Review of 'Aerosol first indirect effect of African smoke at cloud base of marine cumulus clouds over Ascension Island, south Atlantic Ocean'

I appreciate the efforts the authors put into revising the manuscript, which has been much improved compared to the original version. Most of my concerns/comments are well addressed.

That said, after reading the current version of the manuscript, I do have some remaining points that I would like the authors to consider first before finalizing for publication.

The reviewer is thanked for the time and effort spent on the continued review of the manuscript, which has made it much stronger. This is highly appreciated. Below, the remaining concerns are addressed and the changes to the manuscript are indicated.

I recommend publication after minor revisions.

Main comments:

1. Both in the abstract and in the conclusion (where readers read the most), the authors point out their estimates of ACIN and ACIr (line 7 and 294). These ACI metrics are supposed to be unitless as these metrics are calculated as ln-ln regressions. Furthermore, please double check the sign convention of your formula for the 2 ACI metrics (Eq. 1 and 2). The sign convention is supposed to make these ACI metrics appear as positive values, such that decreasing effective radius with increasing aerosol is indicated by a positive value (by a -ve sign infront), and increasing Nd with increasing aerosol is also indicated by a positive value (without the -ve sign infront).

   Thanks for the clarification, indeed the metrics were not consistent with McComiskey et al (2009). This has now been corrected. The sign in Eq. 2 was changed, the ACI numbers are dimensionless in the manuscript and the figures and numbers are now in agreement with the above changes.

   - Your Fig. 7 confused me, according to your Eq. 2, panel a) should have a negative ACI value, and panel b) should have a positive value according to your Eq. 1.
     Corrected

   - Your Eq. 2 is inconsistent with McComiskey et al. (2009)."
     Corrected

2. I appreciate the fact that a comprehensive overview of various aerosol effects on marine warm clouds is now included in the introduction. That said, I do notice that these references are mostly rather old studies (they

are nice studies and should be referenced here). What I recommend is to include some newer studies (in addition to the ones already cited), especially those coming out of ORACLES/CLARIFY/LASIC campaigns that took place between 2016- 2018, to show what we have learned so far thanks to all these amazing campaigns. For instance...

- Zhang & Zuidema (2021) found that the changing smoke vertical distribution during the dry season over the remote SEA (Ascension Island) leads to different cloud adjustments, and thereby an amplified low-cloud fraction seasonal cycle is observed in the presence of smoke.
- Diamond et al. (2022) use a combination of regional and high-resolution modeling to show large-scale smoke–circulation interactions strongly modules the SCT in this region, which has been overlooked previously.
- Gupta et al. (2022) report the same ACI metrics as in this study but based on ORACLES airborne measurements.

I think all these newer papers fit nicely to your discussion in the paragraph of lines 36-49.

The reviewer is thanked for all the references, which has made the paper much more relevant. The first two of the suggestions above have been added to the introduction section, the third to the relevant section on ACI's.

3. Regarding Fig. 8. How is the uncertainty bar for each ACI estimate quantified? A sentence clarifying this would be nice, so that the readers will have an idea of what's going on for those estimates with huge uncertainty bars.

The errors bars are the standard deviation of the measurements during each selected interval. A sentence explaining the error bars is in the caption of the figure.

4. Regarding the fact that you have many ACI estimates outside the "theoretical" bounds suggested by McComiskey et al. (2009), I want to say that I don't think your values are unphysical or unrealistic, besides what you already stated in the text, I want to add that:

   a. For $|\text{ACI}_N| > 1$, a bound of 1 only makes sense to me when aerosol number is used (so that a value of 1 indicates total activation of aerosol particles into cloud droplets). The fact that you are using mean extinction coefficient below clouds may lead to values larger than 1.

   b. For $|\text{CI}_r| > 0.33$, a bound of 0.33 is true only when LWP is controlled when calculating ACI_r, as indicated in McComiskey et al. (2009) Eq. 1b. The fact that you are not controlling LWP when calculating ACI_r may lead to values larger than 0.33 due to covarying LWP.

The discussion on the ACI's was adapted to reflect these considerations.

Minor comments:

Line 93, this sentence suggests that the ARM site is at 859m above sea level, please double check and revise.
The text was changed to make the altitudes of the locations and the volcanic peak more clear.

Line 165-166, how do you define periods of clear sky and cloudy sky, based on what metric(s)? How many periods of clear sky and cloudy sky are there during the studied period?
The clear and cloudy parts of the measurements were selected by visual inspection of the lidar quicklooks. The number of clear sky periods was 29 in 2016, and the number of cloudy sky periods was 43 in 2016. Details are published in Tenner et al, 2017. An explanatory sentence was added to the manuscript.

Line 172-174 and Fig. 6, I am confused about the # 6 and # 31 under 'clean' and 'mixed' in Fig. 6's caption. I know there are 5 clean days and 8 mixed days according to Fig. 5, so they must indicate the number of cloudy periods of each category, i.e., 6 cloudy periods in clean days and 31 cloudy periods in mixed days, correct? Then in the text you say 6 and 31 indicate the number of cloud free periods and cloudy periods. Please clarify.
This was a typo, confusing 'clean' and 'clear' The number of 6 and 31 both refer to cloudy periods, one during clear days (low smoke concentration) and one during mixed days (high smoke concentration). The text has been changed to correctly state the number of clean and mixed days, and clear and cloudy periods

Caption of Fig. 10, inconsistent with your legend, where you indicate variance is shown in black and error in red.
Correct. This was changed.

Line 254, "Nd" $->$ "N$_d$"
Corrected

Line 255 and 258, unit should be cm$^-$3
Corrected

Line 267, "... correlation was found..." what correlation? Word missing.
"No" correlation was found. Corrected.

Line 395, "product" $->$ "produce"
Corrected.