The manuscript “A compact Incoherent Broadband Cavity Enhanced Absorption Spectrometer (IBBCEAS) for trace detection of nitrogen oxides, iodine oxide and glyoxal at sub-ppb levels for field application” by Barbero et al. reports a LED-based IBBCEAS for the measurement of NO_2, IO, CHOCHO, and O_3. By coupling an O_3 generator, concentrations of NO in ambient air can also be measured by the IBBCEAS. The volume and weight of the instrument are suitable for field application. Overall, the manuscript presents valuable information on the IBBCEAS application which deserves publishing on AMT. However, I do have the following comments which I would like to the authors to be addressed before the final publication.

General Comments:

1. As shown in Table 1 in the manuscript, compared with the reported IBBCEAS whose wavelength centered around 450 nm, the instrument introduced here is inferior in terms of mirror reflectivity, optical path length, and time resolution. If the IBBCEAS introduced here cannot be improved from the aspects of above key parameters, novelty of this work should be detailed and highlighted. In addition, authors need to carefully check the data listed in Table 1, the reflectivity and optical path length of Liu et al.’s IBBCEAS is 0.99993 and 10.3 km, respectively (Liu et al., 2019).
2. The description of measuring CHOCHO in the manuscript is limited, as the Fig. 2(b) only showed simultaneously detection of NO_2, IO, and O_3. It should be better if the authors could present a graph which contains 5 gas absorbers (NO_2, IO, O_3, CHOCHO, and H_2O) simultaneous retrieving. It should be noted that the concentrations of NO_2, O_3 shown in Fig. 2(b) were significantly higher than their concentrations in ambient air, even in polluted area. As the purpose of the manuscript is to present an instrument for field application, it would be more persuasive for readers if a fitting example with low concentrations of gas absorbers could be provided.
3. The manuscript does not provide information about uncertainty of the instrumental

measurements, As to the limit of detection (LOD), authors seems to confuse the concepts among LOD, sensitivity, and precision, because these three words appear alternately in Sect. 4.3.1. The using of these concepts needs to be clarified and revised in the manuscript.

Specific Comments:

Line 56ff: References should not be quoted twice in the same sentence if it is already be written at the beginning. For example, “Venables et al. (2006) were …… (Venables et al., 2006).”.

Line 64: “Min et al 2016” -> “Min et al. (2016)”

Line 65: “very high reflective mirrors […]”

Line 130: Eq. (1) There are probably better ways to format the equations such that the size of the brackets is matched to the size of the arguments within the bracket.

Line 150: “Washenfelder et al. (2008) described […]”

Line 152: “(e.g., helium versus air or nitrogen) […]”

Line 153: Such an approach to calculate mirror reflectivity has been proposed before (Venables et al., 2006) and has been used by previous studies (e.g., Duan et al., 2018). It would be better to reorganized the sentences in another way in the manuscript. In addition, did authors compare the difference between two reflectivity calibration methods based on their own IBBCEAS?

Page 8, Figure 2 (a): The text-label (i.e., Reflectivity) on the y-axis was covered.

Line 202: In addition to the discrepancies at low NO_2 concentrations, obvious discrepancies measured by two instruments can also be observed at high NO_2 conditions, e.g., 18/10/01 - 09:00 and 19/07/19 – 05:45. Could authors provide an explanation about the phenomenon?

Page 13, Figure 6 (top): The units of mixing ratio was missing.

Page 14, Figure 7: The left Box-plot is not as useful as drawing a histogram which contains measured NO2 concentrations when performing empty cavity measurements. Such a histogram can not only be used to show averages, but also be used to estimate LOD from the frequency number of histogram distribution.

Line 247: A short discussion about the comparison shown in Table 1 is better than only presenting a Table without any explanation.

Line 308: "[…] sensor.The instruments […]" -> "[…] sensor. The instruments […]"

Line 324: As the inlet sampling line gets saturated in water vapor while passing through the ozone generator, did authors quantify the influence on CHOCHO measurements? For example, measure the CHOCHO standards with and without using ozone generator.

Reference:

Duan, J., Qin, M., Ouyang, B., Fang, W., Li, X., Lu, K., Tang, K., Liang, S., Meng, F., Hu, Z., Xie, P., Liu, W., and Häsler, R.: Development of an incoherent broadband cavity-enhanced absorption spectrometer for in situ measurements of HONO and NO2 Atmos Meas Tech, 11, 4531-4543, 2018.

Liu, J., Li, X., Yang, Y., Wang, H., Wu, Y., Lu, X., Chen, M., Hu, J., Fan, X., Zeng, L., and Zhang, Y.: An IBBCEAS system for atmospheric measurements of glyoxal and methylglyoxal in the presence of high NO2 concentrations, Atmos Meas Tech, 12, 4439-4453, 2019.

Venables, D. S., Gherman, T., Orphal, J., Wenger, J. C., and Ruth, A. A.: High Sensitivity in Situ Monitoring of NO3 in an Atmospheric Simulation Chamber Using Incoherent Broadband Cavity-Enhanced Absorption Spectroscopy, Environ Sci Technol, 40, 6758-6763, 2006.