

## ***Interactive comment on “Reactive quenching of electronically excited NO<sub>2</sub><sup>\*</sup> and NO<sub>3</sub><sup>\*</sup> by H<sub>2</sub>O as potential sources of atmospheric HO<sub>x</sub> radical” by Terry J. Dillon and John N. Crowley***

### **Anonymous Referee #3**

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The authors present new data that help to better constrain reactions of excited state NO<sub>2</sub><sup>\*</sup> and NO<sub>3</sub><sup>\*</sup> with H<sub>2</sub>O. These are challenging experiments to conduct and interpret, and the authors have done a great job. This is a very interesting paper and should be published after my suggestions below have been addressed.

#### General comments

1 - Error bars /estimates.

Errors estimates should be added throughout the manuscript (especially to tables and graphs), if possible.

C1

2 - Manuscript organization.

The results and discussion section gives (too many) experimental details. For example, pg 6, line 25, begins with "A Nd-YAG pumped dye-laser was used to generate 532 and 567 - 647 nm light ... Reagent concentrations and conditions for these experiments ..." These are experimental details. Consider some re-organization (shifting of text) to improve the organization of the paper.

3 - The authors expanded the wavelength regions over which the title reactions have been studied to above 532 nm and below 647 nm. It would be useful if the authors could comment on this chemistry occurring at lower wavelengths (in the intro and future work sections).

#### Specific comments

Pg 1 line 15 "which is". Please rephrase to avoid unnecessary confusion– is it k<sub>12</sub>, or are k<sub>10</sub> and k<sub>12</sub>, more than a factor of 3 smaller?

pg 1 line 20 "370 nm". This seems high (thinking of Talukdar et al., Geophys. Res. Lett., 25, 143-146, 10.1029/97gl03354, 1998), but perhaps I am not read up on the latest literature. Can you please provide a reference?

Pg 2 line 18 – strike comma after (1997)

Pg 3 line 29 "A simple analysis ... " to pg 4 line 2 "(12c). Please provide more detail as to how these calculations were performed (I can guess but shouldn't have to) and a reference to the parameters going into these calculations.

Pg 4 line 12 "two" Figure 1 indicates that one SZA is 27 degrees. What's the other, and what was the result?

Pg 4 line 12 "TUV". More detail is needed. For example, please indicate TUV version, time of day, assumptions made albedo, aerosol optical depth, etc.

pg 4, line 13 "on average" I am not clear what is being averaged. Results at the two

C2

SZA at noon? Results from 10 to 2 o'clock? Dusk to dawn?

Pg 5 lines 24 and 27. Please indicate at what wavelengths HNO<sub>3</sub> and H<sub>2</sub>O concentrations were determined (or were both measured at 185 nm? If so, how were both determined simultaneously?)

Pg 7 line 17. "it is immediately apparent, that our data are not consistent with". Can you add error bars to make the line of reasoning more convincing?

Pg 10 line 13 – replace "is" with "are"

Pg 11 discussion of HO<sub>2</sub>+HONO pathway, line 22 "Given that our experiments were blind to formation of HO<sub>2</sub> or HONO". This was very interesting to read, though speculative. It may be worth pointing that HO<sub>2</sub> reacts with NO<sub>3</sub>, but (probably) too slowly to matter in these experiments.

Pg 20 Figure 5. There are data points between the "2" and "3" line, and it is not clear what data set they belong to. Can you color-code the odd and even data differently, perhaps?

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-645>, 2018.