

General comment:

This study discusses the evolution of aerosol effective radiative forcing (ERF) in the recent two decades, the period when high quality satellite measurements are available. The authors investigated different aspects of aerosol effects on climate, i.e. aerosol emission, aerosol burden, cloud property, and radiation budget, to assess linear trends of different quantities for these aspects based on both satellite observations and global models. The results show that the observed trends differ in sign on average between regions with negative and positive changes to clear-sky solar ERF in CMIP6 models. Overall, this is a nice overview of recent changes to variables relevant to aerosol effects on climate to identify significant trends for some of them, particularly cloud droplet number concentration and cloud fraction among others. I have relatively minor comments as specified below, and recommend the manuscript be published after the authors address them appropriately.

*On behalf of the co-authors I would like to thank the reviewer for the thorough review of our manuscript.*

Specific comment:

Line 142-143: “In contrast, there are some hints at a change in cloud fraction consistent in pattern and sign with the trends in droplet concentration”: Is this derived from Fig.3? Can you provide more specific discussion regarding how cloud fraction trends shown in Fig.3c are interpreted in comparison to droplet concentration in Fig.3a? In general, cloud fraction trends are largely affected by natural meteorological variability, rather than aerosol perturbation, as the authors also pointed out, so it would be very important to demonstrate how aerosol-induced signals can be found in cloud fraction.

*The reviewer is certainly right that there are multiple factors influencing cloud fraction, and aerosols only affect them to a minor, albeit possibly systematic, degree. We now point more clearly to this caveat where we write the statement the reviewer refers to, and also provide more references to the literature that examines at a process level the relationship between aerosols and cloud fraction.*

Line 182-183: “It is split into a strongly decreasing trend in reflected solar radiation and a declining trend in emitted terrestrial radiation (defined positive downwards, so the trend implies more emission to space)”: Is the second statement (for terrestrial radiation) in the parentheses correct? I was assuming that the emission to space is decreasing to accelerate global warming (I might be wrong), but if the authors statement is correct, are the two components (solar and terrestrial changes) compensating for each other? I’m a bit confused with the statement here, and would appreciate clarification.

*We agree with the reviewer that this formulation is confusing. We have now formulated the report about the results by Loeb et al. more clearly: “They find this to be due to a strongly decreasing trend in reflected solar radiation, which they attribute to decreased reflection by clouds and sea ice, and a declining trend in emitted terrestrial radiation due to increases in greenhouse gases and water vapour.”*

Line 208-211: The CERES data shown in Fig. 4 is discussed only briefly in this short paragraph. Can you provide more detailed discussion on observed radiation trends shown in upper panels of Fig. 4 in more specific comparison to aerosol trends of Figs. 1 and 2 to support the statement of the last sentence?

*The reviewer is right indeed that this discussion needed to be extended. It is done now in the revised version.*

Line 218-219: Can you briefly describe the method of Smith et al. (2021a) to constrain the aerosol ERF by considering the ocean heat uptake?

*We now added a short paragraph on this in the revised text.*

Table 2: Is this referred in the main text? If not, discussing these numbers comprehensively in Section 7 would be beneficial to convey the major message of this study. This table is a very nice summary of the ERFaer change.

*The reviewer indeed points to a negligence! It is now corrected in the revision, where we discuss these outcomes.*

Minor/Editorial point:

Line 172: year -> near (?)

*Well spotted and corrected now!*

Figure 2 caption, line 6: (c) -> (e)

*Again, excellent help by the reviewer!*