**Referee 1**

In the following, the referee's comments are reproduced (black) along with our replies (blue) and changes made to the text (red) in the revised manuscript.

**General statement:**

General Comments: Liebmann et al. describe the development and first deployment of a cavity-ring-down instrument to measure total reactivity of NO3. The authors provide a detailed overview of the methodology used to develop and characterize the instrument. The necessity of generating a stable NO3/N2O5 source is described, along with descriptions of several possible interferences and the steps taken to address them. In particular, several methods are used to derive the reaction time of NO3 in the flow tube system, taking into account the production and loss pathways of NO3. NO3 reactivity is then derived by iterating numerical simulations. The experiment was validated using an isoprene standard, and there was good agreement between experimental and calculated results. The authors also describe the dynamic range, limit of detection, and uncertainties of the experiment. Finally, the authors describe the first field deployment of the instrument during the NOTOMO campaign in 2015. The experimental setup used during the campaign is described, along with potential interferences present in the sampled air. The authors note a broken thermostat during the measurement period that may have impacted their reactivity measurements and describe other challenges to effective measurements in ambient air. There is clearly more to learn and I look forward to reports of field measurements using this technique. This manuscript should be published in AMT after attention to the minor issues below

We thank the referee for this overall positive assessment of our manuscript. The manuscript has been improved in line with the comments listed below.

The color schemes utilized in several of the figures are difficult to see when printed and nearly impossible to interpret in greyscale.
The Figures have been re-drawn.

References should be listed in a consistent manner. I prefer chronologically or reverse chronologically.
References are now listed chronologically.

Line 30 (and throughout): a hyphen is not needed in the word daytime.
Corrected

Line 30: a hyphen is not needed in the word photochemically.
Corrected

Lines 60-80: The paragraph could be clearer in its description of the competition for NO3 between reaction with NO2 and reaction with VOC. We now write: "Summarizing, $NO_3$ reactivity with respect to gas-phase losses is a direct indication of night-time oxidation rates of VOCs, with direct impacts on $NO_x$ levels by forming long-lived reservoir species (alkyl nitrates) some of which will partition to the particle phase. Via modification of $N_2O_5$ concentrations (formed in an association reaction of $NO_3$ with $NO_2$, R3), the $NO_3$ reactivity indirectly controls heterogeneous $NO_x$ losses and $ClNO_2$ formation rates."

Line 248: “ln([NO3]t” is missing a right parenthesis.
Corrected

Line 340: “In Fig. 7a. . .” The word “in” does not need to be capitalized.
Corrected

Lines 456-461: Could simulations or modeling be done to indicate that the decision to neglect temperature dependence of reactivity with NO3 is reasonable?
We have added an example to illustrate the effect of divergent ambient and reactor temperatures and now write: “To illustrate this, we consider the reaction between $NO_3$ and the usually most abundant monoterpene, α-pinene. The rate constant at flow-tube temperature (20 °C) is $6.4 \times 10^{-12}$ $cm^3$ $molecule^{-1}$ $s^{-1}$ increasing to $7.0 \times 10^{-12}$ $cm^3$ $molecule^{-1}$ $s^{-1}$ at 5 °C and decreasing to $5.9 \times 10^{-12}$ $cm^3$ $molecule^{-1}$ $s^{-1}$ at 35 °C, which are changes of < 10 %. Note also that for many monoterpenes, the temperature dependence of the rate constant is not known, but expected to be weak (IUPAC, 2016).”

Figure 5: The 1:1 line is not solid, it is dashed.
Corrected.