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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #1

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Since long-range transport of aerosols exerts a great influence on human health and global climate change, this study has employed a composite methodology (i.e., incorporating both the MODIS observations and GEOS-Chen model) to explore multiple Asian and N. American aerosol transport events in order to examine the general features of these exporting plumes. The authors found that Asian and N. American export events are associated with a dipole structure in sea-level pressure anomalies 2 days ahead of the outflow events. In addition, the authors found that a factor of 2–3 lower in precipitation over E. Asia than over N. America accounts for a higher efficiency of exporting the EA SO2 and aerosols to the free troposphere than these from NA. This manuscript is scientifically sound and is very well written. I recommend it being published in Atmospheric Chemistry and Physics after the following minor issues have been addressed:

P21979, L11, “Asian pollution layers intercepted 3–10 days downwind over the Pacific have elevated sulfate aerosol levels but reduced organics”. I wonder why organics are higher over the Pacific without interceptions of Asian pollutants. What is the source of the marine organics? Is this linked to the underestimation of the model AOD?

P21981, L19: remove the second “against”.

P21985, L1, what are the reasons that lead to the large negative summer bias of the GEOS-CHEM simulation? I wonder if this is due to that the SOA scheme is not included in this study?

P21986, L17-19, “We define enhanced aerosol export events during spring as the top 20% days in the frequency distribution of the Asian outflow timeseries for 2004–2010”. Using top 20% days here has some problem in judging real pollution plumes. Why not instead using a fixed criterion (e.g AOD >0.2, or AOD anomaly > 0.1)?

Fig3. The scale of Y-axis for top and bottom plots should be the same, even though one is for sulfate and the other is for all fine aerosols. In addition, the red little triangles illustrated in Fig3 are identified all based on the model simulated plumes, and should be mentioned in the Fig3 caption.

P21990, L4-7, the mean trans-Pacific transport time from east Asia to the west coast of North America is estimated as one week. This timescale actually reflects the rapid transport of plumes. Therefore, on L7 “This transport time” should be changed to “This rapid plume transport time”.

Fig6, the features shown in Fig6 may just represent a few major transport events (i.e. top 1-5% days) as illustrated in Fig3. In addition, in Fig6a for day 5 and day 6, it is hard to tell the AOD enhancement over the western NA is due to transport of Asian sulfate or the elevation of local sulfate AOD since in day 4 there is some local AOD signal over the western U.S. Moreover, it is very difficult to tell the AOD movement from the MODIS AOD anomalies. Therefore, the authors should caveat these uncertainties.

Asian aerosols are a complex mixture of dust and anthropogenic particles, and contain significant levels of absorbing soot and organic carbon as a result of extensive coal burning and biomass burning, but the authors chose sulfate aerosols as a proxy for pollution aerosols. The authors should provide some reasons why only focuses on sulfate. Some uncertainties maybe exist in this simplification.

The authors identified 244 aerosol outflow events from E. Asia (81 in spring, 47 in summer, 56 in fall, 60 in winter) and 251 events from N. America (72 in spring, 60 in summer, 61 in fall, 58 in winter). The number of outflow events from NA is even larger than that from EA, but the elevation in AOD is significantly different. Therefore, the analysis here only reflects the meteorological conditions associated with high exporting efficiency.

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