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.