Response to the Reviewers' comments on the manuscript: Simultaneous detection of atmospheric HONO and NO_2 utilizing an IBBCEAS system based on an iterative algorithm

Dear Editor and Reviewers,

Thank you very much for your letter and the comments from the referees on our paper submitted to AMT. We have checked the manuscript and revised it according to the comments.

Comments and suggestions:

1. As author cited a lot previous works, such as Horbanski et al. (2019); Wu et al., 2010; Leleux et al., 2002, can author be more clarity for the novelty of this work as its quite ambiguous to find out?

Response

Following the reviewer's suggestion, we added the sentence about the novelty of this work in Line 92-96 and Line 102-105.

Comments and suggestions:

2. In L-96: "prevent the instability of light source" Does iterative retrieval algorithm prevent instability of light source which could include both intensity fluctuations and wavelength variations?

Response

The core of the iterative algorithm is to use DOAS retrieval to detect the concentration of the gas. DOAS retrieval algorithm does not depend on the broadband variation of light intensity, the broadband spectral structure with slow change with wavelength is removed by digital filtering, and the fast change part of the remaining spectrum is fitted to obtain the concentration of gas, so the system is insensitive to the broadband change of light intensity. For wavelength variations such as spectra shift and squeeze, it has been considered in traditional DOAS retrieval (please see Stutz et al. (1996)).

Comments and suggestions:

3. In L-121: "Whereas in IBBCEAS it is not a constant and has a dependence on the optical density" What quantification of the optical density can affect? Is it true for the most of ambient measurements?

Response

According to Lambert-Beer's law, we can describe the change of light intensity after passing through an absorption path by using equation, after the corresponding transformation, we can get the defined optical density (Eq. (1)). The measured light consists of photons with different reflection times, so it will experience different distances in the optical cavity. When there is an absorber in the cavity, the effective absorption optical path will decrease nonlinearly. But if all absorbers have sufficiently wavelength-dependent absorption structures, a DOAS retrieval could be used to iteratively calculate optical density and thus determine effective absorption optical path.

Comments and suggestions:

4. In L-135: Please specify the bandpass filter.

Response

We have specified the bandpass filter in Line 135.

Comments and suggestions:

5. In L-165: What is the Helium purity?

Response

We have added the Helium purity in Line 165.

Comments and suggestions:

6. The Eq. 5 and 6 were both simplified, should be explained more clearly.

Response

Thank you for your suggestion. We reexplained the equations.