

Response to Reviewers' Comments: Global Nitrogen and Sulfur Deposition Mapping Using a Measurement-Model Fusion Approach

Reviewer #1:

General comments:

This manuscript is the revised version to address comments raised by three reviewers. The manuscript has been improved; however, I can still find some concerning issues before the possible publication. First of all, I do not raise the wording “machine learning” but used it as I mentioned. I do not understand these responses and intentions. I have again read this manuscript and am still concerned about the following points (most of them will be minor/technical ones but these should be properly done if this manuscript is published by a high-quality journal). I would like to recommend fully checking the manuscript quality before the re-submission.

We thank the reviewer for the comments and we address the suggestions individually below.

Specific comments:

Abstract: I have raised one question about sulfur trends in the abstract and the authors replied “Response: Sulfur trends are now stated more explicitly in the abstract and the results sections. We cannot have an independent evaluation; this is not a machine learning approach.”.

Without any short introduction to sulfur, this abstract is not well organized. We do not follow why sulfur was analyzed by this method. I would like to request to revise again.

Thank you; this is a good point about the organization of the abstract. We have added an introductory sentence to state the global sulfur trends before we start to describe the methodology.

“Global reactive nitrogen (N) deposition has more than tripled since 1860 and is expected to remain high due to food production and fossil fuel consumption. Global sulfur emissions have been decreasing worldwide over the last 30 years, but many regions are still experiencing unhealthily high levels of deposition. We update the 2010 global deposition budget...”

P2, L45: Is “Nosy” typo?

Yes, it was a typo. It should be NO_y.

P4, Table 1: The wording “number of observations” seems to be misread. I guess this should be “number of observation sites”.

“Number of observations” has been changed to “number of observation sites.”

P8, Table 2: I can find a similar table in the supplemental material (Table S2). This is not mentioned in the main text, and what is the difference between this Table 2 and Table S2? In addition to this point, some supplemental figures/tables were not appropriately referred to in the main text. If the authors prepared the supplemental, it is better to clearly mention it in the

main text. We do not fully capture the supplemental information. Please carefully check the revision process.

Table S1 and Table S2 are now referenced in the text:

“**Table 2: 2010 adjusted global wet and dry deposition in Tg N or Tg S**, MMM indicates Tan et al.’s 2018 multi-model mean and MMF is this measurement-model fusion work with a 2.5° interpolation distance. The 1° and 5° interpolation distance results are shown in Tables S1 and S2.”

All other supplemental tables and figures were already referenced in the main text.

P11, Figure 4: Are these figures not using “mg N/m²” and “mg S/m²”? Why the unit is changed? That is correct – the figures are using “mg N/m²” and “mg S/m².” The description has been updated to reflect the proper units:

“**Figure 4. The difference between MMF and MMM deposition with a 2.5-degree interpolation distance. A)** MMF minus MMM reactive nitrogen deposition in North America (**A1**) Europe (**A2**) and East Asia (**A3**) in mg N/m². **B)** MMF minus MMM sulfate deposition in North America (**B1**) Europe (**B2**) and East Asia (**B3**) in mg S/m². Results for other interpolation distances are shown in Figures S4 and S5, respectively.”

P12, Figure 5: These color scales are not understandable. The maximum value for the upper panel is 1500 whereas for the bottom panel is 2500. However, the medium value is respectively 700 and 600 even though the minimum value is the same. Please carefully confirm this figure. There was a typo in the color scale. The median value for the bottom panel is 1600, not 600. The units have also been corrected with a superscript.

Technical corrections:

P2, L36-37: Why to start a new line here?

The extra space has been removed.

P6, L129: Only one sentence?

The sentence has been added to the previous paragraph.

P10, Figure 3: Appropriate super-script for the unit.

The super-script has been modified.

P13, Figure 6: Appropriate chemical species name and super-script for the statistical value.

The figure has been updated to have the appropriate species name and super-scripts. The corresponding supplemental figures (Figures S2 and S3) have also been modified.

P14, L284: Maybe no need to use a dot.

The dots have been removed.

“(16.9 kg ha⁻¹ yr⁻¹)”