

Anonymous Referee #3

General Response: We thank the Referee for your helpful comments. We have addressed all comments and provided point by point response below. The revised manuscript is presented in below Response.

The study reports the observation of aerosol particles collected in the East China Sea (ECS) and the northwestern Pacific Ocean (NWPO) onboard a research vessel. TEM was applied to investigate the physicochemical properties of the aerosol particles over the ocean. The authors reported that more anthropogenic particles were found in the ECS than NWPO, and they further discussed the Cl-depletion in the sea salt particles. This paper provides valuable information for understanding the influence of long-range transported anthropogenic pollutants on the marine environment. The paper addresses relevant scientific scope within the scope of ACP. I would like to suggest it to be accepted for publication after some minor revisions.

Answer: We appreciated the Referee#3's comments which significantly improve the quality of the manuscript. We carefully answer them one by one as below. The modifications were highlighted in red in the revised manuscript.

Comments:

1. Line 72 and Lines 99-100, Please rewrite these sentences for an easy way to understand.

Answer: We revised the sentence in Line 72 for better understanding. The sentence in Line 99-100 was removed from the manuscript.

Context: Therefore, it is important to understand the physicochemical properties of long-range transported anthropogenic aerosol particles in marine air.

2. Lines 126-132, the authors should clarify how they chose the observation areas on the TEM grids for the TEM analysis.

Answer: We added more description about choosing the observation areas in the Section 2.1.

Context: Coarser particles are near the center of the sampling spot and finer particles are on the periphery. Therefore, we selected three or four areas from the center to the edge to guarantee the representativeness of the analyzed particles.

3. Lines 177-180, please explain in a detailed way about the classification of internally mixed particles.

Answer: Most of the aerosol particles observed in this study contained two or more different types of aerosols. Thus, we further defined six internally mixed particles to elucidate the mixing states of aerosol particles. S-metal refers to metal particles mixed with sulfate (Figure 2c). S-fly ash refers to fly ash particles mixed with sulfate (Figure 2d). S-soot refers to soot particles mixed with sulfate (Figure 2e). OM coating refers to secondary organic matter coated on sulfate (Figure 2f). OM-S refers to primary OM

particle mixed with sulfate. S-rich refers to secondary inorganic particles (e.g., $(\text{NH}_4)_2\text{SO}_4$ and NH_4NO_3), which are formed from their gaseous precursors, such as SO_2 , NO_x , and NH_3 (Figure 2h).

We also revised the sentence for clear understanding.

Context: To elucidate the mixing structure of the non-SSA particles, we further defined six types of internally mixed particles: S-metal, metal particles mixed with sulfate (Figure 2c); S-fly ash, fly ash particles mixed with sulfate (Figure 2d); S-soot, soot particles mixed with sulfate (Figure 2e); OM coating, secondary organic matter coated on sulfate (Figure 2f); OM-S, primary OM particle mixed with sulfate (Figure 2g); and S-rich, secondary inorganic sulfate and nitrate particles (e.g., $(\text{NH}_4)_2\text{SO}_4$ and NH_4NO_3) (Figure 2h).

4. Line 180, it would be better if the authors briefly define anthropogenic aerosols at first.

Answer: We provide a brief definition of anthropogenic aerosols.

Context: Anthropogenic aerosols are particles originated from human activities, including S-rich, S-soot, S-metal/fly ash, OM-S, and OM coating particles in this study.

5. Line 234, a “.” is missing in the “e.g.,”.

Answer: Corrected.

6. Figure 8, 0.7-0.9 and 0.5-0.7 in the x-axis are reversed.

Answer: Corrected.

7. Further description on Figure 9 should be provided in the main text.

Answer: We added one more paragraph to describe the schematic diagram in Figure 9.

Context: Based on the results and discussion above, a conceptual model was proposed to summarize the impact of long-range transported anthropogenic air pollutants on marine aerosols. Both anthropogenic gases and aerosol particles could be transported to the downwind marine air. Anthropogenic aerosol particles from the continent significantly influence the ECS air. During the transport, aerosol particles could be scavenged due to dry or wet deposition while some reactive gases can be transported further to the NWPO air and influence the aging of SSA particles.