

## ***Interactive comment on “Direct measurement of NO<sub>3</sub> reactivity in a boreal forest” by Jonathan Liebmann et al.***

### **Anonymous Referee #2**

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The manuscript by Liebmann et al. presents observations of nitrate radical reactivity together with concentrations of speciated VOC and other trace gases in a boreal forest in Finland. NO<sub>3</sub> reactivities were found to be high, especially during nights with strong surface inversions. High nocturnal stability also favored low ozone mixing ratios, likely due to O<sub>3</sub> deposition. A comparison with reactivities calculated based on the VOC observations reveal a “missing” NO<sub>3</sub> sink of 30% during the night and 60% during the day. The authors also present vertical reactivity profiles which show strong nighttime gradients with highest levels near the surface. This is a very interesting and comprehensive study, that presents unique observations and a thorough interpretation of the findings. The paper is very well written and the authors arguments are easy to follow. I found a few minor issues in the manuscript that could be clarified (see below),

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but overall I recommend the paper for publication in ACP without major changes.

#### Minor Comments:

Page 8 line 10-13: Here nights are classified based on  $\text{NO}_3$  reactivity. In the rest of the manuscript types 1 and 2 are typically referred to as night with and without strong surface inversions (see page 8 line 22). It would help the manuscript to stay with one definition for type 1 and 2 nights.

Page 9: I am missing a discussion of the ozone loss associated with the  $\text{NO}_3 + \text{VOC}$  reactions. Depending on the source of  $\text{NO}_2$  (reservoir/transport vs. local  $\text{NO} + \text{O}_3 \rightarrow \text{NO}_2$ ), at least one ozone molecule is lost during each reaction. While this is likely not the dominant source, with sufficient reaction time of a few hours it should contribute to the ozone loss.

Figure 7: The lower panel is very difficult to read. Could it be split it up into one panel with the total mixing ratio and another panel with the fractional distribution of the BVOCs?

Figure 9: Is this average diurnal cycle determined with type 3 nights? If so what is their impact on the average?

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