

Interactive comment on “An aircraft based three channel broadband cavity enhanced absorption spectrometer for simultaneous measurements of NO₃, N₂O₅ and NO₂” by O. J. Kennedy et al.

Anonymous Referee #1

Received and published: 17 July 2011

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.

C1080

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

C1081

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.

C1082