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Estimation of Fresh and Salt Water Fluxes and Transports in the Indian Ocean using satellite observations and model simulations

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This study describes the fresh and salt water fluxes and transports in the Indian Ocean using satellite-derived salinity observations from the SMOS (Soil Moisture and Ocean Salinity) and Aquarius missions, and model outputs from the HYbrid Coordinate Ocean Model (HYCOM) and the Simple Ocean Data Assimilation (SODA) Re-analysis. Argo salinity data is used to validate the aforementioned salinity datasets. Salt budget estimations using SMOS salinity data show favorable comparisons with published results, with the potential for additional novel studies when more valid satellite-derived salinity data become available. On seasonal time scales, there is a considerable exchange of salt and fresh waters between the Bay of Bengal (BoB) and the Arabian Sea (AS) and vice versa. The pathways of the high/low salinity waters are identified using satellite observations. The Sea Surface Salinity (SSS) changes in the Southeastern Arabian Sea are as a result of the advection of low salinity waters from the BoB via coastal Kelvin waves. The long term mean salt transport shows seasonal reversals that are more pronounced in the northern Indian Ocean than in the southern Indian Ocean. Meridional salt transport is northward along the Somali Current (SC) in the Arabian Sea and the East India coastal Current (EICC) in the Bay of Bengal during the southwest monsoon season. The opposite holds during the northeast monsoon season. Mean zonal salt transport is of a higher magnitude than the meridional component and shows significant seasonal reversals in the equatorial region. Empirical Orthogonal Function (EOF) analyses of meridional salt transport show that the variability is primarily seasonally driven and is the result of seasonally reversing monsoonal winds and currents. The amplitudes of the EOFs suggest that the Indian Ocean dipole may also influence the variability. Spatially, the most variable regions are along the northeast African coast, and in the eastern Arabian Sea, the Bay of Bengal and equatorial regions.