

## ***Interactive comment on “Pan-European rural atmospheric monitoring network shows dominance of NH<sub>3</sub> gas and NH<sub>4</sub>NO<sub>3</sub> aerosol in inorganic pollution load” by Y. Sim Tang et al.***

### **Anonymous Referee #1**

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This manuscript describes measurements collected within the EU NitroEurope (NEU) network during the period 2006 – 2010. While some of this data has been previously published, as noted by the authors, the current manuscript provides a comprehensive description of the data quality as well as temporal and spatial patterns of atmospheric chemistry over the lifetime of the network. The data will make a valuable contribution to the field of atmospheric chemistry, in particular with respect to better understanding the role of reduced forms of reactive nitrogen in aerosol processes and for model evaluations. The manuscript is generally well written and the analyses are appropriate, though the manuscript is somewhat lengthy. I recommend publication subject to treatment of the relatively minor comments outlined below, some of which are technical in

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nature and others seek to reduce the length of the paper.

Page 5 – Replicate measurements. It would be useful to see a bit more detail on the replicated measurements to get a better sense of overall precision. For example, scatterplots and summary statistics could be added to the Supplemental Material.

Page 6 – Coordinating laboratories. Some brief discussion of the analytical methods employed by the laboratories (ion chromatography or colorimetry) should be included, along with some discussion or reference to method detection limits (MDL). This information could also be included in the Supplemental.

Page 8 – Bulk precipitation measurements. These measurements will no doubt be useful for deposition assessments. However, as currently written the data do not add much to the current manuscript and could be removed to reduce overall length.

Page 11 – Line 20. The comparison is referred to here as “field inter-comparison” but as “laboratory inter-comparison” in the 3.2 section heading. I understand the distinction, but it is a little confusing at first glance.

Page 12 – Line 14. Knowledge of the laboratory blanks would be very helpful. Is there no way to recover the results from original chromatograms? Granted it might be time consuming but interlaboratory comparison of blanks, particularly for NH<sub>3</sub> which is notoriously difficult, could be enlightening as to some of the laboratory comparisons.

Page 12 – Line 23. Was CEAM the only laboratory that used colorimetric analysis for NH<sub>4</sub><sup>+</sup>? See previous comment on summarizing analytical techniques used by the various laboratories.

Page 15 – Line 4. The overestimation of HNO<sub>3</sub>, or at least that the HNO<sub>3</sub> measurement includes other oxidized N compounds, could be noted again here.

Page 15 – Line 30. See previous comment regarding LOD/MDL for different laboratories/chemical species.

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Page 15 – Line 34. I am unsure of the point of the comparisons between air concentrations and emissions, which is not motivated by the description of the NitroEurope project or in the description of the specific objectives of the manuscript. I think this analysis could be removed from the paper without any implication for the main points or conclusions. But if it is to remain, the purpose of the analysis should be clearly stated and it should be shortened where possible., e.g. only including the comparisons to gridded emissions.

Page 17 – Line 25. Were the high concentrations at IT-BCi indicative of highly local emissions, i.e., adjacent to the field site, or is this concentration more indicative of a broader area? It would be impractical to include a description of every site but where such details are relevant, they should be included. In the same regard, it would be good to know if all of the grassland sites are grazed (Page 17 – Line 41). It appears so.

Page 18 – Line 38/39. I believe “will dominate dry NH<sub>3</sub>-N dry deposition” should be changed to “will dominate dry N deposition”, correct?

Page 19 – Line 11. Remove “that are”.

Page 19 – Line 12. Change “emission” to “emissions”

Page 21 – Line 7. The sentence beginning “This corroborates. . .” is quite lengthy.

Page 23 – Section 3.4. It appears that Figure 13 is incorrectly referred to as Figure 12 throughout this section.

Page 24 – Line 16. Are there other potential reasons for the higher sulfate measurements at these sites? Seems worthy of additional investigation/discussion.

Page 24 – Line 16. Regarding the discussion of the CEAM and NILU Na<sup>+</sup>/Cl<sup>-</sup> regressions and the data below the 1:1 line, there does seem to be correlation among these outliers. Could this be an issue in the way filter blanks were applied? Perhaps an average Cl<sup>-</sup> blank biased high by an outlier was subtracted from all of the field measurements?

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Page 26 – Line 19. Should “Figure 13A” be “Figure 14A”?

Page 26 – Line 23. “. . .with possible uptake and removal of NH<sub>3</sub> from the atmosphere”. Could results from the GRAMINAE project be cited here?

Page 26 – Line 24. Please change “thermodynamic shift to” to “thermodynamic shift of NH<sub>4</sub>NO<sub>3</sub> to”.

Page 26 – Section 3.5.2. To what extent could the temporal patterns in HNO<sub>3</sub> be confounded by the collection of other oxidized N species on the denuder?

Page 28 – Line 12. Consider changing “were provided by” to “were observed at”.

Page 29 – Section 3.6. See previous comment regarding inclusion of precipitation measurements

Page 29 – Section 4.0. It seems like the material in this section could be greatly condensed and integrated into the Conclusions.

Page 30 – Line 10. The sentence beginning “However, SO<sub>2</sub> (by mass). . . .” is quite lengthy.

Page 32 – Line 11. Some additional concluding comments, building on this key feature of the analysis, would be welcomed. For example, what does this shift from a sulfate dominated to nitrate dominated inorganic aerosol regime suggest for future European monitoring needs in support of ecological and human health protection? What else can be gleaned from the current study, with respect to data quality, methods, and ability to resolve spatial and temporal patterns, that can inform future monitoring efforts?

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