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Atmospheric Measurement Techniques Discussions

Interactive comment on "An aircraft based three channel broadband cavity enhanced absorption spectrometer for simultaneous measurements of NO_3, N_2O_5 and NO_2" *by* O. J. Kennedy et al.

Anonymous Referee #1

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General comments:

This is a well written, well organized and convincing manuscript describing a new instrument for measurement of NO2, NO3 and N2O5 from aircraft. I concur with the author's claims of novelty that this is the first example of an airborne instrument based on BBCEAS. The discussion is helpful in understanding the challenges and advantages to the use of this technique on an aircraft in general and the specific application to the measured nitrogen oxide species. I recommend publication after consideration of only a few minor points, as listed below.

Specific comments:

Page 3506, line 26. Briefly describe the need for such a large flow rate.

Page 3507, line 3. Dissociation efficiency of N2O5 is 100% - does the model take into account the time required to heat the gas sample, in addition to the time required to dissociate N2O5?

Section 3.3: NO3 measurement accuracy. The error in T2 associated with NO3 transmission efficiency seems somewhat low. Since (if I have understood correctly) the calibration is based on offline measurements of NO3 wall loss in a stopped flow, the determined T2 does not account for the potential effect of larger wall loss if the tubing becomes contaminated during sampling. Some estimate of, or at least a discussion of, this potential effect would be helpful.

Page 3518, line 21. Cite primary reference for Allan variance.

Page 3519, line 12: “Sensitivity is less than” ... Does this mean better (a smaller detection limit) or worse (a larger one)? Wording should be clearer. The discussion about sensitivity that follows is otherwise clear, however.

Page 3519, line 16: Effect of aerosols on the spectral fitting procedure. Can the authors be more specific about the complications associated with fitting aerosol? Some comparison of the aerosol extinction to the other background cavity losses (e.g., mirror reflectivity, Rayleigh scattering) would be useful since it would seem that aerosol extinction could change the NO3 or NO2 retrieval if not accounted for properly.

Figure 3: Figure is somewhat unclear. For example, there are two flow controllers labeled "MFC", but an arrow points at two other things that are labeled flow controllers. There is something strange and unlabeled in the bottom left corner of the figure. Where are temperature and pressure measured? Temperature and pressure measurements are also not mentioned in the text.

Figure 10: The two NO3 fits should be more clearly labeled as belonging to different

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channels. Also, on the topic of spectral fitting, the authors provide good detail about the spectral fitting of narrow H2O absorption features. Besides that, there is no information about the spectral fitting. What software is used? Do the fits include any arbitrary offsets to account for lamp intensity variations? A short section describing fits would be helpful to the reader.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 3499, 2011.