Introduction:

Large-scale to mesoscale surface currents can be estimated from satellite observations with diagnostic models (Bonjean and Lagerloef 2002). The Ocean Surface Current Analysis Real-time (OSCAR) dataset, one of the most advanced current datasets, has been able to accurately produce Pacific equatorial zonal currents, but not Pacific equatorial meridional currents (Johnson et al. 2007; Fig. 3). The equatorial meridional currents contain quasi-geostrophic high-frequency perturbations amplified near the surface (Yanam et al. 2007) and wind-driven shallow meridional overturning cells (Philander and Pacanowski 1981; Phillips 1987); neither can be estimated by steady, 2-D surface diagnostic models. In this study, we use satellite SSH to identify two modes of tropical instability waves (TIWs) in the equatorial Pacific and develop a non-steady diagnostic model for their currents, especially for equatorial meridional currents of Yanai instability waves.

Summary

- Two modes of TIWs are identified with joint EOFs of SSH' and SST'.
- The new diagnostic model produces relatively accurate u' and v', as validated with models and in-situ mooring, especially for the Yanai mode.
- Two bands of barotropic instabilities energize Rossby and Yanai modes of TIWs.