

SCOR 50<sup>th</sup> Anniversary Symposium:  
The Changing Ocean - From Past To  
Future

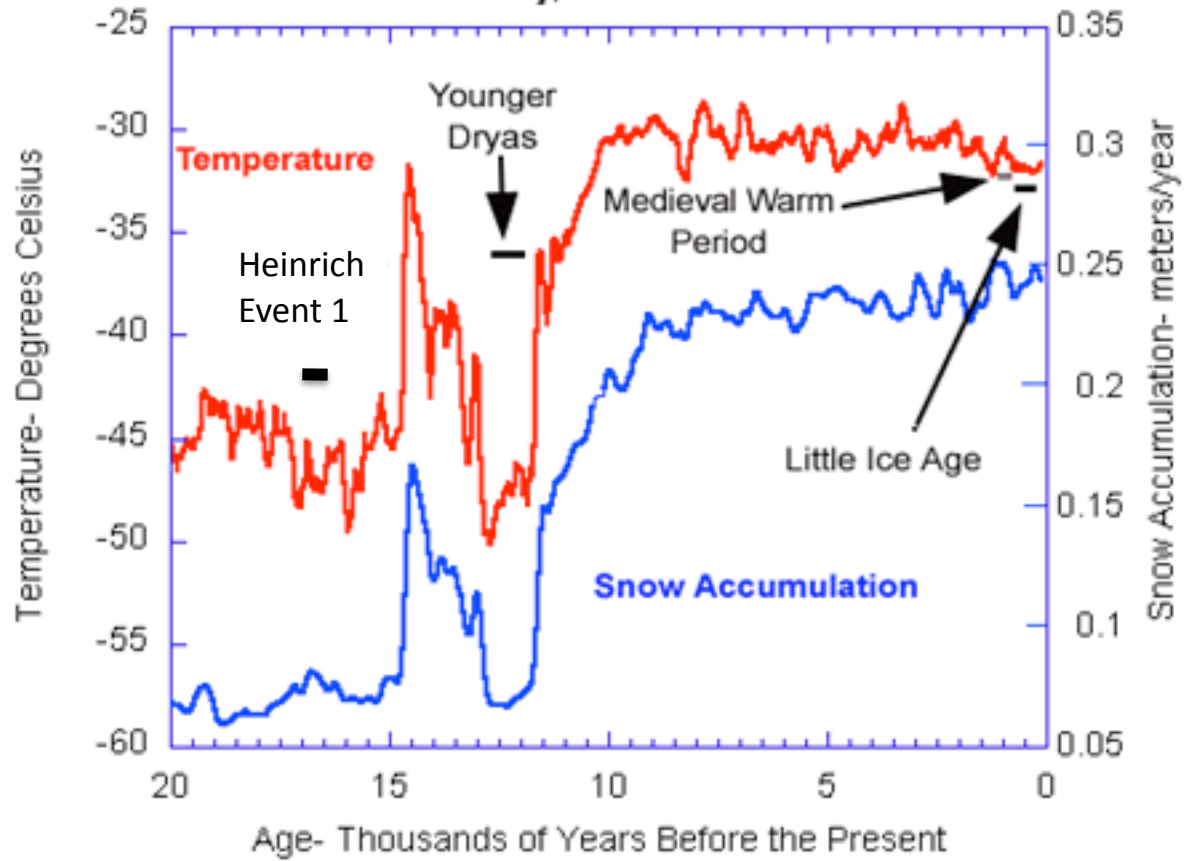
**SCOR/IMAGES WG123 on Past  
Ocean Circulation (2004-2006)**

*Charge: Bring together experts in  
paleoceanography, physical oceanography and  
ocean modeling to determine what is necessary  
for an effective and realistic research plan  
which will lead to a robust reconstruction of  
past ocean circulation.*

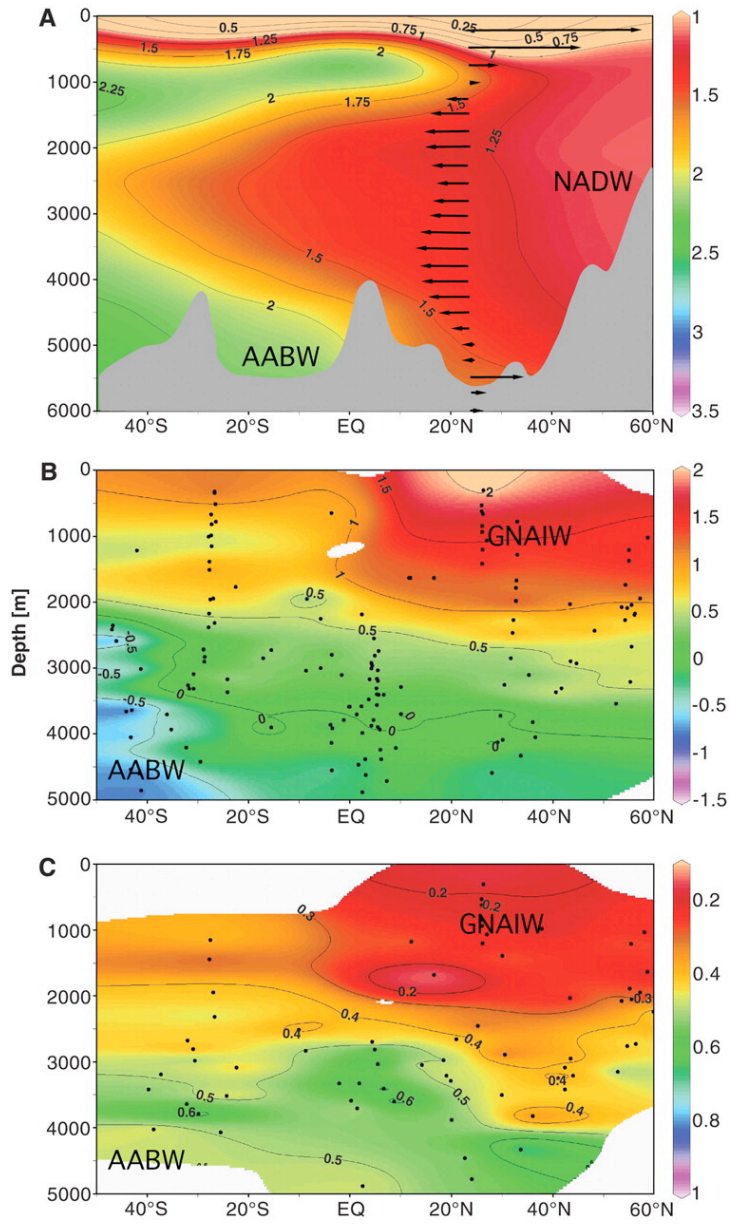
# Working group recommendations

- LGM Data Compilation and Interpretation Working Group
- Paleocean Circulation Experiment (PACE): A coordinated effort to determine the history of circulation changes in the Atlantic over the Last 25,000 years

**GISP2 Ice Core Temperature and Accumulation Data**  
Alley, R.B. 2000



# Last Glacial Maximum



Modern  
 $PO_4$

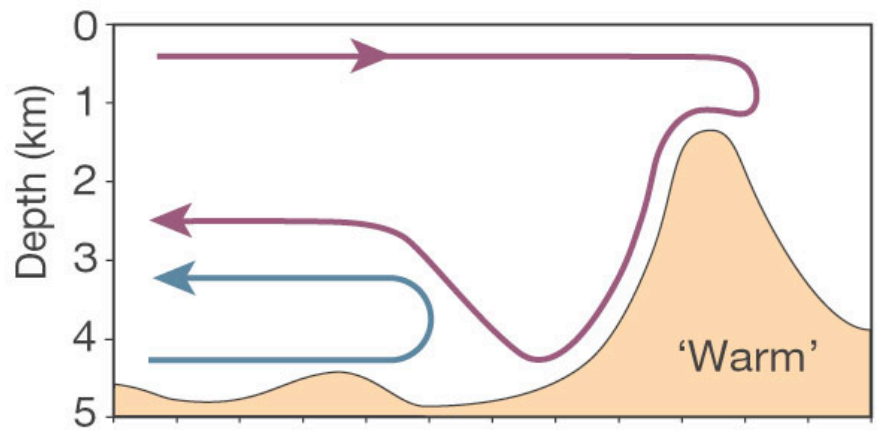
- Low nutrient water mass (GNAIW) above 2 km

- Higher nutrient water mass below 2 km (AABW, NADW?)

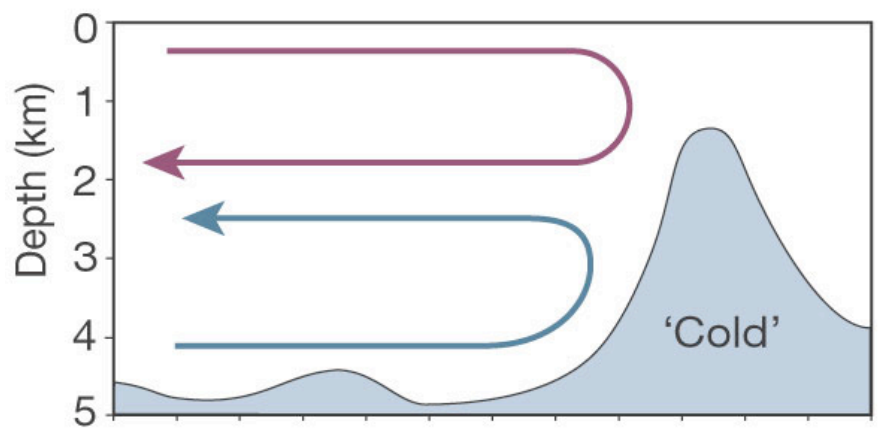
LGM  
 $\delta^{13}C$

- Same structure seen in Cd/Ca, radiocarbon, Nd isotopes

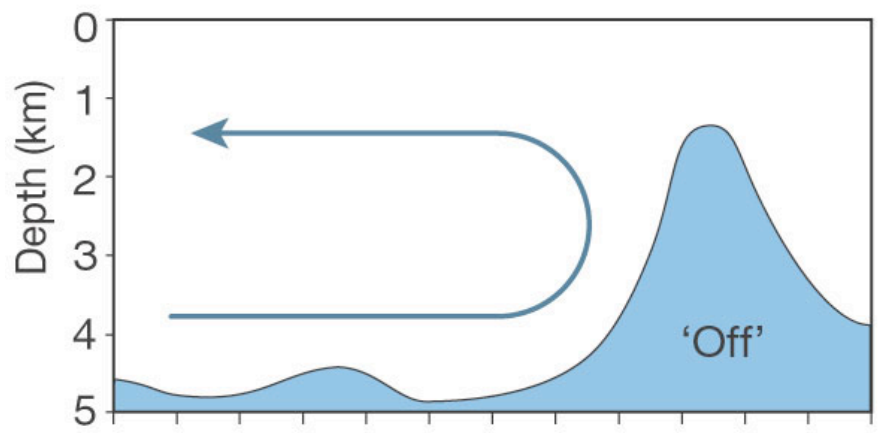
LGM  
 $Cd_w$



Holocene  
Bolling Allerod



LGM  
Younger Dryas

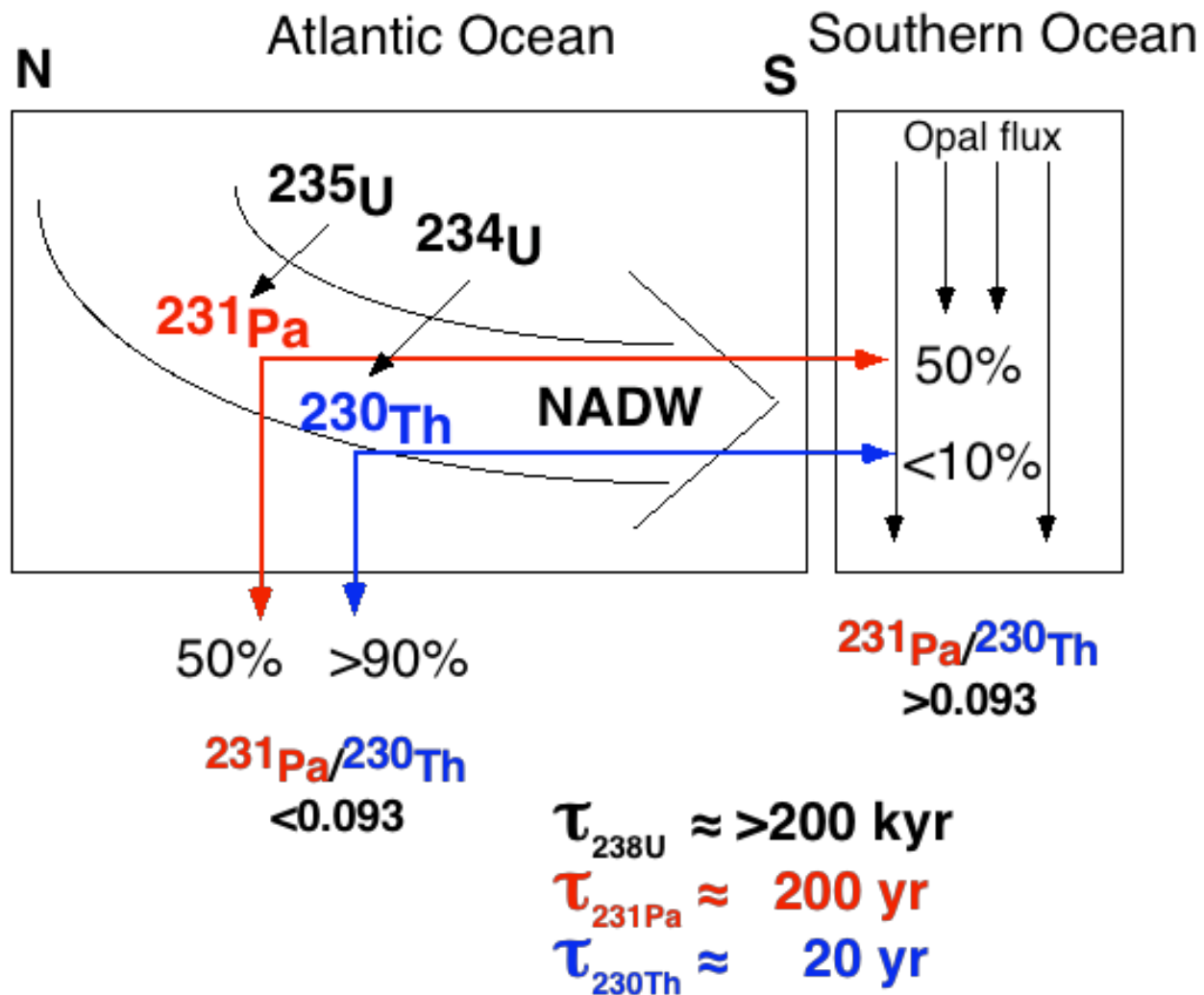


H events  
Ice sheet purges

30°S      0      30°N      60°N      90°N

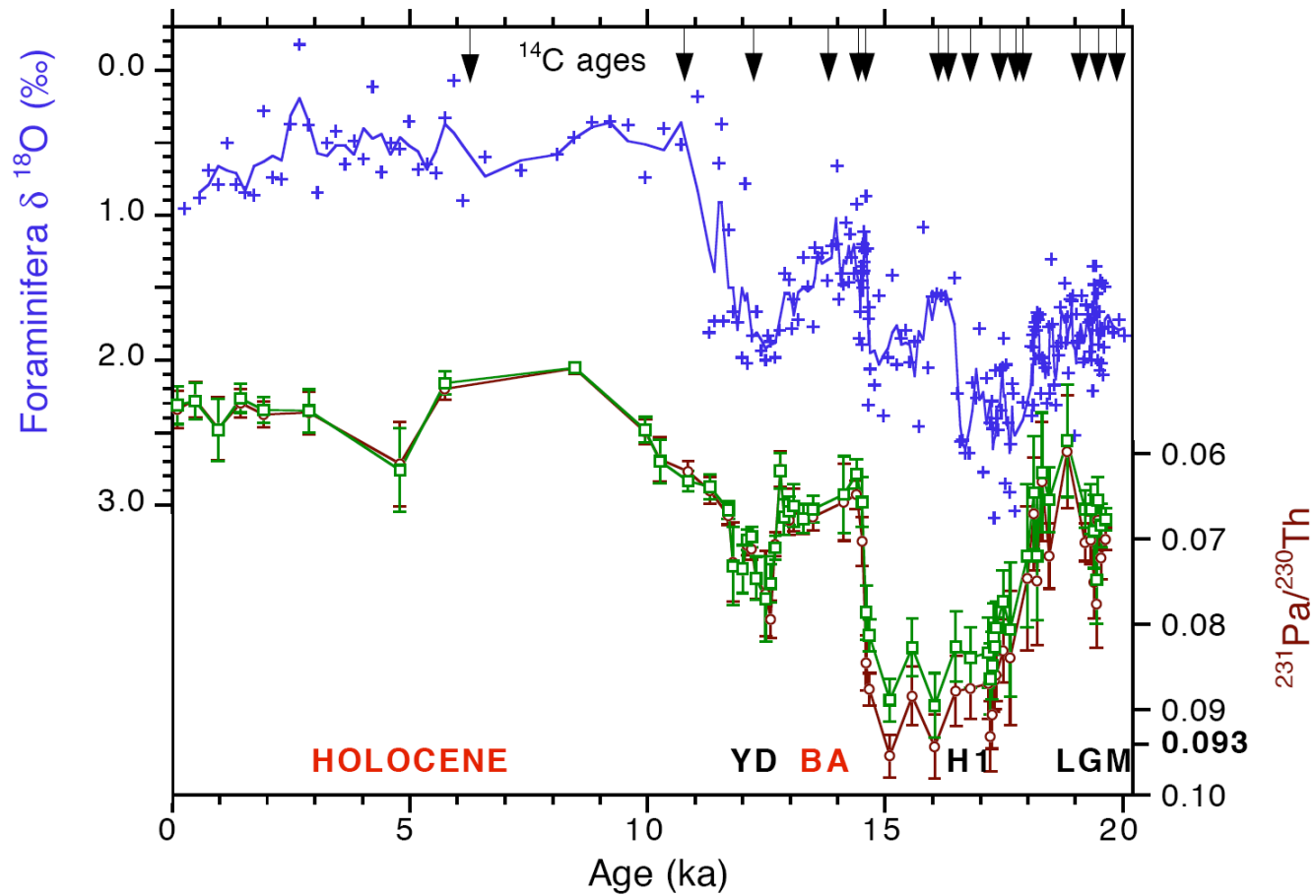
Rahmstorf (2002)

# Atlantic residence time from Pa-Th



From J. McManus

# Atlantic residence time from Pa-Th

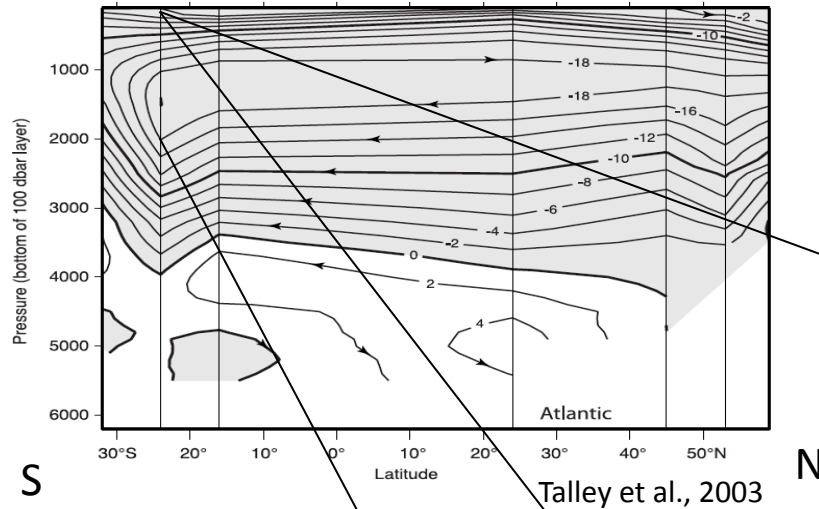


McManus et al 2004

For a quantitative estimate of AMOC changes 0-25,000 at millennial time scales:

- Better understand the controls on cycling of Pa/Th
- Information about particle flux and composition
- More records at more locations

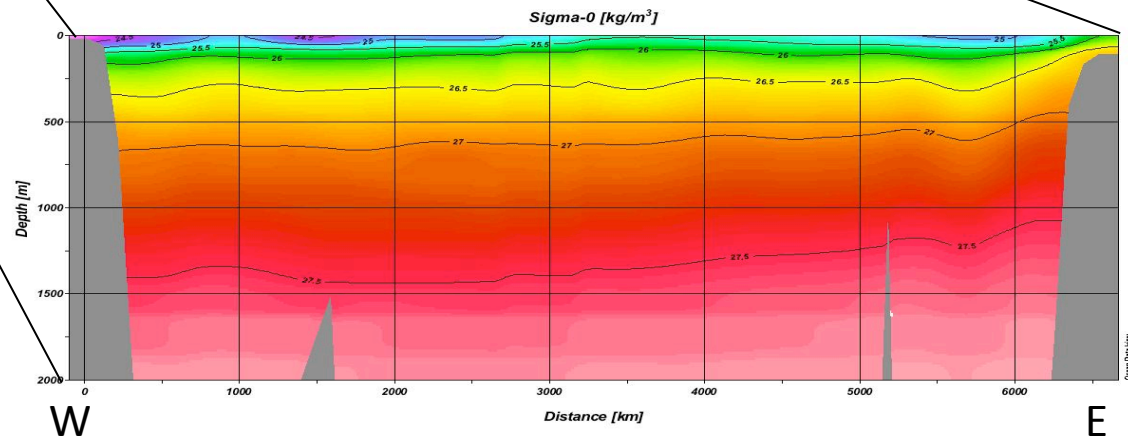
# Shear in AMOC from ocean margin density



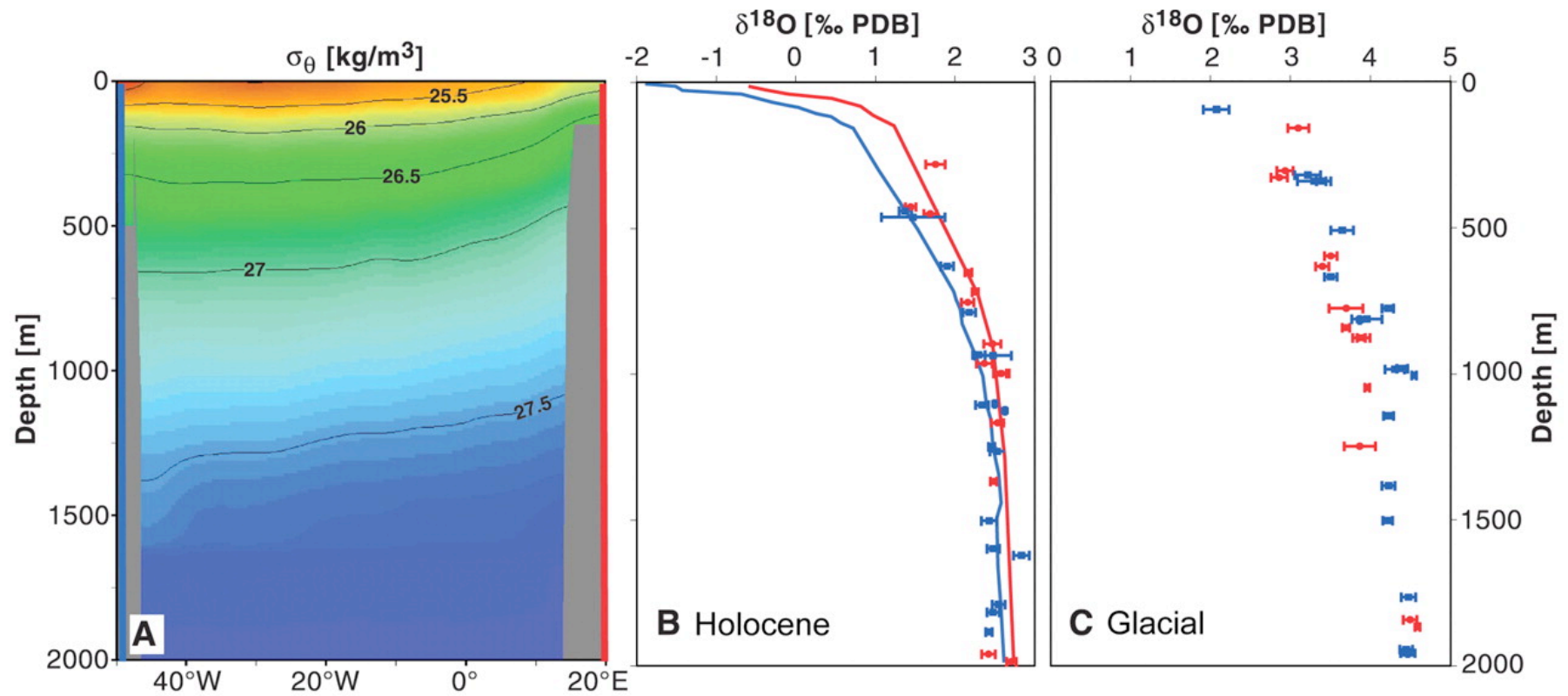
Shear in Atlantic MOC at 30°S reflected in the east-west

$$\frac{f\rho_0}{g} \partial_{zz}\psi \equiv -\frac{f\rho_0}{g} \partial_x(L_x\bar{v}) = \rho_E - \rho_W$$

(Marotzke et al., 1999)



# Shear in AMOC from ocean margin density LGM South Atlantic



Lynch-Stieglitz et al. (2006)

# For a quantitative estimate of AMOC changes 0-25,000 at millennial time scales:

- Highly resolved records on both sides of the Atlantic (we can do this in North Atlantic)
- Quantify relationship between  $\delta^{18}\text{O}$  of foraminifera and density
  - Develop better deep sea paleo-temperature proxy (Trace metals in foraminifera, Triple oxygen isotopes)
  - Constraints on the relationship between oxygen isotope ratio and salinity in seawater (pore water measurements)

For a quantitative estimate of AMOC changes 0-25,000 at millennial time scales:

- Will also need: more high resolution records of water mass tracers– conservative and non conservative (radiocarbon)
- Sophisticated strategies for combining modeling/dynamical constraints with data