

Interactive comment on “Phosphorus solubility in aerosol particles related to particle sources and atmospheric acidification in Asian continental outflow” by Jinhui Shi et al.

Anonymous Referee #2

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The manuscript investigated the P speciation and solubility in aerosols in the eastern China's coast. Phosphorus may ultimately control the primary production in the large areas of the ocean especially in the N-affluent regions such as the marginal seas of the western North Pacific. The previously reported P solubility in aerosols was in a wide range, and therefore it is important to understand the factors or mechanisms determining the atmospheric input of soluble P. The manuscript studied the coordinated effect of relative humidity (RH) and aerosol origins and acidity on P solubility, and also included dissolved organic P in the discussion. The manuscript indicated that P in aerosols from anthropogenic sources had a higher solubility than the P in aerosols from mineral dust. Phosphorus solubility was usually less than 30% when the RH

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was below 60% and the higher RH increased the dissolution of aerosol P to a great degree under acidic conditions (how to define acidic condition?). These results will be very helpful to modeling the input of bioavailable P to the ocean. It would be nice if authors could discuss extrapolation of the results to the eastern China seas, other coastal regions or even the open ocean.

Introduction Page 2 Line 3: Authors may add few sentences on the importance of atmospheric P deposition to the surface ocean. For example, long-term measurements of dissolved P at station ALOHA revealed unexpected temporal variability in PO₄³⁻ concentrations in the surface ocean, which may be partly due to the episodic atmospheric deposition (Karl and Tien 1997).

Karl DM, Tien G. 1997. Temporal variability in dissolved phosphorus concentrations in the subtropical North Pacific Ocean. *Mar. Chem.* 56:77–96

Methods Page 4 Line 26, “P” at the beginning of the sentence should be changed to “Phosphorus”

Page 5 Line 18: “because P is a substance in primary particles”. Here what is the general size range for primary particles? Authors may provide the reference or the size distributions of P and DP to prove the statement. Page 5 line 18-20: “In cases when the samples contained less mineral dust, the aerosol mass would be somewhat underestimated.” The mass loadings estimated from Al concentrations may be compared to the officially reported PM₁₀ concentrations to check for the average underestimation.

Results and Discussion Page 6 Line 3-5: The two sentences can be combined to be more concise.

Page 6 Line 27: “This result was probably caused by the release of primary biological particles and agriculture fertilization in spring.” Was DOP released by the agricultural process in spring or as the loss of fertilizer (I thought that fertilizer should be mainly DIP)?

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Page 8 Line 18: The statement “a small fraction of biological P” needs to be supported by a reference or observatory data.

Page 8 Line 29-31: Why is the correlation of TDP vs soluble AI better than that of TP vs AI? Such comparison is hard to explain. Authors may delete this sentence and just compare the ratios of P/AI to the ratios of TDP/soluble AI.

Page 9 Line 31: “Some data points deviated from the fitting curves.” The specific variables for fitting curves should be indicated here, e.g. for P solubility and total AI.

Page 10 Line 11-13 & 18-20: There is repetition in these sentences.

Page 11 Line 6: “had a statistically significant correlation” What are the variables?

Page 11 Line 17-32: The coordinate effect could be arranged as another section. The relationships between P solubility and humidity, anthropogenic percentage and acidification are complex. The two paragraphs seem to talk about the situations at $RH < 60\%$ and $RH > 60\%$ respectively. But the RH change from $< 60\%$ to $> 60\%$ was discussed again in the second paragraph. This part needs to be reorganized.

Page 11 Line 25: The unit of acidification degree should be unified in the paper. Is it proper to choose 150 acidification degree as the boundary?

Page 12 Line 1-2: The first half sentence talked about the effect of RH on P solubility, and the second half mentioned acidification. The linkage between the RH and acidification was missing.

Conclusion Page 12 Line 12: “. . .from mineral dust and anthropogenic sources” can be deleted.

Page 12 Line 17: “The threshold RH for this effect was approximately 60%.” can be deleted.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-892>, 2018.