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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #2

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This study considers the export of sulfate from East Asian (EA) emissions and the oxidant-limitation effects of changing EA SO2 emissions on local and exported sulfate. They have done this exactly by performing a single experiment with tagged emissions. By comparing the results of this tagged experiment with "sensitivity experiments", i.e. using the difference between a full experiment and an experiment with regional emissions turned off to determine export, the degree of error from excess oxidant availability in the latter method was evaluated. The study has some unique ways of visualizing the effects of changing SO2 emissions on sulfate export, and of assessing the degree of non-linearity. Below are major and minor points that should be addressed prior to publication in ACP.

Specific comments:

1. The study uses emissions from the early 1990's. I was surprised at the amount of agreement of model using 1990's emissions with EANET observations from after 2003. Does this suggest that EA emissions have not changed in the past decade?

2. The SO2 emission inventory used here should be identified and referenced.

3. P 5541, lines 25-28, these seem incorrect: "the wet deposition rate for SO2 is set equal to that of H2O2. For sulfate, the wet deposition rates are set to 20% of that for the highly soluble gas HNO3". SO2 is much less soluble than H2O2. And sulfate is highly soluble.

4. The term "background" to refer to sulfate not derived from the local region is misleading, since background often means natural. "Non-local" might be better.

5. P 5544 Lines 21-end of page. As SO2 increases, maybe the larger increase in sulfate at higher altitudes and smaller increase near the surface is due to greater oxidant availability aloft. H2O2 typically peaks at mid-altitudes of the troposphere.

6. P 5546. In addition to considering the degree of non-linearity to increased SO2, it would be worthwhile to consider also the amount of linearity if emissions are reduced, i.e. at what point of the curve is EA now?

7. A more realistic simulation would include deposition of SO2 on particle surfaces. Discuss how including this in the model would affect the results.

Technical comments:

1. 5538, Lines 9-10, specify that this is in the column.

2. 5538 Line 20, the meaning of "sensitivity" should be clarified here, also on page 5540 lines 14-15.

3. Several periods are missing: p5543 L 25, p5544 L 9, p5544 L 24

ACPD

8, S2394–S2396, 2008

4. P 5548 Sentence starting at line 5 is poorly constructed. The model transport findings do not depend upon the health effects: "Since sulfate aerosol is... harmful to human health, ...summertime trans-Pacific transport.. is important"

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

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8, S2394–S2396, 2008

Interactive Comment