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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The importance of vertical velocity variability for estimates of the indirect aerosol effects" *by* R. E. L. West et al.

Anonymous Referee #2

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General comments:

In this well-written manuscript the authors study the very interesting topic of the impact of subgrid vertical velocity variations on cloud-aerosol interactions in GCMs. The manuscript provides a good reference for the range of uncertainty in the indirect aerosol effects caused by the parameterization of vertical velocity in cloud droplet activation. The physical background behind the locally varying impacts of the different vertical velocity configurations and the differences between the model and observations are also well presented. I find the manuscript well suited for publication in ACP with a few minor comments listed below.

Specific comments:

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-The model simulations used in this study were 1-year long nudged runs with 3 months spin-up, as presented in Section 2.3. If practical, the comparisons between different model configurations (e.g. Figs 3 and 9) might benefit from extending the simulations to e.g. 5 years, since the signal-to-noise ratio for annual mean fields using 1-year model runs is inevitably poor for quantities of significant variability, such as those related to clouds.

-Could you please comment briefly on the SW cloud radiative effect (CRE) as such for present-day simulations in addition to presenting the RFP? In particular, it would be interesting to see the difference in the local features of the CRE between the TKE_0.1 and sigw0.4 configurations.

-Figure 2: Is the cloud top CDNC sampled as in-cloud or grid-box (i.e. normalized by cloud fraction) mean values? As a follow-up, how exactly do you calculate the global mean?

-Page 27059, lines 10-15: Hogan et al. 2009 (doi: 10.1002/qj.413) presented negative skewness of vertical velocity associated with cloud driven mixing and that the sign of the skewness can vary within the same column below the cloud deck when under the influence of both surface-based and cloud-driven turbulence.

-Section 3.2.3 + Section 4: Reutter et al. 2009 (doi:10.5194/acp-9-7067-2009) identified updraft- and CCN-limited regimes for cloud activation in convective clouds. The results seem at least qualitatively applicable also for a more general case and agree with the findings in this manuscript as well.

-Table 3, typo in CSTRIPE: “Sstratocumulus”.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 27053, 2013.