



**MERCATOR  
OCEAN**  
INTERNATIONAL



**AGRIF WG**

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And more or less experienced users: F. Dupont, J. Jouanno, L. Gillard, C. Pennelly, F. Schwarzkopf

## 1. At minima:

- Sustain AGRIF concept ensuring, as much as possible, that it works with all NEMO capabilities. Adapt to the new ones (e.g. LIM3, RK3,...).
- Promote its use and provide support to users.

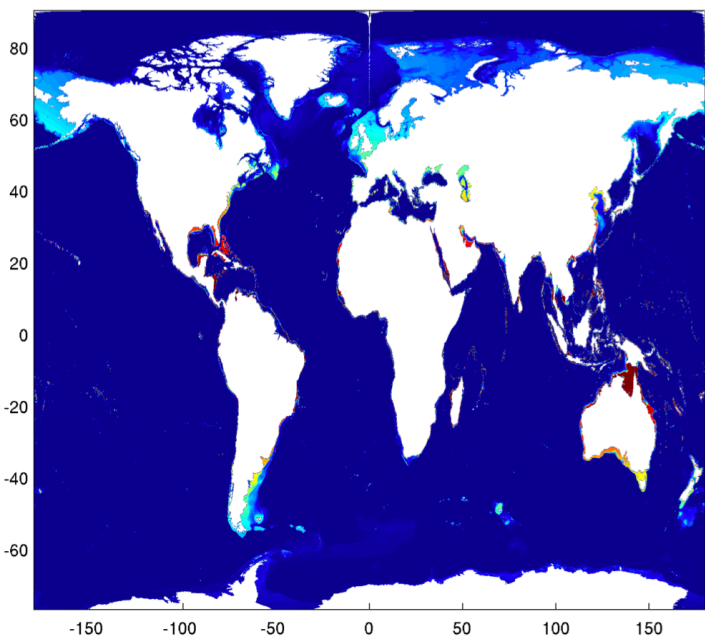
## 2. More challenging:

“Make the integration robust and efficient enough to have  
**a versatile refinement capability at the global scale**”

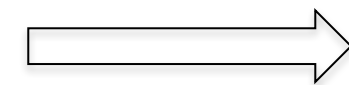
Precisely, this requires:

- Removing restrictions on child grid definitions (e.g. possible overlaps)
  - Having “transparent” connections between overlaps (e.g. barotropic mode coupling)
  - Having pre-processing tools to do do (and think about post-processing)
  - Load balancing
-

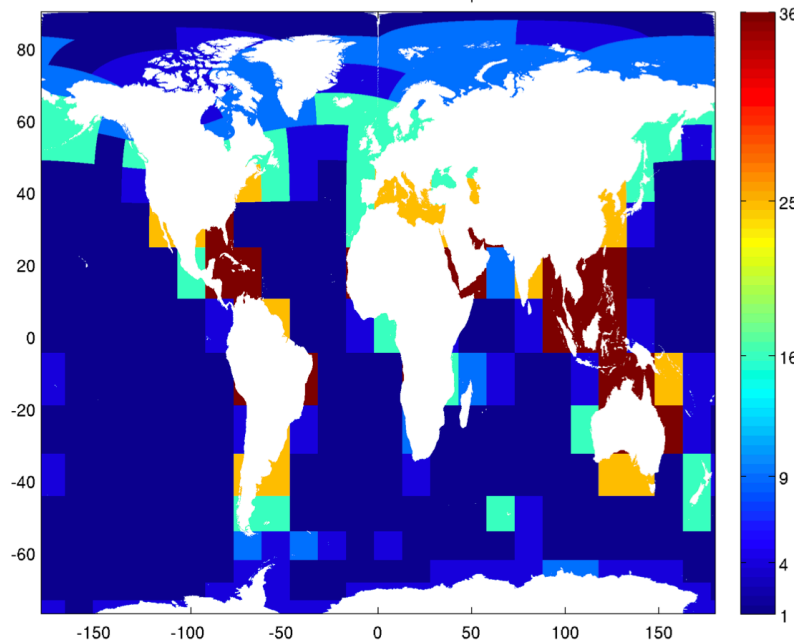
(a) Number of grid cells to resolve  $\min(L_1, L_{bl}, L_T)$   $L_{min}=1.5$  km



Physical scales



Block refinement  $15^\circ \times 15^\circ$  set to 95<sup>th</sup> percentile of F



“AGRIF like” transcription  
(10 times less points than a global  $1/36^\circ$ )

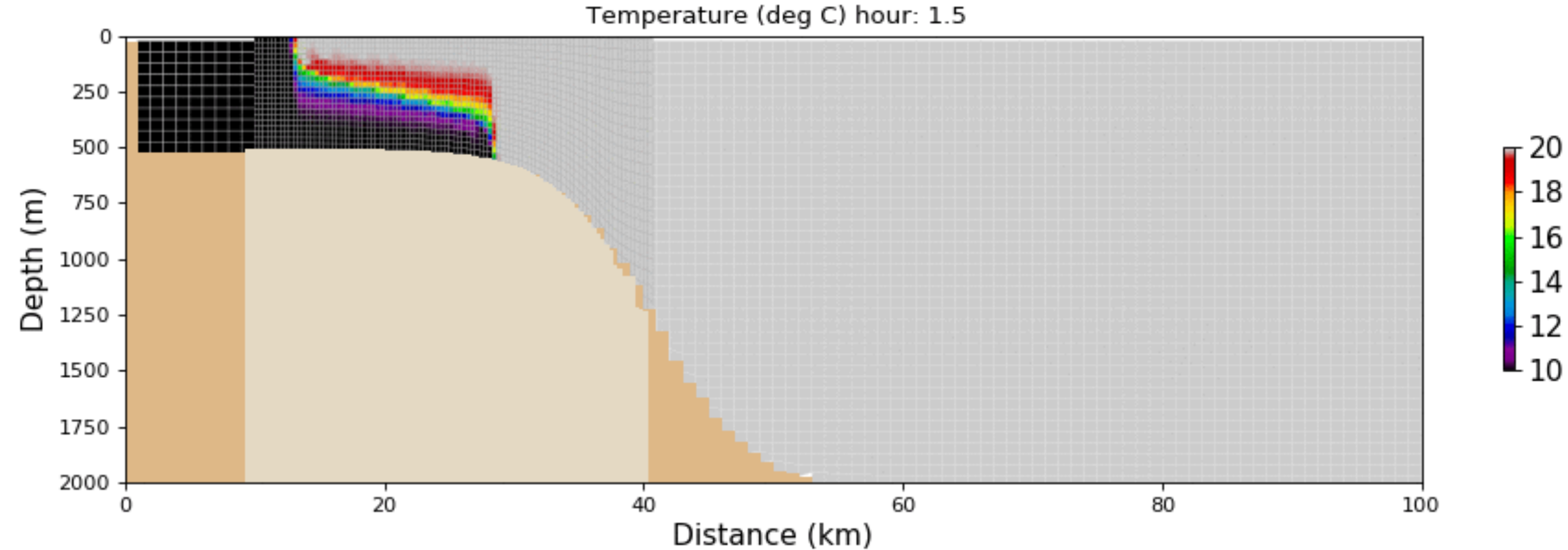
Holt et al,  
GMD, 2017

- ❑ AGRIF should NOT be considered as solely dedicated to regional modelling
- ❑ It should help rationalizing resources, hence **AGRIF should be more on the HPC side** than on the “regional modelling” side.

NEMO version	3.6	4.0.4	4.x
LIM2	yes	-	-
LIM3/SI3	no	yes	yes
GLS vertical mixing	no	yes	yes
$z_*$	no	yes	yes
Land processors removal	no	yes	yes
Use of higher order schemes (nb of ghost cells parameter)	no	yes	yes
Vert. coord. change in zooms	no	Partially	Will be
East-west periodic and/or north fold bcs in zooms	no	no	Will be
Optimized mpp resources on child grids	no	no	Working on it
Coupling at barotropic sub- steps	no	no	scheduled
Overlapping grids	no	no	no
RK3 time stepping	-	-	Should be

2020 WP

2021 WP

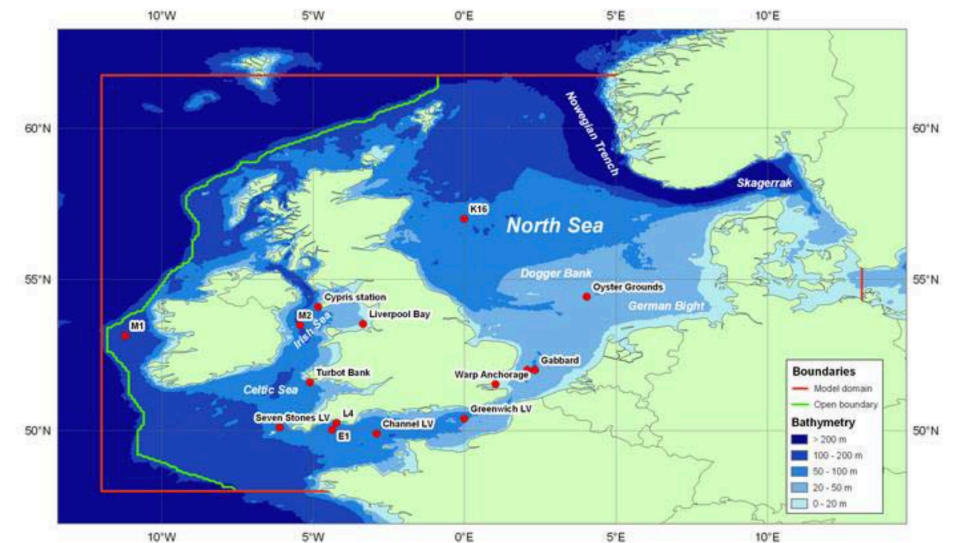


Connecting z and s grids with AGRIF – IMMERSE project

[https://github.com/jeromechanut/IMMERSE/blob/master/DEMO/OVF\\_zoom\\_zps\\_sco\\_corrected\\_smooth.gif](https://github.com/jeromechanut/IMMERSE/blob/master/DEMO/OVF_zoom_zps_sco_corrected_smooth.gif)

# Envisioned but unscheduled

- Use of AGRIF for **BGC coarsening**, i.e. grand mother grid concept. Having global grids with cyclic boundaries was a prerequisite. Running “grand-mother” and “mother” grids with different mpp resources would be required (see next slide).
- **Merging open boundary module (“bdy”) and AGRIF** boundary treatment:
  - => Take advantage of existing open boundary schemes
  - => have a “all in one” open boundary scheme, hence limits AGRIF calls
  - => Enable irregular, complex, boundaries
- **Make DOMAINcfg tool great again** (i.e. in line with NEMO 4)



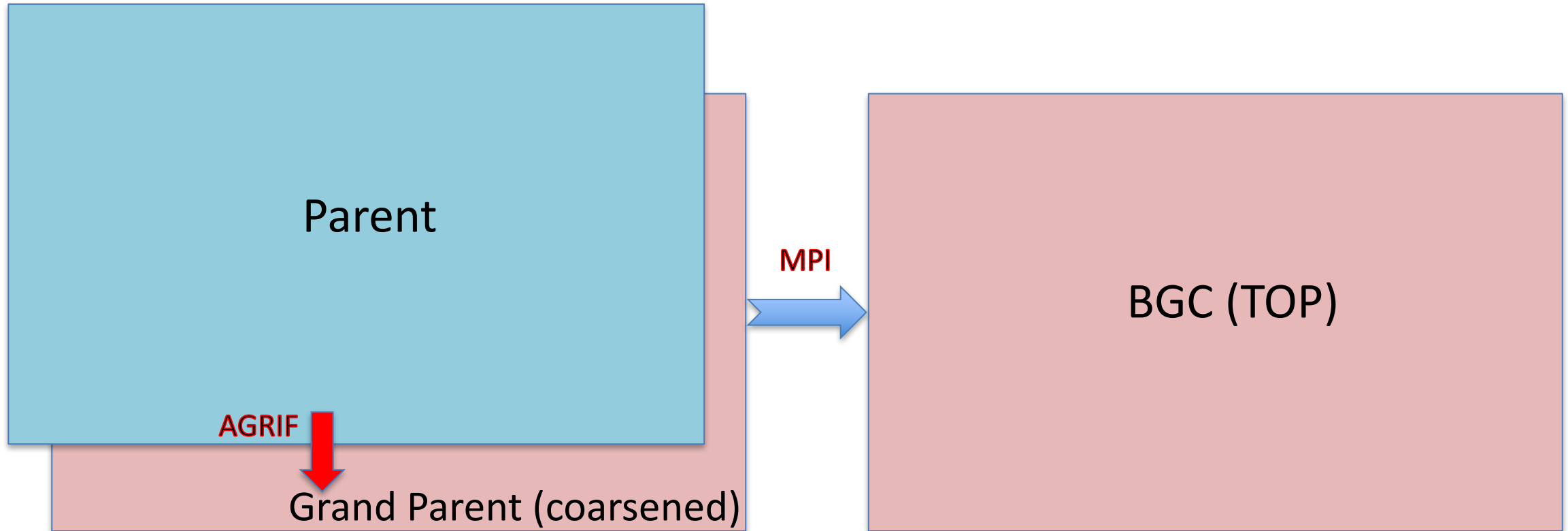
- Reconciling AGRIF with a versatile use on massively parallel computers appears to be difficult.
- Ideally one would like to run parent and child **concurrently** with adjusted mpp resources (coupler approach).
- Achieving the same level of accuracy for interpolations/update as AGRIF with a coupler would nevertheless require lots of coding, and (lots of) data transfer (via MPI).

Let's imagine combining the best of the two

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BGC coarsening (interpolation) case:

- AGRIF manages (conservative) coarsening operations
- Coupler transfers data **in coarsened space**





## Ocean coupling case

- Let define a “sub-model” containing a child grid and a slightly larger parent grid model. Halo size would depend on numerical schemes order but also on barotropic iterations.
- AGRIF still handles conservative interpolations and updates and time integration.
- MPI transfer connects parent and sub-model **in the coarse grid space** and at each parent time step.

