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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Mixing states of Amazon-basin aerosol particles transported over long distances using transmission electron microscopy" *by* Kouji Adachi et al.

**Anonymous Referee #1**

Received and published: 1 July 2020

In this study, composition of Amazon-basin aerosol particles has been studied using transmission electron microscopy (TEM). Aerosol particles were collected during the Green Ocean Amazon campaign in 2014 and over 10000 particles were analyzed. TEM has a very high spatial resolution, which allows the analysis of the composition of individual particles in very detail. However, it has some disadvantages such as particle evaporation during analysis. The results showed that particles have different composition, size distribution and number fractions based on they origin and the particles were mixed to more complex structures during their transport in the atmosphere. In general, aerosol particles play an important role in atmospheric processes and the composition of particles is necessary to know when they influence on the climate is studied. Thus,



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Discussion paper

the study is important and topical.

To my knowledge, this kind of detailed study on individual particles by TEM has not been done before from Amazon-basin particles. Furthermore, it reveals novel information of particle composition, origin and transport. The used methods are very suitable for analysis of composition of individual particles. The manuscript (MS) is quite well organized and written. The content on the MS is in the scope of journal. Thus, the MS is suitable for publication in this journal. However, I have some comments, suggestions and technical corrections that should be considered and discussed before publication.

Main comment:

The main conclusion is that many aerosol particles change their composition by mixing during transport. TEM results showed that analyzed particles are often mixtures of particles from different origins (and composition) indicating that particles have been coagulated in the atmosphere during the transport. How have you ensured that the particles have not just agglomerated on the TEM grid during collection? Have you estimated how many particles per unit area you can collected onto TEM grid in order to avoid particles agglomeration during sampling (i.e. the particles are separately on TEM grid)? Please estimate particle agglomeration on TEM grid and clarify this in the revised version of MS.

Specific comments/technical corrections:

Structure of the MS is now: 1 Introduction, 2 Methods, 3. Results, 4 Discussion, and 5 Conclusions. The structure where Results and Discussion are combined into one chapter could be clearer. Now Results chapter also contains some discussion.

Line 186: . . .shows a positive correlation => Please indicate correlation coefficient/R2.

Line 197-198: . . .show a positive correlation => Please indicate correlation coefficient/R2.

Line 238-239: Na, Mg, and Cl are commonly used tracers of sea-salt particles. . . =>

Why element map for Mg is not shown in the figures?

Line 245-246: The deformed shapes of Na-bearing particles on the substrate suggest that they were hydrated when collected (Fig. 7). => Is it possible that particles are already hydrated before collection in the atmosphere? Please clarify.

Line 322: . . . form internally mixed particles => Is the impact of internally mixed particle of climate different than that of externally mixed particle?

Line 330-331: Sea-salt and sulfate particles commonly occur on the surfaces of mineral and PBA particles. => Is the simple reason that they are just wetted in the atmosphere (or during sampling)? Please clarify in the MS.

References:

Authors of the MS have many own references in the reference list (e.g. Adachi 7 the first author references, Artaxo 5). Please check that all references are needed and remove unnecessary references.

Figures:

Figure 1. The smallest fonts are too small, practically texts are not readable (legend texts, x-axis labels, periods text). Please increase font size (double it in the smallest ones).

Figure 2. Too small fonts. Color bars too small (especially (c)). Yellow shaded area is too light to see, especially in print (a).

Figure 3. Data points and error bars not clear in (d)-(f). Fonts of numbers too small. Please plot 1:1, 1:2 or 1:n lines show assumed relations (or trendlines with R2 values).

Figure 4. Too small fonts (especially legend texts) and unclear plots. Please make clearer plots. Sulfates, carbonaceous and K-bearing have the highest values at smaller particles. Are they formed via new particle formation? What is reason?

Figure 5. Plot d) is unclear.

Figure 6. Does water vapor change the shape of PBA particles (see e.g. 2nd image form bottom/left)? Please clarify.

Figure 7. Plots d)-f) are unclear (too small fonts).

Supporting Figure 3a, 4a and 5a. Please indicate acronym PBOA (PBA?).

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