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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 appreciate the comments and suggestions for the paper improvement. In response to referee's 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. 6497, line 6, "... although the reasons are not clear". The reason is that although the extension-zone methods indeed do not affect the values of the fields in the physical

zone (as stated several times in the paper), they do affect the values of the derivatives in the physical zone. So the way you fill the extension zone has an effect on all spectral calculations (Helmholz solver, calculation of divergence and vorticity, etc.).

The text has been changed to reflect that model calculations can be influenced by the extrapolated values in extension zone through, for example, spectral calculations of derivatives. The sentence now states: "This suggests that the method applied to make fields periodic has an impact on the model performance, for example through the spectral calculation of spatial derivatives during the model integration."

2. p. 6497, line 17, "making the fields periodic". I think it should be better defined what you call "periodic". The detrending method only makes the fields periodic with zero-th order continuity (i.e. the value of the field varies continuously when moving from one boundary to the opposite boundary), but the derivatives are not continuous. This is also the main difference between the Aladin/Hirlam methods and the Boyd method: the former guarantee first-order continuity, while the latter guarantees infinite-order continuity.

See comment above.

3. p. 6499, section 3. If I understand well, the original field is already periodic on the $N_x \times N_y$ grid. But this would mean that (a) detrending has no effect at all (which you seem to refer to when stating that the "detrending method is favoured"), and (b) the Boyd method fills the extension zone with the same values as those from the original field! This can be seen from eq. (8): if implemented correctly, the summation of all windowing functions should be 1: $\sum_{k=-\infty}^{\infty} B(x + 2k\Theta) = 1$. So if the function W is already periodic with period 2Θ, then $W'(x) = W(x)$, for all x (including the extension zone). The fact that the results seem to indicate that both detrending and the Boyd method have an effect on the spectrum means that I misunderstand the setup of the experiment somewhat.

The created wind fields are periodic in a sense that the first value is the logical contin-

uation of the last value in the field while the detrending method actually creates fields with the last value equal to the first value. So there is not much trend to be removed, but still some, as can be seen in Fig. 3. That is why we say that the method is favoured, but it still produces some effect.

4. Some additional minor comments:

- *p. 6491, line 10: NWP models and the expected*
- *p. 6492, line 14: used a posteriori*
- *p. 6495, line 10: should be i = 1, 2, Nxi − 1, Nxi*
- *p. 6496, line 15: "erf" is missing from the equation.*

We revised the paper according to the suggested corrections. We thank the referee for his/her thorough reading.

Yours sincerely,

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Interactive comment on Geosci. Model Dev. Discuss., 7, 6489, 2014.