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Interannual variability of SEC bifurcation and western boundary currents along the Madagascar and the relation with ENSO

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The South Equatorial Current (SEC) in the Indian Ocean bifurcates at the east coast of Madagascar into Northeast and Southeast Madagascar Currents (NEMC and SEMC). In this study, the dynamical mechanism of the SEC bifurcation latitude (SBL), NEMC, and SEMC variations associated with the basin-scale wind variation are investigated using observational data, reanalysis data and the outputs from an atmospheric general circulation model (AGCM). It is found that the interannual NEMC and SEMC variations are dominated by the SEC variations rather than the SBL. Based on the Time-dependent Island Rule calculations, it is also found that the interannual anomalies of the SBL and the NEMC and SEMC transports are the responses to the meridional interior transport, which in turn is a result of westward popagating Rossby waves from 70^{o}E-90^{o}E.

The SBL, NEMC, and SEMC have correlation with Niño 3.4 index with 5-15 month lags, and the wind stress curl fields around 80^{o}E-110^{o}E, 20^{o}S-10^{o}S have positive correlation with the Niño 3.4 index from the late 1990s to the 2000s. From an analysis of AGCM sensitivity experiment, the wind stress curl anomalies around 60^{o}E-90^{o}E, 25^{o}S-15^{o}S may be because of the Matsuno-Gill response to diabatic heating anomalies in the western Pacific, whereas those around 80^{o}E-110^{o}E, 20^{o}S-10^{o}S may be due to the sea surface temperature anomalies off the west coast of the Australia that tend to appear during ENSO events.

Keywords: Indian Ocean, South Equatorial Current, western boundary current, Island Rule, ENSO