Interannual wind forced variability of the AMOC at 26.5°N

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The Atlantic Meridional Overturning Circulation (AMOC) at 26.5°N measured by the RAPID-MOCHA-WBTS array (26.5°N array) shows interannual variability consisting of a gradual increase from April 2004 to October 2005 and a following downtrend which reached a minimum in winter of 2009/2010. The decline leads to about a 30% drop of the observed annual mean AMOC. These interannual AMOC fluctuations are dominated by changes in the geostrophic flow except during the 2009/2010 winter when the anomalous wind-driven Ekman transport also has a significant contribution. While the Ekman transport is linked to the North Atlantic Oscillation (NAO), the dynamics responsible for the anomaly in geostrophic flow are still unclear. In the present study, linear wind forced models, including a simple forced Rossby wave model and a two-layer GCM, are used to investigate the variability of AMOC at 26.5°N. Our results suggest that a large part of the observed variability in the geostrophic flow can be explained by linear wind-driven dynamics. In particular, the intensification and weakening of the southward interior geostrophic flow is modulated by the internal Rossby wave adjustment to the surface wind forcing. The Gulf Stream, on the other hand, is affected by wind forced topographic waves along the western coast. The role of nonlinear effects in the wind-driven circulation is also discussed.