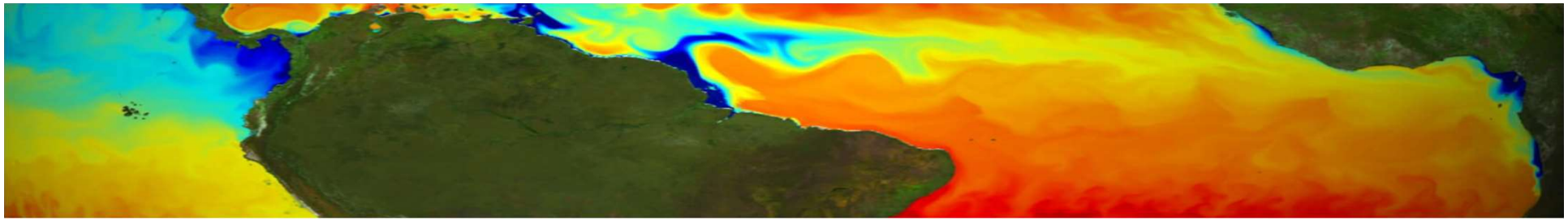

What factors will determine whether NEMO is here in 10 years time

Contents

- Initial remarks & main themes
- Dynamical core
- Physical parametrisations
- Maintaining efficient, readable, flexible, reliable code
- Interface to and use of data assimilation

Intention is to provoke thoughts / invite inputs from NDC members

Note: the sea-ice component is not discussed

Initial remarks

- Aim is to identify different types of potential issues / opportunities
- Not solve them

- 10 years is not a very long time (even though there is a lot of activity)

- Easy to raise a lot of questions that will take > 10 years to address
- Key thing is to focus on the right issues

- The NEMO Consortium agreement requires that
  - NEMO meets research & operational needs
  - any change to the scope of NEMO is agreed

Main Themes

- We need to do two types of things
  - Trail-blaze in a few areas
  - Keep up-to-date with important progress elsewhere

- To have the capacity and flexibility to respond to progress we need:
  - Strong links to the international ocean modelling community
  - Expertise to make good scientific & technical choices
  - Expertise in system integration / testing
    - to sustain a readable/maintainable/reliable code

- We need to work effectively as a team

Dynamical core

- What sort of ensembles/resolutions will we be using?
  - Computer capacity increased by factor of 10-20 (?)
  - Our codes more efficient by a factor of 8
  - So about 4 times horiz resolution or 100 member ensembles
  - Still mesoscale-permitting at high latitudes

- Which issues will be most important?
  - Better overflows or topographic steering?
  - Reduced diapycnal mixing for climate?
  - Higher resolution in coastal waters?

- What is out of scope (it would be a new model not NEMO)
  - non-hydrostatic
  - a very different horizontal grid (e.g. hexagonal cells)

Physical parametrisations

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- Which sub-grid-scale processes need better representation?
  - turbulent surface boundary layer
  - absorption of internal gravity waves?

- Better incorporation/formulation of schemes
  - “scale-aware” schemes – over what range?
  - dynamics compatible schemes
  - assisted by machine learning?

- Better representation of bathymetry?
  - more control of resolved scales?
  - sub-grid scale

Retaining readability / flexibility

- To deploy NEMO efficiently on diverse HPC architectures
- To develop improved dynamics or parametrisations
- To manage the code securely and efficiently

Improving quality assurance process

- To be efficient in upgrading the code
- To have reassurance that the code does what is intended

Interfacing to data assimilation

- Enable required interfaces to data assimilation systems
- Interfaces may use derived types as “containers”

Evolution of other interfaces

- Air-sea interface (e.g. surface waves)
- Dynamics / bio-geochemistry interface (e.g. “degrad”)

Assessment of model errors

- Make better use of measurement data to quantify errors and uncertainties in our models – systematic use of data assimilation (or machine learning?)