Interactive comment on "Verification of a non-hydrostatic dynamical core using horizontally spectral element vertically finite difference method: 2-D aspects" by S.-J. Choi et al.
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Review of the manuscript "Verification of a non-hydrostatic dynamical core using horizontally spectral element vertically finite difference method: 2-D aspects" by S.-J. Choi, F. X. Giraldo, J. Kim, and S. Shin.

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## Specific comments

1. Motivation: what is a typical situation in which the direction splitting would be of

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6. As already noted in a previous comment in the discussion, it would be interesting to evaluate the maximum vertical velocities generated by the model in a long-time simulation of a resting atmosphere above orography.

7. The language needs to be revised as sometimes the phrasing is unclear and the reading flow is lost. This is especially true for, but not limited to, the Test cases Section 4, and subsections 4.3 and 4.4 in particular.

## Technical corrections

- Page 3718, line 9: what does "quadrature" refer to in a finite difference context?
- Page 3718, lines 9-12: "The Euler equation ... in this model". The reader is left guessing which kind of vertical coordinate is used in which model. Please rephrase in a clearer way.
- Page 3718, line 12: "verified"-> validated
- Page 3718, line 26: Graldo -> Giraldo.
- Page 3719, line 18: " an attractive alternatively" -> alternative
- Page 3719, line 22: "conservative flux-form finite-difference method" -> is it a finite volume or finite difference method? Please clarify.
- Page 3720 , line $18-20$ : the sentence is not clear, what does "in which" refer to?
- Page 3720, line 26: "reported by PK13", is the coordinate introduced in PK13? Otherwise please include a reference to the work where the hybrid coordinate is first used.
- Page 3721, line 16: it is not immediately obvious that equation (4) is in flux form, given that $\mu_{d}$ is variable. Moreover, in the last term of the first line of equation (4)
- Page 3722, line 7: are the overbars needed above $z$ as well?
- Page 3722, lines 9-16. The sentence is too long and includes two formulas. Please rephrase.
- Page 3723, line 11: "(X-Z) slice framework", is there a reason why $x$ and $z$ are capitalized here?
- Page 3723, line 19: the text in the bracket is somehow confusing. Surely the basis functions cannot be constant?
- Page 3724, line 10, "basis function": please refer to $\psi_{k}$ here as well.
- Page 3724, line 16, "The right-hand sides is evaluated" -> are evaluated.
- Page 3725, line 13: the index $k$ is used in Section 3.1.1 for the formulation of the horizontal discretization and in Section 3.1.2. in the vertical. The authors may consider using a different index to improve clarity.
- Page 3725, lines 16 and 17: are the brackets encompassing the derivative terms needed in the inline formulas?
- Page 3725 , lines 22-24: which kind of quadrature rule is actually used in the vertical?
- Page 3726, lines 1-8. The sentence is too long and hard to follow.
- Page 3727, line 22: "center of the profile". You can add " $x_{c}$ " afterwards to define it.
- Page 3728, line 14: "The extrema ... is" -> are.
- Section 4.1. Please report the information about the use of 5th order polynomials for this test case as detailed in the caption of Fig. 2 in the text as well. Moreover,

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- Page 3732, line 26 to page 3733, line 5. To facilitate readability it would be a good idea to split the long sentence into two sentences.
- Page 3732, lines 9 and 12. What do you mean by "perfectly simmetric" and "concaving contours"?

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