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Atmospheric Measurement Techniques Discussions

Interactive comment on "Quantification of nitrous acid (HONO) and nitrogen dioxide (NO_2) in ambient air by broadband cavity-enhanced absorption spectroscopy (IBBCEAS) between 361–388 nm" *by* Nick Jordan and Hans D. Osthoff

Anonymous Referee #3

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General comments: This is a really well written manuscript on the development of an IBBCEAS instrument at the University of Calgary, operated in the near UV between 361 and 388 nm for the detection of HONO and NO2. Even though the authors pay excellent attention to experimental detail and characterize the performance comprehensively, including first measurements in ambient air, the technology in this manuscript, the measurement principles, the calibration approaches and verification methods are all known and not really new. Despite the very competent experimental description of the instrument, in my opinion, the manuscript is lacking novelty as illustrated in Table 1,

where 7 other publications are listed using the same or very similar broadband cavity enhanced approaches. The authors themselves recently published a very similar instrument merely in a different spectral region. The most novel aspect in this manuscript concerning the area of 'CEAS for field detection of trace gas species' lies in the comparison of IBBCEAS with TD-CRDS, which is very brief in terms of a discussion and largely kept in the supplementary material. If the work is deemed publishable by the editorial board, then material from the supplementary material (S6,S7) should be moved into the main body of the text and further discussed. The work would gain substantial merit from an investigation of the performance of the instrument in field applications especially under various experimental conditions and atmospheric environments. The long-term performance of IBBCEAS instruments in the field under more or less harsh conditions has not been scrutinized to a high standard in the literature yet, but this was unfortunately not within the scope of this work.

A few observations and comments in detail:

- *The light source has an emitting area of 1.4x1.4* mm^2*...*(l79)

- *1200 grooves* mm^{-1}*...* (l104)

- (Kraus, 2003) is missing in the reference list (l156). More information on the DOASIS retrieval could be given here.

- *third-order ...* (l162)

- The inlet was guided through a partially open window. How far from the outside surface of the wall or window was the inlet line? How long was it? Was the instrument facing N,W,S, or E? What can the authors say about losses in the inlet line. (p8 bottom and also p12)

- In addition to the opening paragraph, there is also merit in the Rayleigh scattering cross-section measurements, as they confirm measurements in the literature from

some time ago.

- *Cleanliness...* (l268)

- The fact that the background in Fig. 4 is quite substantial and negative is not discussed in the manuscript. (p10)

- The authors explain that the common approach in the literature to determine the LOD is not following the more strict recommendation of IUPAC, however, then they do not follow the recommendation either, as far as I can see. (p11)

- The authors list a set of errors limiting the accuracy of their measurements and classify them as random. The literature cross-sections for the retrieval is a systematic error. The mirror reflectivity and R_L are also systematic for a given set of measurements, until they are measured again. (p11)

- *higher flow rate...* (l330)

- *pptv* (typo l356)

- The LED does not seem to emit between 330 and 400 nm as stated in the caption (l558)

- *The effective pathlength...* (l560)

- In Figure 5 the “blue time” and “grey time” are explained, the “white times” are unclear.(p23) - Specify the term "$\pm 1\sigma$ measurement uncertainty” in the caption further or include a cross-reference. (l575)

- *...sample ambient air data...* improve phrase, caption Figure 7 (l586)

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