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Impact of Assimilating Dropwindsonde Data Deployed at Different Sites on Typhoon Track Forecasts

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This study investigates the impacts on typhoon track forecasting by the Mesoscale Model5 (MM5) and its 3DVar system of assimilating dropwindsonde observational data acquired from different sites. All of the sonde data were obtained between 2004 and 2009 in the typhoon surveillance program Dropwindsonde Observations for Typhoon Surveillance near the Taiwan Region (DOTSTAR). Experiments were conducted to test the model's response to five scenarios involving differing dropwindsonde data inputs, namely: (1) no dropwindsonde data, (2) all available dropwindsonde data, (3) data gathered in sensitive regions identified by the conditional nonlinear optimal perturbations (CNOP) approach, (4) data gathered in sensitive regions identified by the first singular vector (FSV) approach, and (5) several sondes selected at random.
The results show that using dropwindsonde data based on CNOP sensitivity can lead to improvements in typhoon track forecasting similar to, and occasionally better than, those achieved by assimilating all of the available data. Both approaches offered greater benefits than the other three alternatives averagely. It is proposed that CNOP provides a suitable approach to determining sensitive regions during adaptive observation of typhoons. Similar results may be obtained if the sensitivity products developed using MM5 are employed in the weather research and forecasting (WRF) model, suggesting that it is applicable to utilize sensitivity produced by MM5 on WRF model.