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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Spatiotemporal variations in atmospheric aerosols in East Asia: Identifying local pollutants and transported Asian aerosols in Osaka, Japan using DRAGON" *by* Makiko Nakata et al.

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Dear Reviewer,

Thank you for your reviewing my manuscript. I greatly appreciate your careful reading and valuable suggestions. Please find my replies itemized according to your comments. Your indication is a great help in revising the manuscript. I would like to say thank you again.

Q1. The title is inappropriate. The observational data used in this study is only limited to the middle of japan near Osaka, which could not present the fact of East Asia. Q2.

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One day's data in a limited region may not be effective to present the spatiotemporal variations of atmospheric aerosols.

A1 & 2. In order to clarify our research object, the title was changed to "Identifying local pollutants and Asian aerosols transported to Osaka during DRAGON-Japan".

Q3. AERONET data, like many other measurements results, contains large uncertainty. The uncertainty may affect the conclusion. This need to be analyzed.

A3. The accuracy of the AERONET-AOT is better than 0.01 at all observational wavelengths, and the obtained spectral AOT data are cloud-screened before aerosol retrieval. The portable sun photometer MT-2 has been calibrated with a standard AERONET Cimel radiometer. The relative errors of the MT-2 from a standard AERONET Cimel radiometer are less than 3% at all wavelengths. The observational biases of PM concentrations measured by NIES/AEROS have been eliminated through careful data screening. The air pollutants observed on March 11th, 2012 were sufficiently dense for allowable observational errors. These explanations are added in the revised manuscript.

Q4. No enough information is provided to the borrowed simulations (Fig. 7). The simulation without considering the practical emissions means nothing on science.

A4. Descriptions on the GCM simulations are added in section 3.3. In order to investigate the origin of high PM concentrations measured in Osaka in the evening on March 11th, 2012, the backward trajectory analysis using a NOAA HYSPLIT model is additionally employed. It shows that an air mass passing above Beijing reached Osaka through Western Japan on March 11th, 2012. The explanation of back trajectory analysis is shown in Fig. 10 in section 3.3.

Q5. It is not shown how the EDX analysis prove that the pollution is from China. It is more of a speculation rather than finding. For a modeler, it is more likely that long range transport would be averaged over such a small region (sites). Then the variations tend

to show local difference. This can upset the conclusion.

A5. In order to clarify the origin of PM concentrations measured in Osaka on March 11th, 2012, complementary figures and their descriptions have been added. One example is the addition of sequential maps of SPM and PM2.5 distributions in Figs. 6 and 7, respectively. These figures explicitly show that the dense concentration sites of PM moved from west to east over Japan in decreasing with the actual amount of PM concentrations throughout the day. The other is the addition of back trajectory analysis already mentioned in the previous response. Both results explain that the high concentrations of pollutants recorded at Osaka in the evening of March 11th, 2012 are due not only to local emissions but also transboundary pollutants. The proportion of sulfur analyzed by EDX increased at the peak of the observed PM concentrations. Sulfur is still one of the major components of PM in normal conditions in Osaka, however its concentration is not as high as the values measured during the period of severe pollution on March 11th. In this study, the factor causing dense concentrations of atmospheric pollutions in Osaka is examined in practice with several ground measurements and/or simulations.

Q6. The expression of this article is somewhat accurate but is not enough for publication. It seems that all the conclusion of this article is based on speculation. This may be the truth. But this is not a scientific research. We need a conclusion that is base on the truth and get proved somehow.

A6. The evident results are mentioned in the summary. First, high concentrations of airborne pollutants were recorded on Fukue Island on the morning of March 11th, 2012, which was during the period of operation of the DRAGON-Japan campaign. In the afternoon on the same day, dense PM concentrations were recorded in Osaka. Ground measurements showed that high concentration parcel of PM moved from west to east in Japan on March 11th, 2012. Simulations indicate that the air parcel carried the particles from Mainland China to Western Japan. Both results indicate the high concentration of PM recorded above Osaka on March 11th, 2012 originated from not only urban

contamination but also transboundary pollutant. Second, component analysis of PM in Osaka using SEM/EDX showed that the sulfur component is clearly dominating beyond the averaged values of ordinal days.

Q7. It is incorrect to think that high SO2 level indicates the pollution from China. As it is also mentioned in this manuscript, the dust storm, may affect acid deposition. There have be many researches on dust storms showing that dust storms in China increase the PH value of air in northern China and in the outflow. When you mention both, you have to do more research to determine the exact truth.

A7. The explanation about the proportion of sulfur increases during dust events has been added to subsection 4.1. Yellow dust events have been addressed in our previous papers in S. Mukai et al., 2007. In order to clearly show the change of fine particle concentration, a sequential map of PM2.5 distribution (Fig. 7) has been added instead of Fig. 6 in the ex-manuscript.

Again, I greatly appreciate your precise and valuable comments.

Very sincerely yours, Makiko Nakata

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