The Possible Influence of the NAO on the Mediterranean Outflow Water Path in the North Atlantic

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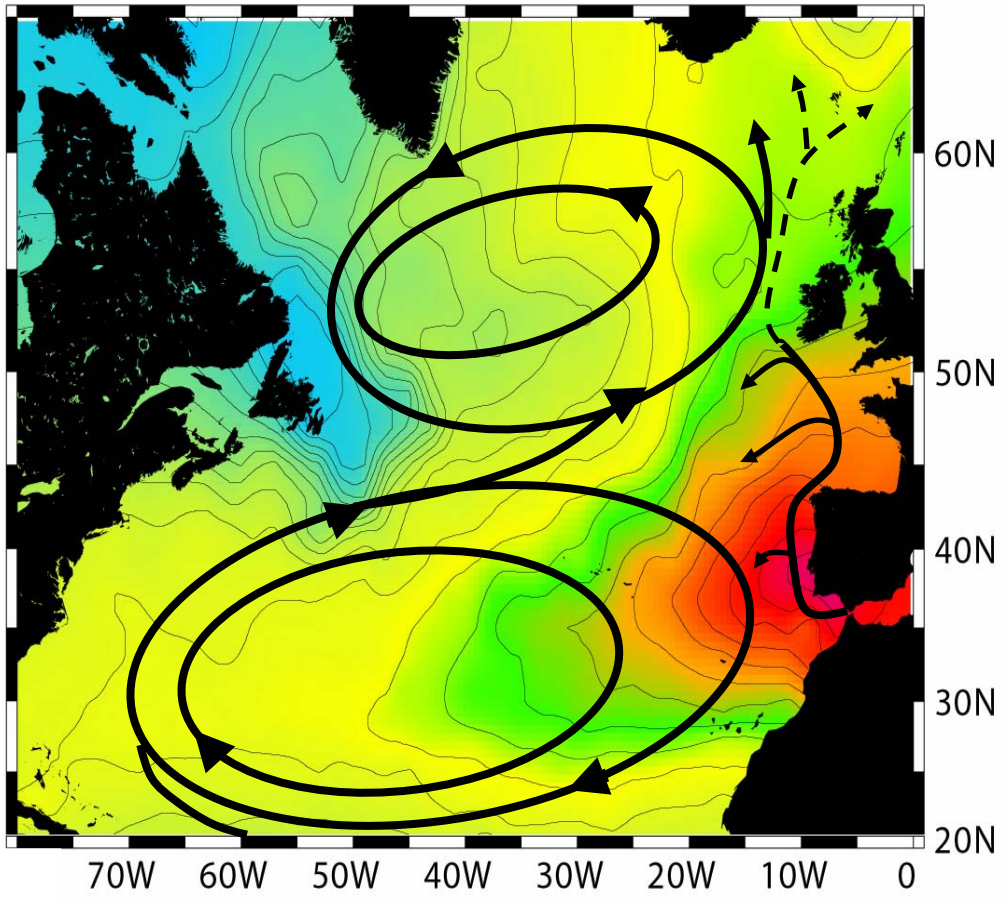
Outline

- Observations
- Parameterization of the MOW tongue in HYCOM
- Results in the 1/3° resolution HYCOM
- Future work

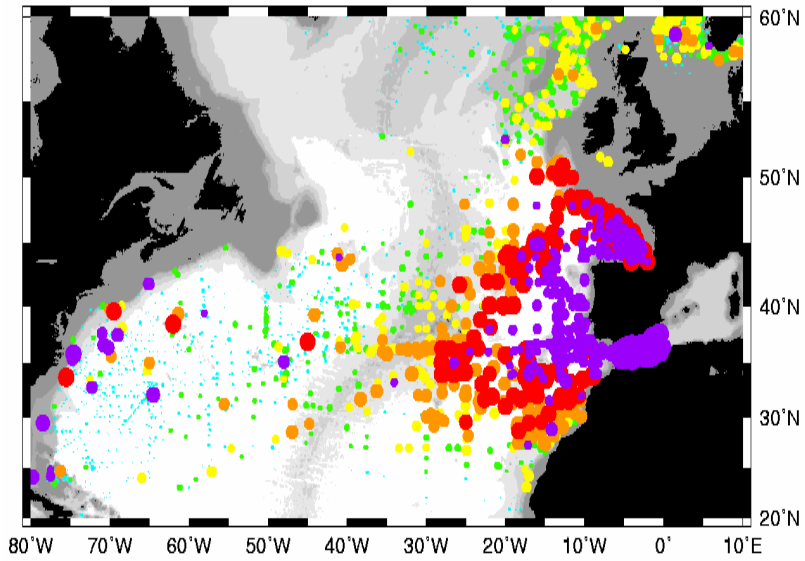
Observations



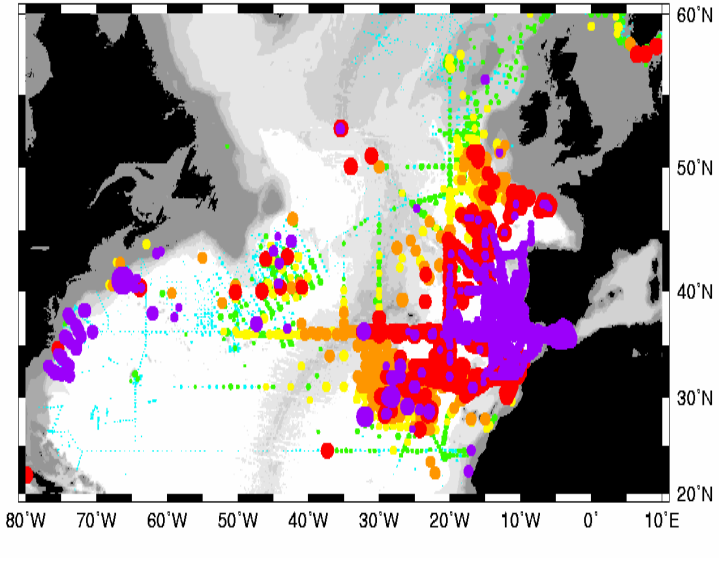
From Lozier and Stewart, 2006

On σ_1= 32.10; at MOW core

NAO- 1960-1969



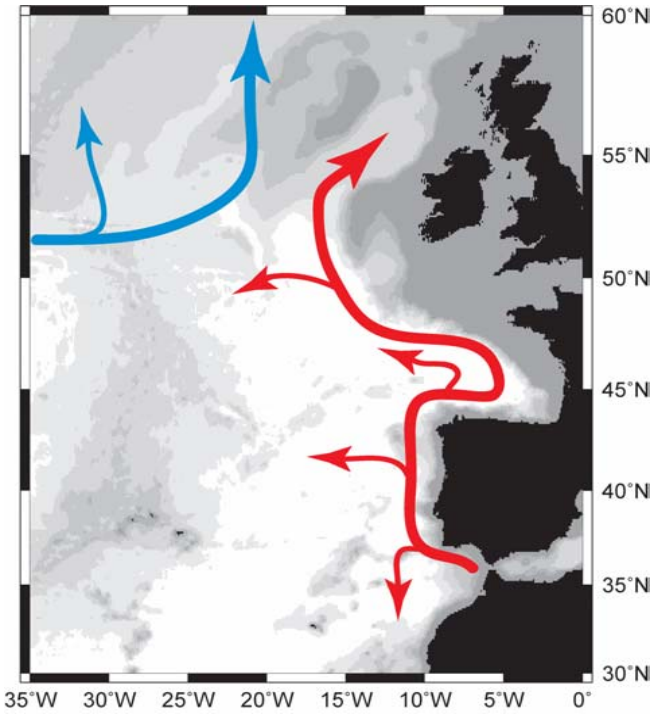
NAO+ 1985-1994



Increasing salinity anomaly

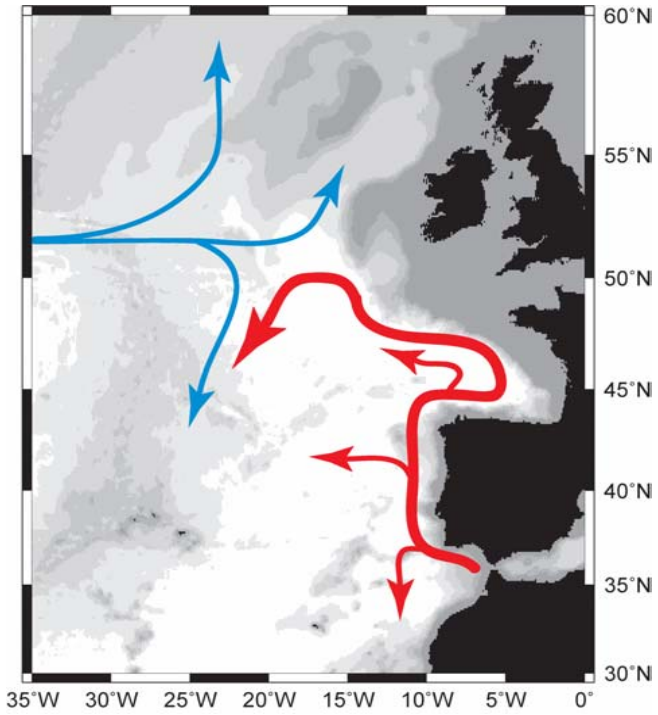
Lozier and Stewart, 2006

Weak westerlies: NAO-



Contraction

Strong westerlies: NAO+



Expansion

Lozier and Stewart, 2006

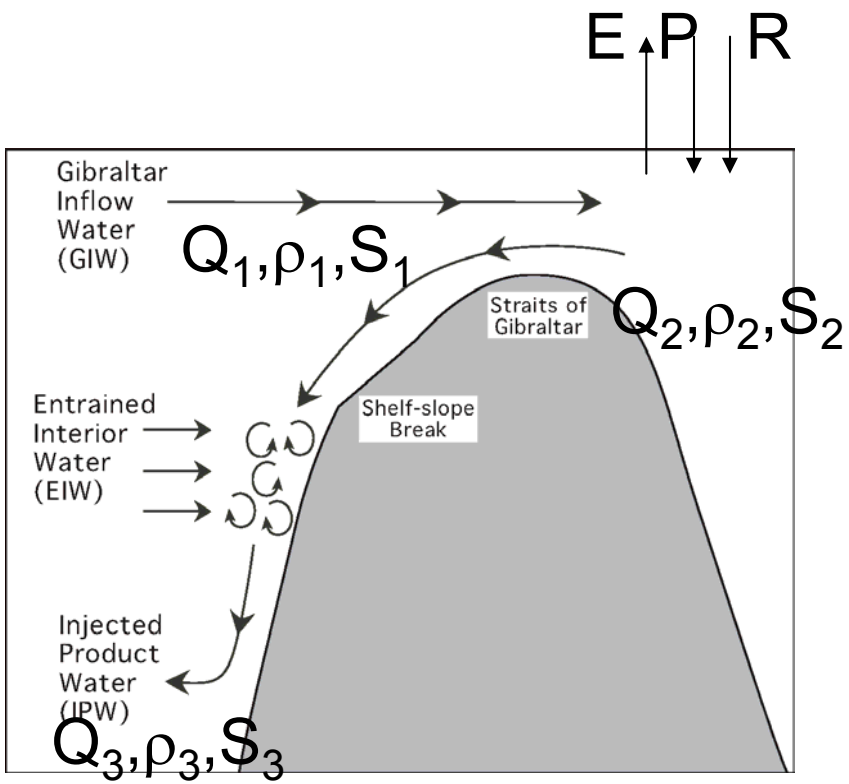
Comparison of the outflow representation in different model resolution of the ATL

- 2° simulation: ATLc2.00 (2deg-PY)
  - Initial state: GDEM3 climatology
  - Forcing: ECMWF-ERA40 climatology
- 1°x0.5°: ATLc1b.00 (extracted from global configuration) (1deg-med and 1deg-PY) (Y. Yang and T. Ozgokmen)
  - Initial state: GDEM3 climatology
  - Forcing: ERA40 climatology
- 1/3° : ATLc0.32 (0.32deg-PY)(Z. Garraffo and G. Halliwell)
  - Initial state: GDEM3 climatology
  - Forcing: interannual NCEP 1948-2003

MOW in HYCOM

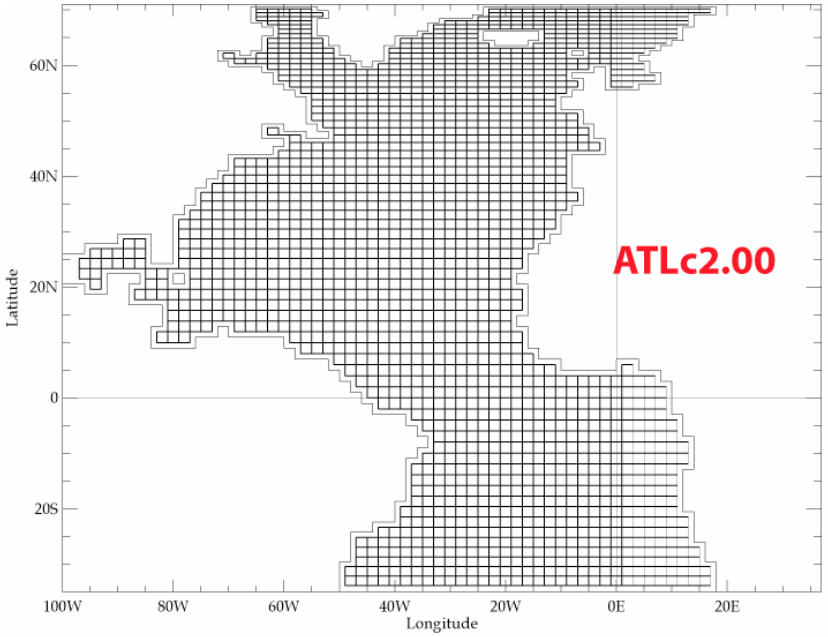
- The Price and Yang model (Price and Yang, 1998) is used as a boundary condition to prescribe the outflow in the **HYCOM ocean model**. Specified parameters are :
  - Med. Surf. Fluxes
    - E-P-R over Mediterranean
    - Net Heat flux over Mediterranean
- Specified Atlantic Ocean Water Properties
    - ρ_1, S_1 of Gibraltar inflow water
    - Density, salinity of entrained interior water at

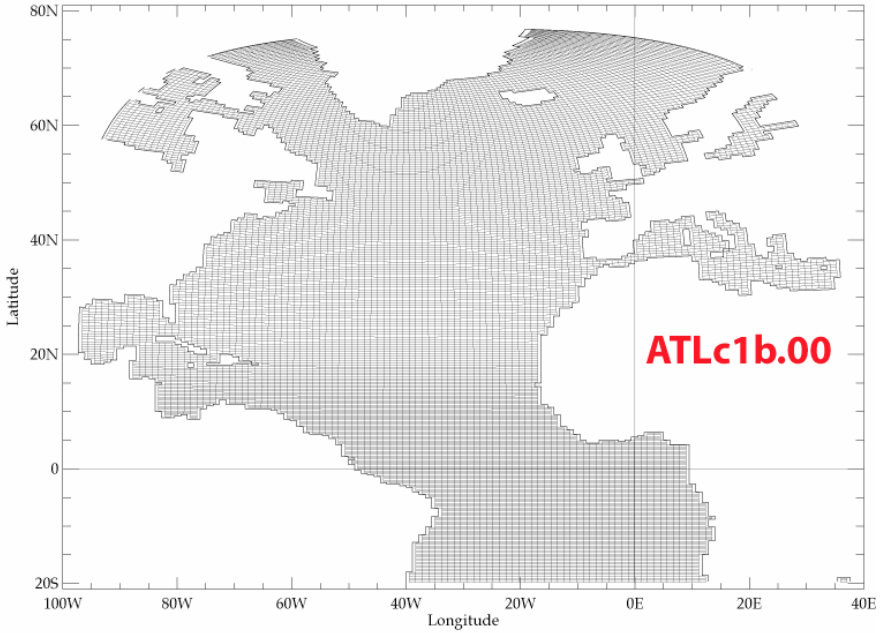
  shelf-slope break
- P-Y Model Output
    - Gibraltar outflow , S_2, Q_2
    - Entrained interior water transport
    - Final product water ρ_3, S_3, depth, transport(Q_3)



(implemented in HYCOM by George Halliwell)

Model Grids


ATLc2.00
60N
40N
20N
0
20S
Latitude
100W
80W
60W
40W
20W
0E
20E
Longitude


ATLc1b.00
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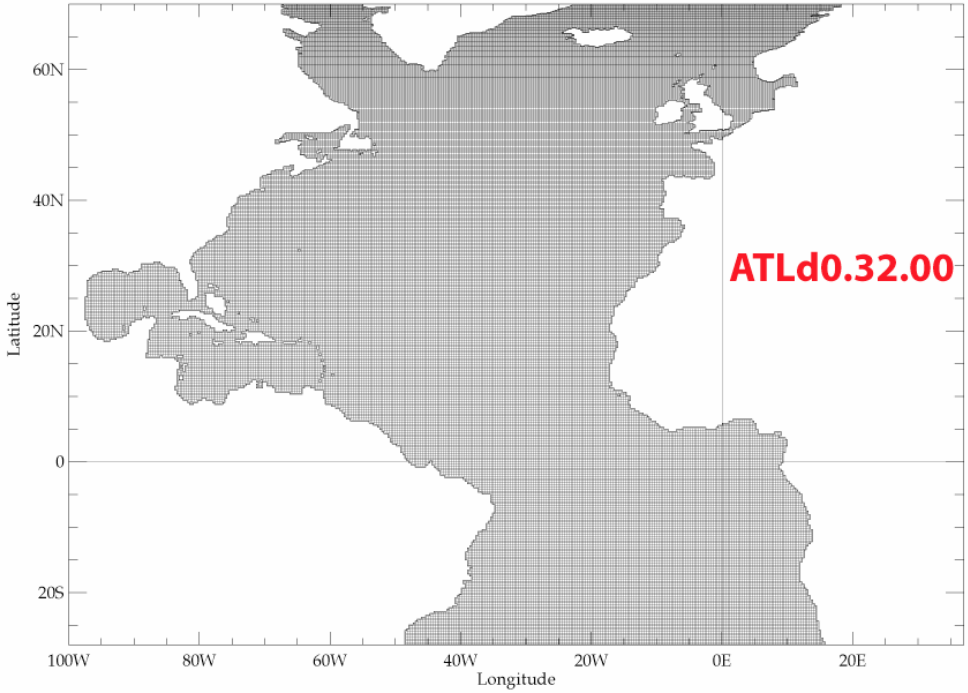
Longitude


ATLd0.32.00
60N
40N
20N
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Latitude
100W
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20W
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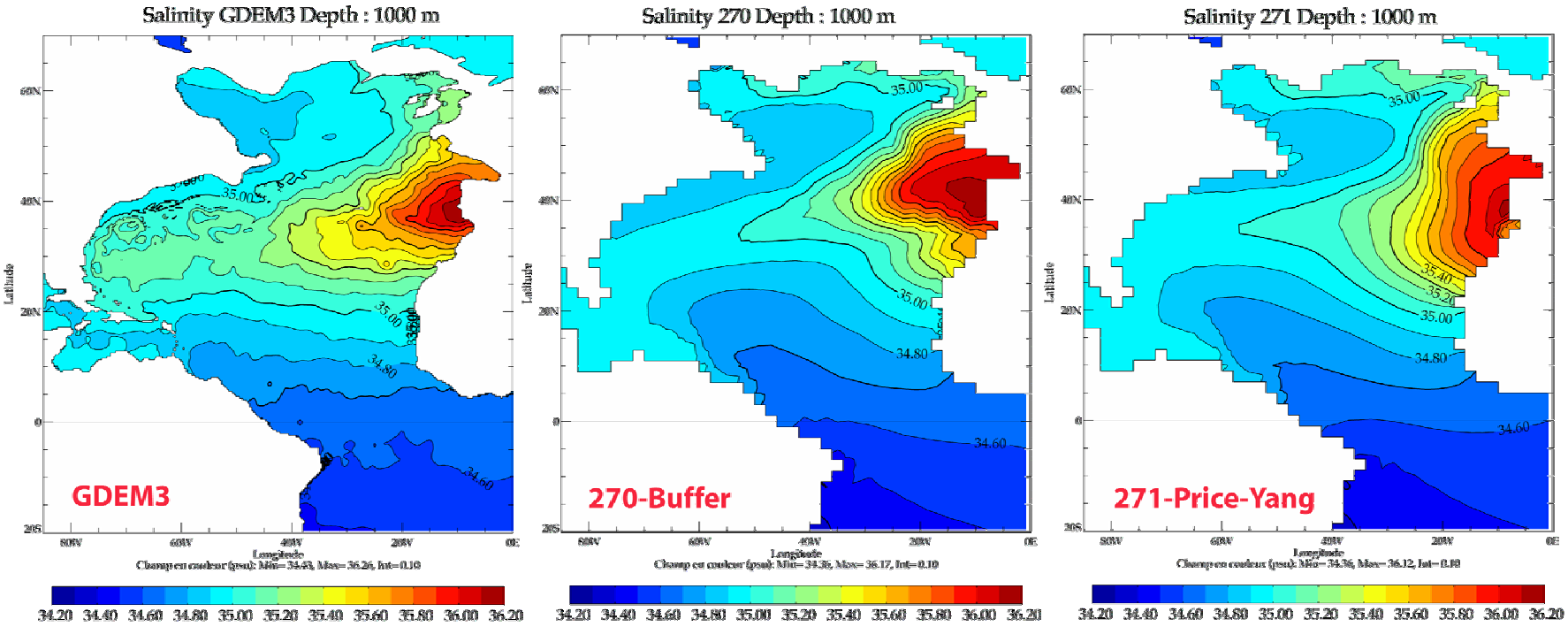
20E
Longitude

Price and Yang in ATLc2.00

Simulation 2° (climatology : ERA40 forcing)

Depth: 1000m

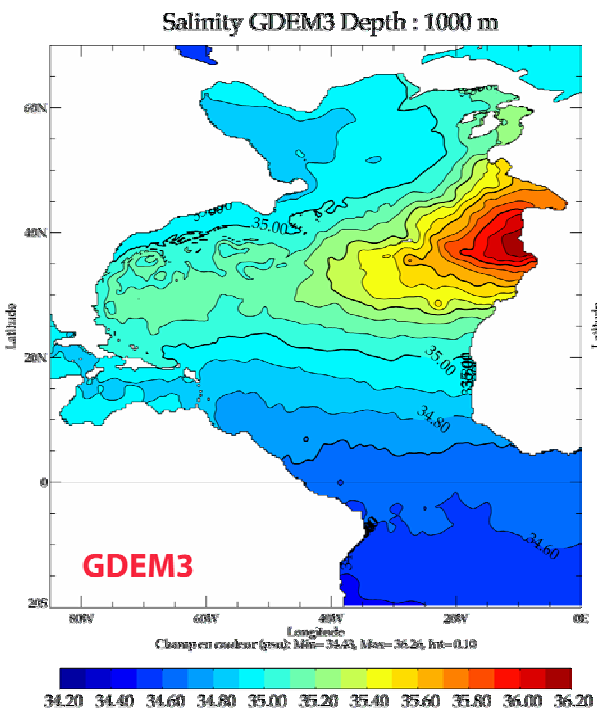


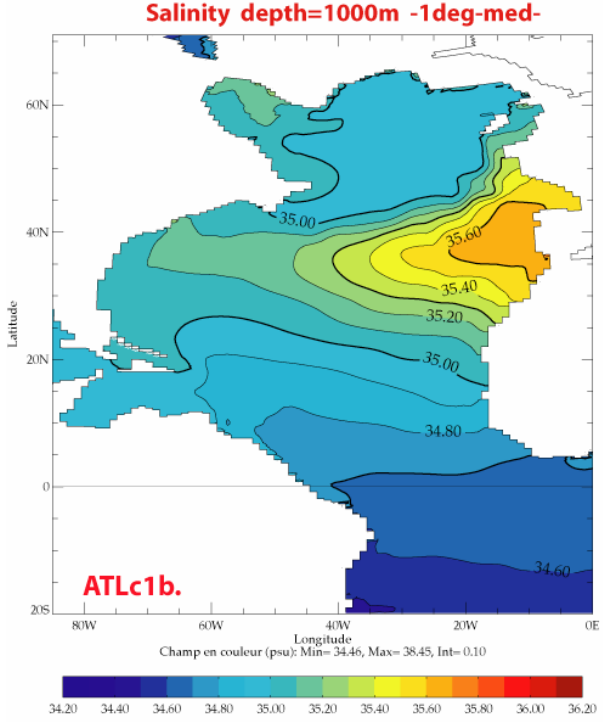
2deg-buffer: with buffer zone in the Gulf of Cadiz

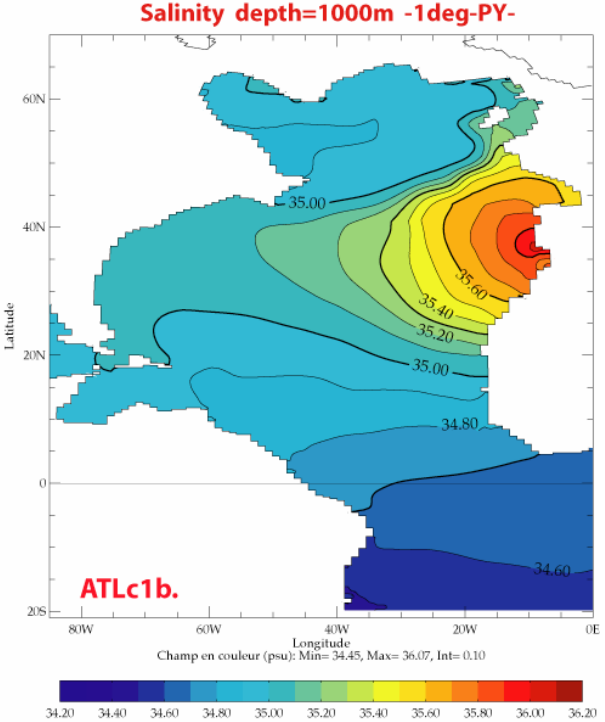
2deg-PY: with Price and Yang

Price and Yang in ATLc1.00

Simulation 1°x0.5° (climatology: ERA40 forcing) Depth=1000m



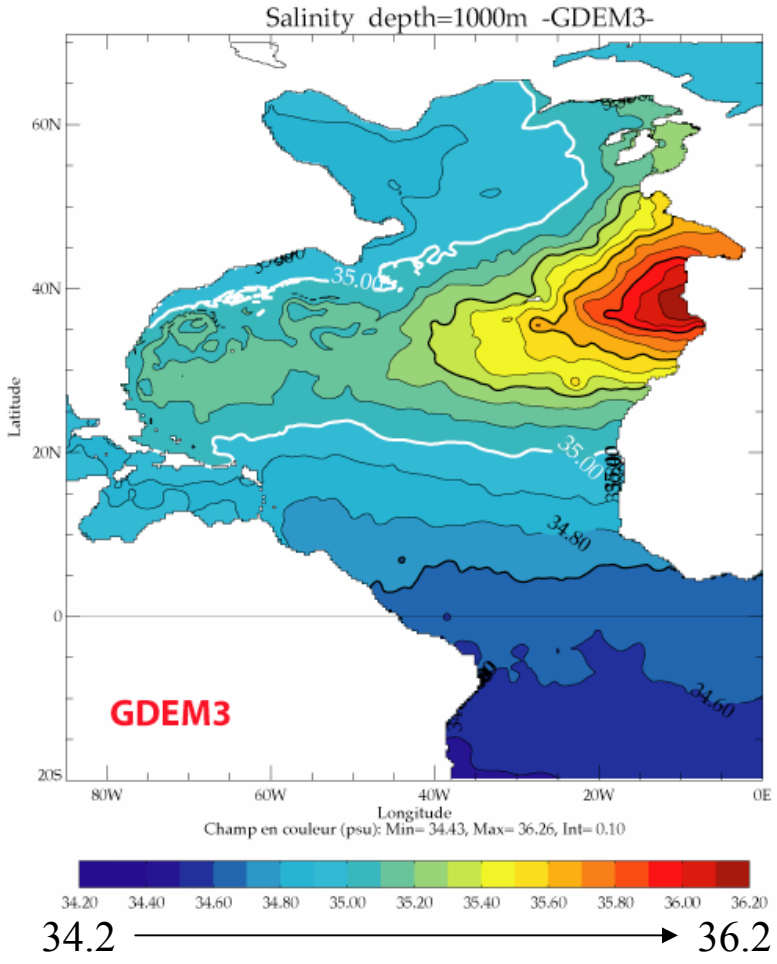


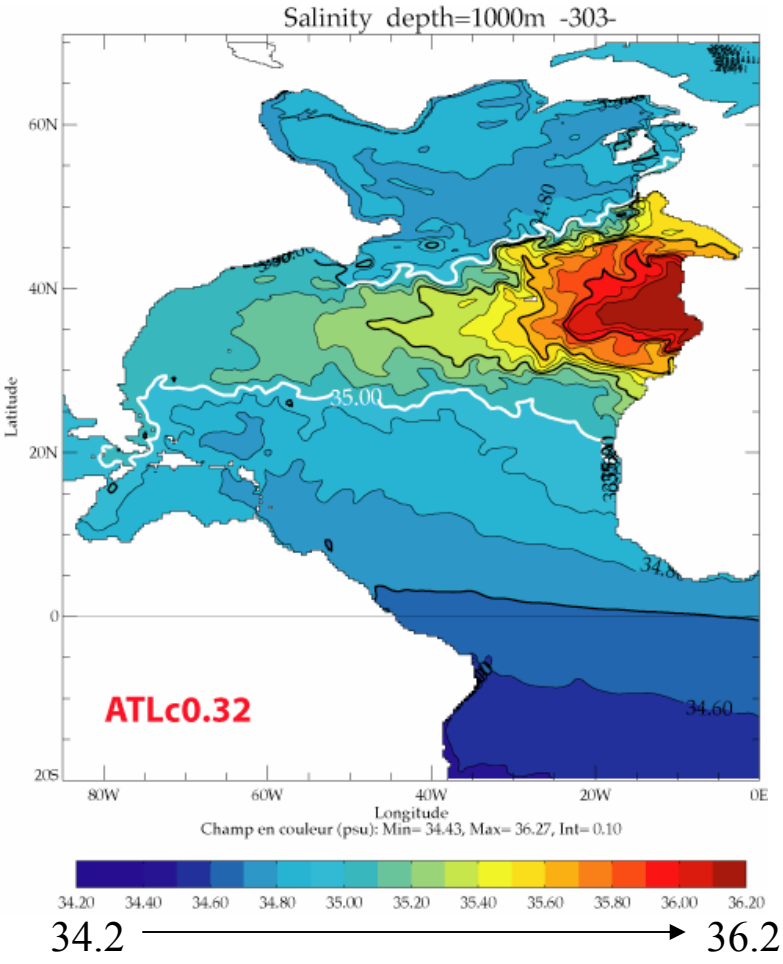


1deg-med: with the Mediterranean Sea

1deg-PY: with Price and Yang

Price and Yang in 1/3°ATL: 0.32deg-PY

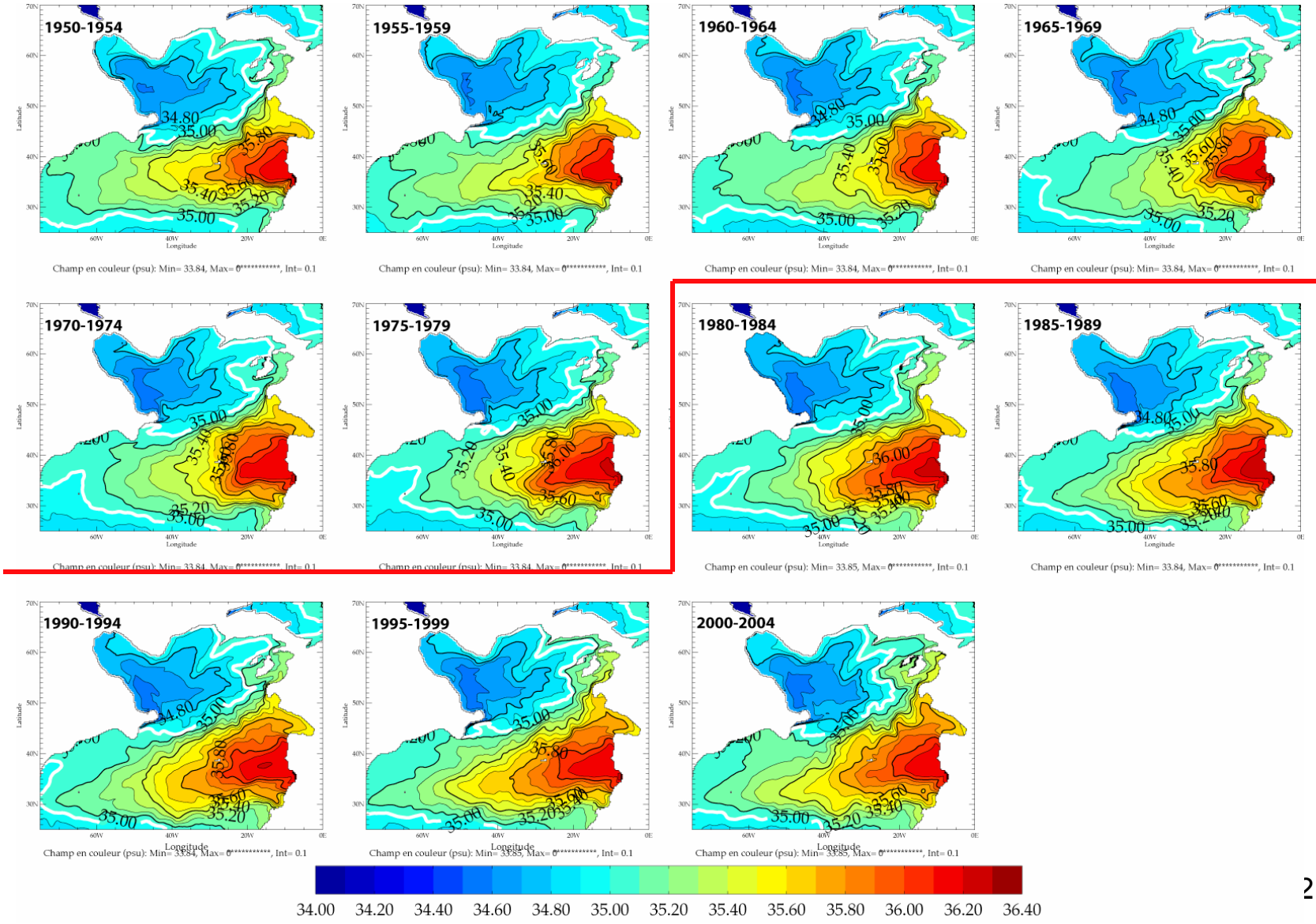




First results: 0.32deg-PY

CONTRACTION

EXPANSION



Conclusion/summary

- The mechanism of expansion/contraction found in the observations is also present in the 1/3° HYCOM interannual simulations.
- Future work : Can we find a relation between the NAO and the salinity anomalies in the Rockall Trough as in the observation ?

If yes, can we develop a physical explanation for the expansion/contraction mechanism as a function of NAO?