We thank the editor for their time and effort evaluating our manuscript. We have made the requested revisions; we reply to individual comments below in blue.

Author response to editor's public justification

Dear authors,

Thank you for the work you have done in response to the reviewer comments. All reviewers noted the high quality of the work presented, and the revision requests were minor in nature, and I am convinced you have addressed those issues raised by the reviewers adequately.

I have one minor comment and a short list of technical corrections to suggest you correct before the article can be accepted for publication.

We thank the editor for their feedback, and respond to their comments and corrections below.

Minor comment:

Supplement equation 1: as far as I am aware, a number density is, by definition, always given in units of m^-3, e.g. in the CMIP variable definition (https://wcrp-cmip.org/wp-content/uploads/2024/12/CMIP-DR_v1_0-feedback-modelling-centres.xlsx) and in textbooks. I wonder if number density (in m^-3) should be combined here with the mass density of air (kg m^-3) to make the units work. There is also an extra air density term in equation 3 compared to the analogous expression in Grainger's online reference (eq 59 in https://eodg.atm.ox.ac.uk/user/grainger/research/aerosols.pdf), which seems misplaced to me, and I don't think this "extra" air density will correct for the potentially missing air density in Eq 1. when one goes through the full procedure described. Please check these calculations and their description.

We have double-checked our calculations and have confirmed that they are correct. The discrepancy comes from the fact that, as pointed out by the editor, the equations in the provided reference and the CMIP variable for number density both use units of (m^{-3}), but most of the models in this study produce the desired output in units of (kg air)$^{-1}$. We therefore used N with units of (kg air)$^{-1}$ throughout:

- Our Eq. 1-2 are taken directly from Visioni, et al. Eq. 1-2; our use of N as having units of (kg air)$^{-1}$ is correct, as the units of the equation become (kg sulfate per kg air)(# sulfate per kg air)$^{-1}$(kg sulfate per m^3 sulfate)$^{-1}$, which simplifies to mean volume in units of (m^3 sulfate per # sulfate).
- In Eq. 3, we multiply our N by the density of air such that $(N)(\rho_{air})$ has units of m^{-3}, analogous to N_0 in Grainger's equations. As such, our Eq. 3 matches Grainger's Eq. 51.
- The product $(N)(\rho_{air})$ carries through to our Eq. 4. However, ρ_{air} appears in the numerator and denominator of every term and is independent of mode i, and so ρ_{air} is a therefore a scalar constant and cancels out (this is consistent with Grainger's Eq. 62, in which N does not appear at all; because we are summing across multiple modes before the

division, we cannot eliminate N entirely, but regardless of whether we use # per m^3 or # per kg as the units of N, the units of the Ns in the numerator and denominator will cancel, leaving only m^3 over m^2 from the r terms).

To reduce confusion, we now define number concentration per unit mass of air N_{mass} to be used in Eq. 1, and then separately define number concentration per unit volume N (consistent with the Grainger/CMIP definition) to be used in Eq. 3-4, meaning our Eq. 3-4 are now identical to those in Grainger. Then, we explain that in Eq. 4, N can be replaced with $(N_{mass})(\rho_{air})$, with ρ_{air} cancelling out, to reflect our actual methodology.

Technical corrections:

Table 2 makes clear that the models have different ways of representing the aerosol size, and it seems fair to be quite explicit about that in the different definitions of D and r of the table. But, wouldn't the table readability improve if the same units (μm or nm) were used throughout? And, wouldn't it be fairly safe to convert diameters to radii (or vice versa) using a factor of 2?

This is reasonable; we have converted diameter to radius and nm to μm where appropriate.

Line 185: "Appendix A" should be removed?

This refers to Appendix A in Brown et al, and not to (a nonexistent) Appendix A in our own paper; we have corrected the citation to clarify this.

Line 195: It might help to be explicit whether this estimated optimal radius for scattering is a dry or wet radius, for better understanding of its application to the results here.

Added (it's wet radius)

L314: one instance of "are small" should be removed.

Fixed

Supplement Text S2: Since supplements are not typeset by ACP, I would encourage the authors to clean up the math formatting a bit here to improve readability. This looks like Microsoft equations was used in word—if so, it is much cleaner to use the equation editor within the text as well as for standalone equations, that way the formatting of the variables is identical. (Currently, the symbols in the text are very different from in the equations, especially the ρ). Also note that functions (In, exp) should not be italicized, this is done automatically in word by pressing "space" after typing the function. Similarly, pressing space after a closing bracket will resize brackets appropriately to the variables enclosed.

We used Google Docs, and the Google Docs equation editor, for the Supplement. To clean up the equation formatting, we have moved the Supplement to Microsoft Word and used the Word equation editor in accordance with the editor’s suggestions. The described formatting mistakes have been corrected.