Mass and heat Transport in the subpolar North Atlantic

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Decrease of LSW formation - weakening of the subpolar gyre --- weakening of the MOC?

Update from Kieke et al., 2007
Positive MOC anomalies follow periods of intensified LSW formation.

- Amplitude of decadal MOC variability: ~ 2 Sv at 40°N
- from overflow another +/-1-2 Sv (Latif et al., 2006)
MOC transport anomalies

Subpolar gyre transport

Böning, et al., 2006
Decrease of LSW formation - weakening of the subpolar gyre --- weakening of the MOC?

Schott et al. (2004): DWBC transport did not change between 1993-1995 (-11.3 Sv) and 1999 – 2001(-11.2 Sv)
• Role of Overflows, LSW formation, gyre strength: relation to meridional volume and heat transport?

• Role of interior pathways for MOC strength and fluctuations?

• Exchange between subpolar and subtropical gyre

• Meridional temporal and spatial coherency?
Idea: extend 47°N array into the Eastern Atlantic, moor a sufficient number of C-PIES
**Time series of the meridional mass and heat transport:**

Separate velocity field \( V \) in

\[ V_{\text{rel}} : \text{geostrophic velocity relative to reference level} \]

\[ V_{\text{fluc}} : \text{geostrophic velocity fluctuations at the reference level} \]

\[ V_{\text{mean}} : \text{mean velocity in the reference level} \]
Relative velocity $V_{rel}$

Travel time measured by IES: transferred to top-bottom T/S profile with GEM (Gravest Empirical Mode)

Use T/S profiles from Argo program, use CTD data from cruises,

No Argo data below 2000m, T/S profiles from moored profilers (one in western one in eastern basin)
$V_{\text{fluc}}$: geostrophic velocity fluctuations at the reference level
calculate from pressure fluctuations $p'$ measured by PIES,
mean pressure cannot be used: unknown drift,...
$V_{\text{mean}}$: mean velocity in the reference level

directly measured by current meter attached to the C-PIES

Horizontal resolution must be sufficient to resolve mean velocity field AND

To calculate heat transport: resolve temperature field
Meridional velocity at 47°N from combined vm-ADCP and LADCP data,

Meridional velocity at 47°N annual mean year 2000
1/12° FLAME model
Rossby Radius of deformation: 20 km
Observed horizontal scales of NAC eddies and meanders: 80-100 km
From Argo data: correlation scale T/S: 80 km

Requested mean horizontal distance between the C-PIES: 70-90 km

about 30 C-PIES are needed