

Interactive comment on “Overview: The CLoud-Aerosol-Radiation Interaction and Forcing: Year-2017 (CLARIFY-2017) measurement campaign” by Jim M. Haywood et al.

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Haywood et al. present a comprehensive overview of the CLARIFY-2017 measurement campaign. From the paper, it is evident that this was a diligently planned and well-conducted campaign, that had scientifically important, well-posed objectives and that excellently linked to other international initiatives and to previous campaigns. The results presented in the paper are impressive, it is evident that already at this short time after the campaign it proved highly useful to improve the understanding of clouds, aerosols, and their interactions in the region and beyond it. The manuscript is excellently written and of large interest to the readership of Atmos. Chem. Phys.

C1

I only have a number of specific comments that I suggest the authors address in a revision.

l29 reconstruct past climate (?)

l30 In fact, some in the community would nowadays use the term “natural laboratory” for a situation where a quasi-external aerosol perturbation is imposed (e.g. volcanic eruption), which is not the case here. So maybe the authors want to choose another term.

l38-43 A reformulation would be helpful to make the distinction between aim 1 (“improve . . . model estimates”) and 4 (“improve numerical models”) more clear.

l42/43 “deployment of the . . . campaign” seems a wrong formulation

l46/53 is 2013 “recent”?

l84-92 perhaps as a bullet list?

l87 close bracket

l118 why the droplet sizes?

l133-138 It would be useful to spell out what the authors have in mind with the “detailed mechanisms of the semi-direct effect”. After all, it seems much more straightforward to parameterise than any indirect effect.

l141 as a follow-up question – isn’t simply the absorption parameterised and the rest of semi-direct mechanisms follows?

l167 one “aerosol scheme” too many in the sentence.

l173 A few words on how the widespread positive forcing due to aerosol-cloud interactions in the GLOMAP version is explained would be useful. It seems a peculiar result, in particular in a stratocumulus region.

l181 what is “Norde-Est”?

l198 maybe the modelling section deserves a new paragraph?

C2

I215/216 It is of course clear these key objectives were carefully formulated and iterated many times, probably since well before the campaign. Nevertheless, I ask myself - How does one “understand” a property? Is “understanding” not usually referring to some causality?
 I249 As the data assimilation for the dust sounds very innovative to me, a few more words on what exactly was done would be useful.
 I275 is the unit wrong in the PDF (g kg⁻¹)?
 I298 Is satellite validation the best scientific goal, or not rather the inverse – using the satellite to put the aircraft measurements into a larger-scale context?
 I300 CIMEL without “s”
 I335-336 wow
 I390 should that be μm ?
 I394 P and N_{ccn} taken at both flight level? Or CCN below cloud? (maybe it is wiser to put this analysis description to where the results are shown, rather than providing it as an isolated example in this section).
 I405 The acronym POC needs to be explained here.
 I427 “solely” is in my opinion an oversimplification.
 I455 the ERA5 reference should be updated to Hersbach et al. QJRM 2020.
 I468 A better reference here is Costantino and Bréon 2013.
 I505-509 Why not show this key result on aerosol-cloud interactions more clearly, e.g. by a scatter plot of MBL BBA mass or number vs. cloud droplet concentration?
 I517 why “also”? at first glance the two statements (vertical gradient in SSA, vertically constant mass absorption coefficient) are in contradiction.
 I598 isn't this contradicting the result quoted earlier that SSA increased with height?
 I564-617 In my opinion, this is a bit of a lengthy discussion of some details that maybe is not a headline result of CLARIFY (i.e. this section might be shortened).
 I692 the *refs* are missing ...
 I699-701 the $\pm$ ranges are awkward, as they imply strong possibility of negative values. An asymmetric range is required in my opinion.

C3

I703 μ ; are the median values for diameters as in Fig. 16? this should be clarified as it is uncommon (typically radii are reported).
 I706 why is this result not clear? Isn't this a large factor? It is also consistent with the results reported for LWP and for Zct.
 I774-786 This seems to me a pure modelling study that is disconnected to the observations of CLARIFY. If so, I suggest to drop the discussion. If my impression is wrong, it would be useful to make the link to the observations at this point.
 I816-819 I don't remember a detailed discussion of this result in the main body. Is it a key CLARIFY observational result?
 I820-824 It would be useful to make the connection to the observations, i.e. that in only a quarter of the cases, a SDE is expected.
 I829-831 This seems to be a bit out of the blue, in particular the statement on the indirect effect, especially given the peculiar indirect effect in GLOMAP. A more clear link to the body text and the observations is necessary.
 I834-837 Sorry if again I missed a point, but were aerosol-radiation interactions from MODIS shown in the body, and compared to the SEVIRI results?

I853 “are thanked”

I1206/Table 1 is “resolved number” and “size resolved number” the same or something different (if the former, give it the same name, if the latter, explain). some μ don't appear in the PDF.
 I1245 it would be useful to show zero COD as white or grey in panel (b) (presumably white in (c) means no cloud?). Why does the figure legend write “Carb.”?
 I1265 the “each year different colour” is probably a remnant from a former version of the Figure? “ARM AOD” or rather “Aeronet AOD”?
 I1290 The caption for (b) should briefly explain how the mean altitude is calculated/defined.
 I1295 why not focus on the lower 3000 m in panel (a) so that the differences between radiosondes and model are better visible?

C4

I1305 The caption needs to clarify where the data is from.
I1330 why not also a Gaussian fit to the precipitating days?

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2020.