# The Atlantic Ocean main pycnocline from Argo data


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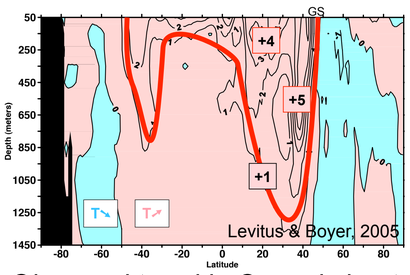
## Outline


At mid-latitudes, the oceanic vertical structure of density is characterized by a permanent highly stratified layer: the pycnocline. The pycnocline is the transition layer between surface water masses ventilated every winter when penetrated locally by the mixed layer and deeper water masses which have been ventilated at high latitudes and circulate equatorward. The pycnocline thus reflects a large scale balance between the penetration of local air-sea interactions and the re-emergence of remote ones.

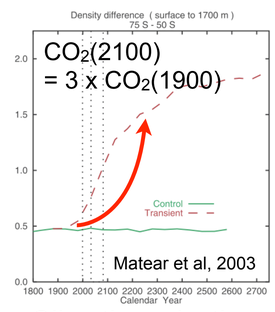
The overall question we want to address is to which extent the variability of the pycnocline properties (depth, thickness and thermohaline characteristics) are influenced by those of air-sea interactions.

To this end, we first developed a new method to characterize the permanent pycnocline properties from Argo data. We then applied this method to study the pycnocline in the subtropical North Atlantic Ocean. Here we present the very first results of this analysis.


## Core motivation



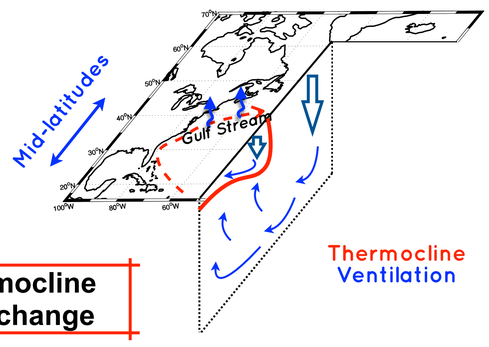

*Observed trend in Oceanic heat content (Atlantic, 1955-2003)*




*Climatic projection of the stratification*

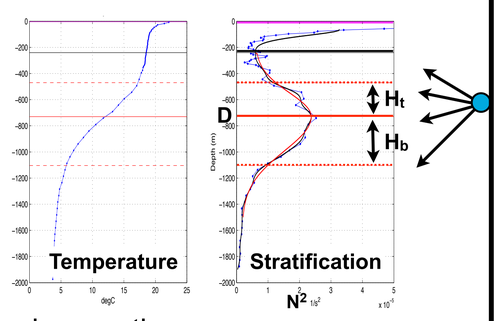
**Oceans warm (past & future)**

**Main thermocline structure change**

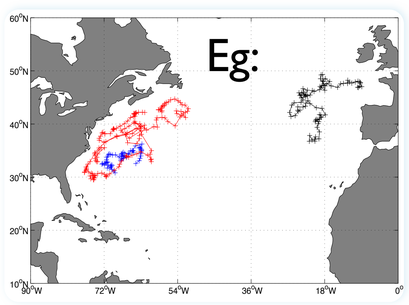


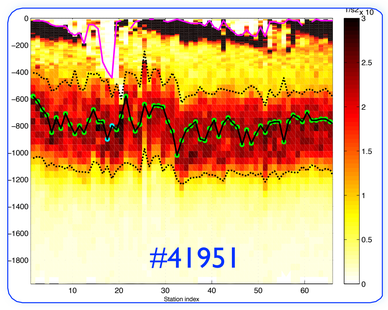

## Objective Method to characterize the pycnocline in Argo profiles

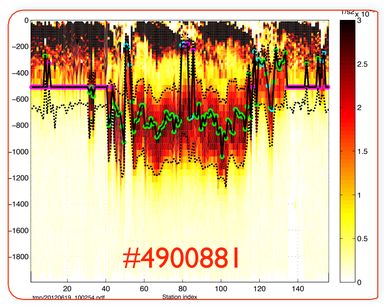
| What we do: | What we get: |
|---|---|
| - Linear interpolation on a regular grid (10m) | |
| - 'Cut' profile below the mixed layer | → Mixed Layer Depth |
| - Smooth profile (scale>50m) | |
| - Find $N^2$ minimum in the top 300 or 500m | → 'Mode water' depth (1st inflexion) |
| - Find $N^2$ maximum below | → Main thermocline depth (**D**) |
| - Fit 2 Gaussian curves above and below | → Main thermocline thickness ($\mathbf{H_t}$, $\mathbf{H_b}$) (asymmetric description) |

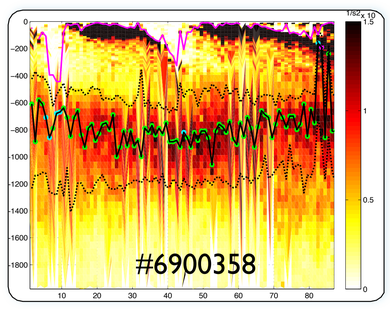



+ Check levels and thicknesses to detect borderline or weird values = QC flag on diagnosed properties

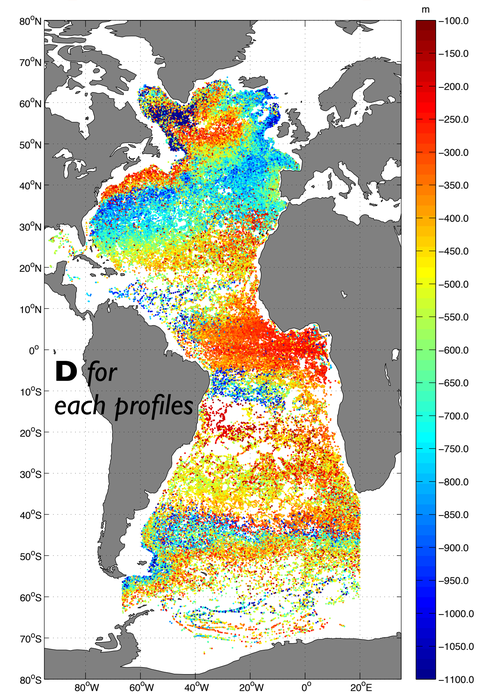


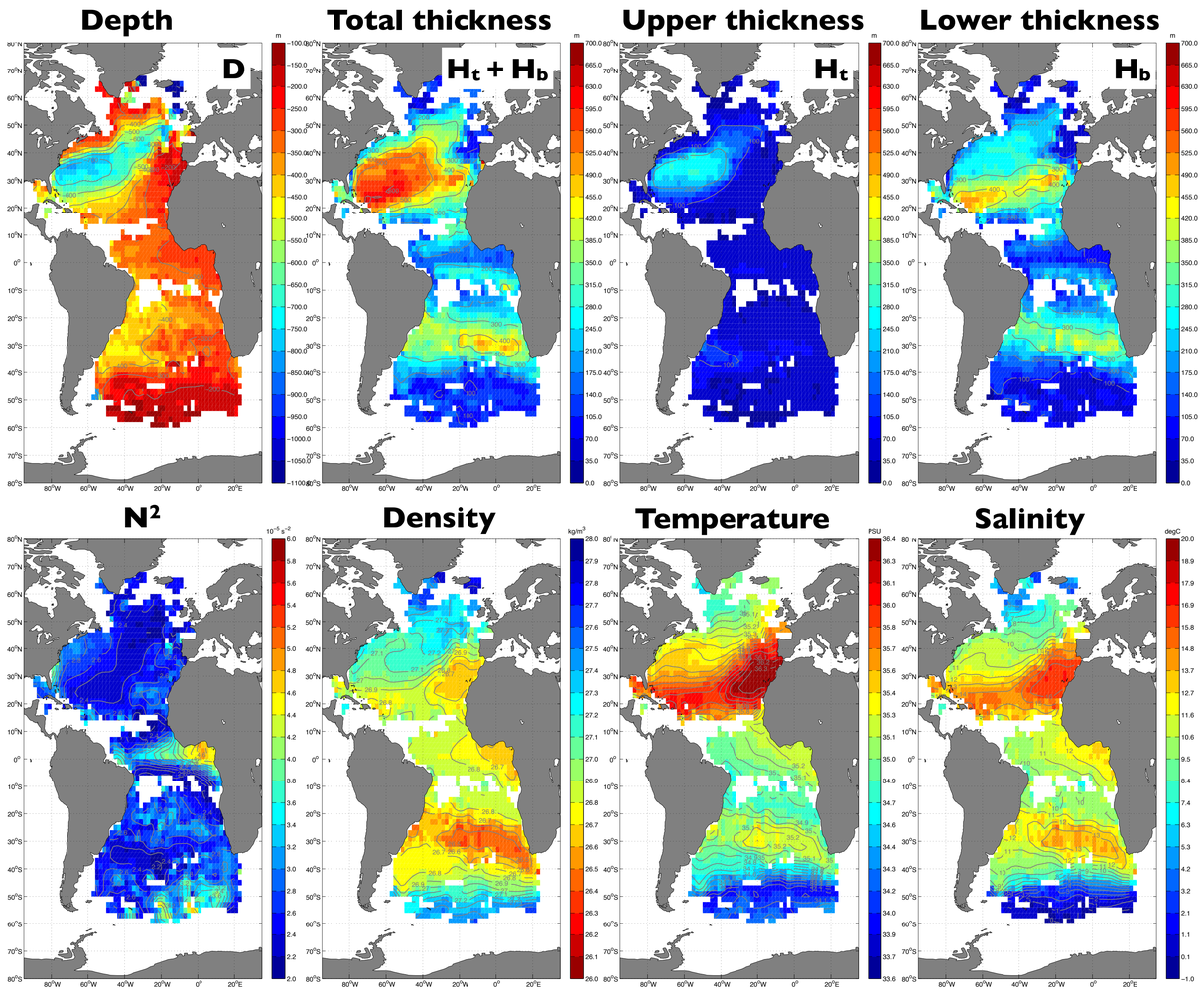




## Pycnocline depth:

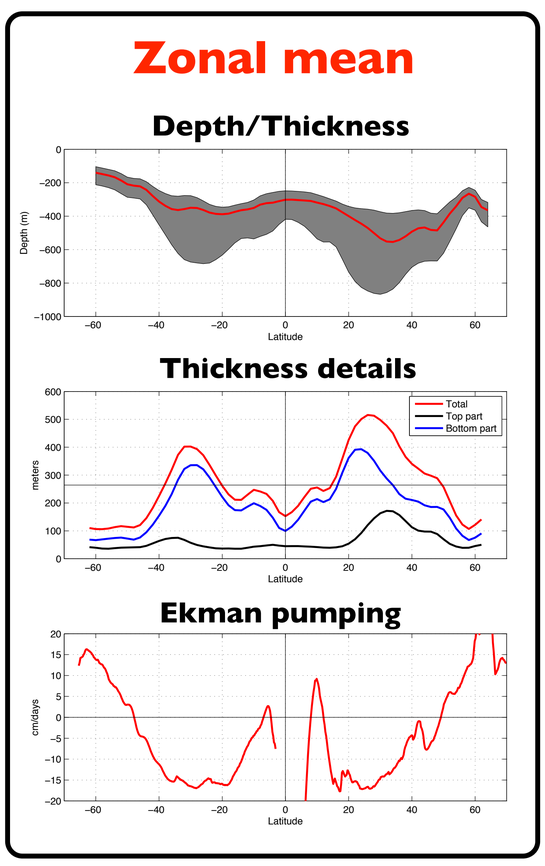



95 497 profiles with a correct QC flag

## Pycnocline mean state estimate



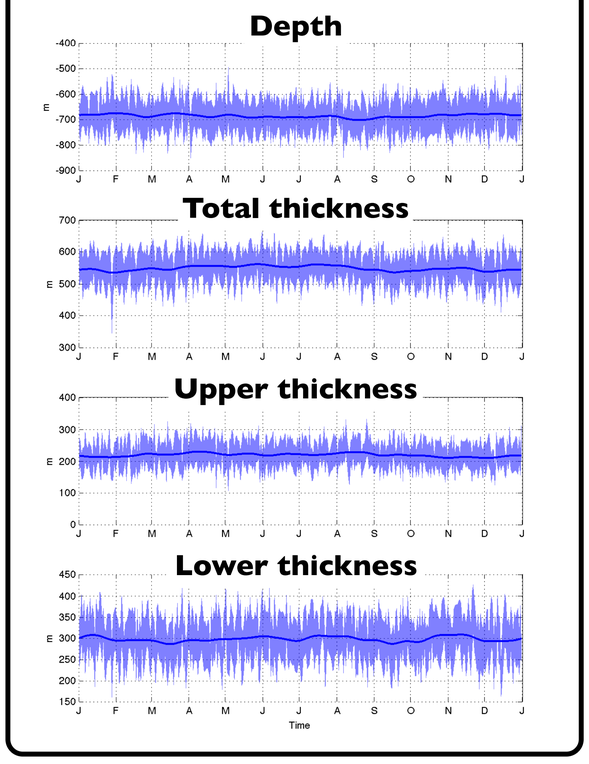

## Zonal mean



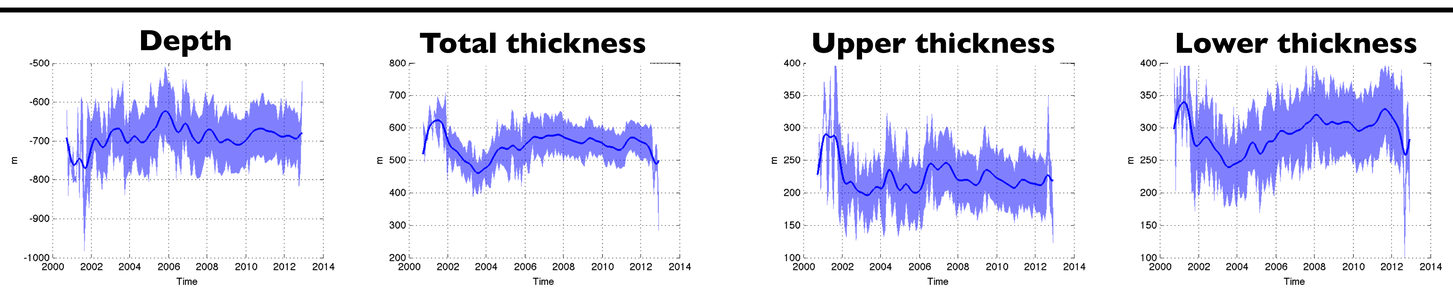

## Seasonal cycle

**Considering the region where $H_t$>100m**

*The core of subtropical pycnocline*




## Interannual variability




## Global Atlas available soon ...

http://guillaumemaze.org/