

On semiannual equatorial undercurrents in the eastern Indian Ocean

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Unlike those in the Pacific and Atlantic, the equatorial undercurrents (EUCs) in the Indian Ocean are transient and eastward only in early boreal spring and fall. Their dynamics is investigated in this study using observations obtained from four acoustic Doppler current profilers (ADCPs) deployed along the equator in the eastern Indian Ocean (78°E, 80.5°E, 83°E and 90°E). The harmonic analysis is applied to observed zonal velocity and reveals that annual and semiannual variability contributes to zonal velocity at the depth of the EUCs (about 100 m). Whereas the annual harmonic does not show any consistent tendency of zonal phase propagation, the semiannual harmonic shows eastward propagation at the depth of the EUCs. Owing to data gaps in ADCP records, the analysis is repeatedly applied to several two-year segments, and the phase speed is estimated using results obtained from various pairs of ADCPs. The results show that eastward phase propagation of the semiannual harmonic is a statistically robust feature. For a further confirmation, zonal velocity and its divergence are calculated using ADCP records. Zonal velocity leads zonal divergence, which is another evidence for eastward phase propagation. These results suggest that the semiannual transient EUCs in the Indian Ocean are Kelvin beams radiated from the surface to the east and to the depth.

Keywords: Equatorial undercurrents, Indian Ocean, Kelvin beams