

Interactive comment on “Top-down and Bottom-up aerosol-cloud-closure: towards understanding sources of uncertainty in deriving cloud radiative flux” by Kevin J. Sanchez et al.

Anonymous Referee #3

Received and published: 25 May 2017

The manuscript presents an interesting study of aerosol-cloud-closure in terms of cloud CDNC and shortwave radiative flux using ground-based and UAV platform measurements, satellite retrievals at Mace Head, Ireland during summer 2015, as well as a 1-D aerosol-cloud parcel model simulations. The authors look at CDNC closure between Hoppel CDNC, satellite retrievals, and ACPM simulations, and cloud-top extinction and shortwave radiative flux closure between UAV measurements and ACPM simulations. The authors find that clouds in decoupled boundary layer have larger shortwave radiative flux differences between observations and simulations. More interestingly, the authors find that accounting for cloud-top entrainment in simulations greatly reduces the radiative flux differences. The manuscript is well written and organized. Overall,

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the article is suitable for publication in the ACP with some revisions. Below are some specific comments.

Specific comments:

L77 and 86: the sentences are repeating.

Section “UAV vertical profiles”: How cloud-top radiative fluxes are measured? It is not illustrated in the manuscript.

L205: need a reference here.

L260: Reference to Hoppel 1979 is not listed. I would suggest giving more details of using D_{min} to estimate CDNC. How accurate is the estimation?

Figure 6: It is better to add variations of measured and satellite-retrieved CDNC. For comparisons between D_{min} -estimated CDNC and simulated CDNC, they both use ground-based aerosol distribution measurements as input, therefore, these two are not independent.

L308: 0.3 or 0.5?

L326: Even for simulations with 50% decreased cloud-base aerosol, decoupled cases still have greater radiative differences than the coupled cases. Does that mean there are other factors other than aerosol between decoupled and coupled cases that contribute to the radiative differences?

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2017-201, 2017.

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