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Interactive comment on “Eddy covariance fluxes and vertical concentration gradient measurements of NO and NO₂ over a ponderosa pine ecosystem: observational evidence for within canopy removal of NO_x” by K.-E. Min et al.

Anonymous Referee #2

Received and published: 16 July 2013

1 General comments

The paper describes field studies of gradients and fluxes of NO and NO₂ over a ponderosa pine forest. It is concluded that the observed values can only be explained by removal of NO_x in the canopy.

The paper is well written and the instrumentation and measurement setup is in general well described. The analysis is somewhat speculative, but provides useful information

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and ideas for further field studies.

I miss some details about O₃ flux measurements and especially about soil NO emission. It seems that some dynamic chambers were applied at very few occasions. I find the omission of continuous soil NO emission measurements a major flaw of this study.

However, I find that the results and analysis are worth publishing after some revision as detailed below.

2 Specific comments

p.12439, l.15: The conversion of NO to NO₂ by reaction of O₃ is also important to mention here.

p.12440, l.15: Other relevant references are:

J. H. Duyzer, J.R. Dorsey, M. W. Gallagher, K. Pilegaard, S. Walton. Oxidised Nitrogen and Ozone Interaction with Forests II: A Multi-layer Model to Describe Above and Below Canopy Exchange and Processing. *Quarterly Journal of the Royal Meteorological Society*, **130**, 1957-1971, 2004.

J. R. Dorsey, J. H. Duyzer, M. W. Gallagher, H. Coe, K. Pilegaard, J. H. Westrate, N. O. Jensen and S. Walton. Oxidised Nitrogen and Ozone Interaction with Forests I: Experimental Observations and Analysis of Exchange with Douglas Fir. *Quarterly Journal of the Royal Meteorological Society*, **130**, 1941-1955, 2004.

p.12440, l.28: I miss a reference for the statement of timescales.

p.12442, l.3: The NO_x concentration within the canopy might be higher due to soil NO emission.

p.12444, l.6: Since the O₃ fluxes are quite relevant to this study, I wonder why no

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details (or a reference) is given. Also the O_3 fluxes are not included in the discussion. It might be because the NO concentrations are so small that they do not influence O_3 substantially. However, for completeness, I think this should be addressed.

p.12444, l.16: As stated above, I wonder why so little emphasis is put on soil NO emission measurements. Measurements at only three specific days (and no information on duration nor timing) is very little and clearly not representative. It also seems that these data are not reported except for a mentioning of the minimum value. If the methodology and data are documented somewhere else at least a reference should be given.

p.12450, l.8: I miss power spectra of the NO and NO_2 measurements. Sampling at 5Hz might lead to loss of fluxes at high frequencies.

p.12453, l.9 ff: I find this quite speculative because of the missing information on soil NO emission, The only information given is on p.12454, l.8, where we are told that the NO emission measured was 3 ppt ms^{-1} in the morning (what morning?).

p.12454, l.23: "Using the lowest measured soil emission rate ..." I wonder whether this is relevant considering the very scarce NO emission measurements.

p.12455, l.17: It might be relevant here to study the works of Leif Kristensen and co-workers:

Title: First-order chemistry in the surface-flux layer Author(s): Kristensen, L; Andersen, CE; Jorgensen, HE; et al. Source: JOURNAL OF ATMOSPHERIC CHEMISTRY Volume: 27 Issue: 3 Pages: 249-269 DOI: 10.1023/A:1005800416423 Published: JUL 1997

Title: Fluxes and concentrations of non-conserved scalars in the atmospheric surface layer - Second-order destruction Author(s): Kristensen, Leif; Kirkegaard, Peter Source: JOURNAL OF ATMOSPHERIC CHEMISTRY Volume: 53 Issue: 3 Pages: 251-263 DOI: 10.1007/s10874-006-9016-z Published: MAR 2006

Title: A Simple Model for the Vertical Transport of Reactive Species in the Convective

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Atmospheric Boundary Layer Author(s): Kristensen, Leif; Lenschow, Donald H.; Gurrarie, David; et al. Source: BOUNDARY-LAYER METEOROLOGY Volume: 134 Issue: 2 Pages: 195-221 DOI: 10.1007/s10546-009-9443-x Published: FEB 2010

p.12460, l.25-26: This is a bit in contradiction to l.20-21. Maybe it can be made more clear by a changed wording.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 12437, 2013.

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