

## ***Interactive comment on “Acid gases and aerosol measurements in the UK (1999–2015): regional distributions and trends” by Y. Sim Tang et al.***

**Anonymous Referee #2**

Received and published: 20 August 2018

Review of Tang et al This is a nice paper that presents the analysis of UK monitoring sites and documents changes in the atmospheric composition over the past fifteen years. This results in a comprehensive view of how the atmosphere has changed during a period of large emission reductions. The authors then discuss the changes in emissions with the observed changes in atmospheric composition. Overall, the manuscript is well written but could benefit from some additional editing in areas outlined below.

### General comments

1. Currently the manuscript is primarily focused on documenting trends and events and with a smaller focus on the changes in atmospheric composition and pollutant fate due to changes in emissions. This manuscript would benefit from a bit more focus. I

suggest focusing more on the trends and how they relate to emission changes and less on specific events captured in the data.

2. The discussion of the trends of NH<sub>3</sub> and HNO<sub>3</sub> are sometimes a bit difficult to follow as the change in aerosol composition and loading over the time frame of the measurements impacts the gas phase concentrations. Consider discussing these trends as total nitrate (gaseous HNO<sub>3</sub> + aerosol NO<sub>3</sub>) and NH<sub>x</sub> (gaseous NH<sub>3</sub> + aerosol NH<sub>4</sub>).

3. There are lots of small sections in this manuscript, some consisting of single sentences. Consider combining them into more general sections. Specifically, 2.3.1-2 and 2.5-6.

4. Many sentences leading paragraphs are structured as “For {atmospheric constituent}, ...”. This is a bit formulaic and the authors may want to revise these sentences.

#### Specific comments

1. Abstract: I find the final two sentences of the abstract to be the most compelling. There is a lot of detail, primarily on page 1, that would be better suited for the results section. Consider summarizing the text on the spatial and temporal trends and better connecting them to the changes in atmospheric HNO<sub>3</sub> and NH<sub>3</sub>.

2. Abstract Page 2 lines 5-6: “... indications that the atmospheric lifetime of HNO<sub>3</sub> and NH<sub>3</sub> has increased ...”. This does not seem correct to me. The lifetime of these gases has not increased but rather the phase/composition of these species have. There are now more gaseous and less aerosol bound NO<sub>3</sub> and NH<sub>3</sub> due to changes in SO<sub>2</sub>. This likely decreases the atmospheric lifetime of total nitrate and reduced nitrogen compounds as NH<sub>3</sub> and HNO<sub>3</sub> typically dry deposit faster than aerosol NO<sub>3</sub> and NH<sub>4</sub>.

3. Page 4 lines 17-29: This paragraph contains similar information as the previous paragraph. Consider combining it with the previous paragraph

4. Page 6 lines 21-22: This is an awkward introductory sentence for this paragraph.

Interactive comment

[Printer-friendly version](#)

[Discussion paper](#)



Interactive  
comment

Consider revising or adding an introductory paragraph that introduces the importance of the denuder base coating.

5. Sections 2.5: Are data that failed the quality checks removed from the analysis?
6. Section 2.5 iv) What is the criteria to determine anomalies and outliers?
7. Section 2.6 Line 22: Does the empirical factor used for HNO<sub>3</sub> bias correction exhibit any dependence on season, temperature or solar radiation? If the bias is due to oxidants, then I would expect a dependence in the bias on seasonal and environmental parameters.
8. Page 9 lines 28-29: The mean difference between the measurements are given here but what is the scatter between the measurements and the median difference. A correlation coefficient would provide some information about the scatter and a median difference would indicate how normal the distribution is and if the bias is being driven by high values in one of the measurement techniques.
9. Page 9 line 32: Difference in the instrumentation flow rates and/or inlets could result in the instruments measuring different sized aerosols and my influence the differences in SO<sub>4</sub>.
10. Page 16 lines 1-2: The peaks in NH<sub>x</sub> and SO<sub>4</sub> in the spring may just be coincidental. The spring time could also be a time in which the aqueous formation pathway of SO<sub>4</sub> is at its maximum or the SO<sub>2</sub> emissions from heating or transportation may be larger. In the US, the SO<sub>4</sub> concentrations typically peak in the summer while the NH<sub>3</sub> concentrations peak in the spring.
11. Page 16 Line 5: “Na<sup>+</sup> and Cl<sup>-</sup>“ have highest concentrations during winter . . .’ Is salt used for the treatment of road surfaces in the Winter in the UK?
12. Page 20 line 18: Significant has a specific statistical meaning. I think “larger” would be a more appropriate.

[Printer-friendly version](#)[Discussion paper](#)

