



Effects of the Cold Tongue in the South China Sea on the Monsoon, Diurnal Cycle and Rainfall in the Maritime Continent

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We investigate the effects of the Cold Tongue in the South China Sea (SCS) on the winter monsoon, rainfall and diurnal cycle in the Maritime Continent using a numerical model verified with satellite rainfall and reanalysis data. Composite analysis of the observation and reanalysis data based on Cold Tongue Index indicates that the penetration of the monsoon to Java Sea is enhanced when the cold tongue is strong. A sensitivity experiment without the cold tongue shows that the winter monsoon is diminished over SCS and around coastal regions because of anomalous low-level cyclonic circulation associated with enhanced convection over SCS due to the warmer SST. The diurnal cycle, in particular, the night-morning rainfall over the ocean in coastal regions is modified. The effect on daytime rainfall over the land is weaker. Along the northern coast of Java far from SCS, the night-morning rainfall is much reduced over Java Sea when the cold tongue is suppressed because of the weakened land breeze front due to the weakened northerly monsoon. In contrast, the afternoon-evening rainfall on Java Island is enhanced showing that the local impacts are not simply the result of large-scale subsidence from the convective anomaly in SCS. Along the northwestern coast of Borneo adjacent to SCS, the weakened winter monsoon tends to reduce the rainfall at the land breeze front near the coastline. On the other hand, the warmer SST forces a stronger land breeze and the weakened monsoon encourages further and faster offshore propagation of the land breeze front. Consequently, the rainfall peak shifts further offshore in the sensitivity experiment. We conclude that the cold tongue has two effects, the sustenance of a strong monsoon (indirect effect) and the cooling of local SST (direct effect), which have opposite influences on the diurnal cycle in the Maritime Continent.

Reference:

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