transports; Sylvain Michel for the Bay of Biscay, etc ...). The complete list is compiled in a separate document.

New collaborations on joint papers are discussed:

- 1) Arne Biastoch, with Sybren, Bernard and Greg. Arne proposes a paper on the influence of the freshwater forcing on the MOC. The study would use the three experiments KNMI/G70/KAB001: KAB and KNMI have a lower MOC (2 Sv less than G70) but by two different mechanisms : the Labrador sea convection is much lower in KAB, while it

is probably similar between G70 and KNMI. Fluxes under ice are different between KNMI and G70 (need to understand how this affects the MOC). We would consider CORE/DFS3 forcing differences, and use the Kiel ORCA05 sensitivity experiments as well. Arne is lead author and prepares the figures and outline for the January Drakkar meeting.

- 2) James Orr, Bernard Barnier, Arne Biastoch: Analysis of tracers: we have CFC in KAB001 and G70 runs. James proposes an analysis in the Southern Ocean (in the perspective of Lachkar's ORCA05 runs). James will present preliminary results in January in Grenoble?

Besides those two projects, ideas are discussed with no firm conclusion (?):

- Bernard: We need to understand the systematic model biases to correct them. Can we make a paper out of this effort? Is there a possibility of a joint paper on validation using Thierry and Greg's work?
- We could aim for an "ocean modelling" paper expanding on the Clivar Exchange newsletter: who is lead author, what is the focus? We need one paper with a more global perspective (paper 1 will be focussed on north Atlantic). Idea: A paper based on Griffies CORE paper: Issue of model resolution (here we would include higher resolution models), variability on shorter time scales. Griffies' paper is about one forcing, many models. Here we have one model, many forcings...
- Greg: An analysis focussing on NADW upwelling (where does it occur), or water mass analysis in the southern ocean is suggested: but how can it benefit from the different runs that have been done? There are no notable differences between KNMI run and G70 in the southern ocean (relaxation under ice does not make much difference since all the ice melts in summer).

2 - Strategy for future ORCA025 experiments

NOCS

Aim: perform one 50-year ORCA025 experiment starting in October 2007. The model will have 64 levels (a grid similar to OCCAM which we agreed on for the AMEN and NATL12 experiments as well). This change in vertical levels is not a sensitivity experiment (a low dependency on vertical grid has been found in ORCA05 and CLIPPER 1/3°). Also, the experiment will use NEMO version 2.3. Jean Marc has tested this version, no big changes compared with previous ones.

The suggestion is to make this new run a sensitivity experiment to the sea surface salinity restoring (this is motivated by Arne's results showing the strong impact of SSS relaxation in the variability of the Agulhas region). The experiment will use DFS3 forcing (like G70). First a short run will be performed with low SSS relaxation (300 days for 10 meters) everywhere excepted under sea ice (12 days). If the MOC collapses, keep this low relaxation only in the

subtropics, and elsewhere have 60 days (open ocean) and 12 days (under ice), following a mask defined by the Kiel group (Arne Biastoch).

The possibility of using the CICE Los Alamos ice model is mentioned, but the time frame is longer (Met Office is implementing CICE in NEMO, not tested yet).

LEGI:

One 50-year experiment could start in november (we have enough CPU in 2007 for 25 years) or else start in january 2008. Alternatively, we could run ORCA05: one sensitivity study to the penetration of solar radiation is suggested (using climatology of ocean color). Gurvan thinks the impact will be large.

For a new ORCA025 experiments we could do a complete update of the configuration:

- Need to rethink the physics (Kz Tides, ice parameters, solar radiation penetration, change advection scheme?)
- Use the new DFS4 forcing (ERA40 humidity corrected, winds corrected).
- What version of NEMO should we use? The new surface module may be available at the end of 2007; it would be best to start using it in a new series of runs.
- initial conditions: we could use Levitus 2005 rather than 1998 (more recent data, medatlas and PhC included; differs from Lev98 mostly in the Southern Ocean).

Suggestion: run an experiment without SSS relaxation, but with a flux correction (Diagnose a flux correction from an ORCA05 run with DFS4, and implement it as a modification of the precipitations (those are monthly fields).

Note that ORCA025 long simulations run at LEGI will be used in the Ocean Reanalysis project in collaboration with Mercator Ocean (and other partners). All the parameterizations validated in this context could be used for the long reanalysis (stream3 : ERA40 period).

Reading, Greg Smith:

A companion experiment to ORCA025-G70 will start in November with assimilation (47 years).

Kiel

The version 2 of the CORE forcing (based on NCEP) will be released end of 2007 (it will cover 1958-2006). New ORCA05 runs will be performed in early 2008, no ORCA025 run before april 2008. The strategy can be discussed at the january meeting.

KNMI: no new ORCA025 experiment planned.

3 - Strategy for other projects/proposals

3.1 High resolution configurations

The use of 1/12° ocean configurations is not yet really defined in the Drakkar project. Two strategies are already developed:

- AGRIF : On line refinement in $\frac{1}{4}^\circ$ north Atlantic for AMEN, or in the global $\frac{1}{2}^\circ$ in the Agulhas area.
- Global or Basin scale $1/12^\circ$ configuration. Especially over the North Atlantic.

Sebastien Theetten has realised the first North Atlantic $1/12^\circ$ simulation covering the period 1980-1992. The first results seems to be good especially the Gulf Stream trajectory and intensity. The convection in the Labrador sea seems to be too deep. Mercator-Ocean has run a north Atlantic and Mediterranean sea simulation over the period 1999-2006. There are several differences with the Drakkar configuration :

- Domain : the Mercator configuration includes all the Mediterranean sea
- Forcing function: Mercator uses CLIO instead of CORE in Drakkar.
- Forcing fields: Mercator uses ECMWF analyses (1 day frequency for all atmospheric fields) when Drakkar uses DFS3 (6 hourly ERA40+ satellite radiative fluxes and precipits).
- Initialization: Mercator uses LEVITUS05 instead of LEVITUS 98.

Regarding the main currents, results are similar between Mercator and Drakkar. The variability of the SSH (or the surface EKE) is comparable to the altimetry data. Nevertheless, the deep convection in the Mercator simulation is not as deep as the Drakkar one.

Mercator Ocean has also run an interannual simulation with the global $1/12^\circ$ from 1999 to 2006. The surface variability at the global scale is comparable to the altimetry data, the intensity of the main currents and transports through the main passages or straits are also in good agreement with observations. Mercator Ocean will use this global configuration to realized real time ocean analysis and forecast, first in a demonstration phase at the end of the Mersea project and second in a real operational mode during the MyOcean project. No plan to use this simulation in the Drakkar project is clearly defined, and the numerical cost of these kind of simulations do not allow longer experiments at Mercator during 2008.

3.2 Computing in Stuttgart

Arne proposes a joint German/french proposal to get computer time in Stuttgart (72 nodes Nec SX8). the focus would be the variability of the Atlantic MOC (under a German-funded project), using the NATL12 and ORCA025 configurations. The proposal can extend over the next 3 years, jobs must be parallel at least across 10 nodes (ORCA025 at least). We could aim for 200 years of ORCA025 or 100 years of NATL12 - the typical allocation is 50% of request. One big problem: all data must be transferred offsite (no storage available). This constraint is discussed: should we propose sensitivity experiments where we need only monthly mean output? Propose one long climatological run? Reduced output during model spin-up? Strategies and transfers to LEGI and to LPO-Brest must be tested.

Action Arne, Anne Marie, Bernard.

Regarding EU proposak: ARCTIC is not funded, MyOcean will probably be (potentially two 2 persons in Grenoble (one for the ocean reanalysis), 1 person in Kiel, 1/2 at NOCS, one engineer in Paris). The possibility of European Training Networks is mentioned, it does not seem worth the effort.

Bilateral proposals: there will be a call for Germany-France in may 2007. It may help get some money for travel. With the UK the bilateral funding is for young scientists only.

Anne Marie suggests that the Kiel and NOCS groups check the possibility of exchanging PhD students or have joint PhD students under the new coordination of doctoral schools ("MENTOR" network with the university of Brest- IUEM).

4 - Technical discussion

Sharing of data is an issue. For ORCA025 the 5-day output is 72 Gbytes/year.

Adding the time-averaged files, the total for G70 (47 years) is 8.5 Terabytes. The 5-day output for the french runs is stored at IDRIS (Orsay). The monthly averages can be moved around relatively easily (Greg proposes to provide his newrun with assimilation to LEGI in this form; 5-day output at ECMWF will not be accessible). Ways of reducing the output are discussed: do we need to keep w and Kz? Yes for Kz if we want to calculate offline tracers; but w can be recalculated anyway. The 16-bit storage is OK, but users must be careful with the land mask (apply the land mask independently, from a "mask" file: it is impossible to rely on "zeroes" in the 16 bits files). Kiel uses "gzip" to store the files (gain by a factor of 3, because land points are compressed). Ferret automatically opens gzipped files. However, gzip takes time.

Note that recent tests on NATL12 files (about 1.8 Gb per file) on zephir, give the following results : gzip takes 191 s, gunzip takes 21 s (9-times less); using the syntax as in Kiel (gunzip -c file.gz > /xxxx/xxx/file, is quite efficient. The data base can be read only, and the gunzip and copying are simultaneous.

Could be use dods servers to share the files? At IDRIS we can define a dods server, but if the files are on their usual storage machine (gaya) they are not really accessible because they are migrated on tapes. The waiting time to get results is not practical (time-outs). We would need to buy a disk to have the dods files directly accessible. Note that there is automatic gzip with dods.

Kiel runs are available on a dods server (not open to the outside until now). dods helps access one file, but it is not a solution for time series across files. We pre-calculate time series of 2D quantities: ssh, sst, etc... systematically to put on the dods. We could agree to do that for all runs. Development planned at Kiel: have a tool that would be between dods and the end-user, so as to be able to run tools like "crush" or "cdftools" to create time series directly from the files on the dods server.

Some of the output files are at Grenoble on "zephir". It is possible for external users to submit jobs on that machine (contrary to the IDRIS machines where it is difficult to have an account). However, before to do so, contact Jean-Marc for explanation of the batch system.

The monitoring: Everybody agrees it is a very useful tool. Is it easy to implement by different users? (opinions vary). We agree that it will be tested at NOCS and also at Reading. We will discuss in January whether improvements are necessary (more integration of the different steps, use of free software instead of Matlab...)