Long-term perspectives for NEMO - from CONCEPTS

Plans and goals:

1. High-resolution ocean-ice forecasting models: global 1/4, 1/12-deg; basins 1/12, 1/36-deg; shelf 1/36, 1/60-deg; limited area 100-500 m; vertical levels 50-200
2. Development of ocean and sea-ice data assimilation capability
3. Coupling the ocean-ice models with numerical weather forecasting model for coupled forecasting, lead time days to a season
4. Coupling with wave models
5. Using the ocean-ice model for hindcast and reanalysis, for durations of 1-6 decades
6. Coupling the ocean-ice model with ecosystem module for hindcast and forecast
7. Detailed analysis/forecast of high-resolution ocean & ice state for environmental services in Canadian waters

Model development of interests to CONCEPTS (and may work on):

1. Sea-ice model improvement: numeric and physics
2. Ice-ocean-topography interaction, e.g., ice embedding (mass & dynamic), land-fast ice. What happens when ice (or the ice keel) touched the bottom?
3. Ice-wave interaction, integration of a wave model into NEMO, preferentially WW3; momentum & heat exchanges, breaking and non-breaking wave induced-mixing…
4. height dependent bulk over ice (done in CICE only right now)
5. Sea-ice data assimilation
6. Tides and tidal data assimilation
7. Introduction of 3-4th Semi-Lagrangian advection for momentum and tracers. Should allow for large Courant Number (>1) while the Eleurian and leapfrog approach is limited to C~0.25-0.5. Could be of interest for biogeochemistry.
8. EC has its own FD global grid with no singularities (actually 2 overlapping rotated spherical grids). How difficult would it be to implement it?
9. Wetting and drying
10. Non-hydrostatic option
11. Inclusion of TEOS10 should lead the way to better total energy conservation
12. Parallelization: Mix of OMP and MPI, GPUs?
13. lesser points (and short term):

a) different directories for each proc output (ln_dimgnnn or netcdf). Seems to confuse less the NFS servers.
b) CICE should get MPI_comm_opa communicator passed through the SBC interface and not assume MPI_COMM_WORLD by default (SAM2 problems)
c) Continue the work on wp (_wp to be added to all fixed value variables) and REAL(*,wp)
d) wish: to replace all timestep count by hours (nn_write, stock…), i.e., more friendly namelists, maybe even considering a GUI that manages namelists…

Long-term perspectives for NEMO - from CCCma (Climate)

Plans and goals:

NEMO-PISCES-CICE as a component of CCCma's Climate and Earth System model (next generation) for:
1) long-term climate projections in support of IPCC,
2) seasonal and decadal climate forecasts,
3) regional climate simulations, etc.

Implementation of NEMO in the CCCma coupled model will bring the ocean component of Environment Canada's current operational multi-seasonal prediction system into alignment with the developments and goals of the CONCEPTS initiative. Specifically, this will enable the CCCma prediction model to assimilate an ocean analysis (provided through CONCEPTS) that is produced using essentially the same ocean model as is employed for prediction, rather than importing an analysis from a foreign modeling system as is currently done. This is likely to improve the initialization of the model ocean and hence the fidelity of the climate predictions.

Model development of interests

most covered by CONCEPT list

- Energetically-consistent parameterization of small-scale turbulence which accounts for the wind energy pathway from its input at the surface to its removal by mesoscale eddies (due to baroclinic instability, through either parameterized or resolved eddies), and then to small-scale mixing in the deep ocean interior. Such a mixing scheme should be able to account for possible changes in wind energy input to the ocean under changing climate.

treatment of mixing, overflows likely important for biogeochemistry

biogeochemistry (BGC)

- implementation of a new BGC component based on the PISCES Architecture

14. The main concern is whether the computational efficiency of tracer advection will allow for an expanded suite of biogeochemical tracers at an acceptable cost (CPU time).
15. The schemes that are optimal for BGC may not be the ones that are optimal for the high-res regional modelling, hence the need for modularity/flexibility in settings.
16. Have common approaches e.g. for sedimentation included within NEMO, with parameters that can be adjusted to make each approach a reasonable approximation of another => improve comparability of different ecosystem models.
17. Generic framework for biogeochemical processes within sea ice (of interest, but not a high priority based on where we are at right now).