

Interactive
Comment

***Interactive comment on* “Stack emission monitoring using non-dispersive infrared with optimized nonlinear absorption cross-interference correction algorithm” by Y.-W. Sun et al.**

Anonymous Referee #2

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General comments:

This paper presented an analysis algorithm for non-dispersive infrared to solve the non-linear absorption problem, which is very common in infrared field. The author presented a complex way to show how to resolve the problem of non-linear absorption. The author just mentioned concentration of the gases, which can cause non-linear absorption, but in my opinion, I think, not only the concentration, but also the optical path which can cause non-linear absorption, i.e. it is the optical depth (optical density) that cause the non-linear absorption. In the most part of the paper, the author wanted to show his method is better than commercial instrument, but in the last part of the

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text (section 5), a commercial NDIR multi-gas analyzer Model 60i manufactured by Thermo Fisher Scientific Inc. was used to validate the CO and CO₂ results measured by the NDIR analyzer prototype. The results showed there was no obvious difference between two analyzers, for readers, it is hard to say which one is better. The author should present enough data to show his prototype is better than the commercial one. And the authors should consider a few points in their analysis to make sure that their conclusions are robust. Current manuscript contains some major deficiencies and thus would require several major revisions before I would consider this paper for publication.

Major issues:

- 1) In section 5 (Field applications), the authors should classify the carbon dioxide volume-mixing ratio(the data in Fig. 11) into two groups, one is below 17% and the other is larger than 17%, and analyze the differences between prototype and Model 60i to make sure the optimized algorithm is better than the classical algorithm. If the differences are not obvious, section 5 is not necessary;
- 2) Please give measurement range of Model 60i, and the authors should make sure Model 60i works in linear absorption within the measurement range;
- 3) The authors said “the upper measurement range of this analyzer prototype for CO₂ and CO is only 5 17% and 850 ppmv, respectively, if cross-interference is corrected by a constant factor”, why? Please give the criterion of this;

Detailed comments:

- 1) What does the “a specified NDIR analyzer” mean? If a NDIR analyzer with constant optical path length is called “specified”, please tell us what is “common NDIR analyzer”?
- 2) In equation (3), the “i” has different means in left and right of the equation, it is very easy to make the readers confused, please avoid this.
- 3) There are some mistakes in equation (5) and (6), please check them carefully.

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- 4) Please combine section 3.1 and 3.2.
- 5) In page 2019, line 22-23, why the measurement error caused by the gas distribution system ignored?
- 6) In page 2020, line 8, “only fitting correlation coefficients are shown for linear fittings” should be “only fitting correlation coefficients are shown for nonlinear fittings”, I guess.
- 7) In Fig. 3, there are just 11 data points, but in Fig. 5, there are much more data points than in Fig.3, I can't understand this from the paper (section 3.1 and 3.2).
- 8) The description of instruments and field campaign in section 5 is tedious, please simplify it.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 2009, 2013.

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