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**Interactive
comment**

Interactive comment on "Understanding aerosol–cloud interactions through modelling the development of orographic cumulus congestus during IPHEx" *by* Yajuan Duan et al.

Anonymous Referee #1

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This study uses a warm-phase cloud parcel model that simulates the cloud droplet activation by aerosol particles, water condensation, collision-coalescence, and lateral entrainment processes to investigate aerosol-cloud interactions in one of the IPHEx cases. The comparisons between the in-situ observations and parcel model sensitivity results indicate that the condensation coefficient is the most important parameter determining cloud droplet number concentrations, liquid water content and size distribution. The cloud development is also sensitive to entrainment and aerosol concentration at cloud base but is not sensitive to aerosol hygroscopicity.

The manuscript is not very well organized. Readers have to resort to different locations

(main contexts, appendix and supplemental materials) for important and necessary information. The development of a cloud parcel model is a non-trivial work. However, such a tool should be used to answer critical scientific questions. There are few new scientific points being discovered in this work, which does not makes it qualified for the ACP publication. I would suggest the authors to submit this manuscript to other journals that have an emphasis on model development or test.

I listed some of my concerns in the following: 1. If the condensation coefficient is the dominant parameter for cloud development and evolution in the early stage, how do the authors choose a value or develop a parameterization to provide a reasonable value for the more detailed 3D simulations? 2. As the authors pointed out, lateral entrainment is not appropriate especially for orography influenced clouds. A more appropriate entrainment scheme might be needed for the work. 3. The equation 8 is not clear to me. Why the droplet number in the ith bin is determined by the aerosol number concentration in the ith bin in entrainment? 4. Page 10, lines 14-15, why the corrected CDP spectra that is shifted to smaller size provided confidence in the performance of the CDP probe during the IPHEx campaign? 5. Page 11, line 31, the volume ratio of 1.026 is not correct. It should be 1.021. 6. Figure 7b looks wrong to me. The condensation process is inversely related to the droplet size. But in Fig. 7b, the entire DSD shifts to the right without showing any narrowing of the DSD. 7. Since many parameters impact the cloud development, there are multiple combinations of these parameters to provide the same cloud development trajectory. How can the authors justify which combination is the right one?

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