Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "The importance of comprehensive parameter sampling and multiple observations for robust constraint of aerosol radiative forcing" *by* Jill S. Johnson et al.

Anonymous Referee #2

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The paper is an important piece for the puzzle called "reducing uncertainty in aerosol forcing" and contains a lot of interesting investigations testing aerosol forcing uncertainty with multiple observations using an emulator. The paper should be published with minor changes.

p1 l29 "improvements in the physical realismn"....I dont think Mann et al 2014 is the right citation at exactly this point.

p2 l2: "although the set of models is different to those used to assess aerosol microphysical properties in Mann et al. (2014), " not really an argument for the stubborness of the ERF uncrtainty, can be omitted here.

P2 l17 I think this paragraph and equation is misleading in pretending "that the forcing depends on the interlinked sensitivities of aerosols, clouds and their radiative properties to changes in aerosol emissions ". Direct radiative effects, fast adjustments are not readily folded in into this equation. Please rephrase.

P3 l23: "there is no equivalent to Equation 1 defining how a bias in simulated aerosol properties affects the forcing " => I think this is overly critical to bias inspections. An underestimate in fine mode AOD or bias in absorption can be translated in forcing bias. Measurmentes of fine mode AOD estimates can constrain anthropogenic AOD to some extent. And there might be other clever interpretations of bias. Please rephrase.

P3 l31 "Model variants that produce implausible results are rejected and, likewise, the forcings that they calculate are also rejected. " => would be nice to explain this at this point a bit more. Do you look at all observations at the same time? What is the criterion for rejecting?

P5 l9 "The analysis is restricted to Europe for the month of July. We do this primarily because regional observations can provide a better constraint on model uncertainty than global mean observations .. but with the disadvantage of being less straightforward to understand. . . . We choose Europe because there are many long-term measurements " => I don't buy these arguments. With synthetic observations this should not be a big problem to do globally. There are no long term measurements used. I assume this is done to save computer time. I think its ok to use just Europe and just July. But the discussion should be more honest and open here. Paragraph please rewrite.

Chapter 2.1 and 2.2. and 2.3: I think they can be reversed. Some simple questions are not clear to me: Are the simulations global? Is it a one year simulation with a 4 month spinup (eg Sep-Dec of the preceding year) and is then just July analysed? Is the emulator producing global fields, from which data are sampled at European tations?

Page 5 counts 191 simulations, while page 9 counts "in total 217 perturbed parameter simulations". Better to harmonize numbers.

Conclusions: I wonder how general the findings are if the ERF is in essence tested only over Europe and July with synthetic observations, but that might be shown in future publications.

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