Geophysical Research Abstracts
Vol. 14, EGU2012-3828, 2012
EGU General Assembly 2012

Influence of conditional nonlinear optimal perturbations sensitivity on typhoon track forecasts

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In this study investigates the influence on typhoon track forecasts by the Mesoscale Model5 and 3D-Var system of assimilating additional simulated dropsonde data in sensitive regions identified by Conditional Nonlinear Optimal Perturbations (CNOPs) for seven typhoons in the western North Pacific. As a reference, a similar analysis was performed for the sensitive regions identified by SingularVectors (SVs), using the same model and assimilation system as that in the case of CNOPs. Six of the seven cases show an improvement in typhoon track forecasts, with the degree of improvement being 13%–46% in the CNOPs sensitive regions and 14%–25% in SVs sensitive regions. Furthermore, track forecasts that consider dropsonde data show improved performance not only during the optimization period for these six cases (24–48 h), when CNOPs and SVs sensitivities were calculated, but for longer forecast times of 48–72 h. However, relatively large observation errors result in reduced forecast performance for the remaining typhoon case. These results show that the deployment of dropsondes in sensitive regions identified by CNOPs has an overall positive influence on typhoon track forecasts, suggesting in turn that CNOPs can be utilized as an adaptive method in determining sensitive regions in adaptive observations