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Revisiting annual mean and seasonal cycle of deep meridional overturning circulation of the Indian Ocean

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The annual mean and seasonal cycle of the deep meridional overturning circulation (MOC) of the Indian Ocean is being revisited here using GECCO synthesis.

Resulting from ocean general circulation models, the annual mean deep MOC of the Indian Ocean are generally weak with inflow in the bottom layer and outflow in the intermediate and upper layer mixing with strong Indonesian Throughflow. For seasonal cycle of deep MOC, two significant and seasonal reversed counter-rotating deep cells over full depth of water column, roughly separated by 20S, are revealed during boreal summer and winter. The coincidences of the latitude 20S with where the maximum climatological wind curl for most of seasons reveals intimate relations between the deep meridional overturning and surface winds.

Dynamical decompositions on annual mean and complete seasonal cycle of the meridional overturning show varying relative contribution of each dynamical component at different time scale. For annual mean deep MOC, Ekman dynamics is found to be dominant in the region of north of 25S, particularly in upper 3000m, whereas south of 25S external and vertical shear components show remarkable “seamount” features and are compensated with much larger strengths because of topo-modulated strong western boundary topography. At seasonal time scale, dominant role of Ekman dynamics and secondary role of external mode are found in the deep cell north of 20S in January and July. However in transition seasons, vertical shear is responsible for major part of meridional overturning and Ekman dynamics has comparable contribution north of Equator.