Meridional Volume and Heat Transport in the South Atlantic

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The Atlantic Meridional Overturning Circulation (MOC), consisting of a northward flow of warm water in the upper layer and southward flow of cold water in the deeper layers, plays an important role in the global energy balance. The Atlantic MOC transfers heat from the tropics and southern hemisphere to the north, and is believed to be linked to several climate phenomena such as past climate change, hurricane intensity in the North Atlantic and anthropogenic climate forcing. Even though the South Atlantic plays a key role by transporting heat from the south towards the equator, and includes large areas where water masses from different oceans mix, this ocean is historically poorly sampled compared to the North Atlantic.

This project aims at understanding the variability of Meridional Overturning volume and heat transports (MHT) across four different latitudes in the South Atlantic using Argo observations, satellite altimetry and wind products. Results from the observations are analyzed in conjunction with model-based estimates from three different models with data assimilation. Time series and mean values of transports are obtained, seasonality (Figure 1), interannual variations and correlations between the overturning volume and heat transports (Figure 2) are examined.

Results reveal differences in seasonality of MOC in observations and model-based estimates. Mean transports from the observations are often higher than the model estimates; the main exception of this are transports from HYCOM. Estimates from the models not only differ observations in mean strengths and seasonality, but the MOC strengths at the boundary and the interior vary greatly in different models.

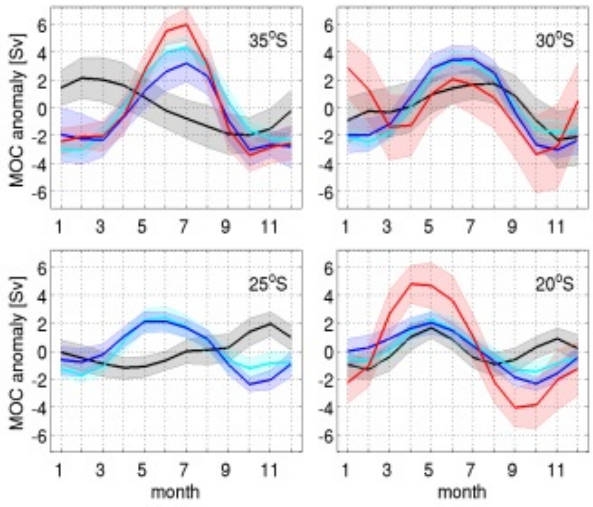

Figure 1
Climatological annual ccyle of anomalies of MOC strengths 35°S, 30°S, 25°S, and 20°S from Argo & SSH (black), NCEP/GODAS (blue), SODA (cyan) and HYCOM (red). Shading indicates 95% confidence interval. Results from HYCOM are not shown for 25°S.

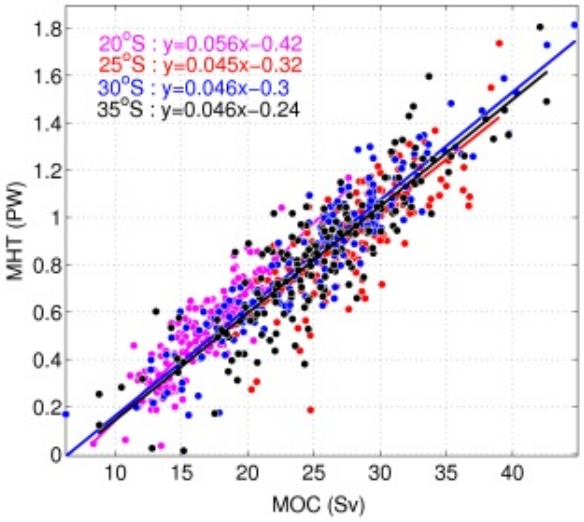

Figure 2
Scatter plot of MOC strengths against MHTs from across Argo & SSH. Straight lines are the corresponding linear fits. latitudes: 20°S (magenta), 25°S (red), 30°S (blue) and 35°S (black).