

Intraseasonal variability of ocean surface in the western Pacific warm pool and its connection with typhoon activity

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It is known that convective activity over the western Pacific warm pool varies in intraseasonal time scale (30-90 days). Recent studies suggest that frequency of tropical cyclone increases significantly during a convectively active phase. It is also known that a tropical cyclone can intensify through the supply of energy from ocean surface, and a significant cooling of ocean surface is sometimes observed just after the passage of a tropical cyclone. However, the variability in an oceanic mixed layer associated with tropical convective activity is not fully understood. In the present study, the variability of ocean surface layer in a time scale shorter than 90 days is examined using satellite-derived sea-surface temperature and vertical profiles observed by high-repetition drifting floats. The relevance of the short-term variation with tropical cyclone activity is discussed.

A spectral analysis of sea surface temperature (SST) was performed using satellite-derived dataset for 23 years (1988-2010). Results show that there is no significant peak of power spectral density but almost equal power in the bandwidth of 5-90 day, meaning the prevalence of irregular variation (like white noise) in the intraseasonal time scale. A close inspection of the variation in each year revealed that this irregularity was resulted from a mixture of signals in various time scales, such as 60-day cycle in 2004 and 20- or 30-day since 2008. This short-term variation has from one third to equal strength of power relative to the semiannual and annual variations.

The close inspection also revealed that many of short-term variations with significant amplitude were associated with tropical cyclone activity. Using tropical cyclone best-track data, a change in sea-surface temperature at grid points along each tropical-cyclone track was analyzed. Results show that a sequence of warming ($\sim +0.5\text{K}$) prior to the passage and significant cooling ($\sim -1.0\text{K}$) after that is a common feature of variation associated with a tropical cyclone (as shown in the attached figure). The time scale of the sequence varies among cases but was usually in between 20 and 60 days. In many cases, a tropical cyclone track coincided with an area where SST significantly increased. This means that a preconditioning of ocean surface usually occurs before a tropical cyclone comes. The vertical profiles of water temperature observed by high-repetition (1 time/day) drifting floats showed that the set of warming and cooling occur in a whole depth ($\sim 50\text{m}$) of a surface mixed layer.

The results of the present study indicate that the western Pacific warm pool is characterized by irregular variation of ocean mixed layer associated with tropical-cyclone activity in intraseasonal time scale.

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