

Interactive comment on “A 5-channel cavity ring-down spectrometer for the detection of NO₂, NO₃, N₂O₅, total peroxy nitrates and total alkyl nitrates” by N. Sobanski et al.

Anonymous Referee #1

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This manuscript reports the development, characterization, and field deployment of a 5 channel cavity ring-down instrument for measuring several components of oxidized nitrogen. Several design improvements over previous versions of similar instruments are discussed including an addition of a zero-air humidification system. An extensive laboratory characterization of potential interferences due to chemistry occurring within the heated inlets is performed and satisfactorily interpreted using an inlet model. The manuscript is thorough, well organized, and provides details useful for other groups performing similar measurements. I recommend publication following attention to the comments listed below.

General Comments:

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On page 6 it is mentioned that the dissociation temperature for the PNs heated inlet during ambient measurements was set to 15 K above the plateau temperature from lab (line 17) and similar steps were taken for the ANs inlet. During times of stability in the concentrations of NO₂, PNs, and ANs it is possible to conduct these types of temperature scans in ambient air. Were these types of field scans performed during the ambient measurements to verify the use of this temperature during the field deployment?

Although small alkyl nitrates such i-propyl nitrate used in the laboratory experiments have negligible sampling losses, multifunctional nitrates such as those formed from biogenic volatile organic compounds are more “sticky.” Has transmission of these types of ANs through the filter or through the tubing prior to the heated section been evaluated? How does this impact the measurements of ANs during the NOTOMO campaign where one would expect to be influenced by multifunctional nitrates derived from biogenics?

Although a lack of HNO₃ decomposition in the ANs channel is clear, did the authors increase the temperature further to see at what point HNO₃ decomposition started? This would be useful both in the context of the lab measurements and also the field data.

Specific Comments:

Pg 1 line 21: should read “all reactive oxidized nitrogen species”

Pg 2 line 23-24: Individual nitrates can also be measured via chemical ionization mass spectrometry (e.g., Beaver et al., 2012). Given the thoroughness of the discussion, it seems prudent to include this.

Pg 10 line 6: Please explain what parts of the heated inlet A, B, C, and D refer to in the main text and not just the supplement.

Figure 4: The wording “black circles” in the caption referring to HNO₃ could be confusing since solid black circles (dots) are also used. I recommend changing the wording to “open black circles.” Supplement pg 2 last line: Please correct urge to purge.

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Supplement Fig. 1: Please convert temperature to K to be consistent with the main text.

Reference Beaver, M. R., Clair, J. M. S., Paulot, F., Spencer, K. M., Crounse, J. D., LaFranchi, B. W., Min, K. E., Pusede, S. E., Wooldridge, P. J., Schade, G. W., Park, C., Cohen, R. C. and Wennberg, P. O.: Importance of biogenic precursors to the budget of organic nitrates: observations of multifunctional organic nitrates by CIMS and TD-LIF during BEARPEX 2009, Atmos Chem Phys, 12, 5773–5785, doi:10.5194/acp-12-5773-2012, 2012.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2016-191, 2016.

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