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Coupled feedback between the tropics and subtropics of the Indian Ocean with emphasis on the coupled interaction between IOD and SIOD

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Indian Ocean Dipole (IOD) is an air-sea coupled variability in the Tropical Indian Ocean (TIO), which strongly impacts climate variability over the Indian Ocean rim countries. Though many positive IODs co-occurred with El Niño Southern Oscillation (ENSO), IODs do evolve independently, suggesting the possible role of internal dynamics of the Indian Ocean. In this study, the subtropical IOD (SIOD) is reported as one of the triggers for non-ENSO IODs. The study highlights the existence of cyclic feedback between IOD and SIOD through tropical subtropical interaction, a possible mechanism for the biennial tendency of both IOD and SIOD modes. The positive SIOD induce warming in the southwest of the Subtropical South Indian Ocean (SSIO) during April-May months and creates a meridional cell with subsidence over the southwestern TIO region (10^{o}S). The subsidence expands the existing anticyclonic circulation over SSIO towards the equator and develops easterlies along the equator, warming the western TIO region. A zonal-vertical cell with convection over the western TIO and subsidence over the eastern TIO originates during June-July, which subsequently generates positive IOD in the following months. The positive IOD triggers negative SIOD by developing a stationary Rossby wave train in the midlatitudes. The southeastern anticyclonic circulation develops during the IOD peak season as Gill's response initiates warm SST anomalies in the northeastern subtropics. As a result of the warming, the evolution of upper-level divergence and high absolute vorticity gradient over the subtropics generate an equivalent barotropic Rossby wave number 3 pattern in the extratropics. The cyclonic circulation over the southwest SSIO related to this Rossby wave pattern creates cold SST anomalies there. The cooling in the southwest and the warming in the northeast SSIO persisted from the IOD peak season, which strengthened the cyclonic circulation over SSIO, reinforcing the existing negative and positive SST anomalies through a positive feedback mechanism and generating negative SIOD, which peaks in the following January-March months.