

Influence of Tropical Cyclone on the Estimation of Climate Variability in the Tropical Western North Pacific

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Abstract

Climate system includes multi-scale interaction. But relatively little is known about the influence of tropical cyclones on large scale environment. In this study, we attempt to understand the roles of tropical cyclones in affecting the climate variability in the Western North Pacific region.

By estimating the differences between the original and TC-removed fields, the contribution of TC accounts for 60-70% of interannual variability. On the intraseasonal time scale, the 2004 typhoon season is studied because of the strong intraseasonal oscillation signal and large number of TC. It is found that the TC contributes a substantial amount to the 32-76-day variance of 850 hPa vorticity. A study on other years also indicates that the intraseasonal variability is enhanced by the TC activity. While the low-frequency, large-scale circulation has clustering effect on TCs, the latter with large positive vorticity, which tend to occur in the positive vorticity background flow, significantly enhances the total strength of the positive vorticity. This TC contribution, which is not offset by the synoptic systems with weak negative vorticity, can therefore leave marked footprints in the climate signal and variability, so it implies that the climate variability, as it is defined, is not contributed merely from the low-frequency large-scale fluctuations. Instead, the TC effect has to be taken into account to understand the climate variability in the tropical Western North Pacific. In order to identify the contribution of TC to the intraseasonal oscillation, we try to use the Purdue Regional Model (PRM) with the 60-km resolution to explore how the TC affects the intraseasonal variability.

This result implies that the ensemble effect of TCs, at least in the statistical sense, has to be resolved in the climate model to obtain better simulation of climate variability in the TC-prone region such as the tropical Western North Pacific.