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Reply on RC2

Yuanyuan Chen et al.

Author comment on "Fluxes, patterns and sources of phosphorus deposition in an urban–rural transition region in Southwest China" by Yuanyuan Chen et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-388-AC2, 2022

Response to reviewer's comments

Dear Reviewer,

Thank you very much for helping us to handle the manuscript entitled "**Fluxes, patterns and sources of phosphorus deposition in an urban-rural transition region in Southwest China**" **[acp-2022-388]**. I am writing a response to the reviewer's comments. The detailed revisions are highlighted in yellow in the manuscript, and the response to comments are listed as follow:

Specific comments

Q1: L20-21: This is incorrect. Correlation doesn't mean causality. Temperature and precipitation doesn't affect total P deposition! P emissions do!

A: Thank you very much for your comments. We rewrite the sentence as: "*Moreover, it was found that the monthly variations of P deposition were strongly correlated with meteorological factors, including precipitation, temperature, and relative humidity.*" on page2, L19-21.

Q2: L24-25: It is well-known that dry P deposition is the primary form of total P deposition.

A: Thank you very much for your comments. In this study, wet and dry deposition were measured separately. Therefore, we considered quantifying the ratio of dry and wet in this study area.

Q3: L62-66: The correlations depend on whether total or wet deposition is analyzed. For instance, wet deposition correlates strongly with precipitation but total deposition doesn't.

A: Based on your comments, we modified the sentence in L62-66 to "*Additionally, field studies have observed that the meteorological factors, including precipitation and temperature, could influence temporal variations of atmospheric P deposition (Tipping et al., 2014; Zhu et al., 2016; Chiwa et al., 2020).*" on page 4, L64-67.

Q4: L79-80: Bulk deposition of P is likely very close to total P deposition.

A: Thank you very much for your comments. Bulk deposition, which includes wet deposition plus a fraction of dry deposition. However, this study measured wet and dry separately and summed to obtain total P deposition. The method of collecting the sample in this study is quite sparse, which is also mentioned in Tipping et al., 2014. Therefore, the difference between the two should be considered reasonable.

Q5: L119-121 & 125: I don't believe you can do this manually for two years!

A: Thank you for your affirmation! Since automatic monitoring is not possible at sampling sites, the manual collection is required. We informed manager site managers about collection methods and precautions to ensure accurate samples were collected.

Q6: L157-158: Why a radius of 5 kilometers?

A: The research group published a research article (Deng et al., 2019) which concluded: " N species deposition were significantly affected by the key land use types when radius were 3, 4 and 5 km". Based on this conclusion, we employ the largest radius (5km) of available land use data.

Q7: L193-197 & Section 4.1: Correlation doesn't mean causality. See comments above.

A: Thank you very much for your comments. We rewrite the sentence as: "*Moreover, it was found that the monthly variations of P deposition were strongly correlated with meteorological factors, including precipitation, temperature, and relative humidity.*" on page2, L19-21. Besides, in section 4.1, we discussed how meteorological factors affect the process of P deposition.

Q8: L215-216: Define agro-facility areas first.

A: Thank you very much for your comments. We added the sentence "*Commonly, agro-facility areas include land designated for livestock and poultry breeding, fertilizer plants, greenhouses with vegetable production, and aquaculture (Current land use classification, GB/T 21010-2007).*" on page 4, L60-63.

Q9: L258-261: Reference?

A: Thanks for your suggestion. References "(Mahowald et al., 2008; Das et al., 2011; Gross et al., 2016)" was added on page 14, L265-266.

Q10: L301: Bulk deposition is measured using a consistently open sampler. For P, I think bulk deposition includes wet deposition and a major proportion of dry deposition.

A: Thank you very much for your comments. For most studies, P deposition was measured using a consistently open sampler, which collected bulk deposition. However, this study measured wet and dry separately and summed to obtain total P deposition. The method of collecting the sample in this study is quite sparse, which is also mentioned in Tipping et al., 2014. Therefore, the difference between the two should be considered reasonable.

Q11: L308-309: Any details and evidences?

A: Thank you very much for your comments. We modified the sentence "*Moreover, the potential risk of P deposition in this study area cannot be ignored.*" to "*As discussed*

before, the flux of P deposition in this study area is at a high level. Excessive P deposition poses a certain threat to the ecosystem (Wang et al., 2015). Therefore, the potential risk of P deposition in this study area cannot be ignored." on page 16, L313-317.

Q12: L350-351: Incorrect statement! Forest canopy strengthens deposition!

A: We are very sorry for our mistake. We modified the statement to "*Notably, monthly fluxes of dry P deposition and total P deposition both had a negative correlation with forest and country roads (Fig. 6b, c). Firstly, a negative correlation indicates lower levels of P sources for P deposition in road and forest than in other land use such as agro-facility and agricultural areas. Secondly, it is well known that forests can absorb harmful gas, aerosols, and dust particles, including P-containing aerosols, which is attributed to the porous sponge-like underlying surface, high productivity, and strong microbial activity (Oladosu et al., 2017; Wang et al., 2017; Zhai et al., 2019). However, forest canopies could elevate P deposition by trapping atmospheric P in the form of dust and particulates (Zhou et al., 2018). Therefore, in this study, a negative correlation indicated that canopy P absorption was greater than trapping of atmospheric P (Parron et al., 2011). Above all, the land use of "sink" denotes a lower level of P sources and a higher level of P sinks than other land use. Due to similar reasons, paved country roads without hardening showed a similar correlation with P deposition.*" on page 18-19, L356-367.

Q13: L370-374: References?

A: We are very sorry for our negligence. Reference "Hochmuth et al., 2015" was added on page 20, L380, and "*Hochmuth, G., Rao, M., and Hanlon, A. E.: The four Rs of fertilizer management. UF/IFAS Extension, 1–4, https://edis.ifas.ufl.edu/publication/ss624, 2015.*" was added in reference lists, on page 24, L463-464.

Finally, the ecological effects of P deposition are mediated by N deposition. What about N deposition in this region? This should be discussed somewhere.

A: We agree with this viewpoint. The study of the N:P ratio is particularly important, especially in forest ecosystems. However, the purpose of this research is to understand the patterns of atmospheric P deposition in this region, from the perspective of temporal and spatial analysis. As a result, N deposition is not covered in this article. In subsequent investigations, we intend to further analyze and discuss N:P ratios in atmospheric deposition, water, and soil.