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Summertime total OH reactivity measurements from boreal forest during HUMPPA-COPEC 2010” by A. C. Nölscher et al.

Anonymous Referee #1

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This paper presents measurements of total OH radical reactivity both above and below a boreal forest canopy using the Comparative Reactivity Method. As discussed in the paper, previous measurements of total OH radical reactivity in forested regions have generally been greater than that calculated based on measurements of the concentration of individual species, suggesting that there may be unaccounted OH radical sinks in these areas which has important implications concerning our understanding of ozone and secondary aerosol production in these environments as well as our understanding of the impact of biogenic emissions on the oxidative capacity of the atmosphere.

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Consistent with previous studies, the authors generally find that the measured reactivity is significantly greater than calculated, both above the forest canopy as well as below. However, the size of the missing sink varied depending on the conditions, with the greatest missing reactivity associated with “stressed” (high temperature) and transported pollution conditions. Based on these results, the authors suggest that the missing reactivity is due to unmeasured reactive emissions and their oxidation products, which are likely higher during stressed conditions and transported pollution periods. However, ambient measurements of these compounds were not available.

The paper is generally well written and suitable for publication in ACP after the authors have addressed the following comments:

- 1) It would be useful to show the NO concentrations measured during each regime in Figure 4 for comparison between the regimes and with other studies. Were there significant differences in the observed NO concentration between “normal boreal” and “transported pollution” periods that could impact the expected oxidation products?
- 2) Figure 2 shows the measured reactivity above and below canopy as well as the deviation from equal OH reactivity. It appears that there are several occasions where the deviation from equal OH reactivity suggests that the above canopy reactivity is 3-4 times greater than the below canopy reactivity. Yet the absolute values of the reactivity shown below do not appear to reflect this. What are the reactivity values that led to Γ values greater than 2?
- 3) The authors state that higher rates of emissions during “stressed boreal” conditions are likely responsible for the significant missing reactivity, as the diurnal OH reactivity profile is similar to the monoterpene profile. However, is there any significant correlation between the measured monoterpene concentration and the missing reactivity fraction that would provide additional quantitative evidence that the missing reactivity is related to monoterpene emissions?
- 4) Similarly the authors suggest that the missing reactivity during the “transported pol-

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lution” regime may be due to reactive unmeasured oxidation products, as the measured concentration of PAN and pinic acid is higher during this period. However, it also appears that there may be a correlation of the fraction of missing reactivity with pinic acid concentrations based on the data shown in Figures 5 and 6, which would provide additional evidence to support their conclusions. Are there correlations with other possible oxidation products, such as formaldehyde?

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 7419, 2012.

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