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.

Anonymous Referee #3

This paper presents a systematic comparison of different methods to calculate the kinetic energy spectrum. The goal of the study and the followed methodology are described very well.

Some points that deserve a bit more attention:

- 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.).

- 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.

- 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 functions 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.

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 $i = 1, 2, N_{xi} - 1, N_{xi}$

- p. 6496, line 15: "erf" is missing from the equation

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