Atmos. Chem. Phys. Discuss., 13, C299–C300, 2013
www.atmos-chem-phys-discuss.net/13/C299/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observations of total $RONO_2$ over the boreal forest: NO_x sinks and HNO_3 sources" *by* E. C. Browne et al.

Anonymous Referee #2

Received and published: 2 March 2013

This manuscript addresses an important and relevant topic — the fate of NO_x in regions with high biogenic VOC emissions. It provides important new insights and the methods and results are novel. I strongly recommend that it be published in Atmospheric Chemistry and Physics.

I do have one suggestion for how to improve the manuscript. At the start of Section 5, the authors state "Using the ARCTAS data we are unable to constrain the exact $\sum$ANs lifetime since to do so would require knowledge of the photochemical age of the airmass..." The sections that follow present a credible calculation, and furthermore, the authors test their results against uncertainties in the assumptions. This is a real strength of this work. However, I am left wondering if some of the results are influenced by the differences in photochemical age of the air parcels. For example, in Figure 5(a),

evidence is shown for an additional HNO3 source when the HNO3:NO2 ratio is high but OH is low. An alternate explanation is that photochemically aged airmasses tend to have low NOx, high HNO3 and high $\sum$ANs, where as airmasses recently influenced by NO emissions have relatively low HNO3 and low $\sum$ANs. Is it possible to segregate the data set based on an indicator of aging, such as altitude or acetone:monoterpene, and then check if the relationships presented in Fig. 5 still hold for both recently influenced and aged airmasses? Does excluding airmasses with greater than 200 pptv NO_x help restrict the analysis to airmasses of a certain photochemical age where the steady-state assumptions are representative? These are potential suggestions for how to address this, but the main issue is that it would be useful for the authors to address the issue of photochemical age again in the Implications.

Editorial comment:

In addition to those raised by the other reviewer,

Fig. 5 caption, line 5: "should equivalent to OH" -> "should be equivalent to OH"

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 201, 2013.