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Typhoon prediction with SABV method and the effect of asymmetric components

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The track and intensity forecast experiments of typhoons in 2010 were performed using the structure adjustable balanced vortex (SABV) tropical cyclone (TC) initialization scheme, and the effects on the forecasts including the asymmetric components were also identified. For the purpose of forecast, the global forecast system (GFS) data provided by the National Centers for Environmental Prediction (NCEP) was adopted as initial and boundary conditions. Since the SABV method contains only axisymmetric components, the asymmetric components should be included to make more realistic bogus vortex. The asymmetric components being existed in tropical cyclone scale were extracted from the short model integration that started from the 6 hours earlier than targeted time. In the procedure for obtaining the disturbance of asymmetric components from the total field of the model output, the high-order spectral filter for limited-area domain applied to the Mercator map projection is used to separate the scale components. The average track and intensity (in terms of central pressure) errors at 48 h forecast time for 10 typhoons were 176 km and 10.7 hPa, respectively, showing smaller forecast errors than those of Regional Specialized Meteorological Center (RSMC) Tokyo that were 204 km and 14.8 hPa. Also, forecast experiments without TC initialization were conducted to evaluate the effect of initialization. The experiments with SABV method reduced track and intensity errors by 11% and 10%, respectively, compared with those without TC initialization. The forecast experiments with asymmetric components were carried out for the track error larger than the average of the experiments with the axisymmetric bogus vortex. The effects of the inclusion of asymmetric components showed positive effects for both track and intensity predictions and those errors were reduced by about 7.8 % and 7.9 %, respectively. These results suggest that the SABV TC initialization method with more realistic bogus vortex can be a promising scheme even in the case that global forecast data is incorporated in a series of forecast experiments of Cheong et al. (2011) where the global final analysis (FNL) data was used as the initial and boundary conditions.