

***Interactive comment on* “The impact of precipitation evaporation on the atmospheric aerosol distribution in EC-Earth v3.2.0” by Marco de Bruine et al.**

Anonymous Referee #2

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This manuscript “The impact of precipitation evaporation on the atmospheric aerosol distribution in EC-Earth v3.2.0” by de Bruine et al. presents a model study on how aerosol removal by clouds and the subsequent vertical redistribution of aerosol in precipitation affects the simulated 3D global aerosol fields. They evaluate model approaches of different complexity for representing these effects. The topic is interesting and the methods presented in the paper can be useful for global aerosol modellers. The paper is clearly and well written and thus easy to follow. I can recommend publishing the paper after the following minor points, that have been detailed below, have been addressed. The line numbering is a bit confusing and in the following comments I refer to the line number indicated in the margin of the pdf.

- Page 2, Line 23: Change “aerosol distribution” to “aerosol size distribution”.
- Page 5, Lines 4-5: This sentence “The large-scale precipitation is described using variables like cloud cover and water content” is very ambiguous and it is not clear how this actually is distinct from that of convective precipitation. Cloud cover describes a sub-grid scale property of a cloud and I also assume that the large-scale precipitation is parameterised.
- Page 5, Line 14: I assume that these are boundaries categorizing warm, mixed, and ice clouds. However, it could be more clearly stated.
- Page 5, the last line of the page: What do you mean by “partly”?
- A more appropriate location for Section 2.5 would be after the model description (at the end of Section 3).
- Page 11, Equation 10: Why do you calculate the mean density volume weighted as opposed to mass weighting?
- Page 19, Line 7: I don’t understand this sentence “This shows that a substantial part of the scavenged aerosol, has been scavenged and released before.” Before what?
- Page 12-14: Change “raindrops only release one aerosol” to “each raindrop releases one aerosol”.
- Section 4.3: Which MODIS product do you use?
- Page 20, the last line of the page: What do you mean by “a valid MODIS AOD”?
- Page 20: Why don’t you collocate all time instances of the model AOD to when there is a MODIS observation (see e.g. Schutgens, N. A. J., Partridge, D. G., and Stier, P.: The importance of temporal collocation for the evaluation

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of aerosol models with observations, Atmos. Chem. Phys., 16, 1065-1079, <https://doi.org/10.5194/acp-16-1065-2016>, 2016.)

- Page 22, Figure 10: Please add the uncertainties of CALIOP observations to the figure.
- Page 22, Line 29: What do you mean by small aerosols? The aerosol particles that are the most efficient scatterers of 550 nm solar radiation are few hundred nanometers in diameter while the smallest particles have a very small radiative effect.
- Page 22, Line 37: what do you mean by “relative magnitudes”?
- Page 23, Line 15: what do you mean by “underlying patterns or mechanisms”? How do you deduce that they don’t have any major errors?
- Please also do a thorough language check (proof reading + grammar check)

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2017-259>, 2017.

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