Wind driven seasonal cycle of the Atlantic Meridional Overturning Circulation

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This study combines a hierarchy of numerical models, from Rossby wave model to Ocean general circulation model, to investigate the seasonal cycle of AMOC and understand the corresponding dynamical processes. On seasonal time scale, the AMOC is split into Ekman transport and geostrophic transport components, and this reveals that the seasonality of AMOC is determined by both components in the subtropical ocean and dominated by the Ekman transport in the tropics. The physics governing the seasonal fluctuations of Ekman and geostrophic transport are explored in three latitudes (26.5°N, 6°N, 34.5°S). Although the Ekman transport is directly driven by the zonal wind changes, the comparison between different numerical models suggests that the geostrophic transport involves more complicated oceanic adjustment to the wind forcing. The oceanic adjustment is further evaluated by separating the zonally integrated geostrophic transport into barotropic and baroclinic parts. Our result indicates that the seasonal cycle of the meridional geostrophic transport is either shaped by the Western boundary current (WBC) or determined by both WBC and interior flow in deep ocean. The WBC is controlled either by the topographic waves or the wind driven circulation established by the barotropic and baroclinic Rossby waves, whereas the interior flow is mostly affected by the local wind stress curl near the basin boundary.