

Interactive
Comment

Interactive comment on “Source-receptor relationships between East Asian sulfur dioxide emissions and Northern Hemisphere sulfate concentrations” by J. Liu et al.

J. Liu et al.

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Response to Reviewer #3

We thank the reviewer for helpful comments and suggestions. We have incorporated most comments into our revised paper. Please see below for our response to each suggestion:

"General comments

This paper presents a modeling study by focusing on intercontinental transport of sulfate aerosols from East Asia and its impact on North America. Authors examined the transport sensitivity of sulfate aerosols with varying emissions over East Asia. This re-

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search includes interesting and important results which are worthy of publication. The paper is generally well written but can be improved. I recommend that relatively minor but important revisions be made in the paper before acceptance.

Specific comments"

"1) Page 5541, line 15: The model computes cloud pH interactively using mostly inorganic species. How about organic acids in the atmosphere which are important for cloud pH calculation?"

In MOZART-2, the contribution of organic acids to pH has not been included, as we now mention in Section 2 (p.7). We will address this issue in our future simulations.

"2) Page 5541, line 25: The model assumes the wet scavenging of SO₂ with the same rate of H₂O₂ which is too fast I guess. Also is there any consideration of sulfate formation in raindrops? I think that it should be because evaporation of rain drop could be a source of aerosol in the atmosphere."

The detailed description of sulfate simulation in MOZART-2 is given by Tie, et al (2001, 2005). As we now discuss in Section 2 (p.7), while the Henry's law constant of SO₂ is indeed low, 'In the case of SO₂, its dissolution in cloud droplets and precipitation is enhanced considerably over its physical solubility by acid dissociation and by rapid aqueous-phase oxidation from S(IV) to S(VI) (primarily by H₂O₂). To reflect this enhanced solubility, wet removal of SO₂ is calculating using an increased effective Henry's law constant, equal to that of H₂O₂, as assumed by Tie et al. (2001, 2005). '

The approach used here is a somewhat approximate attempt to account for the enhancements to solubility. A unified treatment of SO₂ dissolution and oxidation in clouds and precipitation would certainly be better.

"3) Page 5542, line 5: It would be greatly appreciated if the authors provide a table summarizing SO₂ emissions in each region."

We have added a table comparing the regional SO₂ emissions in the revised paper.

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"4) Page 5544, line 9: 500mPa should be 500 hPa."

We have fixed these errors in the revised paper. Thank you.

"5) Page 5544, line 12: Is there any particular reason for selecting 0.1 ug/m3 value?"

We choose 0.1 ug/m3 because in our baseline simulation the spatial extent of AEA0.1 covers the western U.S. at the surface. If we use other values, for instance 1 ug/m3, its spatial extent only covers the western Pacific (see Figure 3b).

"6) Page 5544, line 20: The authors argue that the sensitivity of increasing EA emissions is less important than the decrease of SO2 in terms of transpacific transport of EA sulfate aerosols in surface air over North America because of predominant scavenging of sulfur over the Pacific. However, I guess that it is more related with the subsidence over the Pacific which is a critical factor for contributing EA sulfate aerosol in surface air over North America. This is clearly shown in the figure at 500 hPa."

We have incorporated the reviewer's comments in our revised paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 5537, 2008.

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