

## New tropical cyclone removal technique based on potential vorticity inversion and its application in climate diagnostics

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Several studies have revealed the large-scale environmental effects on a tropical cyclone (TC) during its life cycle. By contrast, few studies have considered the effects exerted by TCs on the large-scale environment. An effective way of investigating the TC effects on different spatial/temporal-scale environmental fields is to use a data set from which the TCs have been removed. Although dynamical balance is required for analyzing TC contributions, the balancing of TC-removed fields obtained by the existing TC removal method (which is widely used in the TC bogus procedure) remains unclear. In this study, a novel TC removal method incorporating the potential vorticity (PV) inversion technique is proposed. This method objectively detects the PV disturbance associated with TCs. The TC-removed field is well balanced due to the balance of the PV inversion framework.

A stronger TC vortex is derived, and the vortex has a wide range of effects compared with the TC components derived by the existing TC removal method. Therefore, after the removal of TCs, the environmental field surrounding TCs remains largely unchanged in the existing method, while it changes markedly in the new method. Moreover, both the existing method and new technique are applied to evaluate the TC contribution to the intraseasonal variance in the tropical WNP during JJASO 2004 and the results are compared. The results confirm the significant contribution (up to 50%) of TCs to the intraseasonal variance along the TC tracks. The existence of TCs enhances the amplitude and propagation of intraseasonal oscillation.

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