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Depiction of tropical instability waves in the NCEP Climate Forecast System Reanalysis

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Tropical instability waves (TIWs) are commonly observed mesoscale eddies as westward-propagating wavelike oscillations of SST front along the equatorial cold tongue in the Pacific and the Atlanticoceans. TIWs involve active air-sea coupling. There is an increasing need to understand and monitor TIWs due to their significant roles in modulating ocean momentum and heat exchanges as well as upwelling and nutrient supplies. However, the historical reanalysis data sets are incapable of adequately representing TIWs variability owing to their coarse resolution and lack of air-sea coupling. The recentlycompleted Climate Forecast System Reanalysis(CFSR) at NCEP, which use a 6-hour coupled model forecast as the first guess, a strong nudging to daily OI SST and high spatial and temporal resolution(available at hourly time resolution and 0.5x0.5 horizontal resolution) , has a potential to depict TIWs well. The primary motivation of this study is to inform user community the main characteristics of TIWs in the CFSR and how well they agree with those derived from in situ and satellite observations. Consistent with previous studies, TIW-induced SST variations in the CFSR exhibits pronounced seasonal and interannual variability. At the two eastern TAO moorings (140W, 2N and 110W, 2N), the temporal variations of SST signals are highly consistent among the CFSR, TMI SST and TAO. Low-level wind fluctuations associated with TIWs in the CFSR resembles the QuickScat very well although the amplitude in the CFSR is weaker than those of QuickScat by 30%. The characteristics patterns of regressed SST and wind fields and their phase relationship are remarkably similar with those derived from Satellite products (TMI SST, QuickScat wind).It indicates that air-sea coupling processes associated with TIW-induced SST and winds are well represented in the CFSR and the weak wind response might be attributed to weaker SST signals.Our results highlight that the 28-year period (1982-2009) CFSR provides unprecedented opportunities in studies of physical mechanisms of TIWs as well as their long term impact on the climate.