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Variabilty of the South Atlantic Circulation, numerical analysis

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Interannual variability of the South Atlantic Circulation is analyzed using the output of the Geophysical Fluid Dynamics Laboratory (GFDL) Modular Ocean Model (MOM) in three different configurations. The two ocean-only models have one and two degrees of horizontal resolution, respectively, and are forced by interannual observational atmospheric datasets of the past sixty years. The third model, with 1 degree spatial resolution, is the coupled version of the GFDL-MOM, the Coupled Model CM3, which is part of the Coupled Model Intercomparison Project version 5 (CMIP5) database. In all three cases, we focus on the period between 1947 and 2007, and preliminary results are presented.

A major motivation for studying the South Atlantic Circulation (SAC) and its variability is the fact that the SAC is a key component regulating North Atlantic sea surface salinity, and hence the strength of the Atlantic Meridional Overturning Circulation (AMOC). The time series of heat transport through 32S latitude section shows a high correlation with the time series of the AMOC, which is consistent with previous studies. This correlation is higher in both ocean-only models. Although the intensity of the heat transport has the same order of magnitude in all the experiments, the AMOC strength is higher in the coupled model. It is worth pointing out that the values showed by ocean-only models are indeed in correspondence with the observations. On the other hand no correlation is observed with the salt flux time series.

The ocean-only models indicate a linear increasing trend both for AMOC and heat transport in the last twenty years of the time series. This trend is stronger in the higher resolution model. No long term variations are evident in the coupled model. In order to identify the dynamic components involved in the evolution of the AMOC, the transport was separated between its Ekman and geostrophic contribution. Strengthening of the AMOC does not seem to be related to the Ekman component and its time-mean magnitude is dominated by geostrophic transport.