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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observations of reactive nitrogen oxide fluxes by eddy covariance above two mid-latitude North American mixed hardwood forests" *by* J. A. Geddes and J. G. Murphy

Anonymous Referee #2

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The paper presents result of NOy (and NO/NO2) flux measurements above two North American mixed forests during some weeks/months. The measurements were performed by the eddy covariance (EC) technique using a fast chemiluminescence NO analyser in combination with a molybdenum (for NOy) or photolytic converter (for NO2), respectively. As pointed out by the authors, this is one of only very few experimental studies in the field of total NOy exchange.

The manuscript is very well written and fully fits into the scope of the journal. I recommend publication after moderate revisions. The corresponding comments and suggestions are listed in the following.

1) The authors state, that one focus of the paper is "on reporting the instrumental methods" (p895, line 9). While the molybdenum converter (MoC) is a crucial method in the present study, it is not adequately introduced, described and discussed:

a) Section 1 or Section 2.2: The general ability of molybdenum to convert NOy should be introduced in more detail, including literature references if possible.

b) Section 2.2: For eddy covariance NOy measurements, it is crucial to make sure that the MoC system not only has a high conversion efficiency, but also a fast response even for problematic compounds like HNO3. Problems with fast response sampling of HNO3 have been reported e.g. by Horii et al. (2006). Therefore it is important to accurately describe the design of the sample air inlet and the MoC (geometry, wall materials, heating, . . .) used in this study.

c) Section 4: Since this is (to my knowledge) the first study using a MoC for EC measurements of NOy, the usefulness of this converter type should be discussed (e.g. in comparison to the gold converter).

2) p901, line 11.: The WPL correction is not overestimated if it is applied after the high-frequency correction of the NOy flux, and if a similar damping of H2O and NO in the sampling tube is assumed (which would be a very reasonable assumption).

3) p905, line 23: Obviously, in Fig. 5 average cospectra were calculated over different wind speed and stability conditions!? This is very problematic and may result in erroneous interpretations of the spectral slopes. Averaging of cospectra should only be performed within certain stability classes (at least separately for stable and unstable cases) and, also important, the individual cospectra should be described as a function of the normalized frequency f*z/u (instead of just using the frequency f).

4) p909, line 20/21: I doubt if this interpretation is correct. Considering the very steep increase and decrease in the NOy concentrations (at midday of 7 Oct., I estimate a decrease of about 12'000 ppt within 2 hours), the storage change below the flux

measurement height can play an important role. The mentioned decrease results in a pure storage change related flux of about 45 ppt*m/s during 2 hours! This should be taken into account here.

5) Section 4.1: It would make more sense to discuss the influence of wind direction (advection source areas) not only in terms of fluxes but also to include the respective concentrations and deposition velocities.

6) Table 1: Add average concentrations if available.

7) Fig. 5: Indicate at least the (different) data sources of (a) and (b) in the figure caption. Referring to the main text should only be used for extensive details/explanations.

TECHNICAL AND LANGUAGE COMMENTS

p895, line 5/6: This sentence appears somewhat inconsistent. NO and NO2 are also "individual NOy species".

p897, line 7: I guess that 'Pneucleus' is the name of a company? Please specify more clearly.

p900, line 19/24: better write "water vapor" instead of just "water"

p900, Eq. 2: This equation is not very clear: what is the difference between lowercase "c" and uppercase "C" here?

p909, line 18: replace "or" by "are"

p915, line 16: correct to "interferences"

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 27891, 2013.