**Biogeosciences
Discussions**

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Interactive comment on "Atmospheric reactive nitrogen concentrations at ten sites with contrasting land use in an arid region of Central Asia" *by* K. H. Li et al.

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Dear Editor, First of all, we thank you and two referees' comments/suggestions on our manuscript "Atmospheric reactive nitrogen concentrations at ten sites with contrasting land use in an arid region of Central Asia". The manuscript has been made substantial revisions based on two referees' comments. The revisions include almost all Sections of the manuscript from Introduction, Materials and Methods, Results (including Tables and Figures), Discussion, Conclusion and References. We are feeling the quality of the manuscript has been largely improved and can be accepted for publication in the Special Issue of Biogeosciences. Detailed responses to two referees' comments are

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listed as follows. Xuejun Liu On behalf of all co-authors

Author's responses to two referees:

By Z. Xiong (Referee #1), zqxiong@njau.edu.cn Received and published: 2 July 2012 General Comments: "Atmospheric reactive nitrogen concentrations at ten sites with contrasting land use in an arid region of Central Asia" by Li et al. determined the spatial and seasonal characteristics of atmospheric Nr pollution in different ecosystems within the arid Xinjiang region of Northwest China as a typical region for central Asia. This study provided important data and results on atmospheric reactive nitrogen concentrations in arid region. Analysis of spatial and seasonal variations indicated their probable sources and was of high use for local air quality and pollution controls. Response: The authors appreciate your high evaluation on our paper. Thanks for your general comments.

Specific comments: 1. Reorganize the ten sites at certain order such as land use type (section 2.1 and Table 1) and focus on the different ecosystems as emphasized in this study. Then describe the results according to this sequence and analyze the difference for several sites within the same category, particularly for the farmland sites. Response: Good suggestion. We have re-organized the ten monitoring sites in the order of alpine grassland (BYB), desert-based land use (TZZ, CLZ, TLF), farmland (FKZ, YPH, AKS, BTH), suburban (TFS) and urban (SDS) in Table 1 and Section 2.1.

2. As for the "effect of environmental factors on atmospheric Nr concentrations" in Section 3.3 and Figure 6, results should be re-analyzed according to different ecosystems since the environmental factors are secondary to the ecosystem type. Such kind of analysis might be misleading authors for conclusion. Response: Agree and revised accordingly. To avoid misunderstanding, we delete Fig. 6 in the revision. Meanwhile, we have analyzed the correlations between different reactive nitrogen species in Section 3.3.

3. Explain the reason for sampling from two weeks in one month for passive samplers

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and 7-10 days for PM10 collection and the criteria for such period selection. Response: There are no strict criteria for the length of sampling period each month. For passive samplers, exposure up to 15 days is feasible and representative in our arid region of central Asia because the relative humidity (the main restricting factor for the exposure period of passive samplers) in the region is much lower than 70% for the entire sampling duration, indicating that the relative humidity will not affect the sampling efficiency of passive samplers (www.radiello.com). Therefore both 'NH3' and 'NO2' passive samplers were sampled for two weeks per month. For PM10 sampling, our previous study (Shen et al., 2009. Environmental Pollution 157, 3106-3113) showed that 5-7 daily samplings (referring that each PM10 sample will last 24-hr) are enough to get representative monthly average data on PM10 in the North China Plain. Even considering the spatial and temporal variations in arid region of Xinjiang, we randomly collected 7-10 daily samples per month for each site (covering different weather conditions including sandstorms) and the results should be representative for the whole month.

Technical corrections: P6629 L9 Rewrite as ... "The increasing order of total concentrations: : :" Response: Agree and revised accordingly.

P6632 L21 ": : :concentrations each month at both sites: : :" need rewrite for clarity. Response: Agree and revised accordingly. The "both sites" were replaced by "all sites".

P6633L7,9 digital numbers for AKS and BTH are inconsistent among sites. Keep consistent for numbers. Response: Agree and revised accordingly.

Table 1 Provide information on average temperature and precipitation for each site and delete them from the text. Reorganize the ten sites at certain order (land use type?) and accordingly revise them in the manuscript for clarity. Response: Agree and revised accordingly. Also see our earlier response (to Special comment 1).

Table 2 Put column of PM10 before NH4+ or revise the table title as "Concentrations of secondary particles in PM10 and PM10: : :" Response: We put PM10 before NH4+ and NO3- and add NH3 and NO2 concentrations in the Table as comparison. We also

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give a brief note about the ratio in the last column (referring the ratio of NO3- to NH4+ in PM10.

Fig. 4 Delete "in PM10" for figure caption Response: Agree and revised accordingly.

Fig. 4 and 5 can be combined into one figure Response: Figs. 4 and 5 have been combined into one figure (the new Fig. 4) in the revision.

Fig. 6 Delete "precipitation" for figure caption Response: The 'precipitation' has been deleted in the caption of Fig. 6.

By anonymous Referee #2 Received and published: 31 July 2012 General Comments: This manuscript, "Atmospheric reactive nitrogen concentrations at ten sites with contrasting land use in an arid region of Central Asia", is a good baseline assessment of the concentrations of nitrogenous species for an understudied region of the world, the arid Xinjiang region of China. This study will provide foundational information in understanding air quality over this region. That being said, there is nothing particularly novel or noteworthy about the study, it is a simple assessment of the region. In addition, it is quite short, so it's difficult to ascertain its potential impact. However, these types of baseline studies are still important in contemporary ecological sciences. Response: Thanks for your general comments on the paper. In fact, this is really first integrated attempt to monitor the atmospheric concentrations of various reactive N (Nr) species and particulate matter (PM10) in an arid region of Xinjiang, central Asia. We agree your viewpoint — this is a good baseline assessment of air pollution of Nr and particles in arid Xinjiang of China, as an important source region for sand/dust storm worldwide. However, we do not fully agree that there is nothing novel or noteworthy about the study. Our study selected ten monitoring sites along a distinct gradient with different anthropogenic impacts, from the least anthropogenic impacted site (e.g. BKB, only grazing), to medium anthropogenic impact (e.g. BTH, AKS, CLZ, FKZ, farmland sites), and to the strongest anthropogenic impacted sites (e.g. SDS and TFS, urban and suburban sites in Urumqi, the capital city of Xinjiang province). The typical gradient of our

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monitoring sites has revealed how human activities affect air quality and air chemistry (through gaseous Nr concentrations and ions composition in PM10) and also provided important implications on how to mitigate air pollution of Nr in the arid-oasis region. We agree that the length of our earlier version of the manuscript is relatively short but the length (in particular the section of Discussion) has been improved largely in the revised manuscript.

Specific and Technical Comments: I would like to begin with the caveat that my expertise is in the impacts of excess atmospheric N on ecosystems (aquatic and terrestrial), not on the technical areas of the measurement of atmospheric concentrations. Thus, I rely on others to assess the technical approach in this effort. That being said, there were areas for improvement of the study. Response: In the revision (section of Introduction), we begin with negative impacts of excess atmospheric reactive N deposition on ecosystems especially in the ecosystems in arid regions. We have also strengthened the importance of the current study and the potential improvement of the study in the future.

I would have like to see more extensive analyses of the results presented, which are numbered here. (1) There is no information as to which differences were significant and which were not, this could easily be added in a Table. (2) I would like to see greater analyses as to correlations among the different air pollutants, in addition to correlations with environmental factors (i.e. in Figure 6). (3) The regressions in Figure 6 do not confirm to homogeneity of variance assumptions. I would suggest making some transformations to the data, or using a more generalized approach. Response: Good suggestions. 1) Differences of different reactive nitrogen species across all sites have been added in the Table 2 in the revision; 2) We have analyzed the correlations between different reactive nitrogen species in Table 3 and in the Text (e.g., Lines 144-146); 3) In Fig. 6, you suggest making some transformations to the data, or using a more generalized approach. This is really good. However, we are not sure which kind of data (weather data or air pollutant data?) should be transformed and what kind of

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a more generalized approach could be used in our study. As a general relationship between air pollutant concentrations and weather conditions, we think the current correlation is fine for the study. We agree that further correlations (strictly based on the homogeneity of variance assumptions) between Nr air pollutants and environmental factors should be conducted in the future.

Figures 3 and 4 are very difficult to read as to render it non-informative. I would suggest trying some other configurations. Response: Figures 3 and 4 showed the seasonal (spring, summer, autumn and winter) variations of concentrations for different Nr species at ten sites, so we think the two Figs. (which are now merged into one Figure (Fig. 3) in the revision) are informative and important to understand temporal variations of atmospheric Nr concentrations in our study region. We have also revised the captions of the Figure to provide more background information.

Not all farmland is the same, and there should be some elaboration as to the different land uses on the region (if there are any). Response: More information about all farmland sites has been added in the section of Monitoring sites.

The discussion is very clear, though I would like to see more information as to how these results are similar to or different from (and why) other studies. It is quite short, so it's difficult to assess the implications of this study. Response: Agree and revised accordingly. More information has been added so as to explain how our results are similar to or different from other studies as well as the implications of this study to air pollution control in the section of Discussion.

Interactive comment on Biogeosciences Discuss., 9, 6627, 2012.

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