

Interactive
Comment

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

Anonymous Referee #1

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Based on calculations using a chemistry transport model the study investigates the influence of East Asian sulfur dioxide emissions on sulfate concentrations in the Northern Hemisphere. Main conclusions are that the impact of East Asian sulfate on surface concentrations in North America are at maximum in spring and summer. Moreover, the study concludes that changes of North American background sulfate due to increasing sulfur dioxide emissions from East Asia do not respond linearly. However, reductions in EA sulfur dioxide emissions significantly reduce the sulfate load over the North Pacific and North America. Finally, the authors compare different approaches to assess source-receptor relationship by comparing sensitivity studies to a tracer tagging technique. The topic of long-range pollution transport is certainly of interest (as demon-

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strated in many publications) and the study contributes to a better understanding of the atmospheric sulfur cycle.

A main topic of this study is the non-linearity between sulfur dioxide emissions and sulfate mixing-ratios at surface and in the free troposphere. This aspect needs a more thorough analyses. Non-linearity is caused by low oxidant concentrations (OH and H₂O₂) in winter and by H₂O₂ limitations in regions with high SO₂ emissions. As oxidation rate is the key process controlling the non-linearity, the vertical and seasonal distribution of the oxidation rates should be presented and the importance of the different chemical transformations depending on altitude, latitude, season, and magnitude of SO₂ mixing-ratios should be discussed (e.g. E-W cross section over Asia and Pacific).

Minor comments:

1. Abstract: I miss, the conclusion that mainly local emissions not long-range transport affects air quality.
2. page 5541 In 25: same wet deposition rate for SO₂ and H₂O₂: The solubility of SO₂ is considerably lower than that of H₂O₂? In my opinion, the wet removal of SO₂ is negligible.
3. page 5542 In 15-25: The meteorology of the simulations covers the period 1990 to 1991, whereas the observations used for evaluation cover different periods. As regional sulfur dioxide emissions underwent significant changes between the 1980es and the early 2000es, this should be addressed in the discussion about the model's performance.
4. chapter 3: "Global contribution of sulfate aerosol from EA" Kritz et al (Tellus B, 1990) reported fast transport of radon-222 from EA to North America in spring and explain this fast transport by convective activity in China and subsequent mixing of radon into the jet-stream. Please, refer to Kritz's study and discuss whether this mechanism might be important for sulfur dioxide and sulfate transports as well.

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5. Typo: Please, replace throughout the paper "mPa" by "hPa".

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

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8, S2540–S2542, 2008

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