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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 #1

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Browne et al. discuss observations of organic nitrate and nitric acid concentrations measured within the boundary layer over the Canadian boreal forest during the summer (ARCTAS campaign). On average, nitric acid concentrations were higher than organic nitrate concentrations, as anticipated. However, Browne et al. calculated the production of organic nitrates to be greater than gas-phase nitric acid, suggesting that the organic nitrate lifetime is less than that of nitric acid. The manuscript is a nice combination of observations and modeling sensitivity studies designed to test potential reasons for this initial discrepancy. An insightful discussion is included that proposes particle-phase hydrolysis of organic nitrates, resulting in HNO3 production within the particle. Minor suggestions are provided below to improve the clarity of the manuscript.

Comments: It is often unclear whether "HNO3" refers to "HNO3(gas)" or

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"HNO3(particle)" or "HNO3(gas+particle). Please clarify throughout the manuscript. For example, I am assuming that the comparison of the concentration of organic nitrates vs nitric acid considers both gaseous and particulate forms of both species. However, this should be clarified, and if it does not, then it would seem appropriate to also consider gas-particle partitioning of both species.

As is noted, BVOC concentrations, and thus organic nitrate concentrations, are altitude dependent, even within the boundary layer. Therefore, please state (at the end of section 2) the altitude range of the measurements averaged for the analysis in the manuscript. The reader could infer from later discussion that the measurements were from ∼500-1500 m agl, but this is not clear. What was the variance in the sum(ANs) within this altitude range? This variance could impact the discussion in section 3.

When discussing Table A2 in the text, it might be useful to include the names of the sensitivity studies (as shown in the table) in parentheses in the text. This should make it easier to follow when comparing to Table A2.

Pg. 226, lines 11-12: Since experimental evidence of organic nitrate hydrolysis leading to HNO3 production was only inferred, not observed, it might be more appropriate to state that "This study suggests that particulate organic nitrates. . .".

Technical Corrections: For references to the relative yields of various isoprene nitrates, see Table 2 in Pratt et al. (2012, ACP) for corrections to Lockwood et al. (2010).

Pg. 224, lines 8-9: VOC reactivity with respect to what oxidant(s)? Please clarify.

Pg. 226, line 5: Fix typo.

Pg. 229, line 10: Fix typo.

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