



**Barcelona  
Supercomputing  
Center**

*Centro Nacional de Supercomputación*



# NEMO at the BSC

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## What

Environmental forecasting

## Why

Our strength ...

- ... research ...
- ... operations ...
- ... services ...
- ... 60 people ...

## How

Develop a capability to model air quality processes from urban to global and the impacts on weather, health and ecosystems

Implement a climate prediction system for subseasonal-to-decadal climate prediction

Develop user-oriented services that favour both technology transfer and adaptation

Use cutting-edge HPC and Big Data technologies for the efficiency and user-friendliness of Earth system models

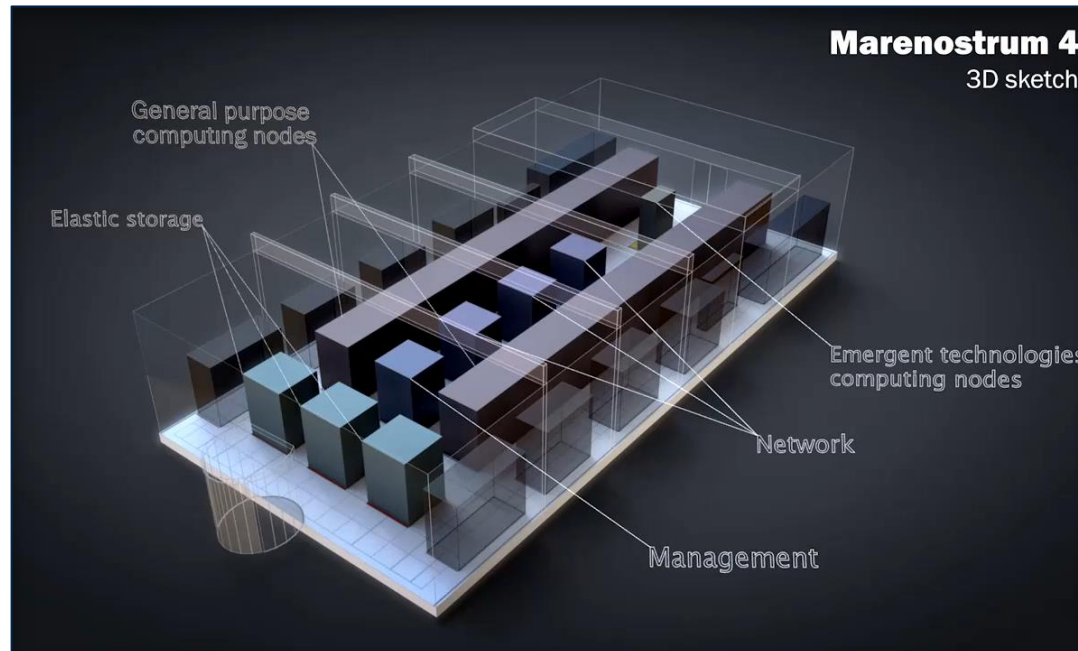
Earth system  
services

Climate  
prediction

Atmospheric  
composition

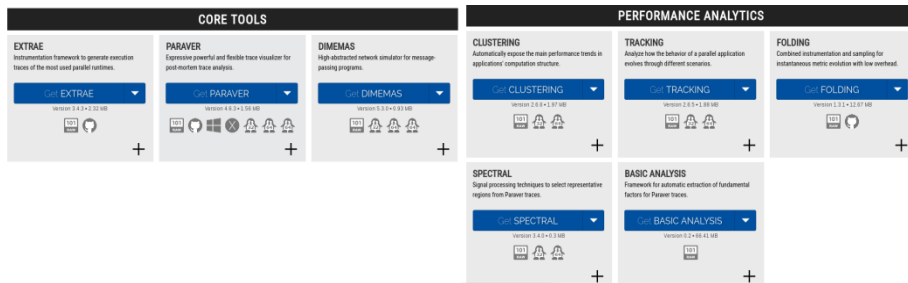
Computational  
Earth sciences

Emergent technologies  
General purpose computing nodes  
Elastic storage  
3 systems with  
Mor  
EK  
Network  
IB EDR/OPA  
Ethernet  
Operating System: SuSE  
PFS  
load  
mips/s  
v8



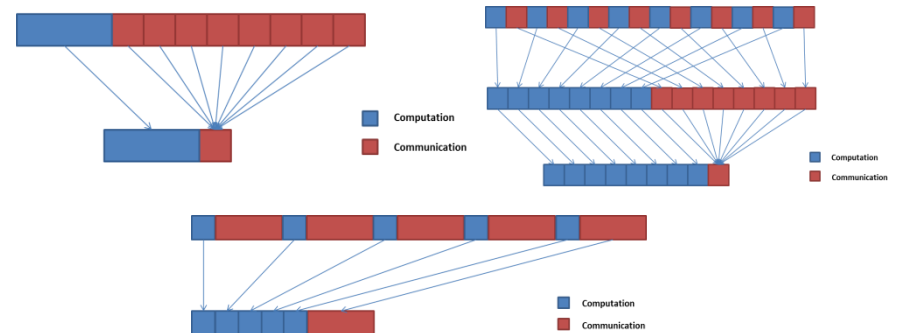
## Collaboration with computer sciences department

### BSC performance tools



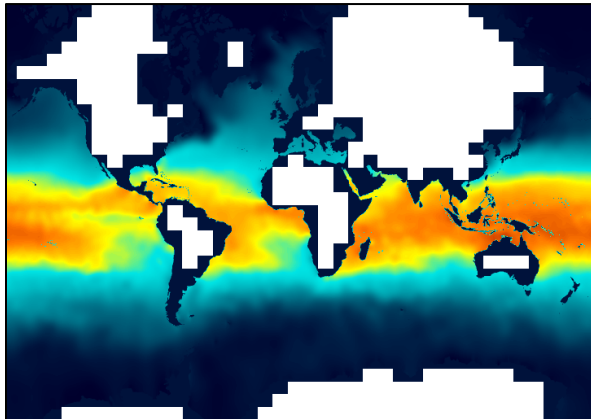
## MPI communications optimizations

### Reducing p2p and collective communications overhead



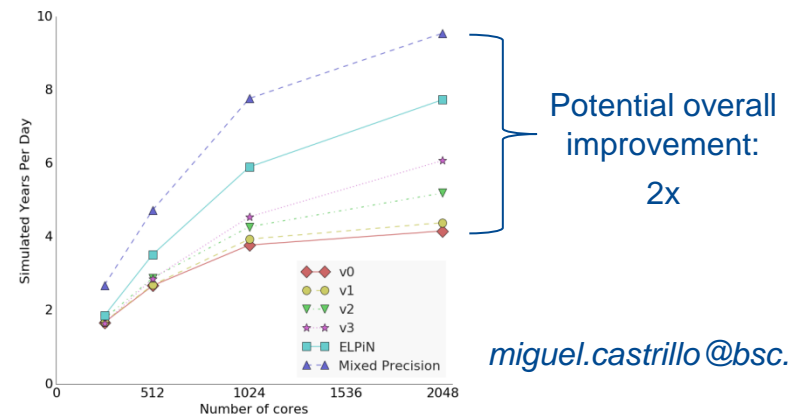
## Exclude land processes in NEMO

### Finding an optimal domain decomposition



## Explore mixed precision

### Which precision is needed in NEMO?

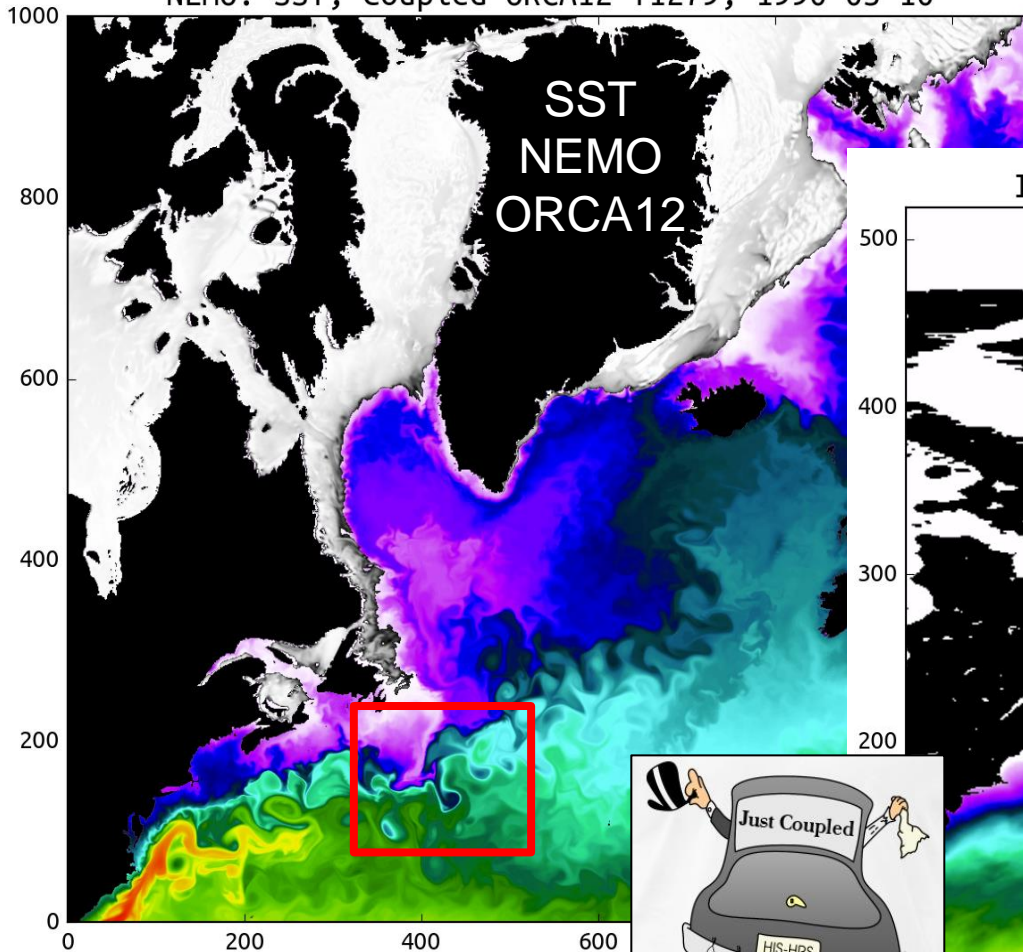


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# NEMO-related activities at BSC

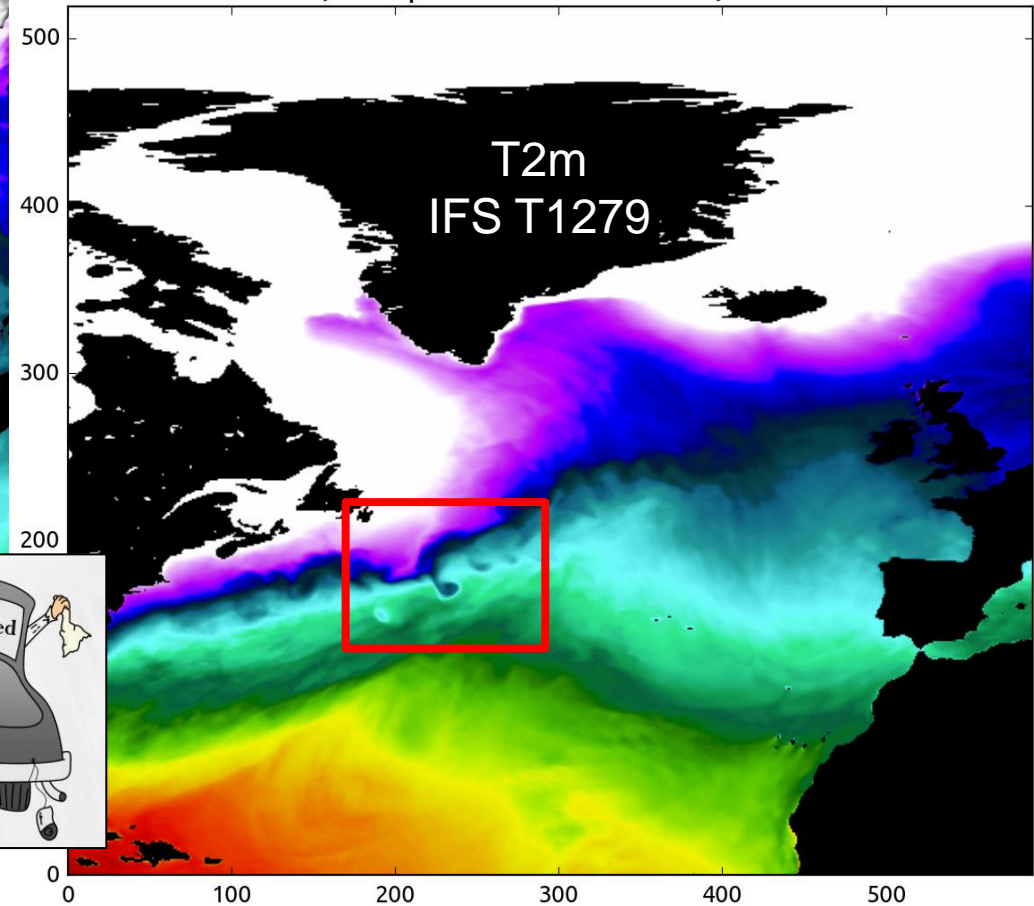


NEMO: SST, coupled ORCA12-T1279, 1990-03-10

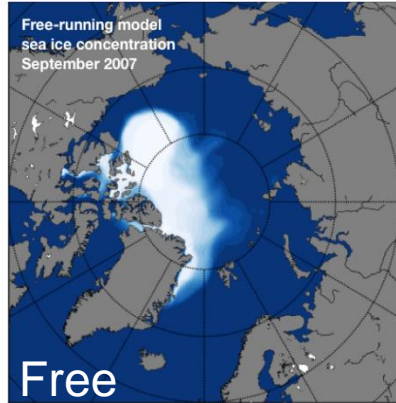


EC-Earth GLOBAL ORCA12-T1279  
(ocean and atmosphere at ~15 km!)

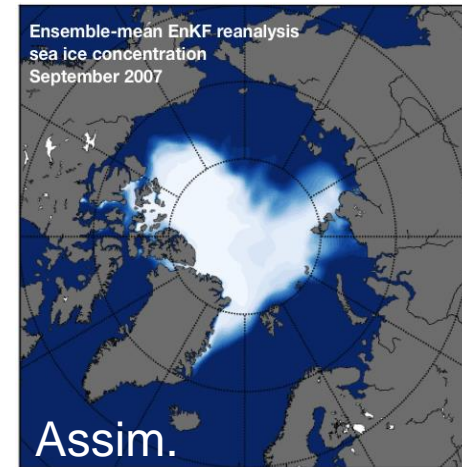
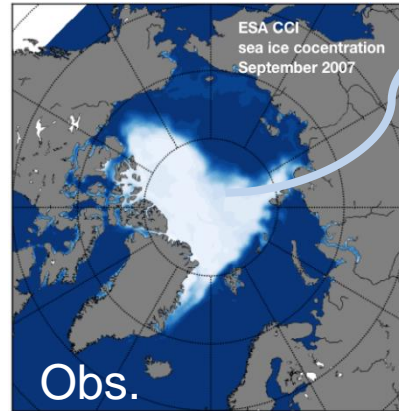
IFS: T2m, coupled ORCA12-T1279, 1990-03-10



## Ensemble Kalman filter ocean and sea ice reanalysis



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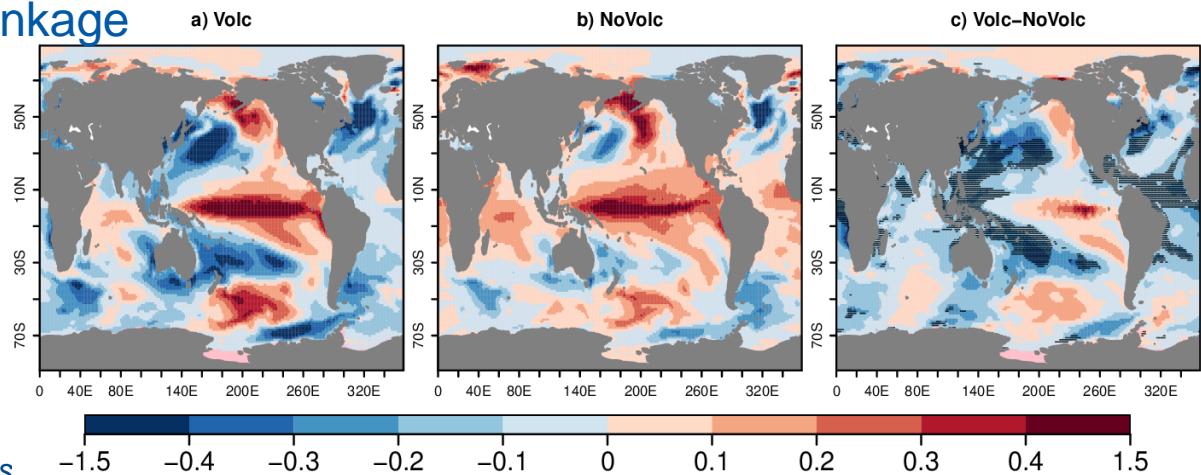


25-member ORCA1L75 NEMO3.6 reanalysis forced by perturbed DFS5.2 fields and assimilating ESA CCI sea ice concentration

## Volcanic eruptions - ENSO linkage

Mean SST anomaly the first forecast year following the Agung (1963), El Chichon (1982) and Pinatubo (1991) eruptions in EC-Earth2.3 decadal hindcasts, a) including the volcanic forcing (Volc), b) not including the volcanic forcing (NoVolc) and c) difference (volc-NoVolc). The stipling indicates the differences that are statistically significant.

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- Contact Laurent and Miguel if you have questions or need help with some local organisation aspects.
- A large meeting (RDA plenary) is organised simultaneously by the BSC.

**Welcome to Barcelona**