Impact study of updating SST on TWRF typhoon predictions over the western North Pacific

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Abstract

The ocean surface plays a major role in modulating the TC intensity and structure changes. It is well known that strong winds of a TC can induce significant upwelling in the ocean, bring down the underneath SST and affect subsequent TC intensity for slow-moving storms. Without coupling of ocean model, the intensity prediction skill of atmospheric-only TC models suffers from this shortcoming. However, due to computational limitation, most operational TC prediction models are not coupled. The TC prediction system, TWRF of Central Weather Bureau uses the forecast fields from the NCEP FV3 for the boundary conditions. Due to the lack of ocean-coupling, TWRF suffers over-prediction of TC intensity when a storm moves slowly over the ocean. A new strategy is designed for this remedy that uses the predicted SST from ECMWF coupled IFS instead of a fixed SST from NCEP forecast fields.

Typhoon In-Fa is selected due to its over-intensified prediction and slow speed. In the operation run where the SST is fixed, the over forecast intensity error is 35 hPa in the 3km domain at 120h. When the SST is updated with ECMWF predicted SST, the intensity errors are improved by 20 hPa. Meanwhile, the track error has increased slightly in the 3km domain. We speculate the that the slight degradation is due the inconsistent between the bottom boundary condition from the ECMWF and the lateral boundary condition from NCEP. We tested a combination strategy using NCEP and EC, and a blending of them as the boundary conditions for TWRF. The blending strategy, mixing the EC and NCEP forecast fields as the lateral boundary condition and ECMWF SST as the bottom boundary condition, performs the best in the test case of In-Fa. The blending strategy consistently beats the operation version of TWRF on the intensity prediction with 204 cases/19 typhoons. This blending method posts as a working strategy for uncoupled models to account for the feedback from the ocean in a computationally efficient way.