Combined effects of SSTs in the Indian and Pacific Ocean on the seasonal modulations of the western North Pacific rainfall and typhoons

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During the beginning of the twenty-first century, corresponding to global warming slowdown, sea surface temperature (SST) anomalies are characterized by continued warming in the Indian Ocean (IO) and La Niña-like patterns of the Pacific SST. During this period, summertime rainfall over the East Asia were below normal. The warm SST anomalies in the Indian Ocean generate anomalous anticyclone (AAC) to the east of Philippines through Kelvin-wave induced Ekman divergence, which has a suppressant effect for in situ convection [1]. Based on the numerical experiments, enhancement of rainfall takes place over the tropical western Pacific in relation to the local SST rise relevant to the prolonged La Niña, while its amplitude becomes about the half of that due to the remote IO-origin teleconnection [2]. Consequently, the Pacific-Japan teleconnection emerged during this period, which accounts for the less rainfall over the East Asia including Japan. Those results indicate the importance of combined effect of Indian and Pacific Ocean on the modulation of rainfall involved in the Asian summer monsoon. We also investigated tropical cyclone [TC] frequency obtained from ensemble of high-resolution atmospheric general circulation model simulations with a particular focus on the decaying phase of El Niño [3]. Our analysis reveals a prolonged decrease in TC frequency over the tropical western Pacific during the post El Niño years until the boreal fall. Dominance of anomalous AAC over the western Pacific induced by the delayed warming in the tropical Indian Ocean is the main factor for the suppressed TC activity rather than the local SST change. In contrast, the TC number over the South China Sea tends to increase during the post-El Niño fall (SON). The physical reason can be ascribed to the weakening of AAC associated with the termination of IO warming. Thus we demonstrate that the duration of the IO warming should be taken into account when the ENSO is considered as an environmental factor for predicting TC activity.

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