Title

Introduction to the Korean Integrated Model (KIM) based global ensemble prediction system

Abstract

The Korea Meteorological Administration (KMA) has been running the Korean Integrated Model (KIM) global forecasting system semi-operationally since April 2019. KIM is based on a spectral-element non-hydrostatic dynamical core designed for a cubed sphere grid. Deterministic forecasts are currently run with an approximately 12 km horizontal grid spacing and 91 vertical levels, and we are also running a 50-member KIM-based Ensemble Prediction System (EPS), but with a much coarser horizontal grid spacing of ~50 km.

Initially the EPS was used only to provide the 9-hour ensemble forecasts required by the hybrid-4DEnVar deterministic data assimilation system, but more recently we have been developing the system further to create a full (EPS) for the short and medium range. The data assimilation method is the Local Ensemble Transform Kalman Filter (LETKF), and we also apply multiplicative and additive inflation. The ensemble perturbations are generated by subtracting the weighted average of the global analysis and the ensemble mean for each analysis time. Stochastic physics schemes are not yet applied in the semi-operational system.

As a preliminary test for operations, we have compared the KIM EPS with KMA's operational implementation of the UM-based MOGREPS-G system, which is currently run with a 32 km horizontal grid spacing and 48 members, 25 of which are run into the medium range and combined with lagged forecasts to produce EPS products. The performance of the ~50 km version of the KIM EPS is not yet comparable with the operation MOGREPS-G system, suffering from a relatively small spread. Decreasing the grid spacing to ~32 km gives better results, but the ensemble remains under-spread and worse than the operational system. To try to improve the spread, the Relaxation-To-Prior Spread (RTPS) method has been applied in place of multiplicative inflation, and we have also introduced stochastically perturbed physics tendencies (SPPT) and stochastically perturbed dynamics tendencies (SPDT) into the forecasts to represent model uncertainty. These changes have increasing the spread, with stochastic physics found to be particularly helpful in the tropics.