

Interactive comment on “MICS-Asia III: Multi-model comparison of reactive Nitrogen deposition over China” by Baozhu Ge et al.

Anonymous Referee #1

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This manuscript has presented the analyses of atmospheric nitrogen deposition to China as simulated by an ensemble of chemical transport models participating the MICS-Asia III model intercomparison. Available surface measurements of wet deposition fluxes are integrated to assess the model performances. This represents an important step towards a better understanding the model range and uncertainties in simulating nitrogen deposition. Different from previous studies on multi-model nitrogen deposition simulation, most models analyzed in this study used the same emissions and driving meteorology, allowing a closer attribution of the factors driving the model uncertainties. The results show that most models calculated consistent spatial and temporal variations of nitrogen deposition for both oxidized and reduced nitrogen, yet considerable differences exist among models.

C1

I think the study is an important contribution to the MICS-Asia III special issue. The analyses are mostly fine, and it would be much scientifically stronger if having a deeper investigation on the drivers of model differences. The following comments also need to be addressed. In addition to my specific comments as elaborated below, improvements on the language are necessary and need caution.

Specific comments:

1. Page 5, Line 199-202: How about natural sources of nitrogen, e.g., nitrogen oxides from soil and lightning? Are they included in any of these models?
2. Page 6, Line 220-223:
Did any of the models also simulate dry deposition of other nitrogen species, e.g., PAN, isoprene nitrates? How important are these nitrogen species contributing to dry deposition, and the uncertainty induced by excluding them in the analysis? Please clarify.
3. Page 7, Line 261:
It is not clear how the data are normalized as monthly wet deposition fluxes. Do you mean that the raw measurements are at different temporal resolutions (daily, weekly, etc.), and then are interpolated to monthly values? This shall be explained in the text.
4. Page 7, Line 279-281:
This sentence is not clear. Do you mean the correlation coefficients are lower than the value when only comparing with EANET data? Please clarify.
5. Page 7, Line 285-286:
Need to add a sentence defining FAC2.
6. Page 10, Line 417-423:

C2

The sentence here needs rewritten or removed. It is a long sentence, and the information is repetitive in the paragraph.

7. Page 12, Line 478-480:

Is Figure 8 for the surface layer or the atmospheric column? As dry deposition only applies to species at the surface layer, while wet deposition can extend to the whole tropospheric column, an explanation is needed here to justify why you use it for both dry and wet depositions.

8. Page 12, Line 500-510:

How about dry deposition velocities? Did all the models calculate the dry deposition fluxes as the products of surface concentration and dry deposition velocity? It is missing something that the discussion of dry deposition only examined concentrations and not include dry deposition velocities.

9. Page 13, Line 538-548:

The discussion of different allocation is not clear and may not correct. Do you mean dry deposition or wet deposition vs. gas column concentrations? From Figure 9, the spatial distributions of dry deposition of oxidized and reduced nitrogen are rather consistent with their column concentrations. Also the discussion of conservations is not clear. Higher emissions would have higher depositions as both oxidized and reduced nitrogen have short lifetimes, and the differences between emissions and depositions do not reflect their concentrations in the air.

10. Page 14, Line 591-592:

"higher contribution of Nox to TIN in SE indicated more oxidant ratio of the precursors than NC". It is not clear what "more oxidant ratio of the precursors" means. Please clarify.

C3

Technical comments: 1. Page 5, Line 194:

"US 25 National Aeronautics and Space Administration", should delete "25" here?

2. Page 8, Line 322:

"almost double higher than", should be "almost double" or "almost a factor of 2 higher than"

3. Page 12, Line 488:

What do you mean by "the correlated consistence"?

4. Page 12, Line 496:

"the magnitude difference", do you mean "large differences"?

5. Page 12, Line 510:

"this need to be" should be "this needs to be"

6. Page 13, Line 547:

What do you mean by "this conservation data"

7. Page 13, Line 555-558:

Use "major contributions" to denote "18

8. Page 14, Line 572:

Change "increasing trend" to "increasing order"

9. Page 14, Line 579:

Change "correspondingly" to "corresponding"

2020.

C5