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Generation of the Equatorial Intermediate Current in the eastern Pacific Ocean

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It has been shown that the Equatorial Intermediate Current (EIC) in the Pacific Ocean, which is a westward current along the equator at intermediated depth (from 500m to at least 2000 m), has a basin-wide zonally uniform structure. In addition to the EIC, intraseasonal variability (ISV) has also been observed near the equator at 1000 m depth with significant amplitude in the eastern Pacific Ocean. Although this intermediate ISV in the eastern basin is considered as an energy source for the EIC, the origin of the intermediate ISV and its relation to the EIC in the Pacific Ocean are still open questions. In this study, we use the observed data and idealized simulations to investigate the relationship among the EIC, the ISV at the depth of 1000 m, and the ISV in the upper layer.

The observed meridional component of eddy kinetic energy (V-EKE) at 1000 m depth depicts large intraseasonal variability with a period of about 30 days in the equatorial eastern Pacific, showing a significant seasonality and interannual amplitude modulation. The upper-layer ISV signal also indicates significant seasonal and interannual variation in its magnitude, which has the highest correlation with the ISV at 1000 m depth at a time lag of 3 months. These results suggest that the ISV at a depth of 1000 m is provided by the upper layer ISV through a downward propagating Yanai wave, which takes about 3 months to reach 1000 m depth from the upper layer.

Argo-based zonal velocity in the equatorial Pacific Ocean is found to be westward during most of the high V-EKE season, and its magnitude varies on semiannual to interannual time scales. This suggests that intermittent Yanai wave propagation generates a westward flow at 1000 m depth, which could contribute to the generation of the EIC. Furthermore, a comparison of results from two numerical simulations of idealized box ocean with or without eastern basin ISV indicates that the downward propagating Yanai wave in the eastern Pacific Ocean generates westward flow locally at the intermediate depth. This may explain the observed basin-scale zonal extent of the EIC, which is unique to the Pacific Ocean. Influences of the realistic topography on the ISV and EIC at the intermediate depth will also be discussed.

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