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Geoscientific Model Development Discussions

Interactive comment on "Towards the closure of momentum budget analyses in the WRF (v3.8.1) model" *by* Ting-Chen Chen et al.

Anonymous Referee #2

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This paper analyzes methods for horizontal and vertical momentum budget estimation, and compares them to an inline budget retrieval method using the WRF model in a simulated 2-D slantwise convection case. The authors presented clear analysis that point out the shortcomings of using offline budget calculations, and make suggestions to improve the estimation accuracy. The guidance should be useful to the modeling community, and especially to the inexperienced. The paper is generally well written and well organized, and figures are clear. Here are some questions for the authors to consider.

1. Despite the difficulties to obtain a closed budget through an offline method, people are careful using that approach to address the issue at hand. In the example presented in this paper, the slantwise convection simulation, can you say something about how

inaccurate budget calculation could impact your study, and possibly affect the scientific conclusion?

2. It's unfortunate it is concluded that the vertical momentum budget via offline method doesn't work. The discussion may need some work. It is unclear why the acoustic mode would impact the budget since one would expect the larger terms are the vertical PGF, the buoyancy as well as the advection? Supposedly, the acoustic modes are meteorologically insignificant, how do you explain it significantly impact momentum budget? Could it be the nature of vertical motion? It is certainly very variable, and are small scale features itself.

3. This is a minor issue. Would map projection or map-scale factor contribute to the accuracy of momentum budget? I understand it is not relevant in your test case, but map-scale factor will come in in a real data simulation. Should people consider it when doing offline calculations?

4. Would you like to contribute the inline budget code to the WRF repository?

Other minor points:

Lines 166-167: Why do you need the vertical velocity damping option? Using a micro-physics could impact momentum tendency through density variations, and would affect the pressure field too.

Page 9, section 3.2.1(b): The discussion may need to be made simpler and clearer. I was lost. With C-staggering, the computation of PGF for V is easy because pressure is naturally located at 1/DX to the north and south of V grid.

Lines 384-385: What does this sentence mean?

Section 3.2.3 Should vertical diffusion be considered in W budget? Would it account for some of the residual term in Fig 4?

Line 467: Disk space is another big issue.

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