

Interactive comment on “Composite study of aerosol export events from East Asia and North America” by Y. Luan and L. Jaeglé

Y. Luan and L. Jaeglé

jaegle@atmos.washington.edu

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This is a very well written manuscript that provides useful information on the export pathways of aerosols from East Asia and North America. This is an obvious topic to explore and I wonder why no one has done it before. Perhaps we just needed to wait for many years of reliable satellite observations, which the authors make very good use of. The paper is well suited for publication in ACP and I recommend that the paper be accepted for publication after a minor revision, according to my comments below.

Page 21979 line 2 Technically the ocean east of Asia should be referred to as the “North Pacific Ocean” here and throughout the document. *This has been corrected in the revised manuscript.*

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Page 21980 line 11 Another good reference that discusses summer time lofting of air pollutants and the relationship to convection and mid-latitude cyclones is Kiley and Fuelberg, 2006. *We have corrected this omission in the revised manuscript.*

Page 21980 lines 22-23, change to Furthermore, as warm air from the polluted continental boundary layer advects over colder marine air, stable conditions with minimal vertical mixing can be produced. *Done.*

Page 21980 lines 24-25 change to As a result the pollution layers. *Done.*

Page 21981 line 6, change to 25% reached the N. American West Coast. *Done.*

Page 21981 lines 25-26, change to: . . .we construct composite Asian and N. American aerosol outflow events based on dozens of individual cases in order to. *Done.*

Page 21982 lines 15-16 If the Modis data is 1x1 degree and then regridded to 2x2.5 degrees, at most the re-gridded product contains five 1x1 grid cells. So I don't see how a 2x2.5 degree grid cell can have as many as 25 valid pixels. How many pixels are in a 1x1 degree grid cell? *This statement was indeed confusing. The original MODIS pixel size is 10x10km (not 1x1 degree) and this is what we refer to. The revised manuscript has been corrected.*

Page 21982 line 16, change to This limits cloud contamination and produces statistically meaningful data. *Done.*

Page 21986 Here SO₂ is used as a tracer of outflow events but there needs to be some discussion of the fact that SO₂ emissions are decreasing in China and N. America. See Lu et al. 2010 and EPA, 2012. *This is a good point. This was not made clear in the original manuscript. We use constant anthropogenic emissions in our simulations. For China, we use the 2006 inventory of Zhang et al. (2009). Between 2006 and 2010, SO₂ emissions from China have decreased by 9% (Lu et al., 2011). The decrease in the US has been more pronounced (~50%). We note this in the revised manuscript in section 2.2. Keeping anthropogenic emissions constant allows us to put equal weight*

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on all years, thus focusing on the role of meteorology, instead of emphasizing the early years in the 2004-2010 period for the US.

Page 21989 line 1 Are the export events primarily ahead of, or behind cold fronts? *By examining individual outflow events, we find that some occur behind cold fronts, while others are ahead of cold fronts. This has been noted in the revised manuscript.*

Page 21991 In this section a lot of general statements are made regarding transport and emission processes but no references are given. Please give references for the following: Line 4-5 Here state that the storms are at the start of the storm tracks. Papers by Stohl or Eckhardt would be appropriate. Lines 13-14 please provide a reference that contrasts biogenic emissions in N. America and Asia. Lines 15-16 need a dust reference. *Thank you for pointing out these omissions. We have added references in this section.*

Page 21992 lines 2-3 To my eye, it doesn't look like a small summer maximum. I see a broad spring/summer enhancement. Lines 3-4 Change to: meteorological conditions. *Done.*

Lines 3-4 You could test the hypothesis of weaker seasonal contrast in meteorological conditions across N. America by plotting seasonal average surface temperature, humidity and wind fields for both continents, using your GEOS met. fields. *We have calculated these differences and discuss them in the text in section 4. There is indeed a much stronger seasonal contrast in temperature, wind speed, humidity, and precipitation over E. Asia than over N. America.*

Page 21992 line 11 Change to: over the Western North Atlantic Ocean. *Done.*

Section 4.3 Here there is a lot of discussion regarding the wet deposition of sulfate. A simple analysis that could shed some light on the wet deposition efficiency in Asia and N. America is to plot the ratio of sulfate to CO with altitude. CO is a conserved tracer that is not wet deposited. If Asia has less wet deposition, then the SO₄/CO ratio

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should decrease with altitude at a smaller rate than above N. America. Also, it would be helpful to state that all discussion of sulfate aerosol applies to the GEOS-Chem simulation and not satellite retrievals. *We have clarified that the discussion of sulfate applied to the model simulation in the revised text. We agree that relating SO₄ to CO would be a useful analysis, however we do not have CO fields archived in a convenient way to conduct the type of study proposed by the reviewer.*

Page 21996 In the discussion of long range transport of sulfate please also reference the very nice in situ measurements discussed by Brock et al. 2004. *Done.*

Page 21997 lines 3-4 Measurements of Asian plumes at the US west coast also indicate that Asian pollution mixes with dust emissions [Jaffe et al., 2003; Price et al, 2003]. *This statement in the paper refers to the outflow region, while these references are for the inflow to N. America.*

Figure 3 Are the letters on the x-axis supposed to be there? They are difficult to read. *This has been fixed.*

Figure 11 What is the text on the right hand side of the plots? Are these data all produced by the model? *This has been fixed. We have clarified that these profiles are model results.*

In general the figures are very tiny and hard to read and most should be enlarged by at least 20%. *We will make sure that the figures have the proper size in the final version of the manuscript.*

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 21977, 2012.

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