

Interactive comment on “The concentration, source apportionment and deposition flux of atmospheric particulate inorganic nitrogen during dust events” by Jianhua Qi et al.

Anonymous Referee #2

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General comments:

This paper attempts to study the impact of spring time dust storms in the Chinese deserts on the atmospheric concentration and deposition of inorganic nitrogen (IN) in the coastal Yellow Sea location. The study uses 4 years of particulate matter measurements and their chemical composition to understand how different types of dust storms can affect the abundance of inorganic nitrogen and calculate dry deposition of IN to the coastal Yellow Sea. This type of work is relevant since atmospheric deposition of nutrients and its implications is not a well understood topic and can be important for the regions that receive high atmospheric input like the Yellow Sea. However, the authors have not made best use of the data. There needs to be significant improvement in data

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interpretation and much more analysis needs to be done to support the main results. I would thus recommend a resubmission and see if there is any substantial improvement in the manuscript. My main comments are given below.

First of all, the manuscript needs an overall improvement in writing. Not sufficient care has been given to the details and there are parts which are difficult to follow. I will provide some examples later, but there are many such cases of improper and awkward sentence constructions. Second, on what basis are these dusty and non-dusty days decided? More information are needed to show whether the dust storms originating from the deserts are actually passing over the measurement site and it is not the locally produced soil dust in cases of the days with low TSP values. Satellite aerosol products and meteorological data can be used to support this. Again later AI concentration is used to identify dust weather (lines 171-172). Please provide a clear definition of dust days and maintain that throughout the manuscript.

The authors have divided dusty days into 3 categories based on inorganic nitrogen (IN) concentrations relative to the non dust (ND) days. They are reporting that in some cases IN concentrations are more than the ND days, in some cases IN concentration are less than the ND days and in some cases nitrate concentration on dust days are less than ND days while ammonium concentrations on dust days are more compared to ND days. Next, the authors are reporting that sand from Duolun (which is a source for dust storms affecting the Yellow Sea region) is poor in nitrate and ammonium content. First of all, trajectory analysis does not seem to point that coastal Yellow Sea region is only affected by dust originating from Duolun region. There are many other dust sources over which the trajectories are passing. And if Duolun is deficient in IN you need to provide a detailed discussion on the possible sources of IN in dust sampled from the coastal region of the Yellow Sea and about the mixing of anthropogenic aerosols with the dusty air mass.

The authors have related the 3 cases of IN in dust samples to the wind speed concluding that when wind speed is less IN concentration increased and vice versa. I am

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not clear how this conclusion is arrived at, especially, with only 5 cases for IN<ND. For example, in Table 5 sample number 110501 NO₃⁻ and NH₄⁺ concentrations are low and the wind speed is also low. Again, sample 080315 has higher NO₃⁻ and NH₄⁺ concentrations at higher wind speed. What is the rationale of using wind speed of 40.5 km/h in this study and how is this threshold derived? I would suggest the authors to group the trajectories according to dust and non dust days and also according to the levels of nitrogen and see which of these trajectories are passing over highly populated regions.

Specific comments:

L11-13: Reconstruct the sentence.

L20-25: This is not conclusive from the discussions that follow. Statements like “storms were weak or slow moving” and “rapid transport in a strong dust storm” are not supported by proper analysis of the storm characteristics.

L35-36: This is contradicting L32-33.

L40: These references point to anthropogenic contribution to atmospheric nitrogen deposition.

L62-64: The first part of the sentence seems to contradict the last part.

L79-81: Meaning is not clear.

L102: Zhurihe in Hunshandake Desert. Later you are using Duolun region which is not introduced in Section 2. It will be difficult for readers to follow if they are not very familiar with this region.

L135: Explain how the PMF model works.

L139: Explain how Williams' model works and cite the original paper.

L140. Expand U10. In general, all the abbreviations used should be clearly defined.

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L143: Meteorological data not “climatic” data.

L146: This heading does not reflect the text content.

L152: Please provide details on the MICAPS information used.

L164: What is the average TSP concentration on dust days?

L167: Please provide a brief description on how EF is calculated and what is the significance of using this method.

L171-173: The authors were using MICAPS information of dust storm (which has to be explained) and now are relying on AI levels to define AD events. How are these two definitions consistent?

L178-179: This has to be explained with respect to the EF of the anthropogenic elements.

L214-216: You need to examine the dust sources, transport pathways (if passing over heavy populated regions), the height at which dust is transported together with dust concentration on a case by case basis to conclude these lines. This is very important for the entire paper. How do you decide “stronger a dust storm”?

L225-230: The average for Case 1 is 700 $\mu\text{g}/\text{m}^3$ with values lying well above the average as is evident from Table 5. Again, there are TSP values in Case 2 in Table 5 which are lower than average of Case 1.

L230-231: Again, what is your definition of “strong dust storm”? Without sufficient analysis I am not sure how “dust might be transported quickly” is factoring here. This entire section has to be revisited.

L242: How is the value 40.5 km/h arrived at? Is it estimated at the dust source region? How many dust storms were studied to derive this value? More explanation is needed.

L250-252 needs explanation. Once the dust storms are properly categorized and the

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pathways are determined the interpretation of Table 5 might change.

L250: Less than 40.5 km/h not 42.4 km/h.

L281-283: These statements need to be backed by more analysis of the dust events on a case by case basis.

L301-311: The text is very confusing. It is very difficult to follow when the authors are referring to TSP and when they are referring to IN or nitrate or ammonium.

Technical corrections:

L260: Colors used in Figure 4 are not clear. Please indicate the dust source regions on the map. L343-442: Not proper attention has been given to the References and needs to be corrected.

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