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

Anonymous Referee #2

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1. General Comments

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

In this manuscript, on the base of Yang's preliminary implementation, the authors describe a scale dependent blending technique of re-introducing large-scale features from global analyses and forecasts into regional model, which is supposed to resolve the problem of the obvious large-scale forecast error in regional WRFDA system running in full cycle mode. The results of a 2-week period full cycle assimilation and forecast experiments indicate that the blending scheme does show the merit of improving largescale weather features while keeping the well-developed small-scale signals active in the WRFDA analyses and regional model, and the blending scheme led to reduced analysis and forecast error and better precipitation forecast quality. The results shown in the manuscript are exciting as it provides a practical method to resolve the problem relating to the large scale error due to the inherent deficiency of regional model, especially for the operational regional numerical forecast running in full cycle mode. Therefore, I recommend the manuscript to be published.

We thank you very much for your invaluable and encouraging comments. Here are our responses.

2. Specific Comments

The choice of cut-off length scale determines the amount of information extracted or retained from the host/regional model respectively. As mentioned in page 2463, line 14-15, 'response functions to various cut-off length scales are examined to aid in selecting cut-off length scales', there is on further discussion about the selection of cut-off length scale in the manuscript. It's correct that the response function only reveals the performance of the filter to a certain cut-off length scale, which aids, but can not provide an objective criteria. Actually the selection of 1200 and 600km in the manuscript still looks as an empirical choice. The authors need to emphasize the issue.

Reply: Thank you for your suggestions. We added discussions on choice of cut-off length scale in the revised manuscript. Please see section 3.2 in the revised manuscript.

We agree that there is no a definite objective criteria or standard for selections of the cut-off length scale. However, the size of model domain, and experience on a data assimilation system do help to select the cut-off length scales. It is pointed out that one of reasons is given why the cut-off length scales of 600 and 1200 km are selected in the previous manuscript. The two cut-off length scales of 600 and 1200 km are selected because they can reintroduce the large-scale components in GFS with wavelengths above 3000 km that might not be well presented in the current model domain region of about 6300km×4800 km.

It's mentioned that "The filtered fields become smoother when the cut-off length scale

becomes larger (Fig. 2b and c). Those filtered fields represent the large-scale information that is kept in blended fields (Fig. 2g and h) using Eq. (6c) "(page 2462 line 10-11). And " The differences showed in Fig. 2e and f represent the small-scale information that is kept in blended fields (Fig. 2g and h)."(page 2462 line 14-15) . But we can identify the similar noise-alike(relating to topography) distribution of 500hPa geo-potential height from both the filtered (Fig.2b-c) and the residual (Fig2e-f). If possible, please give some explanations about it.

Reply: It is noted that the filter was implemented over the WRF model ETA level space. The noise-like distributions was caused by interpolation fields from model levels to pressure levels. If figure are drawn exactly on the WRF model level, you will not see the "noise".

3. Technical Comments

Page 2459, line 11: equation (3) not correct

Typo error is fixed.

Page 2461, line 24: should be 'perturbation potential temperature'

Accepted.

Page 2464, line 20: why 'next WRF cycle'?

Changed to "this WRF cycle".

Page 2473, Fig.1: I think the labels of GFS and WRF are confusing. In caption of figure1, it is only about the 'amplitude response' ,whatever it is for GFS or WRF. I understand the authors are trying to express after blending, most of large-scale part is from GFS and the residuals are from WRF. If so, the caption needs more revision.

Accepted. We added description on GFS and WRF in the Fig. 1 caption. Fig. 1 is also used to explain the idea of blending. Please see section 2.2 for details.