Observational Calibration of Numerical Weather Prediction with Anomaly Integration

Xindong Peng (1), Yuzhang Che (1), and Jun Chang (2)

(1) State Key Laboratory of Severe Weather, Chinese Academy of Meteorological Sciences, Beijing,China
(pengxd@cams.cma.gov.cn), (2) College of Atmospheric Sciences, Chengdu University of Information Technology, Chengdu, China

Bias of numerical weather prediction (NWP) exists whenever because of the uncertainty of initial condition, model dynamics and physics. Perfect numerical solutions are therefore not accessible. The historical observations, however, record the real variation of atmosphere. The corresponding information can be used for NWP calibration. We developed an anomaly numerical-correction with observations (ANO) method for the NWP improvement with the help of historical reanalysis data. Tests and validations with several winter and summer case of sustained heavy rainfall in China show the nice effectiveness for improving circulation in NWP within two weeks. In a coarse CAM3.0 (T42 or T85) model configuration, the ANO correction extends numerical prediction by 1 day at the condition ACC > 0.6. Obvious improvement to ACC and RMSE of geopotential height, temperature, relative humidity and wind components is shown in both winter and summer cases. Correction to temperature at 500 hPa reaches 3.4 K in a winter storm case of 2008. In the tests, great calibration is observed at lower-latitude region, and the summer hemisphere is more obvious than the winter one. Out of thirty cases, 67% are significantly improved and the other 23% have a marginally amelioration.

In addition to the circulation fields, we also verified the ANO for rainfall prediction using the nonhydrostatic WRF 3.5 model. Thirty-year hind cast is carried out using a three-region nesting configuration. The highest resolution is 4 km. Increase of ACC and decrease of RMSE is also shown for geopotential height in the high-resolution numerical prediction, and the accumulated rainfall illustrates also general amelioration in both amount and the position when the same ANO correction is used. Due its spatial and temporal discontinuity of precipitation, the effect of ANO is not that significant as for circulation fields. In the presentation, we will show more detailed verification of the correction in several heavy rainfall cases and the application for daily numerical prediction.