GRAPES-REPS Mesoscale Ensemble Prediction System: methodology and evaluation

Jing Chen, Hanbin Zhang, Xiaoli Li, Yinglin Li, Li Gao, Yuanzhe Wang, and Guo Deng
(chenj@cma.gov.cn),Numerical Weather Prediction Center, CMA

Mesoscale severe weather systems have been the hot topic of the meteorological research in recent years. The high intensity and sudden occurrence of mesoscale severe weather phenomena make them difficult to predict. The current method for predicting mesoscale severe weather phenomena relies greatly on the high-resolution regional ensemble model. A new short-range regional ensemble prediction system based on GRAPES-MESO model, named the GRAPES regional ensemble prediction system (GRAPES-REPS), was developed by the China Meteorological Administration (CMA) . CMA has been routinely running this system since the summer of 2014 and it has become an effective tool for mesoscale weather prediction. The GRAPES-REPS ensemble calculates the initial condition perturbations using the ensemble transform Kalman filter (ETKF). A T639 global ensemble that provides lateral boundary conditions to this regional ensemble.The perturbations using the ETKF for the regional ensemble contain more detail on small scales and less power on large scales. Thus a Multiple Scale Blending(MSB) perturbations method has been operationally impletmented. Aside from the ICs perturbations, the multiple-parameterization scheme and Stochastically Perturbed Parameterization Tendencies (SPPT) scheme were employed in GRAPES-REPS to describe the model uncertainty.in this system, the random field which is described with first order Markov chain has a time-related characteristics and Gaussian distribution, and also has a continuous and smooth horizontal structure.
The skill of probabilistic forecasts using GRAPES-REPS was studied. The operational run of this system has shown skillful probabilistic forecasts of the heavy-rain-producing MCSs in the east side of Tibetan Plateau and landfall typhoon cyclone, the most two severe and significant systems in China.

Keywords: GRAPES, Regional EPS, Methodologies, Evaluation , MCSs, Typhoon