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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Are Atmospheric Updrafts a Key to Unlocking Climate Forcing and Sensitivity?" *by* L. J. Donner et al.

Anonymous Referee #2

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General comment: This paper discusses two issues that are key to further advancing climate models, representation of updraft and scale-dependence, primarily in the context of reducing uncertainties in climate forcing and climate sensitivity. Highlighting the two understudied issues is timely, and thus I recommend its publication after the following concerns are addressed.

Specific comments:

1. The manuscript reads more like a "perspective" than a "review". It seems a bit thin as a review paper. As a perspective, it could be condensed by consolidating some repetitive texts. Maybe the authors have something in between in mind, based on the sentence "This review presents the perspective that ...." in P2. Guess the decision is between the editor and the authors.

2. It is not clear whether the paper is about deep convection, shallow convection, or convection in general. Please clarify. In fact, the issues in question are very generic.

3. The scaling argument in the second paragraph of Section 4 seems incomplete. The resolution dependence derived from the continuity equation should be for vertical velocity difference, not the velocity itself. A relationship between the vertical velocity and its spatial difference seems necessary for the latter?

4. The discussion on role of vertical velocity in climate sensitivity in Section 3 is not as obvious as one would like. Entrainment and convective mixing are identified; but some link of entrainment and mixing with vertical velocity would help. For example, a recent study by Lu et al (J. Atmos. Sci. 73, 761-773, DOI: 10.1175/JAS-D-15-0050) examined the relationship between vertical velocity and entrainment rate in shallow cu.

5. Guo et al (Characteristics of vertical velocity in marine stratocumulus: Comparison of LES simulations with observations, Environ. Res. Lett., 3, 0450J. doi:10.1088/1748-9326/3/4/045020) seems a good ref to the discussion in P8, esp. in the context of how well vertical velocity is represented in LES, its PDF, structure function and resolution dependence.

6. Some subscripts are missing in Fig 1, maybe due to file conversion. Also what do the different colors represent?

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