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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Source contributions of sulfur and nitrogen deposition – an HTAP II multi model study on hemispheric transport" *by* Jiani Tan et al.

Anonymous Referee #2

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This study utilizes the HTAP2 perturbation experiments to investigate the source-receptor relationship of the deposition for 6 major world regions. This work was an update study based on the first HTAP study, with more redefined regions and consistent emissions changes. The manuscript is well written and considered to be accepted on ACP after considering the following comments.

I am not convinced by the descriptions of the hemispheric transport on deposition in section 3.2. The range of the fractions (%) seems arbitrary to me and not very illustrative. Please consider alter way to better present the results.

Specific comments:

Pg 3 line 68-69: Since North America and Europe are reused later in the content, suggest to define the abbreviations when they first appeared.

Pg 3 line 76: define the time periods of so-called "increasing trend of the hemisphere transport of air pollution" as well as for the directions of the transport. Since the emissions from NA and Eur have been decreasing for the past decades, the hemispheric transport from these regions to others should be lower. Also lots of studies have shown that Chinese emissions have been decreasing since the peak around 2011 (Liu et al., 2016; Li et al., 2017; Zheng et al., 2017; Zheng et al., 2018).

Pg 3 line 83: Double check Arndt and Carmichael (1995)'s study for the S-R relationship. Is it 1900s, or 1990s?

Pg 3 line 87: change "That study uses" to "That study used"

Pg 3 line 90: change "is deposited" to "was deposited"

Pg 4 line 101: change to "we include 2 more regions"

Pg 4 line 109: remove "other regions"

Pg 4 line 122: extra space in front of the "The project involves"

Pg 5 line 130: I thought the HTAP2 experiments only involved the global CTMs which do not need the BCs?

Pg 5 line 146: remove "are"

Pg 5 line 155: remove the repeat sentence "In terms of wet deposition . . ."

Pg 6 line 161: keep consistent by using either "modelling" or "modeling"

Pg 6 line 174: change "the same emissions" to "constant"

Pg 7 line 203-204: Suggest to change to "less than 3% is deposited"

Pg 7 line 212: From Table 1, the statement is not right. Please clarify. For ME, about

50% deposition in the source region, and more than 70% for the other 5 regions.

Pg 7 line 215: I suspect the authors want to declare that the seasonal variations of S export are around 5-10% for all the regions, except for SA. The sentence was confusing when the author added the annual average of NA which are clearly different from the other regions.

Pg 8 line 228: describe the reasons for the larger export fractions of S/NOx/NH3 in ME

Pg line 233: Should “NOy emissions” be “NOx emissions”?

Pg 10 line 288: change “20” to “20%”.

Pg 12 line 360: change “the RERER of NA reached” to “the RERE of NA reaches”

Pg 13 line 378: change the second “own region deposition” to “source region”

Pg 16 line 462-463: rephrase the sentence.

Figure 1. Define region 1.

Figure 7. I have two questions: for the oxidized deposition inter-model comparison (middle plots), the authors should include the organic species (PAN, Orgn), or explain why they did not. For the NH4+ Wet deposition in the bottom plot, I did not see the error bars as other components. Also for NO2 Dry deposition, some regions are missing the error bars too, i.e. EU, ME, RU.

Table 2: Define the RERER in the captions.

In the supporting: Table S3: I would expect to see the seasonal differences for the emission reductions for EA, NA for S and NOx since the HTAP2 emissions have monthly variations (Janssens-Maenhout et al., 2015). Explain why they are always the same amount of reductions.

References: Liu et al., 2016, Recent reduction in NOx emissions over China: synthesis of satellite observations and emission inventories, doi:10.1088/1748-

9326/11/11/114002.

Li et al., 2017, India Is Overtaking China as the World’s Largest Emitter of Anthropogenic Sulfur Dioxide, DOI:10.1038/s41598-017-14639-8.

Janssens-Maenhout, G., Crippa, M., Guizzardi, D., Dentener, F., Muntean, M., Pouliot, G., Keating, T., Zhang, Q., Kurokawa, J., Wankmüller, R., Denier van der Gon, H., Kuenen, J. J. P., Klimont, Z., Frost, G., Darras, S., Koffi, B., and Li, M.: HTAP_v2.2: a mosaic of regional and global emission grid maps for 2008 and 2010 to study hemispheric transport of air pollution, Atmos. Chem. Phys., 15, 11411-11432, https://doi.org/10.5194/acp-15-11411-2015, 2015.

Zheng et al., 2017, Air quality improvements and health benefits from China’s clean air action since 2013, https://doi.org/10.1088/1748-9326/aa8a32.

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