

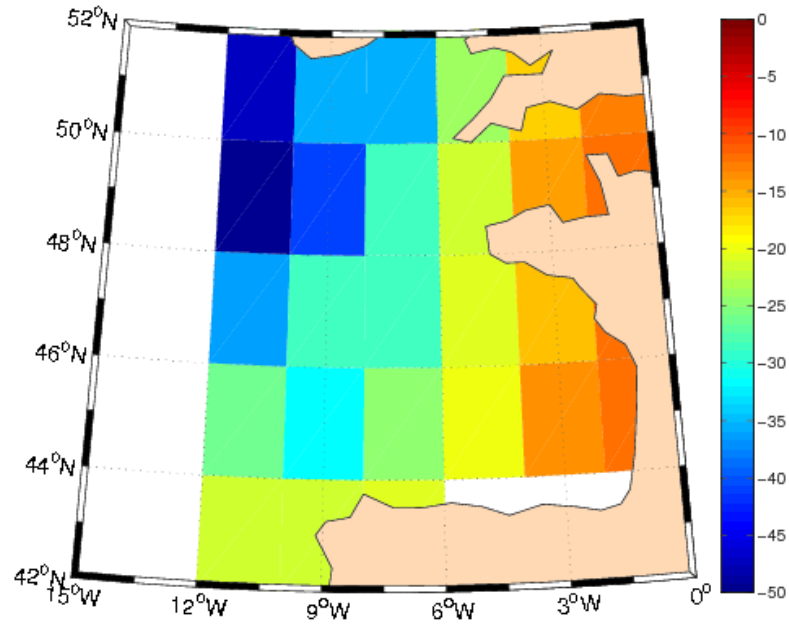
On the mixed layer depth in the Bay of Biscay during Spring/Summer 2010

F. Guillon, Y. Morel, R. Baraille





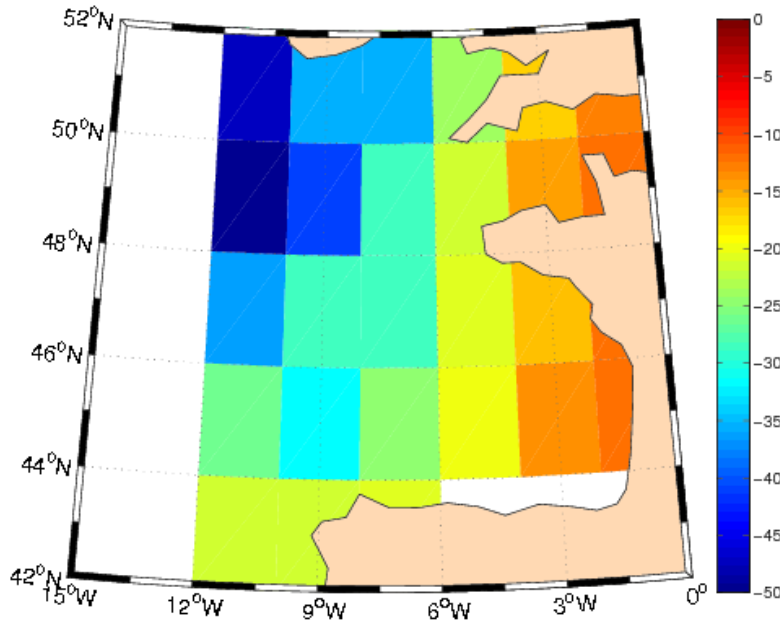
Previous studies / Context



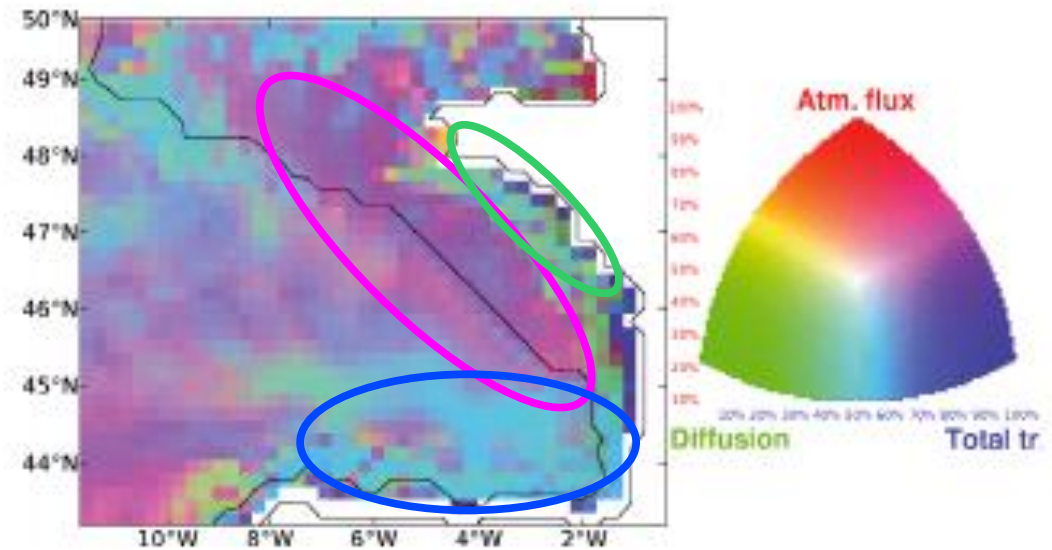
MLD in May determined from a T°C criteria from *Montégut et al. (2004)*



Previous studies / Context



MLD in May determined from a T°C criteria from *Montégut et al. (2004)*



Relative contributions of the 3 major terms to the interannual thermal balance in the 0-200 m layer from 40 years numerical experiments (From *Michel et al., 2009*). Consistent with the results of *Somavilla et al. (2011)*

Mixed layer depth responds to different processes with a highly variable temporal-spatial spectrum

- Influence of global pattern and climate processes (NAO, etc.)**
- No influence of Atmospheric forcing on the warm pool?**
- No influence of the mixing at the continental slope/shelf?**



Open questions and Motivation

- It is not clear what is the contribution of each processes on determining the mixed layer depth in the Bay of Biscay
- Validation of our operational model (Hybrid Coordinate Ocean Model)
- This study pursue the *Michel et al. (2009)* and *Somavilla et al. (2011)* studies but focuses on re-stratification periods
- MLD climatology of the Bay of Biscay
- Importance of an accurate simulated MLD for coupling with biogeochemical models



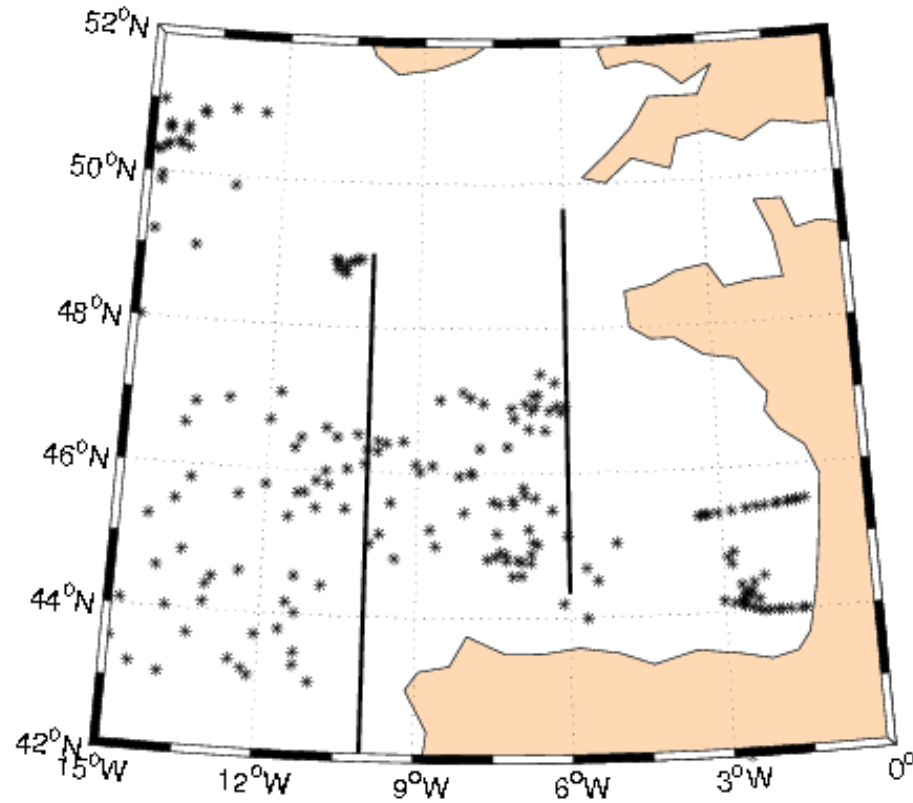
Methodology / Outline

- Set of observations (climatology from *F. Vandermeirsch*, Coriolis database)
- Set of numerical experiment with the Hybrid Coordinate Ocean Model (HYCOM):
 - I. Realistic experiment (reference)
 - II. No advection experiment
 - III. No advection but using currents from the realistic experiment on the vertical mixing scheme
- Determine the MLD with a complex criterion from *Lorbacher et al.* (2006) based on the shallowest extreme curvature of density/temperature profile
- Validate the reference experiment
- Compare the MLD results of each experiments



Observations

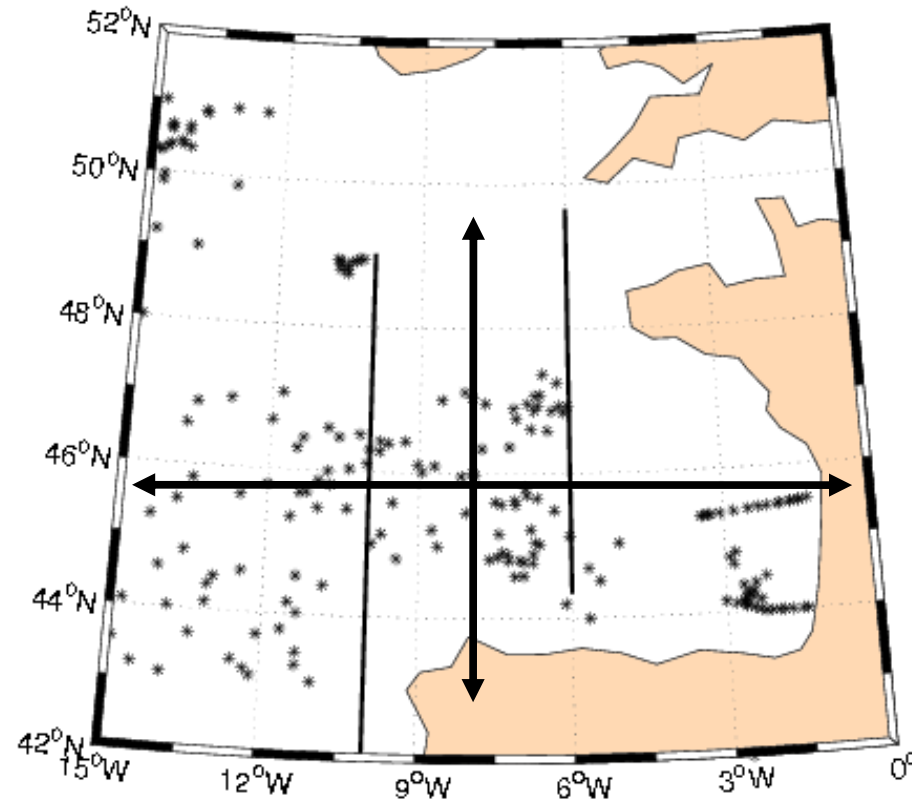
Coriolis data (May to September, ~200 obs) and Mouton Campaign (May)





Observations

Coriolis data (May to September, ~200 obs) and Mouton Campaign (May)



Directional gradients of the different fields will be captured to see trends and global patterns



The BobbyClim MLD climatology (Vandermeirsch)

from raw data, no Objective Analysis

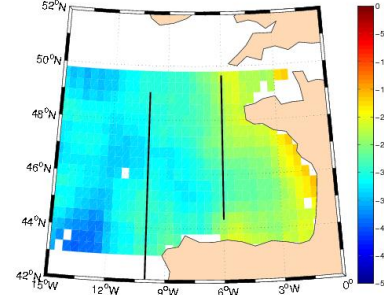
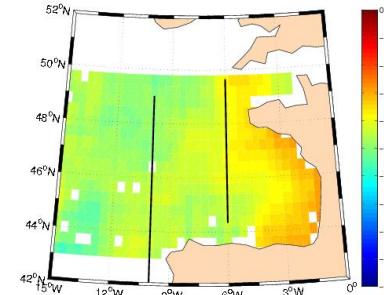
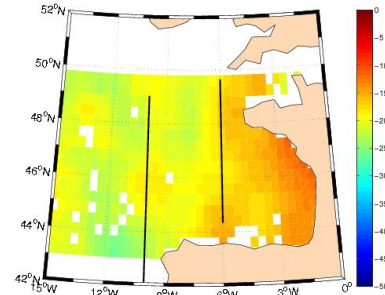
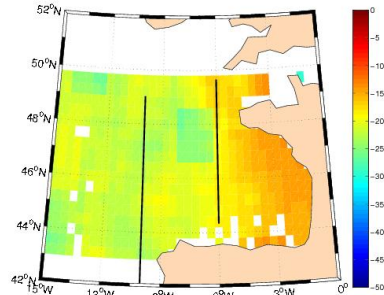
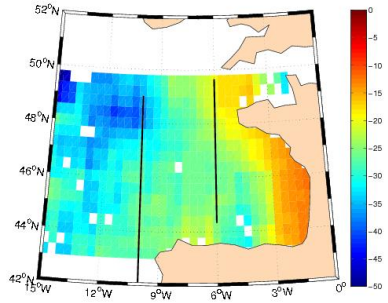
May

June

July

August

September



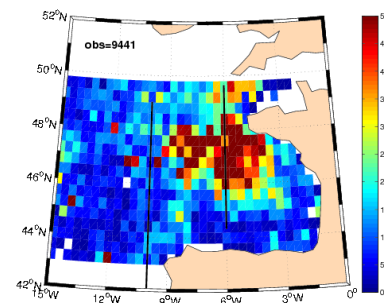
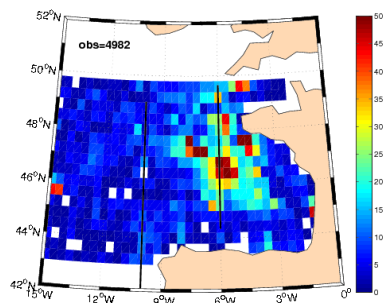
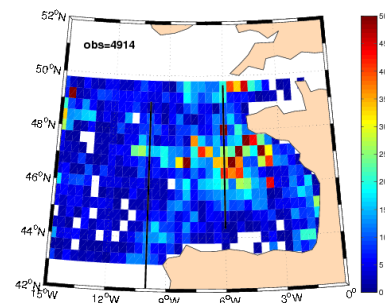
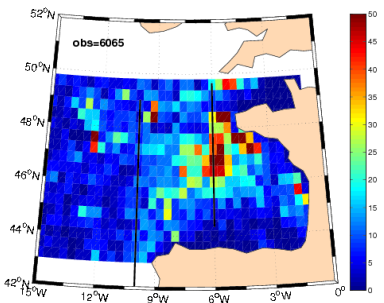
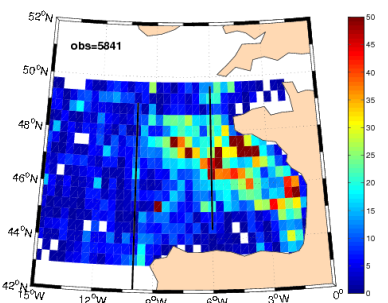
5841 profiles

6065 profiles

4914 profiles

4982 profiles

9441 profiles



East-West pattern

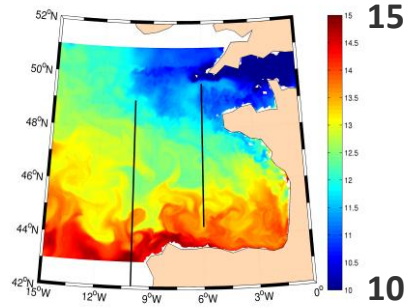
Weak variability of the MLD during J/J/A



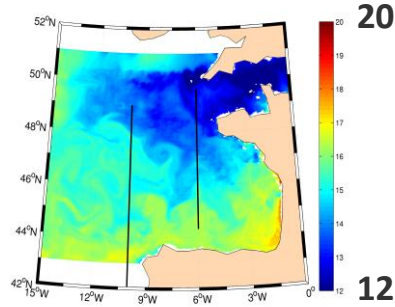
HYCOM SST and MLD climatology

Model SST, Snapshot on the 15th

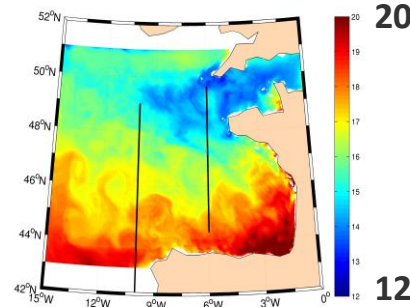
May



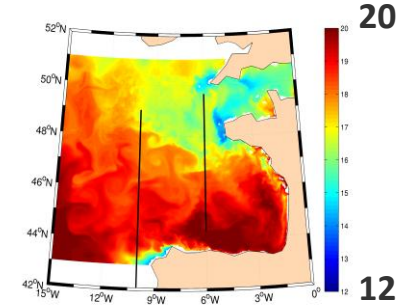
June



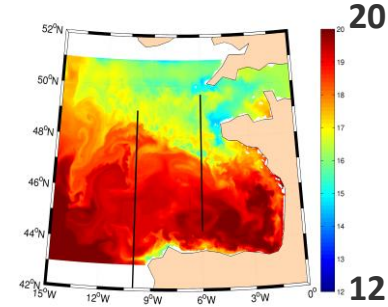
July



August



September





HYCOM SST and MLD climatology

Model SST, Snapshot on the 15th

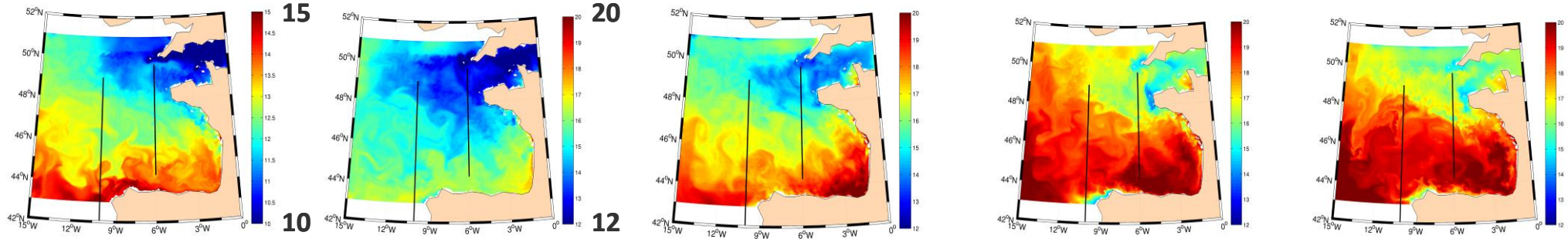
May

June

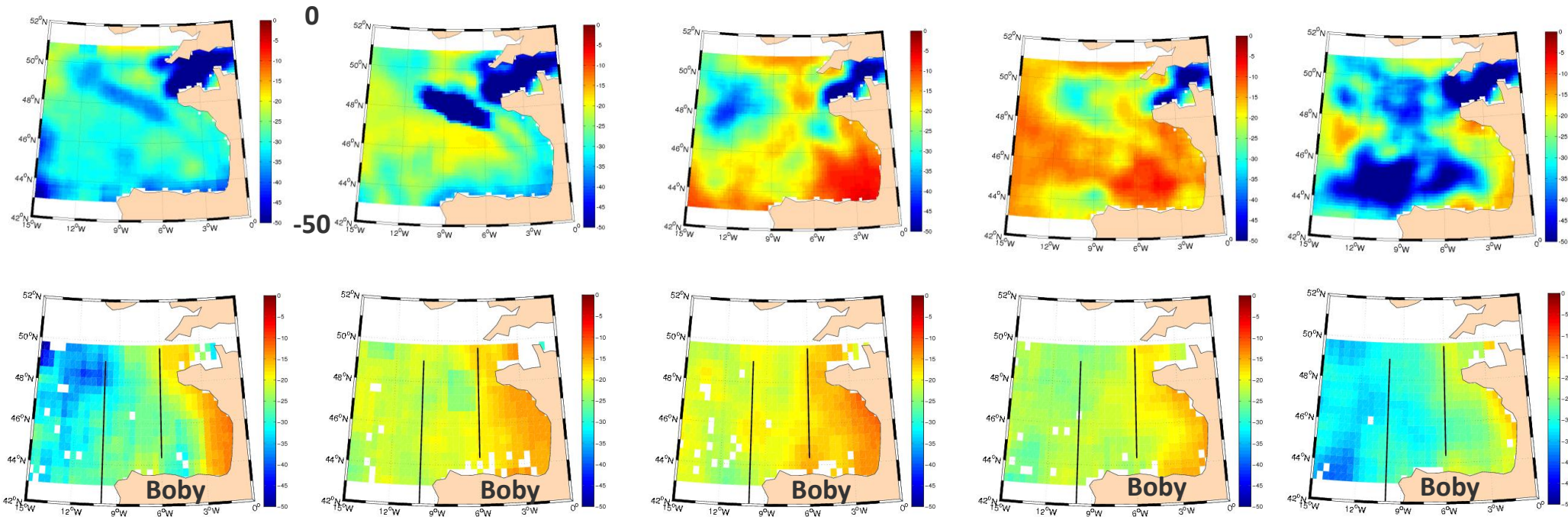
July

August

September



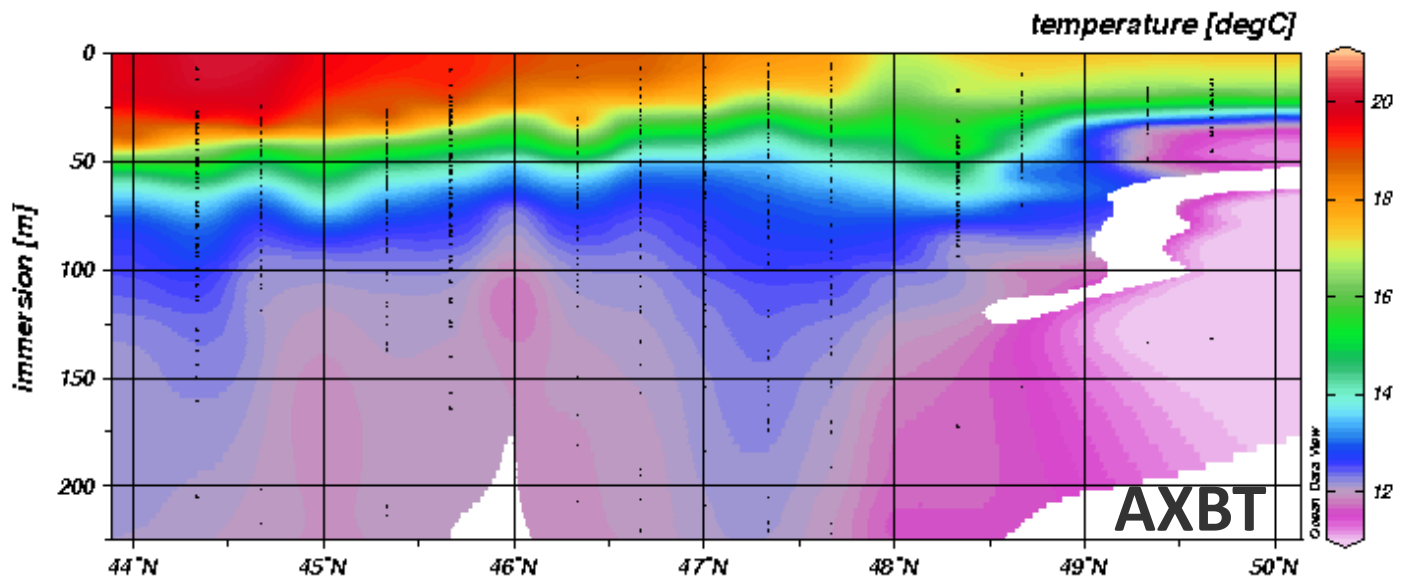
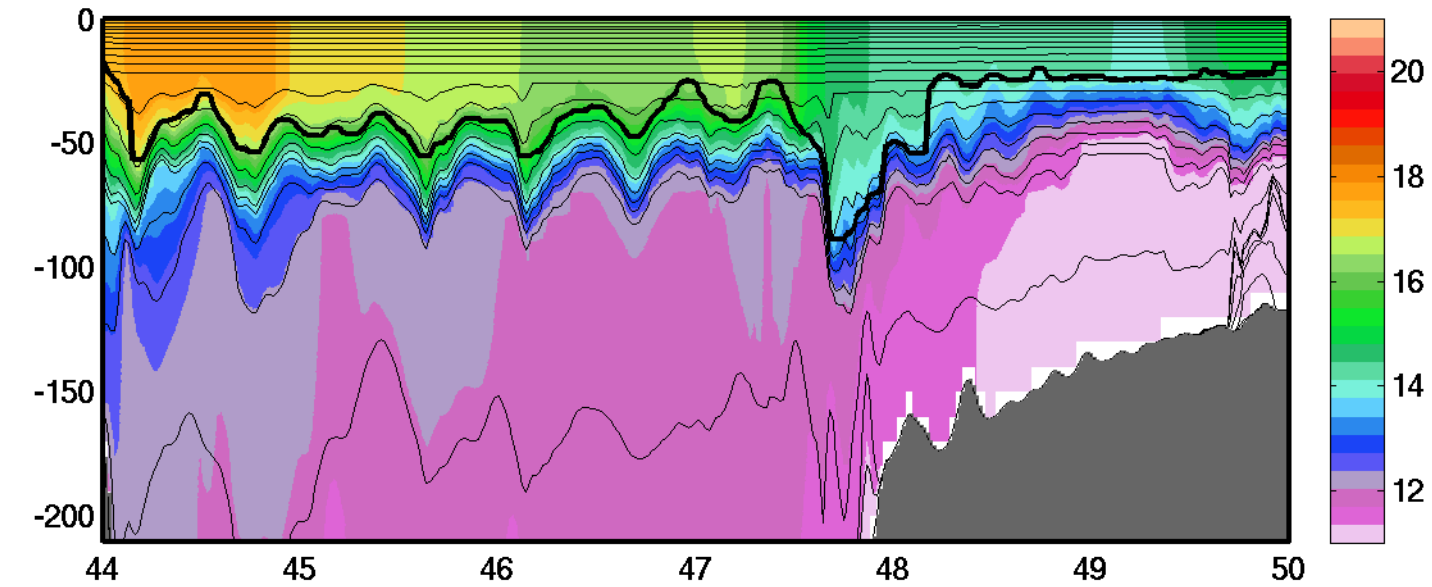
MLD (15 days averaged)





HYCOM – Section

July



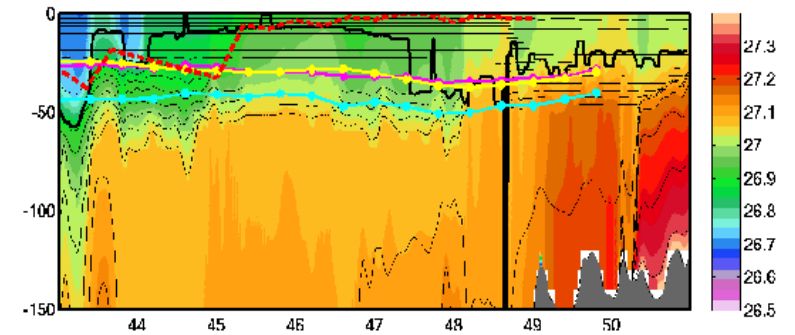
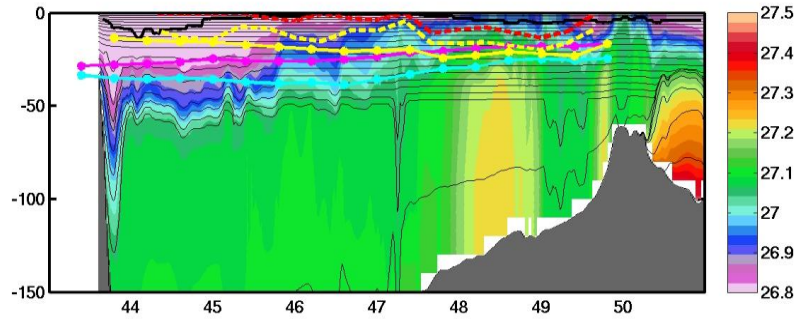


HYCOM – Section

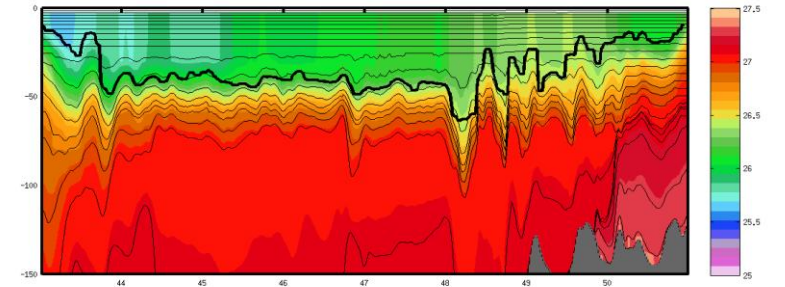
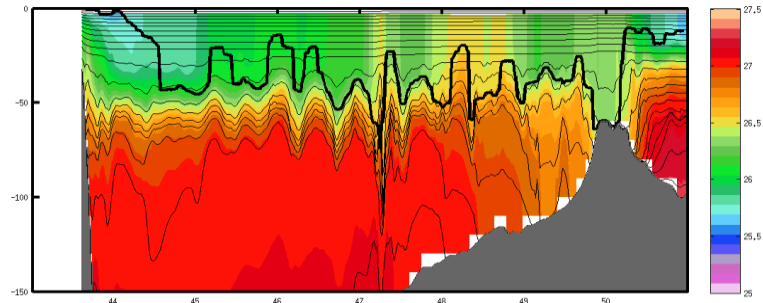
6W

10W

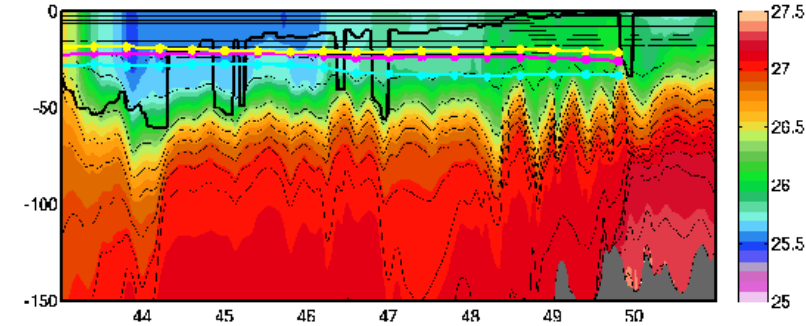
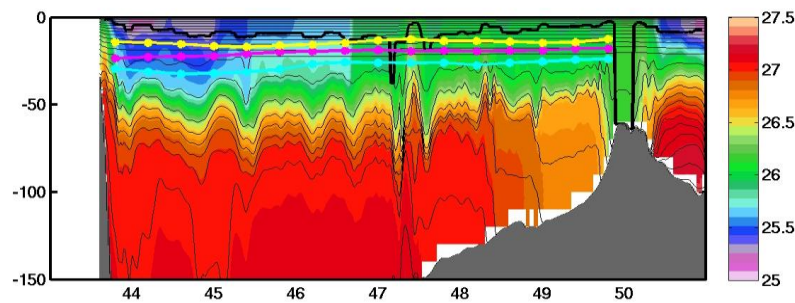
May



July



August



AXBT Lorbacher



AXBT T°C



Model Lorbacher



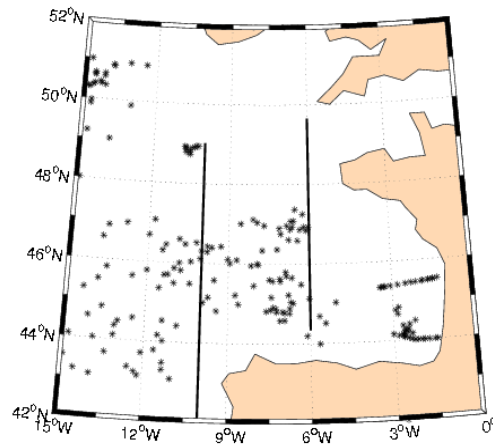
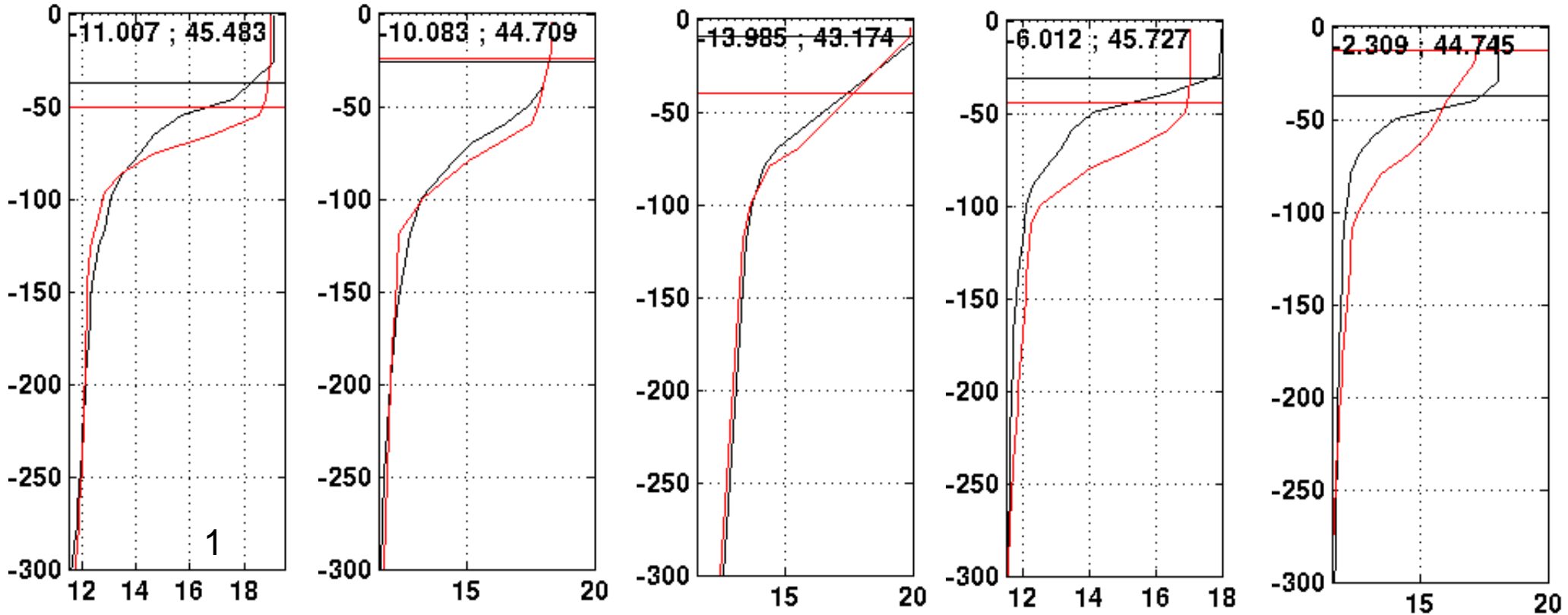
Model Lorbacher (MLD max)



BobyClim

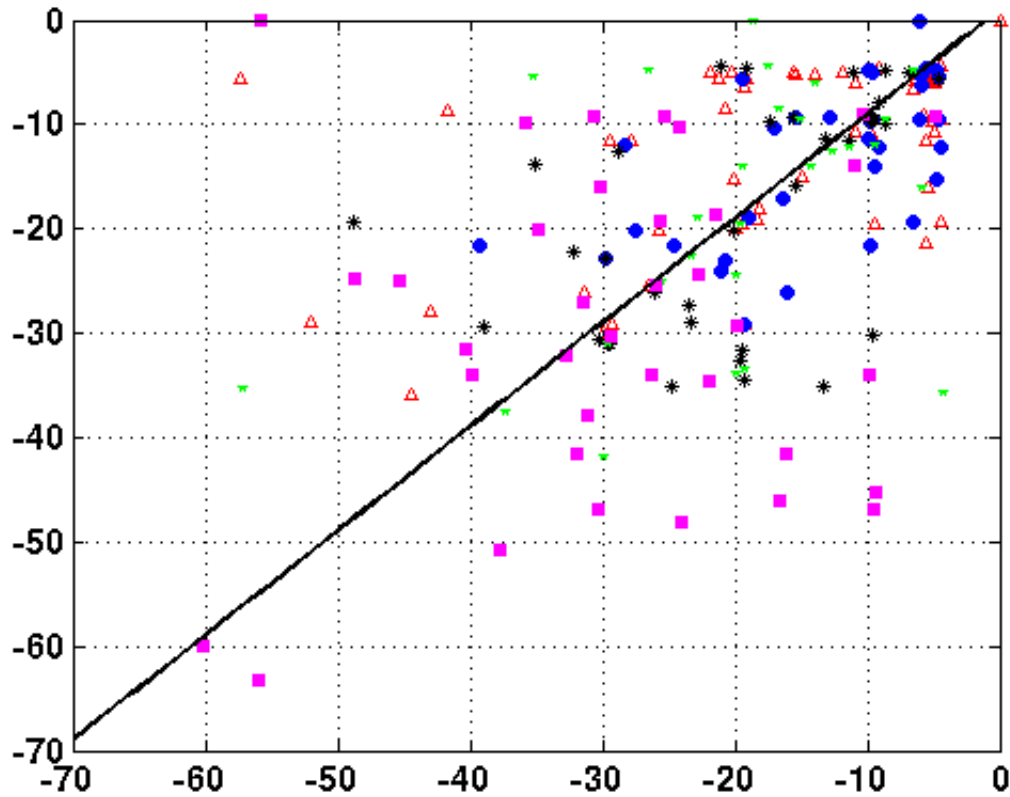


HYCOM – MLD comparison to profiles





HYCOM – MLD comparison to profile



May

June

July

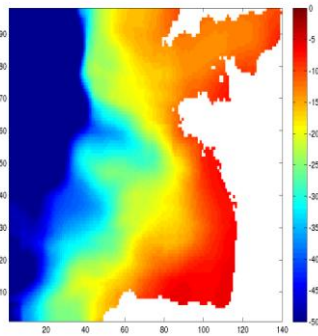
August

September

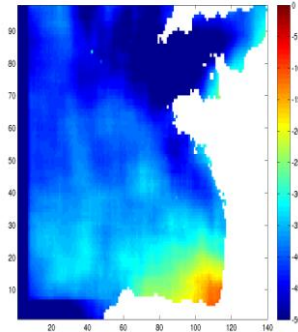
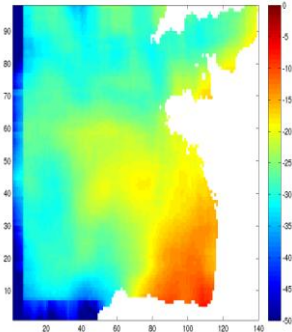
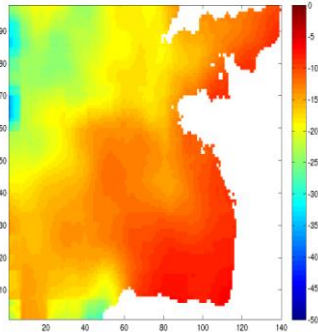


Perspectives

- Isolating the different processes that contributes to the MLD variability and dynamics:
- Numerical experiment that removes the terms of advection in the equation (Ekman circulation that constrains the velocities)
- No advection but “true” mixing via the use of the realistic experiment velocity in the KPP algorithm



May



August





Take home messages

Strong sensitivity of the MLD to the choice of the criterion (temperature? Density?)

MLD in the Bay of Biscay exhibits strong geographical pattern (East-West)

It is possible to determine which process contributes to the deepening of the MLD