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Transport variability associated with the Meridional Overturning circulation in the Subtropical North Atlantic

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The Atlantic Meridional Overturning Circulation (MOC) is responsible for a northward heat flux and consequently Northwest Europe enjoys a mild climate for its latitude. However, abrupt rearrangement of the Atlantic Circulation has been shown in climate models and in paleoclimate records to be responsible for a cooling of European climate of between 5-10°C.

To continuously monitor the size and strength of the MOC requires measurements of the complete basin wide Atlantic circulation. This strategy is pursued in the RAPID-MOC experiment along 26 N in the subtropical Atlantic, which provides hitherto unavailable basin-wide integrals of meridional flow. The northward flow of warm water in the Florida Current is measured using disused telephone cables between the US and Bahamas; and the compensating southward circulation of cool thermocline and cold deep water are observed using a transatlantic array of moorings, that measure top-to-bottom density profiles and bottom pressure near America and Africa and on either side of the mid-Atlantic Ridge. The array was deployed for the first time in early 2004. The upper ocean wind driven transport is measured by satellite wind scatterometry and derived from SOC and NCEP climatologies.

Here we focus on the transport variability of the various components of the MOC, based on data from the March 2004 to March 2005 period. Of particular interest are the magnitude, vertical and horizontal distribution and spectral properties of fluctuations of the transatlantic wide integrated internal and external flows, as inferred from the end point measurements of density and bottom pressure, respectively. Also, we'll highlight aspects of interrelation between the different transport components to assess how much of the observed variability is explainable by local wind forcing, deep western boundary current variability and Rossby waves. Our analyses indicate that the external and internal components compensate each other and that only a small fraction of the external variability can possibly be explained by a depth-independent compensation of the Ekman transport. The latter may indicate the importance of non-local forcing of MOC variability in the subtropical North-Atlantic.