NEMO developments:
Summary of Progress in 2019

C. Lévy - 8 Jan. 2020

Successful developments produced in 2019 (1)

New features:

- AGRIF vertical coordinates: allow each inner nest to use a different vertical coordinate from the model in which it is nested
- Atmospheric boundary layer: Implementation of a new 1D vertical atmospheric boundary layer model to improve air-sea interactions & bulks
- Air-sea fluxes: More accurate air-sea flux estimates through the implementation of a cool-skin/warm-layer parameterization in NEMO &more advanced bulk formulae over sea-ice
- Air-sea interactions: Create a simple parameterization of the current feedback
- Tidal harmonic analysis: replace current implementation by a facility for generic multiple linear regression to enable tidal harmonic analyses of three-dimensional fields, make harmonic analyses across model restarts possible, and improve the computational efficiency of the analysis, as well as facilitate a wide range of non-tidal regression analyses.
- Tidal forcing: enhance the implementation of tidal forcing with the addition of an optional, alternative parameter set for the harmonic expansion of the tide potential

Successful developments produced in 2019 (2)

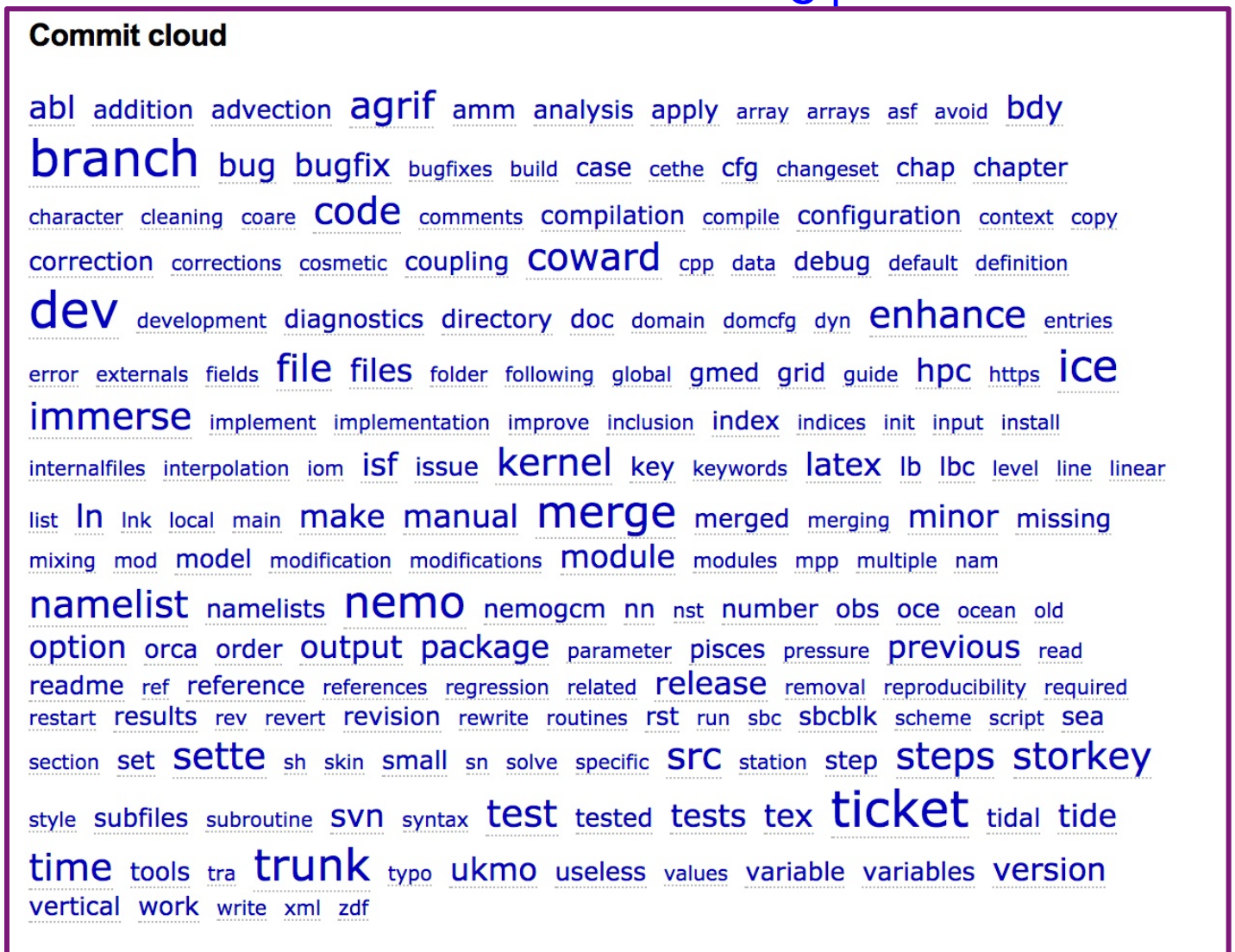
Improvements: reliability, robustness, preparing the future

- AGRIF: in NST routines, remove restrictions to a minimum grid size
- Ice Shelfs: Coupling with ice sheet model, split explicit cavity and parametrisation to run with some cavity (the giant for example) and a parametrisation for the small ones, Code cleaning, improve test cases
- Domain definition: simplify DOMCFG tools and improve generality & reliability
- CMIP6 diagnostics: add all the diagnostics developed for CMIP6 in the NEMO reference (dynamics, sea-ice and biogeochemistry)
- TOP: cleaning of lateral boundary condition for passive tracers
- Improving the code's reporting facilities, namelists-as internal files
- HPC: optimization of communications in BDY

- **Preparatory work for kernel evolutions: full recoding of NEMO kernel: array dimensions, loops… to prepare for new time stepping and tiling**

By end 2019:

Result of Merge Party meeting, all the developments merged in a new NEMO version: dev_r12072_MERGE_OPTION2_2019. Starting point for 2020 developments



Other developments and actions started in 2019

39 development branches created on NEMO repository in 2019, including some work to be continued in 2020:

- Adding new schemes for open boundaries options
- Adding new diagnostics for wave coupling
- OSMOSIS implementation to reduce the too-deep winter mixed layers
- Wave coupling upgrade to include enhanced ocean mixing due to breaking waves and add terms in momentum equation
- HPC 2D tiling
- HPC MPI3, collective and neighbours communications
- HPC halos elimination of ghost rows and columns associated with single core performances improvements
- HPC optimisation on communications in DYN
- Xios used to read initial conditions, restarts…

Also in 2019:

Closing tickets: better than ever!

Test case: systematic with each development

Also in 2019:

Publications

- Report on vertical coordinates comparison
- A paper on Wetting and Drying

GMD Special issue in 2019: 6 papers published

- Impact of the ice thickness distribution discretization on the sea ice concentration variability in the NEMO3.6-LIM3 global ocean–sea ice model Eduardo Moreno-Chamarro, Pablo Ortega, and François Massonnet
- Tracking water masses using passive-tracer transport in NEMO v3.4 with NEMOTAM: application to North Atlantic Deep Water and North Atlantic Subtropical Mode Water Dafydd Stephenson, Simon Müller, and Florian Sévellec
- On the discretization of the ice thickness distribution in the NEMO3.6-LIM3 global ocean–sea ice model François Massonnet, Antoine Barthélemy, Koffi Worou, Thierry Fichefet, Martin Vancoppenolle, Clément Rousset, and Eduardo Moreno-Chamarro
- Development of a 2-way coupled ocean-wave model: assessment on a global NEMO(v3.6)-WW3(v6.02) coupled configuration Xavier Couvelard, Florian Lemarié, Guillaume Samson, Jean-Luc Redelsperger, Fabrice Ardhuin, Rachid Benshila, and Gurvan Madec
- The INALT family – a set of high-resolution nests for the Agulhas Current system within global NEMO ocean/sea-ice configurations Franziska U. Schwarzkopf, Arne Biastoch, Claus W. Böning, Jérôme Chanut, Jonathan V. Durgadoo, Klaus Getzlaff, Jan Harlaß, Jan K. Rieck, Christina Roth, Markus M. Scheinert, and René Schubert
- Nemo-Nordic 1.0: a NEMO-based ocean model for the Baltic and North seas – research and operational applications Robinson Hordoir, Lars Axell, Anders Höglund, Christian Dieterich, Filippa Fransner, Matthias Gröger, Ye Liu, Per Pemberton, Semjon Schimanke, Helen Andersson, Patrik Ljungemyr, Petter Nygren, Saeed Falahat, Adam Nord, Anette Jönsson, Iréne Lake, Kristofer Döös, Magnus Hieronymus, Heiner Dietze, Ulrike Löptien, Ivan Kuznetsov, Antti Westerlund, Laura Tuomi, and Jari Haapala

Where are we today, end 2019?

The new version “Merge2019_option2”contains the advances expected by IMMERSE and by NEMO Development Strategy and will be the starting point for 2020 developments.

2019 has been a successful year: some major preparatory work has been produced and everything is in place for the NEMO 4.2 release to be created end 2020 with all the expected new features.

We have worked to make 2020 workplan more realistic as requested .
The additional resources from IMMERSE should also help.