

# My Projects

- 1) Spurious diapycnal mixing in fixed vertical coordinate models
- 2) HYCOM wetting and drying
- 3) Upper ocean dynamics in the Bay of Biscay

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- 1) with Eric Chassignet
- 2) and 3) with Rémy Baraille and Yves Morel

SHOM, Toulouse

LOMW 2011, Miami



# 1) Spurious diapycnal mixing in OGCMs



- A numerical ocean model needs to be able to **accurately represent the observed ocean interior mixing**
- Ocean interior mixing is however very **weak** ( $\sim 10^{-5} \text{ m}^2/\text{s}$ )
- Numerical truncation errors can in some cases induce mixing that is larger than observed
- Large levels of numerical mixing can be generated via internal wave propagation



# 1) Spurious diapycnal mixing in OGCMs

## Objectives

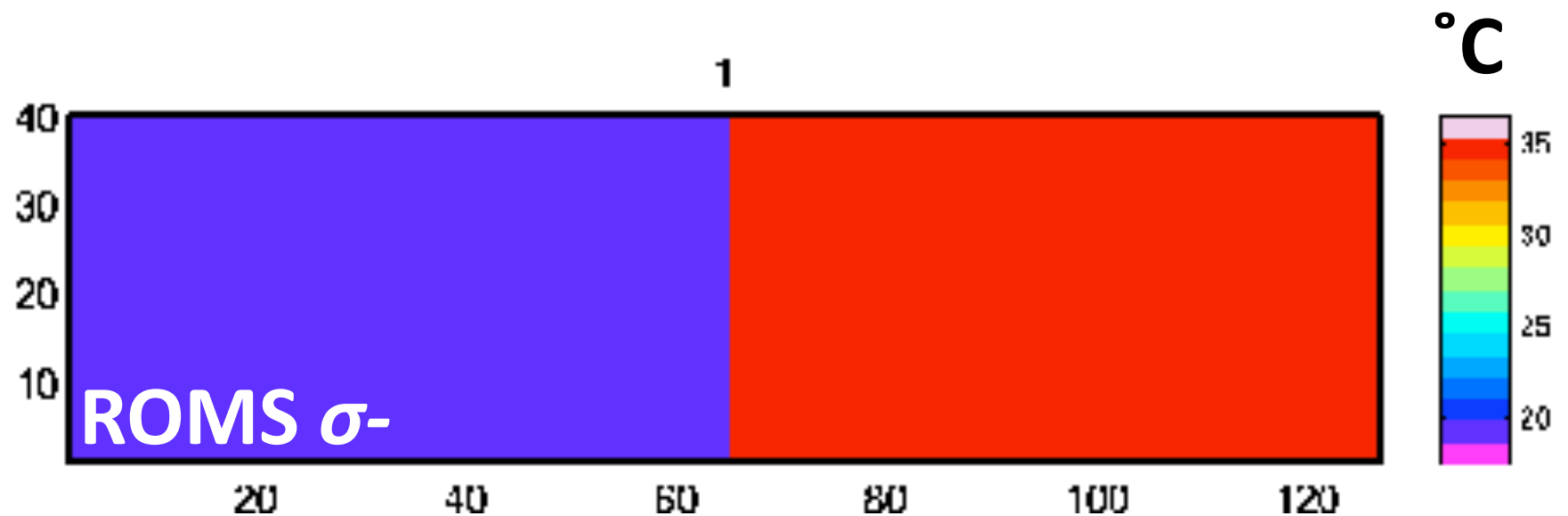
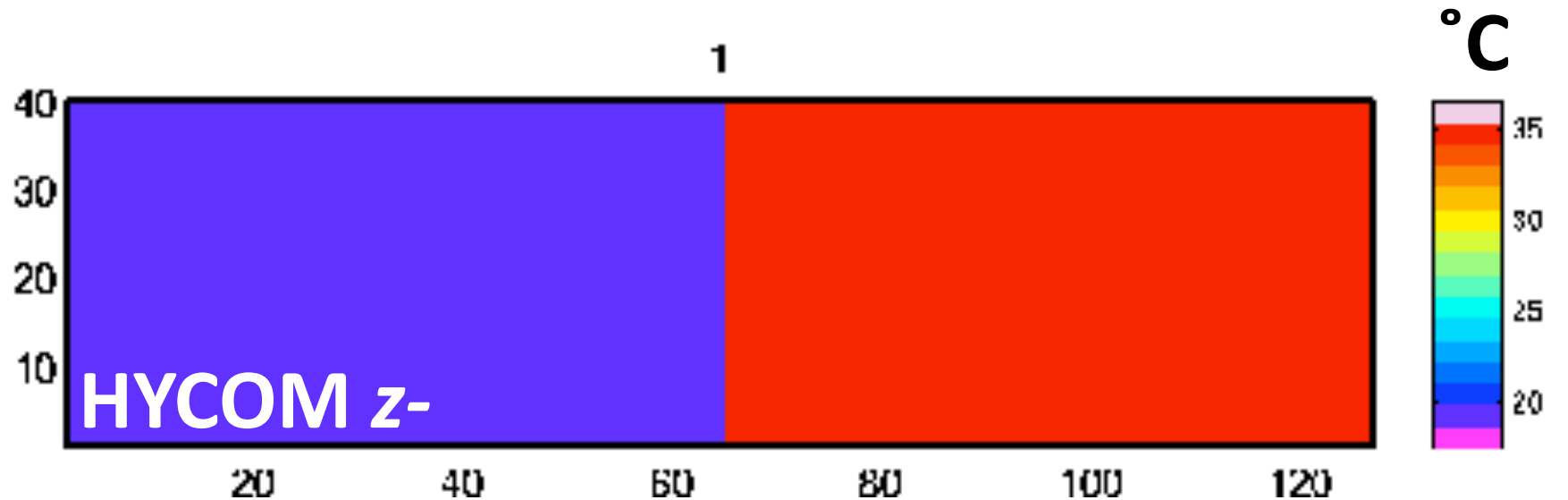
- **Document the magnitude** of the spurious (i.e., numerical) diapycnal mixing induced by the propagation of internal waves
- Show the **impact of the model resolution and the choice of the advection scheme** on the magnitude of the spurious mixing

## Approach

- **Multi-model** (HYCOM, ROMS, MITgcm) study using **idealized scenarios under adiabatic conditions** (lock exchange, internal wave)
- Use of **tracer flux method** (*Winters and D'Asaro, Griffies*) to compute diapycnal diffusivity

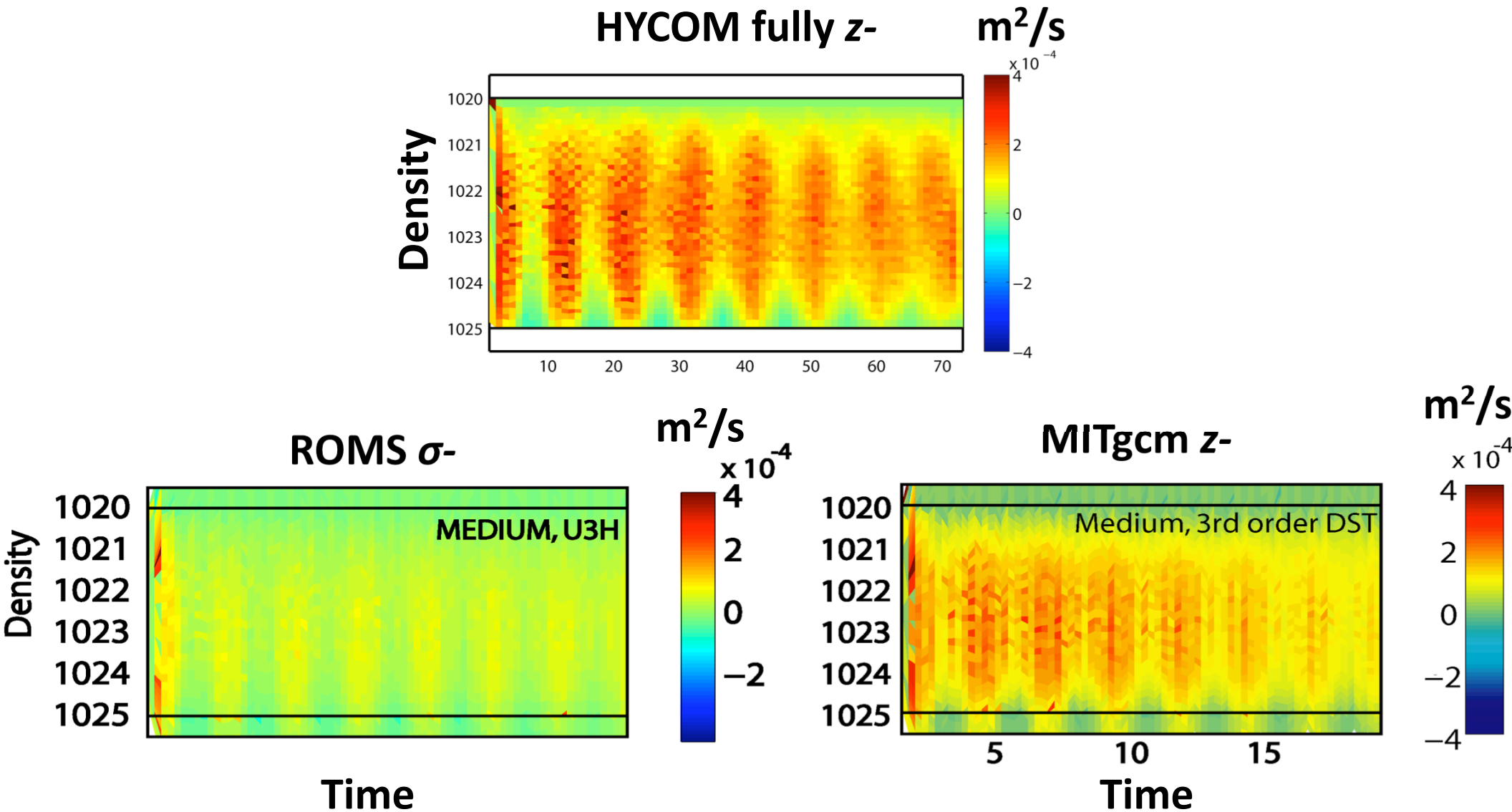
# 1) Spurious diapycnal mixing in OGCMs

## Temperature field animations



# 1) Spurious diapycnal mixing in OGCMs

## Numerical diapycnal diffusivity Hovmöller



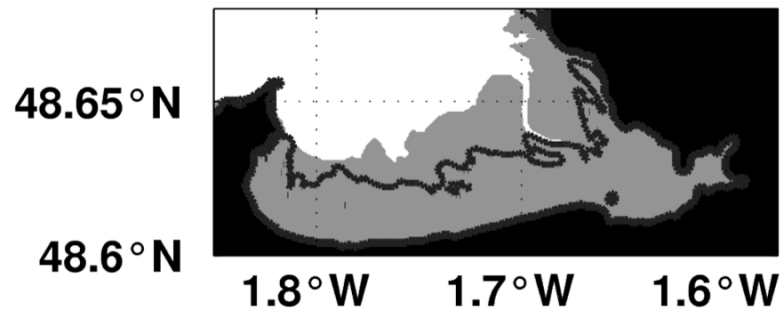
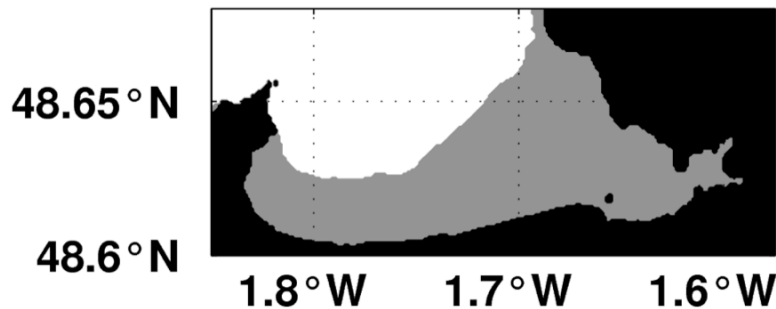
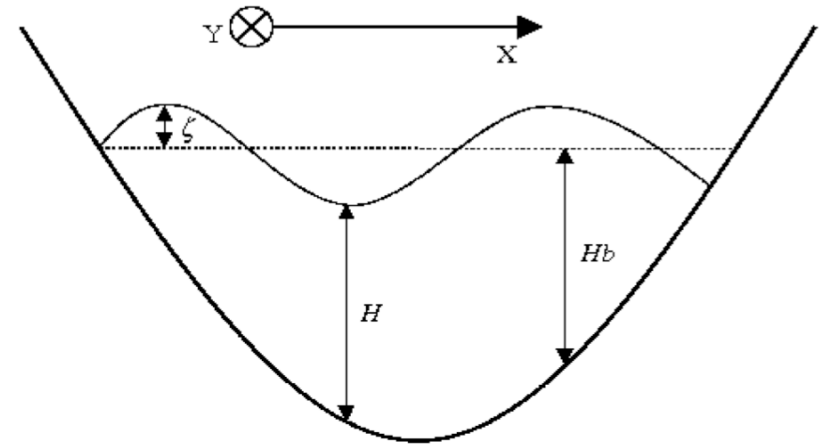
**Gouillon, Chassignet: Internal Wave Propagation and Numerically Induced Diapycnal Mixing in OGCMs. In preparation.**

## 2) Wetting and drying in the HYCOM-SHOM



*Lahaye, Gouillon, Baraille, Pichon, Pineau-Guillou, Morel, 2011: A numerical scheme for modeling tidal wetting and drying. Journ. Geophys. Res. - Oceans. Accepted.*

Water sloshing on a bowl: numerical scheme optimized to accurately reproduce *Thacker's* analytical solution



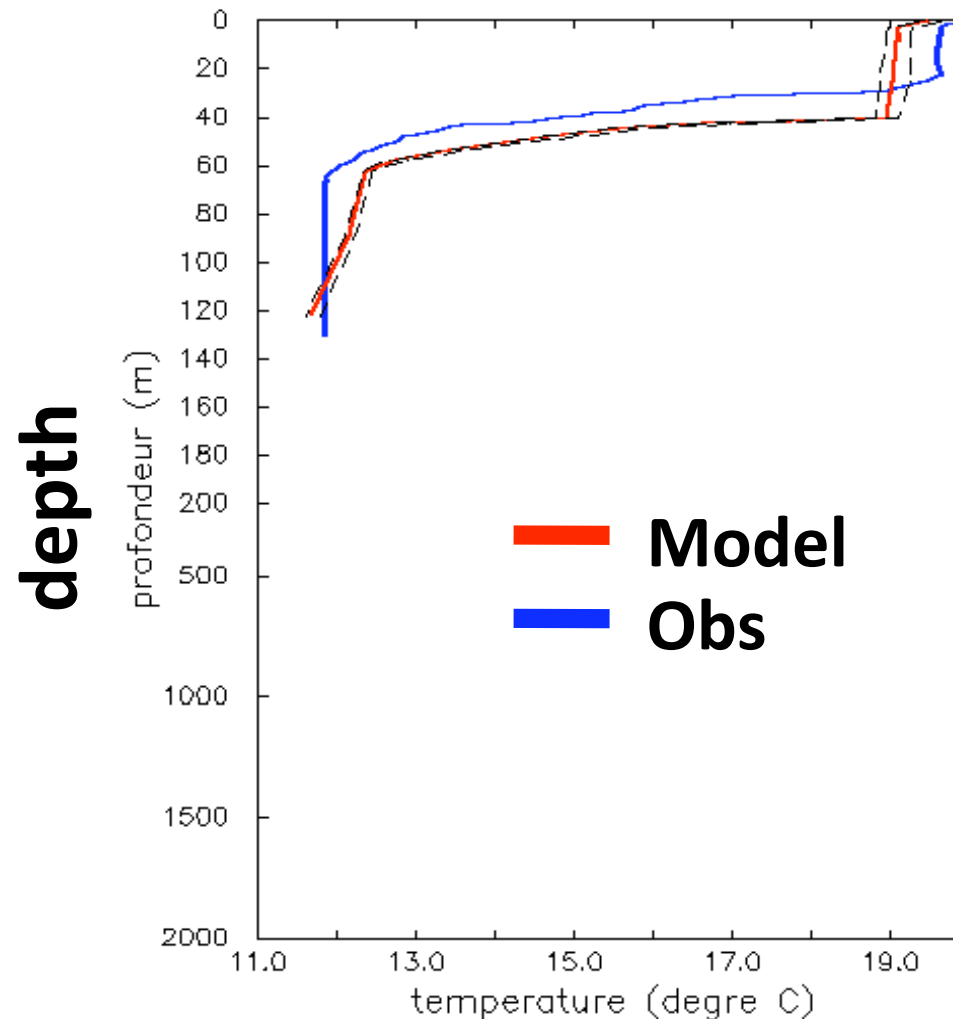
Periodically dry area (gray) simulated/observed by MARMONDE (left) and simulated by HYCOM-SHOM (right) during the 'great' tide of September 1997

## 2) Upper Ocean Dynamics in the Bay of Biscay



Inaccurate representation of the mixed layer depth in HYCOM-SHOM at the end of Summer

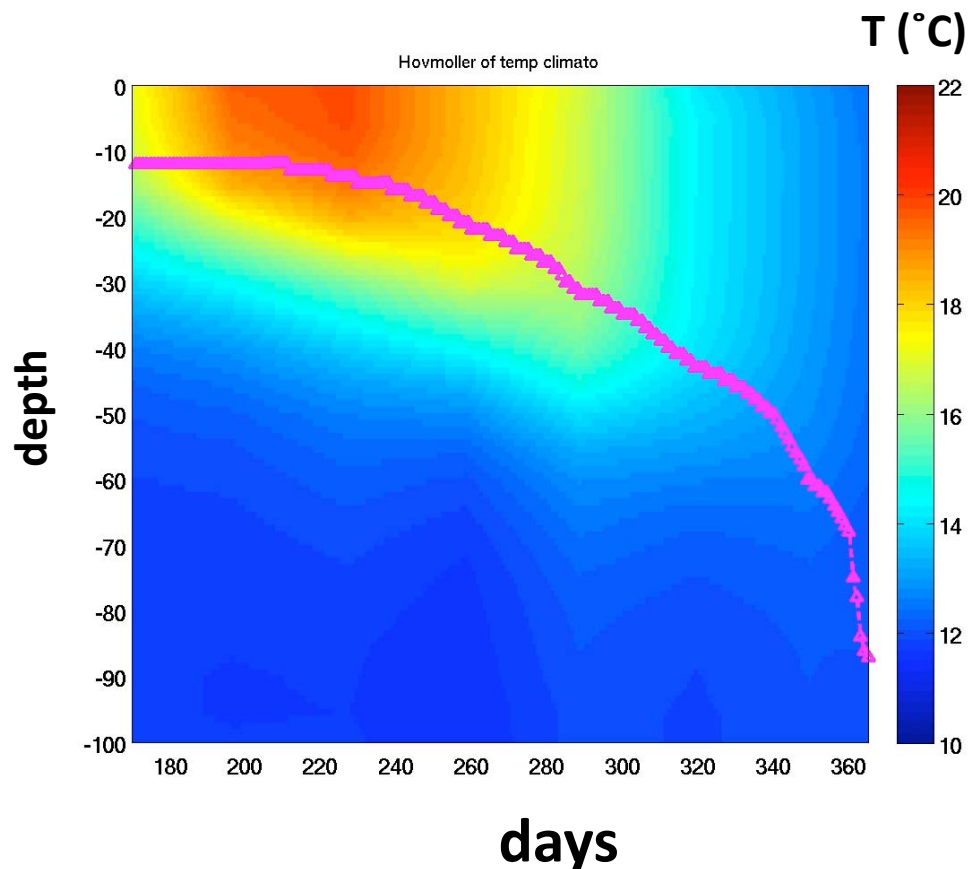
Mooring, 10 September, Bay of Biscay



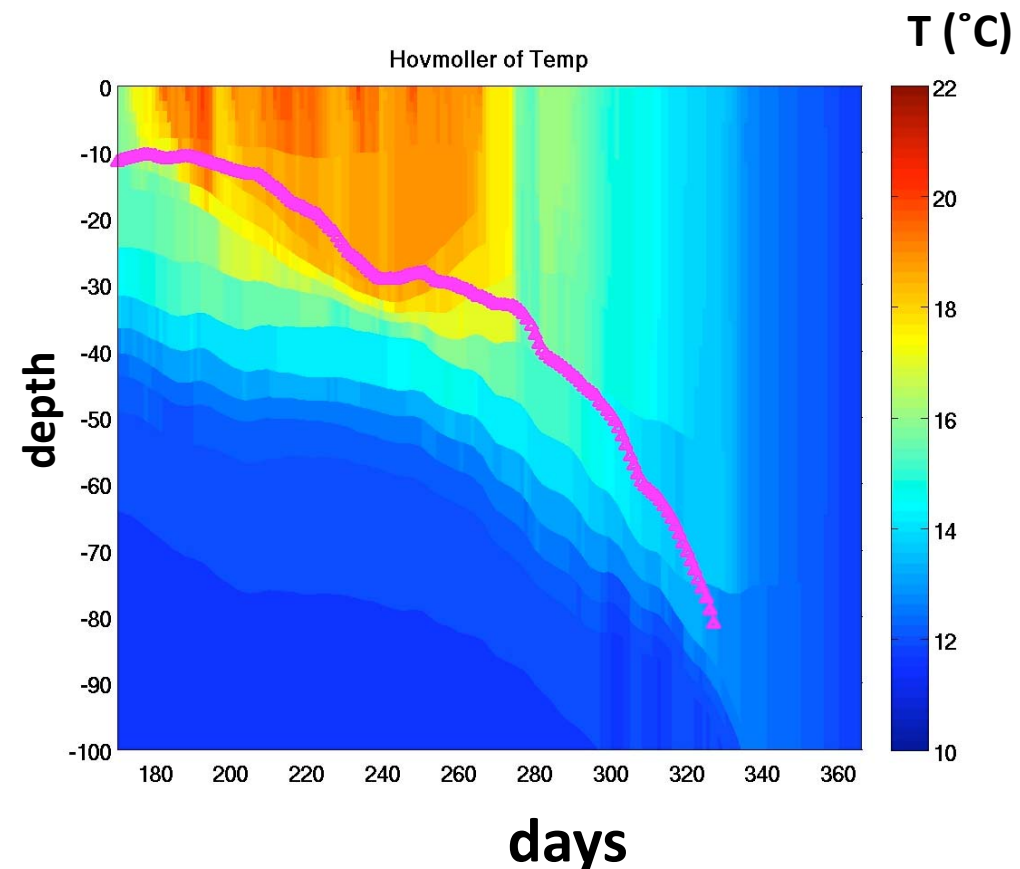
# 2) Upper Ocean Dynamics in the Bay of Biscay

Inaccurate representation of the mixed layer depth in HYCOM-SHOM at the end of Summer

**Climatology**  
(from *Vandermeirsch*)



**HYCOM**

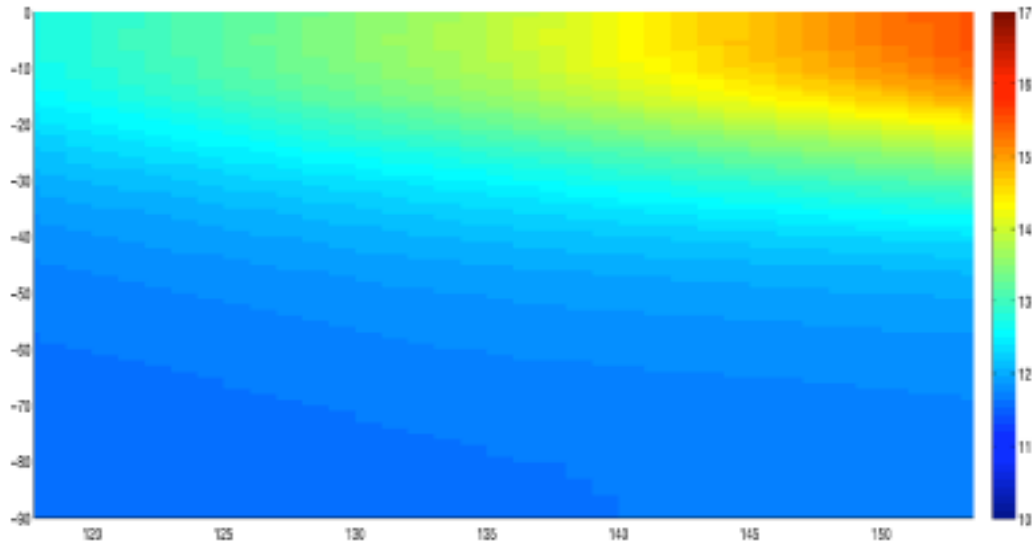


# 2) Upper Ocean Dynamics in the Bay of Biscay

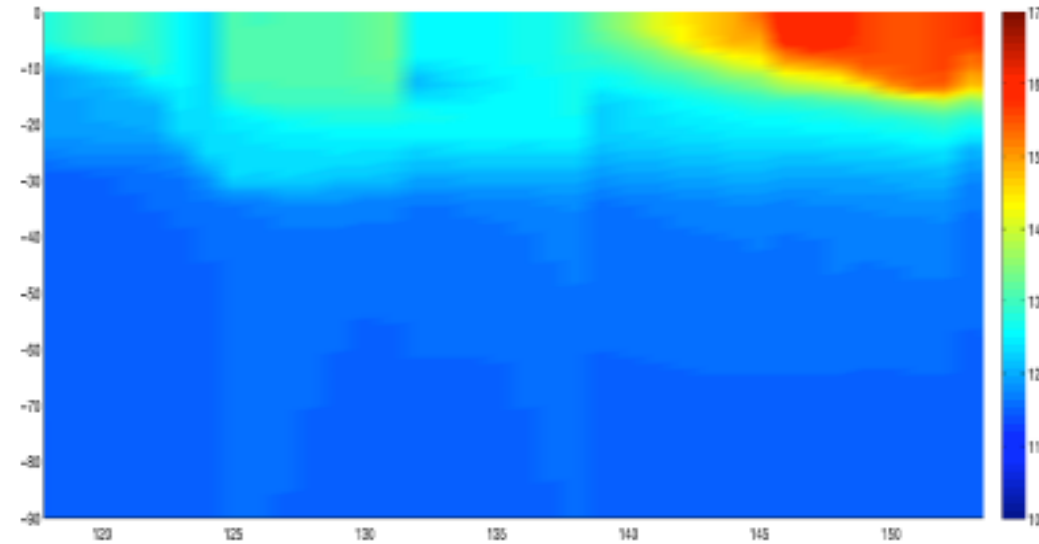


## Comparison between real time simulations and in situ data

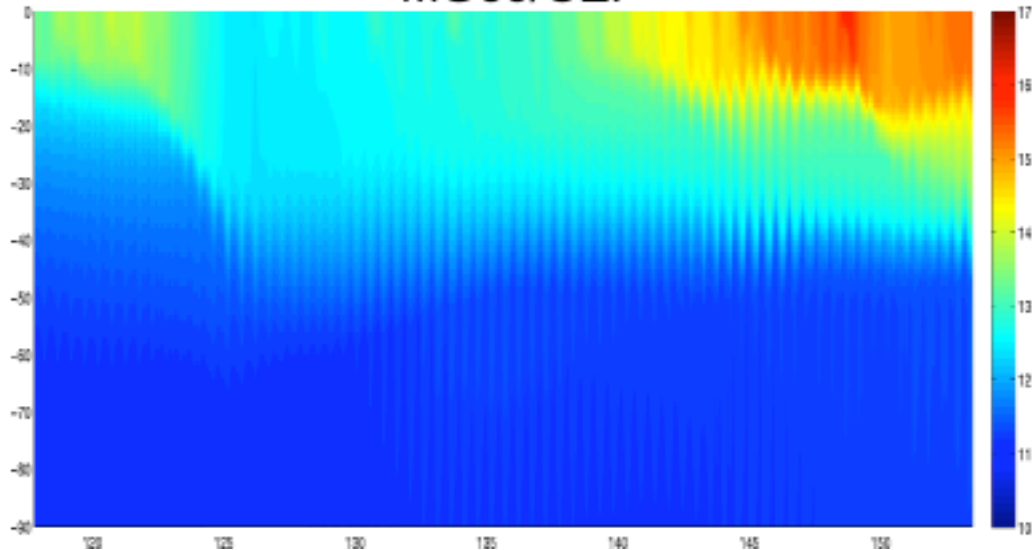
Climatologie Bobyclim



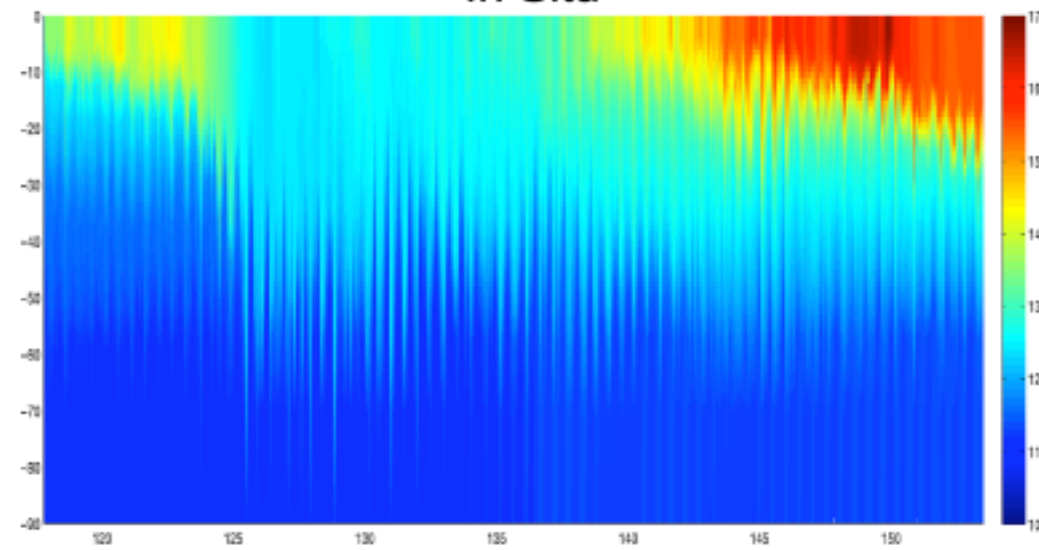
Mercator PSY2V3R1



MG60/CEP



In Situ



## 2) Upper Ocean Dynamics in the Bay of Biscay

### Inaccurate representation of the mixed layer depth in HYCOM-SHOM at the end of Summer

- Can be due to:
  - Forcing?
  - Numerics (model resolution)?
  - Physics of vertical mixing scheme?
- Approach to tackle the problem:
  - Use of observations to better understand MLD variability
  - Idealized simulation (1D)
  - 3D experiments

