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Impact of tropical instability waves in the Eastern Equatorial Pacific

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The systematic changes prompted by Tropical Instability Waves (TIWs) on large-scale atmospheric circulation in eastern equatorial Pacific are studied using an Atmospheric General Circulation Model (AGCM). A number of different strategies for incorporating the effect of TIWs in the daily SST climatology along with/without El Niño Southern Oscillation (ENSO) phase are exercised with Community Atmospheric Model version 3.1 (CAM) integrations in Atmospheric Model Intercomparison Project (AMIP)-style framework. Based on the objectives, this study is categorized into two parts. In the first part, we study how the TIWs change the near surface atmosphere circulation in association with ENSO phase, and the second part of the study examines how the circulation in the Atmospheric Boundary Layer (ABL) changes with the strength of the TIWs. The presence of TIWs in SSTs in association with an ideal ENSO phase directly impacts the mixing of the ABL temperature anomalies, thereby smooth the air temperature gradients set up by oceanic fronts through out the ABL in the eastern equatorial Pacific. Though this impact is seen both in El Niño and La Niña years, the mixing in the La Niña years is most affected (≈0.4^{o}C for every 1^{o}C SST change) compared to El Niño years (≈0.2^{o}C for every 1^{o}C SST change) during cold seasons (July to December) because the La Niña years are marked with strong meridional SST gradients. The impact of different strength of TIWs on large-scale circulation in absence of ENSO shows that the TIWs induce spatial and temporal variability in air temperatures, zonal and vertical velocities near the surface on TIW spatial and time scales (referred as TIW signatory mode). For the simulated meridional wind velocities, the TIW signatory mode is detected at the top of the ABL instead at near surface due to the meridional momentum mixing between ABL and the free atmosphere. However the meridional wind pole ward of 6oN does correlate with the TIWs near surface, which signifies meridional momentum mixing, despite this meridional momentum mixing alone cannot explain the changes in the meridional wind as a function of TIW strength. As the strength of TIWs increase the location of the meridional wind maxima shifts equator-ward instead of pole-ward.