

Progress on NEMO Development Strategy on Ocean Dynamics



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Reminder on NDS chapter on ocean dynamics

<u>Focus</u> : Assessing and improving the representation of the physical processes that affect ocean circulation at resolved scales (in NEMO target applications) .

Listed priorities

- Parameterised processes :
 - mixing in the ocean interior and BBL (inc. overflows)
 - closures for balanced turbulence (meso/submeso, moment./tracers)
- <u>Resolved</u> processes :
 - balanced turbulence (+ inc. its interaction with topography)
 - fast barotropic motions (inc. tides) (propagation, dissipation)
 - internal waves and internal tides (propagation, dissipation)
 - more generally, assessing fast (<1d) processes down to km scale

(OSBL processes are discussed in NEMO Air-Sea Interactions WG)



Reminder on NDS chapter on ocean dynamics

Specific actions proposed in NDS

a.setting-up working groups for assessing the representation of specific physical processes and for proposing improvements

b.using idealised test cases for documenting the impact of new developments to NEMO on (resolved) physical processes

c.consolidating NEMO online diagnostics as a tool for developing physically consistent closures

d.improve the liaison with NEMO users community in order to expand the community of process-oriented NEMO users (demonstration cases, project endorsement, dev. outside ST)



Working groups

assessing the representation of specific physical processes and proposing improvements

- The chapter's scope is very large, so that setting-up a single WG for all the physical processes is difficult
- Developing new parameterisations is generally more a topic for scientific collaborations than open "panel" discussions
- In mid 2019, we have decided to focus in priority on
 - eddy closures for 1°-1/4° global ocean models
 - tides and fast barotropic motions in regional and global models
- A group on tides led by F. Dupont has been set-up, clarifying that there is no "big" issue with tides in NEMO, this group will carry on its activities in 2021
- But slower progress on setting-up a group on eddy closures. Still looking for a co-chair for this group.



Idealized test cases

monitor the impact of new developments to NEMO on resolved physical processes

- A Github repos for collecting and documenting test cases has been established in 2018; now includes 11 test cases.
- Many dev. actions of 2020 WP are associated with dedicated test cases for illustrating their impact on model solutions
- The approach to collection/distribution of NEMO test cases should probably be clarified (duplication, responsibilities)
- Test-cases have probably not been developed enough from a process validation perspective (in liaison with subgroups)
- But overall, good progress (see for instance the overflow test case on the next slide)



Idealized test cases

Ambition :

- each NEMO dev. comes with a test-case
- gathered in a dedicated GitHub repo
- to be used for teaching and outreach
- also used for continuous integration
- test-cases are turned into boolean tests

| | | github.com/NEMO-ocean/NEMO- | examples C |
|--------------|----------------------------|--|--|
| D. Plans for | HdR-outline HdR-DR-pr | Explore the GitHub - NE GitHub - NE | IMMERSE/o climate-ma National Oc loga.png 1 |
| | NEMO-ocean / NEMO | 0-examples | O Watch 9 ★ Star 5 V Fork 4 |
| | Code () Issues () | 1) Pull requests 1 O Actions III Projects 0 | Security 🛄 Insights |
| | Simple configurations to s | tudy specific oceanic physical processes and be use test-cases jupyter-notebooks nemc-ocean | d as a tool for training http://forge.ipsl.jussieu.fr/nemo |
| | 20 commits | | eleases 🏭 3 contributors 🎄 View license |
| | Branch: master - New pull | Irequest | Find file Clone or download - |
| | 🔠 guillaume-smo add missin | g input files to run ICE_AGRIF test case | Latest commit 1392a18 on Dec 10, 2019 |
| | BENCH | Fix typo on README extension in BENCH | 12 months ago |
| | IIII CANAL | Import work done previously by @sflavoni on Jupyter | notebooks 12 months ago |
| | ICE_ADV1D | Add empty README for BENCH and ICE_* cases | 12 months ago |
| | ICE_ADV2D | Add empty README for BENCH and ICE_* cases | 12 months ago |
| | III ICE_AGRIF | add missing input files to run ICE_AGRIF test case | 2 months ago |
| | III ISOMIP | Add ISOMIP image and include it in global README | 12 months ago |
| | LOCK_EXCHANGE | Import work done previously by @sflavoni on Jupyter | notebooks 12 months ago |
| | OVERFLOW | Import work done previously by @sflavoni on Jupyter | notebooks 12 months ago |
| | IN VORTEX | Add VORTEX anim and include it in global README | 12 months ago |
| | iii WAD | Import work done previously by @sflavoni on Jupyter | notebooks 12 months ago |
| | gitignore | Initial commit | 2 years ago |
| | | Add CeCILL LICENSE | 12 months ago |
| | README.md | Update README.md | 12 months ago |
| | | | |

Temperature (deg C) hour: 1.5





On-line diagnostics

• No progress against the strategy

Liaison with process oriented users

broaden the community of process-oriented NEMO users (demonstration cases, project endorsement, dev. outside ST)

- implementing idealised experiments with NEMO is now objectively easier than in 2017
- IMMERSE will deliver in 2022 outreach material for show-casing how NEMO can be used for process oriented studies
- good articulation established with D. Marshall on GEOMETRIC
- but still no clear "endorsement" mechanism for NEMO
- no real contribution to NEMO dev from outside NEMO ST.



Summary of successes and issues

Successes

- good progress on implementing the strategy with respect to idealised test cases but we will need to monitor this carefully in the future
- the representation of km scale processes should (in principle) be assessed thoroughly through IMMERSE WP6
- A subgroup on tides and fast barotropic motions is up and running

Issues

- we don't have a working group in charge of implementing the strategy on ocean dynamics
- slow progress in setting up subgroups so that :
 - it is not clear how existing test-cases actually cover the range of processes we want to represent with NEMO;
 - no real progress on online diagnostics
- identifying co-chairs and initiating subgroups takes time and JLS is probably too busy with other things...
- improving the liaison with process oriented users is a slow process. Not sure we are approaching this question adequately.