Upper-Ocean Circulation Anomalies of the Western Equatorial Pacific Observed in 2016 Summer

*Yilong Lyu[1]

1. Institute of Oceanology, Chinese Academy of Sciences

Mooring measurements at ~140°E in the western equatorial Pacific documented greatly intensified eastward subsurface currents, which largely represents the nascent Equatorial Undercurrent (EUC), to ~67 cm s^{-1} in boreal summer of 2016. The eastward currents occupied the entire upper 500 m, with the westward surface currents nearly diminished. Similar variations were also observed during previous El Niño events, as suggested by historical in-situ data. Further analysis combining satellite and reanalysis data reveals that the eastward currents observed at ~140°E are a component of an anomalous counterclockwise circulation straddling the equator, with westward current anomalies retroflecting near the western boundary and feeding southeastward current anomalies along New Guinea coast. A 1.5-layer reduced-gravity ocean (RGO) model is able to crudely reproduce these variations, and a hierarchy of sensitivity experiments are performed to understand the underlying dynamics. The observed circulation anomalies are largely the delayed ocean response to the strong equatorial wind anomalies over the central-to-eastern Pacific basin emerging in the mature stage of El Niño (September-April). Downwelling equatorial Rossby waves are generated by the reflection of equatorial Kelvin waves and easterly wind anomalies in the eastern Pacific. Upon reaching western Pacific, the Southern Hemisphere lobe of Rossby waves encounter the slanted New Guinea island and deflects equatorward, establishing a local sea surface height maximum near the equator and leading to the detour of westward currents flowing from the Pacific interior. Additional experiments with edited western boundary geometry confirm the importance of topography in regulating the structure of this cross-equatorial anomalous circulation.

Keywords: ENSO, OCEAN CIRCULATION, OCEAN OBSERVATION

