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Tropical cyclone forecast using a hybrid EnKF-4DVar system
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Analysis increment is dependent on the prescribed background error covariance **B** in addition to innovation and model dynamics that describes the development of perturbations. Traditionally, **B** is assumed to be static in time according to so-called NMC method. Following this method, the differences between pairs of forecasts valid at the same time, but having different lead times, are taken to represent the background error. While **B** in NMC method approximates the climatological background error covariance, recent studies have shown that the forecast skill of 4DVar is further enhanced by making flow-dependent **B** out of the perturbations in the ensemble-Kalman filter (EnKF) (Buehner et al. 2010). This system is referred to as Hybrid EnKF-4DVar. We have developed the meso Hybrid-4DVar system based on the meso 4DVar system (JNoVA) in the Japan Meteorological Agency since the improvements is thought to be more pronounced for severe impact weather such as tropical cyclones and heavy rainfall. In this presentation, we present a preliminary result for a forecast of tropical cyclone Talas (2011). Figure 1 shows the analysis increment of horizontal wind in the conventional 4DVar and hybrid EnKF-4DVar. The first guess of the zonal wind is overplotted. It shows a pseudo observation of wind field near the center of the tropical cyclone yields the analysis increment of a pair of cyclonic and anti-cyclonic circulations. It corresponds to a vortex displacement in the hybrid EnKF-4DVar system. In contrast, the analysis increment does not fit the structure of the tropical cyclone when using **B** based on the NMC method. It suggests that the hybrid EnKF-4DVar system reproduces the reasonable analysis increment with a little information.

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