Impact of GPS Radio Occultation Data
Assimilation on Typhoon Predictions

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Abstract

The mesoscale model WRF with three-dimensional variational (3DVAR) assimilation was utilized to investigate influences of GPS radio occultation (RO) data on predictions of typhoons past Taiwan. Two typhoon cases were simulated, namely, Typhoon Kaemi in July 2006 and Typhoon Shanshan in September 2006. The GPS refractivity profiles are taken from the six FORMOSAT-3/COSMIC satellites that give a daily measurement of more than 1500 occultation points. Prediction is found to be slightly improved by use of the nonlocal operator to assimilate excess phase (an integrated amount of the refractivity along a raypath) as compared to local operator assimilating refractivity. The performance by 3DVAR was further improved in cycling runs with a bogus vortex. A 4DVAR impact study using the MM5-adjoint model was also conducted, in which the bogus data assimilation (BDA) producing an initial reasonably strong vortex gives improved typhoon tracks as well as rainfall predictions. Performance of the prediction with assimilation of GPS RO refractivity incorporated into BDA was investigated, which indicates that the strong vortex tends to dominate the cost function as compared to the modification by GPS RO observations. Sensitivities to different assimilation procedures with GPS RO observations and a bogus vortex were examined.