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.

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General comments: Towards the closure of momentum budget analyses in the WRF (v3.8.1) model by Chen et al. provides a clear and useful overview of the most common ways to obtain the various budget components from model output. While no novel techniques for calculating the budget components are developed within this study, the utility is within the comparison of existing techniques and highlighting the advantages and shortcomings of these techniques. For a study such as this, the rudimentary 2-dimensional setup is justified as it pertains strictly to the techniques to calculate the budget components and not the physical processes within the simulations. The study focuses analysis on the 99th percentile of the residuals for each method as well as the spatial locations and magnitudes of the individual budget components and residuals at

instances in time throughout the simulation. The authors are careful to draw conclusions that are within the scope of the provided analysis. Overall, the paper is easy to follow and understand, remains on topic, and provides useful guidelines to the community and suggested best practices for calculating budget components moving forward. Further, the explanations of the steps involved in order to repeat such a study appear thorough and the recommended technique for the calculation of budget components is provided via a GitHub repository. As the model utilized is open sourced, it could be beneficial to the community to have this code submitted to be included in a future release.

Specific comments: If I am understanding the analysis correctly, it appears that analysis of the residual is confined to analyzing the 99th percentile whereas the figures show both large positive and negative values of the residuals. Should the lower end of the distribution (i.e. the 1st percentile) also be considered here? Further, is there a reason that only the extreme ends of the distribution are considered? If there is no reason, have you performed any sensitivity to the percentile chosen?

Technical Corrections:

Figures 3 and 4 are somewhat difficult to see the "canceling out" between PGFBUOY and CUV in the filled contours, but the contour lines do help. Would a log-scaled colorbar be more appropriate here? Or maybe just adding panels to show the difference, PGFBUOY - CUV?

Figure 4 caption: The second to last sentence explaining the rightmost column never mentions the the residual is contoured in the background and reads as though it is plotting strictly the acoustic-step components of PGFBUOY.

Figure 5b legend: blue solid line "POST10imn" should be "POST10min"

Line 313: "Moving the first term on the rhs of Eq. (17) is to the lhs..." should the word "is" be there?

Lines 318 smf 387: Section titled, "3.2.2 Results- horizontal momentum budget" and "3.2.3 Results- vertical momentum budget" should have a space between "Results" and the hyphen

Line 356-358: "Next, we repeated POST10min-(E+I)/2 but applied to the output data that have been interpolated to the universal/un-staggered grid same as the one for the pressure variable (p-grid) (POSTnonstag-(E+I)/2)." I recommend this sentence to be revised. It is not very clear what is going on. Throughout paper and figures: Phrases like "v tendency" sometimes include a capital "v" and other times a lowercase "v" (eg. Figure 2 figure and caption are all lower case, Figure 3 has both lower case and capitalized "v", Figure 5 figure and caption are all capitalized; Lines 207-210 use both lowercase and capital). This should be made consistent throughout the paper.

Line 441: "two time larger" should be "two times larger"