Mechanisms of Seasonal Variability of the Atlantic Meridional Overturning Circulation

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The upper branch of the Atlantic Meridional Overturning Circulation (AMOC) consists of Ekman and geostrophic transport, and the seasonal variability of both components contributes to the seasonal cycle of the AMOC. The annual fluctutions of the Ekman transport, determined by the large scale atmospheric dynamical pattern, show latitudal dependence. On the other hand, changes of the geostrophic component are determined by the modification of the dynamic height at basin boundaries. Direct observations of AMOC by the RAPID-MOC/MOCHA array along 26.5N revealed that the seasonal variations of AMOC mostly come from the geostrophic part, which in turn is mainly forced by the local wind stress curl at the eastern basin boundary. This study investigates this mechanism at other latitudes in the basin using a two-layer ocean model forced by satellite wind stresses that are constructed to preserve wind stress gradients nerar the basin boundaries (SCOW). Both the western boundary (WBC) and upper midocean (UMO) contributions to the geostrophic annual cycle are studied. It is found that there is significant annual variability in the UMO transport over subtropical regions. Using both in-situ temperature and salinity profile data the results of this simple model, it is verified that these seasonal varations are attributed to the local wind stress curl forcing at the eastern boundary. Moreover, the WBC transport is found to be sensitive to both local forcing and remotely generated signals propagating along western boundary.