Reply to Interactive comment on "A scale-dependent blending scheme for WRFDA: impact on regional weather forecasting" by H. Wang et al.

Anonymous Referee #1

Received and published: 6 May 2014

Review of the manuscript
A scale-dependent blending scheme for WRFDA: impact on regional weather forecasting
by H. Wang, X.-Y. Huang, D. Xu and J. Liu

General comment

The manuscript describes the utilization of large scale information from global numerical weather prediction (NWP) models in regional NWP models. Regional NWP models has difficulties to handle the large scale information in a proper way, partly due to use of observations within the regional model domain only and partly due to the effects on non-perfect lateral boundary conditions (on the lateral boundaries of the regional model domain). This is a problem that is well known to the NWP community applying regional high resolution models operationally for short range weather forecasting. Various "blending" schemes to mix in large scale information from global NWP models have been invented and are also applied successfully for operational forecasting. These "operational" blending schemes are hardly described in the scientific literature. The blending scheme of the current manuscript by Wang et al. is, for example, very similar to the blending scheme of Yang that has been operationally applied in the HIRLAM forecasting system for many years but only described in a HIRLAM Newsletter article. For this reason, I think that it is worthwhile to publish the current manuscript by Wang et al. since it also has merits by itself with a thorough comparison between "no blending data assimilation", "background blending", "analysis blending" and "downscaling (no data assimilation)".

We thank you very much for your invaluable comments that improved the revised manuscript. Here are our responses.

Detailed comments

Page 2464, lines 28-29: The ECMWF reanalysis data set seems to me to be on a too large scale for verification of WRF forecasts produced by a model with 15 km grid resolution. Preferably, observation verification scores should also be provided for u, v, T and q.

Reply: We agree that 'small' scale information in WRF forecasts can not be well verified by use of the ECMWF reanalysis. Here we only intend to verify 'large' scale component of forecasts that can be presented by ECMWF reanalysis (0.7 degree). We chose ECMWF reanalysis as independent reference because it is well known that the ECMWF reanalysis has high accuracy because it is produced by an advanced 4-dimensional variational data assimilation system that ingests in-site and remote observations. Moreover, it is not used in the experiments in this manuscript.

Following your suggestion, we verified WRF forecasts against conventional data (radiosonde, wind profiler, et al.). In general, the forecast skills are consistent to those compared to the

ECMWF reanalysis. So we do not add the verifications skill against observations in the revised manuscript. Here is an example of 24 h forecast verification, which is same to Fig. 5 in the manuscript but against observations.

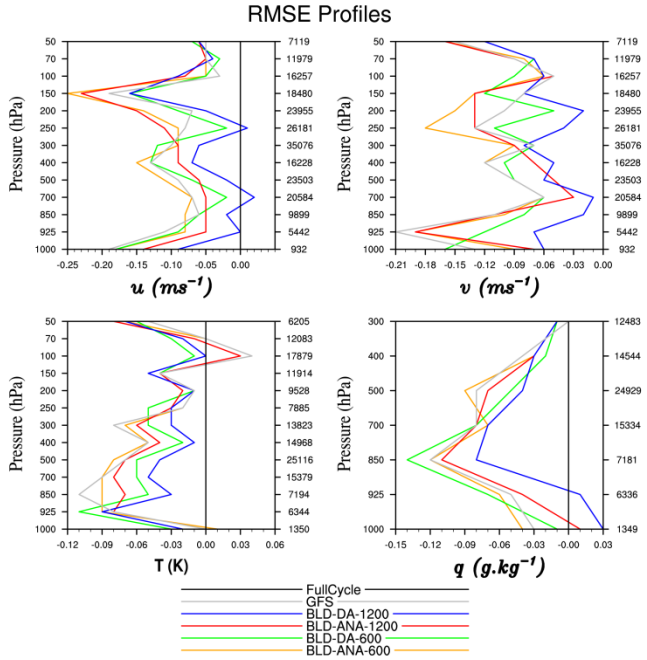

Fig. 1. 24h forecast RMSD reduction compared to FullCyclce. (a) *u*, (b) *v*, (c) T, and (d) q. Number of observations is shown in the right side y-axis.

In the verification of precipitation forecasts, it seems that observations were used, indeed. Please provide a short description of the precipitation observations (Stage IV) that were used.

Reply: The Stage IV precipitation is the regional hourly/6-hourly multi-sensor (radar+gauges) precipitation analyses at NCEP. We added a short description on Stage IV precipitation in the revised manuscript, and reference was added as well.

Lin, Y., and K. E. Mitchell, 2005: The NCEP stage II/IV hourly precipitation analysis: Development and applications. Preprints, 19th Conf. on Hydrology, San Diego, CA, Amer. Meteor.Soc., P1.2.

Language and editorial comments

Page 2457, line 9: .....when a forecast error .....

Accepted.

Page 2457, line 28: .....study of such a method

Accepted.

Page 2458, line 9: ..... took a slightly different .....

Accepted.

Page 2458, line 25: I would prefer “in order to reduce spin-up effects” rather than “this can reduce spin-up issue”.

In the revised manuscript, the statement is change to: is expect to reduce spin-up issue.

Page 2459, line 3: I would prefer “The component of a field x at length scale” rather

than “A field x whose component at length scale”.
Accepted.
Page 2460, line 13: ..... maintained at the National .....
Accepted.
Page 2461, line 2: ..... when the wave length is equal to the .....
Accepted.
Page 2462, line 17-18: ..... WRF forecast compared to that .....
Accepted.
Page 2463, line 14: Before performing the blending experiments .....
Accepted.
Page 2464, line 1: ..... to generate a forecast difference ensemble to model the background ....
Accepted.
Page 2464, line 7: ..... from the Global .....
Accepted.
Page 2464, line 24: ..... that were initiated from .....
Accepted.
Page 2468, line 6: .... in the first few hours .....
Accepted.
Page 2468, line 15-16: ..... Compared to the GFS.....
Accepted.