

Thanks to the editor for carefully reviewing our responses and the manuscript. We make the suggested edits as requested by the editor as they help clarify the text. Comments from the editor are in red, our responses are in black.

Thank you for the substantial revision of the manuscript and for addressing all reviewer comments. After reviewing your responses and the revised manuscript, I am pleased to accept it for publication, pending the following minor additions and corrections.

Line 92-95: It should be mentioned that the estimate is at surface.

Good point. The sentences are rewritten to:

“Climate models without ammonium nitrate aerosols omit ~10% of the globally averaged surface concentration of aerosol particles in both PM_{2.5} and PM₁₀ size fractions, with up to 50% of the surface concentrations not included in some regions.”

Line 148 & 1489: Update to the published paper, so Thornhill et al. 2020 -> Thornhill et al. 2021a.

Thank you, good point: we fix this throughout the paper.

Line 209-210. A reference for the choice of OM to OC ratio of 1.8 would be encouraged since the ratio is quite variable. (Ratio given as well at line 318-319).

Good point. We add the the following citations to justify our choice in 209-210 Aiken et al., 2008; Font et al., 2024; Turpin & Lim, 2001.

Lines 318:321: “For example, OM is assumed to be 1.8 times OC if OC measurements are available but not OM measurements. Different ratios of OM to OC appear in the literature, but 1.8 appears to be the best average for a mixture of aged and fresh plumes (Aiken et al., 2008; Font et al., 2024; Turpin & Lim, 2001).

Line 496-498: Overestimation of SO₂ could also be due to too slow reaction to sulphate or too slow deposition. Consider expanding on this point.

Good point, there are a lot of reasons for model errors, so we add in these examples, and try to make it clear there are many reasons for model errors:

501-503 “In addition, these discrepancies could be due to an error in the aerosol transport or chemical modelling, such as incorrect reaction rates or deposition rates or alternative

due to the differences in the time period: the observations are more recent while the assumptions for the emissions are for the year 2010 (Quass et al., 2021).”

Line 855-858: Update to the final published paper of Bowdalo et al. (2024)

Thank you. We do this.

Line 945: Include journal for Fasullo et al.

Thank you for catching this.

Line 1124: Include journal for Kok et al.

Thank you for catching this.

Line 1165: Update to the final published paper of Li et al

Thank you, we do this.

Line 1335: Correct page numbers for Neff et al.

Thank you, we correct this.