

Interactive comment on “Examination of aerosol distributions and radiative effects over the Bay of Bengal and the Arabian Sea region during ICARB using satellite data and a general circulation model” by R. Cherian et al.

Anonymous Referee #1

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General

The authors present an interesting summary of measured (sunphotometer from a ship), retrieved (Aqua and Terra MODIS), and modeled (ECHAM-HAM) aerosol properties. I think the paper is a good technical report of findings during ICARB, but I am not clear how this advances the scientific understanding of either aerosol properties or the simulation of aerosol loading in the region near India. I think, therefore, that the paper should be rejected. I discuss my reasons below.

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The authors conclude that underestimates in model AOD are due to poor simulation of dust, but this conclusion highlights a problem that should be tested with respect to the ICARB measurements. What changes to the dust parameterization in ECHAM-HAM would minimize the discrepancies? What about the wind fields? Are the changes in the parameterizations within uncertainties? Similarly, aerosol swelling could be an interesting question to explore from the modeling perspective. Could changes in $f(\text{RH})$ improve the disagreement in cases which are thought to be impacted by aerosol swelling?

As the paper is now, I think there are two things that can be removed entirely. The discussion and figure about heating rates do not seem to add any substance to the paper, and should be removed. The aerosol forcing discussion is confusing. If I understand correctly, measured AOD is combined with simulated AAOD to derive a measurement-model hybrid ARFE. This ARFE is then applied to retrieved AOD to get the regional forcing map in Figure 6. There is, however, no discussion of any available measurements of AAOD or SSA to verify the accuracy of modeled or retrieved AAOD. SSA is as important as AOD in determining radiative forcing, so even a literature search of previous studies in and around India might be a useful way to constrain AAOD beyond the comparison in Figure 5a and 5b.

Specific

p 13918, line 5: Why did you use 0.7 to weight AOD on low retrieval days? Why not something like weighting by number of valid retrievals?

p 13918, line 15: Would absorbing organic matter impact OMI retrievals in the region?

p 13930, lines 15-20: Change Reaction to Region.

Fig. 1 caption: Delete 'See text for details.'

Figures 1-3: It may be more informative to show these figures as a difference plots.