Geoscientific
Model Development
Discussions

Interactive comment on "The impact of periodization methods on the kinetic energy spectra for limited-area numerical weather prediction models" *by* V. Blažica et al.

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We would like to thank Referee #1 for his/her comments and suggestions for the paper improvement. In response to the comments, some additional changes to the paper have been made to correct the errors and provide better clarity.

Replies to the specific comments and questions raised by the referee are provided below using the same organization as in posted interactive comments. The referee comments are italicized.

1. p. 6492, line 17-18: replace AROME and HARMONIE by AROME and ALARO. HARMONIE is the common denominator for both model configurations. These two are

described in the following papers,

- *For AROME you can cite the paper: Seity, Y., P. Brousseau, S. Malardel, G. Hello, P. Bénard, F. Bouttier, C. Lac, and V. Masson, 2011: The AROME France convective-scale operational model. Mon. Wea. Rev., 139, 976–991.*

- *For ALARO, it is described in: De Troch, R., R. Hamdi, H. Van De Vyver, J.-F. Geleyn, P. Termonia 2013: Multiscale performance of the ALARO-0 model for simulating extreme summer precipitation climatology in Belgium, J. Climate, 26 , 8895-8915.*

The text was corrected as advised and we added another reference for ALARO (Gerard et al., 2009): "In the case of the ALADIN model and its versions AROME (Seity et al., 2011) and ALARO (Gerard et al., 2009; De Troch et al., 2013) . . ."

2. Fig 1a: specify the powers of the dotted lines and mention it in the figure caption.

The figure and the figure caption were corrected accordingly.

3. p. 6496, line 13-14: cite Boyd 2005 and Termonia 2012, to be correct.

Corrected as advised.

4. Fig 4: Mention that the extension zone is included and draw it on the figure. It is clear for the HIRLAM and ALADIN and ALADIN smooth where the extension line is located from the fields, but not for the others.

Corrected as advised –the extension zone is drawn in the figure and the sentence "The black lines denote the borders of the extension zone." is added in the figure caption so that it is clear where we applied the extension zone.

5. p. 6500, line 7, I do not agree with the statement that the method "favors" Boyd's method. In fact it depends on what your goal is. For instance, in a LBC relaxation you have the large-scale fields at the boundaries, so even inside you never have the

true spectrum and there will be some errors in the scaling (in the scales smaller the truncation of the large-scale coupling data). Nevertheless, your methodology is clean and you should certainly mention this issue. I propose you write: "Mind that for the Boyd method the grid-point values are obtained from the "true" spectrum with the correct theoretical scaling in the extension zone. This is not the case in the lateral-boundary couplings of real models where the goal is to nudge the solution to the one of the host model grid-point values as best as one can, obeying the spectrum of the host model."

The text was corrected as advised.

6. Regarding the conclusions: I conclude you recommend the use a large extension zone for data assimilation and together with the last bullet (p.6505, line 6), it is concluded that it should be done with either a detrending or Boyd's method. It might be useful to write this explicitly.

From the data assimilation point of view, the use of wide extension zone is appropriate, but it needs to be stressed that no explicit periodization is carried in data assimilation since the assimilation increments are calculated in spectral space and "forced" by observation innovations in the inner model domain only (no observations in the extension zone). For evaluation of the spectra, detrending and DCT are also suitable. The choice of the method mainly depends on the purpose of computing the spectra. For this reason we do not state explicitly the recommended method. Keeping in mind the limitations of ALADIN/HIRLAM methods, these methods can still be used, for instance, for observing the short scales when evaluating the parametrization schemes.

7. You might add a sentence in the conclusion stating that the results in the present paper confirm the improvement of the Boyd method found by Degrauwe et al. (2012).

We added this information in the first bullet of the Conclusions: "The Boyd method is from this point of view therefore a suitable method to replace the existing spline interpolation in the ALADIN model, in agreement with the study of Degrauwe et al. (2012)."

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Yours sincerely,

V. Blažica, N. Gustafsson, and N. Žagar

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