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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Particulate sulfate ion concentration and SO_2 emission trends in the United States from the early 1990s through 2010" *by* J. L. Hand et al.

Anonymous Referee #2

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This paper is a thorough analysis of trends in sulfate and SO2 power generation emissions in the United States over the last decade(s), providing useful information on the link between decreasing emissions and the response in observed sulfate levels. While this is a fine analysis, I found the paper somewhat lacking in insight into the origins of the observed behavior. I've detailed this a bit more below with some specific examples.

Major Comments:

1. Often the trend for a specific site or region is given with little discussion of the potential causes. While it may not always be clear to the authors, some discussion of possible causes would provide some useful context to the results. Examples as follows:

a. Page 19320, lines 4-6: Why is sulfate increasing at these 3 sites? How does this correspond with the local trend in emissions?

b. Page 19321: Discussion of Dec trends in N/Central Great Plains: Why are such large increases apparent?

c. Page 19321: Discussion of Dec trends in central-eastern US: again, why do these show winter time increases?

d. Page 19321/19322: Springtime trends possible associated with transpacific transport? Does this affect the California sites?

e. Page 19325, line 14-15: So if not urban emissions, what is the cause of this difference?

f. Page 19325-19326: There is an increase in sulfate concentrations in 2005 across the entire US which is inconsistent with the emissions. What is the possible cause of this? What about the similar, although more modest, enhancement in 2007?

g. Page 19327, lines 14-15: Why? (see #4 above)

h. Page 19327, lines 15-22: Why? (see #2 above)

i. Page 19328, lines 7-12: This is the first discussion of transpacific transport, but you mention long range transport as a factor in sulfate concentrations trends in the Introduction, so this is on the reader's mind as they go through Section 3 (see #4 and #7 above). Why wait to say this?

j. Page 19329, lines 2-5: ditto.

2. Are the monthly trends shown in Figures 2 statistically significant (given few samples each month)? Is the lack of data for each year a potential cause for some of the spurious looking "hotspots"? Perhaps it would be better to look at seasonal trends?

Minor Comments:

1. Abstract, line 11-12: The text is ambiguous as to whether the 2 different trends given are for urban vs. rural or simply the two together over two different time horizons. Clarify text.

2. Abstract: It would read better if trends in emissions and concentrations were given for the same time horizon (so as to be directly compared) in the abstract. The differences in record lengths is discussed in the manuscript, so perhaps these summary trend numbers should all be provided for 2001-2010.

3. Page 19313, line 3: 40-60% is a narrow range, is this for the annual mean contribution? Clarify in the text.

4. Page 19313, line 8: why has the NW max shifted to the spring?

5. Page 19314, line 17: What does “decreased concentrations were largest” mean? It implies that the concentrations were “largest” when I think the authors mean that the decrease was largest.

6. Page 19317, line 10: What does “(3*sulfur)” mean? Please expand or remove text.

7. Page 19319, line 6-7: Was the increasing trend one of the significant sites?

8. Page 19325, lines 19-20: This last sentence should be given in the figure caption.

9. Page 19329, lines 6-15: This discussion would be more appropriate in Section 3.4 when discussing the correspondence of the emissions & concentrations. Also, when reading 3.4 I was thinking that looking at the correlation coefficients for each region by season would be a good summary of when concentration trends are predominantly related to emission trends or not.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 19311, 2012.