

**ed applications** : whole or sub-set of the following system

**an / bio / ice** + interfaces to

- atmosphere/lands (and their chemistry)
- ice sheet / icebergs
- surface waves
- data assimilation

ied at *global* scale :  $\Delta x = 1^\circ, 1/4^\circ$  (CMIP6 & Paleo),  $1/12^\circ$  to  $1/36^\circ$

AKKAR)

*regional/coastal* scale :  $\Delta x = 10$  to **1** km (Med, Peru-Chilli, Salomon, Bengal Gulf ...)

grid refinement (AGRIF)

remains competitive on forthcoming supercomputers (from thousands to millions CPU

**within the existing kernel** (finite differences, structure grid) :

- improve the numeric and physics of all NEMO components
- improve the existing interfaces (AGRIF, atmosphere, land, bio, sea-ice)

grated system (multi-components) but preserve *stand alone capabilities* for each part  
serve the physical & numerical upgradability of each individual component)

vide a new suite of validated **test cases** (COMODO project)

ote the **use of data assimilation techniques** via demonstrators and tutorials  
m., parameter estimate, design of parameterization, or model analyses).

ntain the **Tangent & Adjoint Models** (TAM) in phase with the dynamics  
sible extend it to some other components)

**an kernel:**

olution of **ocean numerics in both time and space** (adaptation to targeted high resolution  
better control of implicit numerical diffusion)

e of **mixed vertical coordinate:  $z-s$ -tilde** in global configurations for  
ter overflows, bottom boundary layer processes, and explicit tides.

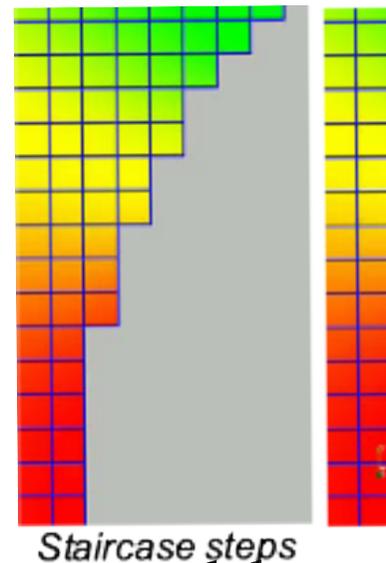
**cut-cell technique** and development of time-varying cut-cells for  
mplex geometry of ocean basins and the time-variation of ocean cavities.

**n physics**

ter surface ocean dynamics and air-sea fluxes : interface to an *external* wave model.

er force an eddying ocean : downscaling of the atmospheric forcing at ocean scale  
a coupling to an atmospheric boundary layer model.

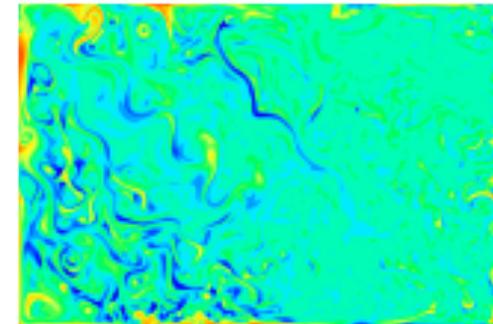
er representation of the cold ocean sphere : dense water *formation* (polynia, ocean cavity



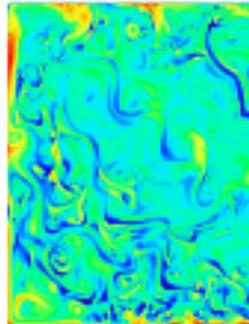
ion of a BGC component for LIM sea-ice and its interface to PISCES  
(initially interfaced to others sea-ice and BGC models)  
ology and thermodynamics adapted to higher resolution  
ics of air-ice-sea interaction, snow compartment.



1/54° Offline



1/54° on 1/



tracer concentration at 30m at day 10

## GeoChemistry (BGC)

er-parameterization of the ocean dynamic for BGC (higher  $\Delta x$  on ocean than on BGC):  
of BGC in very large configs. at reasonable cost while preserving the results  
esign ocean-BGC interface: sinking of particles moved in the ocean transport part.  
agement of carbon and nutrient fluxes provided by land models

## refinement (AGRIF)

oved of AGRIF maintenance, robustness, and versatility  
le different vertical grids & coordinate systems between mother and child grid(s)  
ove AGRIF robustness (AGRIF library base on open source lexical analyzer)

**em environment :**

**configuration manager** (regional O/I/B configs with AGRIF grid refinements)

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grid size	1,442 x 1,021	4,322 x 3,059	12,962 x 9,011
nb of points	1,400k	13,000k	120,000k

nb of core	1k	10k	100k
elapse time/year	4h (2h)	12h (6h)	~36h (18h)
local size	38 x 38 (26 x 26)	36 x 36 (26 x 26)	~ 35 x 35 (26 x 26)

**Today**

**Tomorrow**  
light improvement

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## Target

deep reorganization  
(MPI + OpenMP,  
computational layer,  
...)

nb of core	10k	100k	1,000k
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elapse time/year	1/2h	1h30	< 6h
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## **sustainability and user support**

**Support** : a large variety of task (emails, forums, user meetings, on-line or on site tutorials, specific documentations and publications...)

**Sustainability** : a key point of code quality which contributes to its success  
require a full validation of each release for all reference configurations  
and potentially for all available physical/numerical options...

**Frequent releases** : better equilibrium between developments and maintenance

**Enter the system**: a focus on a few numerical/physical options (and remove the others)

**little reference config.** : regional with obc, ice, bio, AGRIF zoom, vvl, GLS, waves, ...

test cases for each components (in stand alone mode)