

# ***Interactive comment on “Adaptive Cartesian Meshes for Atmospheric Single-Column Models, a study using Basilisk 18-02-16” by J. Antoon van Hooft et al.***

## **Anonymous Referee #1**

Received and published: 27 April 2018

This article describes tests of an adaptive grid scheme in a single-column model for two ABL cases. The results are compared with a fixed-resolution version of the same model, and with various other models.

This is an interesting study and the results are clearly presented. The quality of the adaptive scheme solutions is encouraging. While the overall scope of the research is limited, it presents a possible avenue for future adaptive GCM development. There are a few places where more detail and clarification would be helpful (described below). I recommend acceptance of this article pending minor revisions.

In the model overview, it is stated that the grid refinement criteria are tuned based on

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trial and error. How sensitive is the scheme performance to the tuning? If this type of adaptive scheme is implemented in a full GCM, will different tunings be necessary at different heights, geographical regions, or seasons?

Specific comments:

p.2 Sec. 1, Line 17: Sentence starting "However, it is important..." is unclear and needs to be rewritten

p.2 Sec. 1 Line 23: Sentence starting "This work departs..." makes it sound like this work uses different methods than van Hooft (2018), yet the next page Line 25 suggests the opposite. This sentence needs to be modified to make the meaning clearer.

p.3 Sec. 2 Line 12: Could you state at least the nature of the surface fluxes parameterization (e.g. bulk flux). Which type of closures in Holtslag and Boville are you referring to?

p.56 Sec. 3.2 : Could you add a little more qualitative description of this GABLS case? Were there clouds? Is it a surface driven convective BL? Is the wind shear significant or important?

p.5 Sec. 3 Line 12: It would be good to reiterate here that each 'level of refinement' halves the local grid spacing.

p.5 Sec. 3 Line 21: Are you saying the differences are only minor compared the the LES spread, or only minor compared to the SCM model spread?

Figure 3a: Unlike most models,  $\theta_{av}$  in your solution has a negative slope in the boundary layer, more negative even than the one other plotted model with a negative slope. Is this slope also consistent with your fixed-grid solution? Is there something atypical about your SCM physics that would allow this?

Figure 3c: What is the difference between the various shades of gray in the figure?

Figure 5 should have the simulation dates somewhere on the x-axis or at least the time

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coordinates referenced to a date in the caption.

p. 6 Sec.3.2 Line 20: Stating that the evolution of the wind speed profile 'is the same' suggests that it is identical which is inaccurate. Perhaps 'is nearly the same'.

p. 6 Sec.3.2 Line 22: Could you clarify what is meant by 'Stullian image'? It would be helpful in this discussion if you qualitatively describe which parts of the diurnal cycle require the most/least refinement.

Technical corrections:

p.1 Sec. 1 Line 3: 'receives' should be 'receive'

p.2 Sec.2 Line 18: 'have' should be 'has'

p.4 Sec.2 Line 10: 'trail' should be 'trial'

p.4 Sec.2 Line 28: is 'that' referring to equation 6?

p.5 Sec.2 Line 33: Would be clearer as 'Online links are provided in table 1.'

p.5 Sec.3 Line 23: 'Noting' should be 'Note'

p.6 Sec.3.2 Line 17: '22-th' should be '22nd'

p.6 Sec.3.2 Line 22: 'Fig. 2' should be 'Fig. 5'

p.7 Sec.4 Line 3: 'efficient' misspelled

Appendix: Line 13: Sentence starting 'Using a domain...' is not a complete sentence.

Appendix: Line 18: 'facilitate' misspelled

Appendix: Line 18: would be clearer as 'we diagnose the number of used cells...'

Appendix: Line 19: Sentence starting 'Were the adaptive grid results....' is not a complete sentence.

Appendix: Line 22: Should be 'This plot reveals' or 'These plots reveal'

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Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2018-21>, 2018.

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