Concentric Eyewall Formation in Typhoon Sinlaku (2008) - Integration of T-PARC Observations Based on EnKF Data Assimilation

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In this study, a new tropical cyclone (TC) initialization and assimilation method is constructed based on EnKF. Three observation operators are selected for the assimilation, including the vortex center location, vortex translation vector, and lowerlevel axisymmetric component of the wind-radius profile. It is shown that after the 24-h assimilation period in WRF model, with the above three parameters assimilated through EnKF, a more realistic, dynamically well-balanced, and model-consistent vortex structure can be constructed in the model. This method provides a useful means to improve the initial condition for TC model predictions, especially when detailed TC structure data are available. The valuable TC data obtained from multiple airplanes in T-PARC in 2008 are then assimilated through update cycle to reconstruct a model-observation consistent dataset, which can be used to examine the evolution of TC track, intensity and structure change. In particular, with the well-assimilated T-PARC data in Typhoon Sinlaku (2008), important parameters, including the filamentation time and beta skirt (vorticity gradient), are calculated to examine the validity of the extant theory on the formation of concentric eyewall. Implication of this method to improve our understanding of both TC dynamics and predictability is also demonstrated.