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ITOP ドロップウィンドゾンデを使用した台風進路予測のための観測システム実験
Observing System Experiments for Typhoon Track Prediction using ITOP Dropwindsonde Data

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An international field campaign, Impact of Typhoons on the Ocean in the Pacific (ITOP), was conducted in 2010. While ITOP aimed to study the ocean response to typhoons in the western Pacific, a number of dropwindsondes were released from research aircrafts during the field experiment. The dropwindsonde data was provided in real time via the Global Telecommunications System (GTS) in order for operational numerical weather prediction (NWP) centers to assimilate the data.

In this study, the impact of the dropwindsonde data collected during the ITOP field campaign on typhoon track prediction is investigated. For this purpose, the global forecasting system at the Japan Meteorological Agency (JMA), which consists of the Global Spectral Model (GSM) and Four-dimensional variational assimilation (4D-Var), is used. The resolutions of GSM and the inner model of the 4D-Var are TL319L60 and T106L60, respectively, while those of the operational system are TL959L60 and TL319L60, respectively. Two sets of numerical experiments are performed; one is that all dropwindsonde data is assimilated in the 4D-Var, and the other is no dropwindsonde data is assimilated. The period of the numerical experiments is 3 months, 22nd Jul. to 22nd Oct., which cover the whole ITOP period. The total number of dropwindsondes used in the experiments is 656.

The results of the data denial experiments show that the dropwindsonde data has a small impact on typhoon track prediction. It is found through detailed analyses that many of the dropwindsonde data are rejected in the data assimilation due to large differences between the observations and the first-guess fields. In addition, the displacement of typhoon central position in the first-guess field is also found to be the cause of the rejection of observational data. Different from airborne observations targeted on typhoon track prediction, where the dropwindsondes are deployed not only around typhoons but also in the synoptic environment, most of the dropwindsondes are collected near the center of typhoons in ITOP. Besides the horizontal resolutions of GSM and the inner model of the 4D-Var used in this study are about 60 km and 120 km, respectively, which is not enough to resolve the typhoon structure near the center. It would be needed to improve the representation of the first-guess fields to assimilate the dropwindsonde data near the center of typhoons. Increasing the horizontal resolution of GSM and the 4D-Var or using a regional forecasting system such as the JMA Non-Hydrostatic Model (NHM) may be a promising approach. At the same time, a study on adaptive observation techniques is of great importance because the observations near the typhoon center may not necessarily have a large impact on the reduction in the typhoon track prediction errors.

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