

Interactive comment on “Satellite observations of aerosol transport from East Asia to the Arctic: three case studies” by M. Di Pierro et al.

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General comments

This paper presents a study on the long-range transport of aerosols from East Asia to the Arctic using the satellite observations together with models. Authors examined three observed transport cases by the CALIOP lidar onboard CALIPSO to show the dominant pollution transport pathways from East Asia to the Arctic and the general synoptic meteorological conditions over the NW Pacific. By comparing with model results the authors confirmed the sources of transported aerosols and their main chemical components based on the general good agreements between the model and the observations. This manuscript includes interesting and important results that are worthy of publication. The paper is generally well written but can be improved from careful edit-

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ing for language. I recommend that relatively minor but important revisions be made in the paper before acceptance.

Following the suggestion of this referee we have very carefully edited the language in the revised manuscript.

Specific comments A) Page 25359, 18: percent should be removed!

Done

B) Page 25404, 14: “likely underestimates the dust in the model”, Any possible reasons for this? How does the GEOS-Chem simulate the wet scavenging of dust aerosols? This might worth a little bit of elaboration because the long-range transport from East Asia accompany in general wet processes such as the warm conveyor belt and deep convection as the authors indicated.

We attribute this to a model underestimate of dust emissions for this case. Indeed, when compared to MODIS AOD observations over the Sea of Japan, where the dust/pollution mixture had accumulated at the onset of the transport event, GEOS-Chem is a factor of 2 too low. Wet scavenging was similar in this case compared to the other cases.

C) Page 25405, 7: The mixing state of aerosols affects aerosol extinction according to the previous literature. Wonder if any effects of the assumed external mixing in the GEOS-Chem on the discrepancy shown here.

As noted above, we attribute the difference between model and observations is due to an underestimate in dust emissions. Assuming an internal instead of external mixing state of aerosols would lead to a 10-30% reduction of the model calculated extinction (Lesins et al., 2002), further exacerbating the model underestimate of observed extinction.

D) Page 25407, 21: asian => Asian, but here and elsewhere, careful editing is highly recommended.

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Typos were corrected.

E) Page 25408, 21: Is there any particular reason why the authors use the WP and PNA indices?

We chose these two indices because they are the two leading modes of low-frequency variability that affect the Northern Pacific. This is now explained more clearly in the revised version of our manuscript: “The two leading modes of low-frequency variability that affect the Northern Pacific are the Western Pacific (WP) and the Pacific North American (PNA) indices.”

F) Page 25410, 10: It would be appreciated if the authors explained reasons for the strong seasonal dependence of correlation coefficients.

This is now clarified in the following sentences:

“During summer and autumn, the correlation between AME and Asian sulfate AOD disappears as both timeseries display much less variability (Figure 13). This reflects a more zonal configuration of geopotential height with a diminished frequency of blocking patterns in the Northern Pacific in summer/early autumn (Lejenas and Økland, 1983), leading to reduced outflow of pollution from East Asia to the Arctic.”

G) It is difficult to see the map and color shadings in Figs 1, 5 because they are too small. Also labels and inset are too small to read especially in Fig 4.

Figures 1, 5, 8 (now named Figure 1, 6, 9) have been enlarged and the number of panels has been reduced from 5 to 4. Insets in Fig 4 (now Fig. 5) have been enlarged.

Reference: Lesins, G., P. Chylek, and U. Lohmann (2002), A study of internal and external mixing scenarios and its effect on aerosol optical properties and direct radiative forcing, J. Geophys. Res., 107(D10), 4094, doi:10.1029/2001JD000973.

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