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Seasonal Cycle of Cross Equatorial Flow in the Central Equatorial Indian Ocean

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This study investigates the seasonal cycle of meridional currents in the upper layers of central equatorial Indian Ocean using acoustic Doppler current profiler (ADCP) data and other data sets along 80.5°E for the period 2004-13. The ADCP data set is the most comprehensive collection of direct velocity measurements in the central Indian Ocean to date, providing new insights into cross equatorial flow in this region. Mean meridional currents are characterized by subsurface divergence between 50-100 m depths with relatively weak convergence above, driven by the annual mean westward pressure gradient force and the surface westerly wind stress respectively. However, in response to a mean northward component of the surface wind stress, the maximum mean surface layer convergence is shifted off the equator to 0.75°N. Evidence is also presented for the existence of a shallow equatorial roll, consisting of a northward wind-driven surface drift overlaying a southward subsurface flow. Cross equatorial transports during boreal summer and winter indicate that a quasi-steady Sverdrup transport balance dominates the seasonal cycle of upper-layer meridional currents. In addition, semi-annually varying westerly monsoon transition winds force Ekman convergence in the surface layer and set up transient zonal pressure gradients that drive seasonally enhanced meridional geostrophic divergence in the thermocline. These results quantify expectations from ocean circulation theories for equatorial Indian Ocean meridional circulation patterns with a high degree of confidence given the length of the data records.