

*Black: referee's comments green: authors' answers*

*First of all, we want to thank the two referees for taking the time to review our paper and for their helpful comments. For the details, please look into the paper with keeping track of changes.*

Referee #2

General:

This paper describes the variations and sources of CO, C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>6</sub>, H<sub>2</sub>CO and HCN columns observed with ground-based FTIR at Xianghe in North China along with the retrieval methods. The paper is well described, and it should be published after some minor revisions.

Comments and questions:

p3, l7 Please add the altitude of the Xianghe site.

Done

p3, l25-28. If you want to describe only InSb measurements, the number of the optical filter should be 5. I think it is better to describe MCT measurements even you don't use the spectra in this paper.

Thanks for the suggestion, but currently we only operate the InSb and InGaAs measurements, and the MCT measurements are not recorded at Xianghe.

p5, l2 Please add the version of SFIT4.

Done

l3-4 Full name of NDACC-IRWG was already described in section 1.

Corrected

l29 What kind of a priori profiles were used for H<sub>2</sub>O, HDO, H<sub>2</sub><sup>17</sup>O and H<sub>2</sub><sup>18</sup>O?

Added. They are derived from the NCEP reanalysis data.

Table 3 Wavenumbers for the retrieval windows of H<sub>2</sub>CO and HCN are incorrect.

Thanks, it is corrected now.

Figure 3 Don't you show the observed spectra?

We prefer to keep it more readable like now.

p11, l10  $10^{19}$  should be  $10^{18}$ .

Corrected.

Figure 5 The yellow shaded area is hard to see because it is almost covered by gray dots. The box plots become narrow at the median value (Only the box plot for XCO in Figure A1 is box shape). As for outliers, did you exclude them in the correlation analysis? I think you used them because they have strong information of the local anthropogenic emissions. So, the word 'outliers' is misleading.

The Figure 5 is updated. The 'outliers' are used in the correlation analysis.

We agree with the referee that the 'outliers' is not appropriate. We changed it to 'extremely high/low values'.

p13 l6 42% maybe wrong. 62%?

Corrected

l27-33 Is this paragraph worth writing in this paper?

The referee #1 also suggest to remove it. We have removed this paragraph now.

p14 l16 less --> smaller?

Done

p17, l4 southeast --> southwest?

Corrected

l17 south-east --> southwest?

Corrected

p18 l3trace --> tracer

Corrected

l5-6 Schroeder et al.(2014) --> (Schroeder et al., 2014)

Corrected

l9 Cao et al. (2014) --> (Cao et al., 2014)

Corrected

p20 l1

are summed up before each airmass releasing day --> before each airmass releasing day are summed up

Done.

3.5 p21 l20 Emission estimation for  $C_2H_2$  and  $C_2H_6$  maybe better.

Done.

p22 Figure 13 It is better to put year in figure (b) and (c).

Done.

l6-7 Is this mean that you used the slopes shown in Figure 6? Is it better than using data in categories B and C (or only C)?

Yes, the slopes used here are derived using all categories. In fact, the slopes using all categories and only categories B and C are close to each other.

p23 Can you add some more discussion for the difference of the  $C_2H_2$  and  $C_2H_6$  emissions between the inventories and your estimations? The emissions of the two species are nearly the same in two inventories while fossil fuel/biofuels source for  $C_2H_6$  is twice larger than that of  $C_2H_2$  in Table 1. The source values in Table 1 seems to be consistent with your estimations.

Thanks for the suggestion. The  $C_2H_2$  and  $C_2H_6$  emissions are almost the same from both inventories. The reason is probably because that the emission factors of  $C_2H_2$  and  $C_2H_6$  inventories are both based on the EMEP/EEA guidebook (Huang et al., 2017; Kurokawa et al., 2020). However, the uncertainty of the emissions of the NMVOCs is pretty large. The emissions of  $C_2H_2$  and  $C_2H_6$  derived from our FTIR measurements at Xianghe indicates that the emission factors used for  $C_2H_2$  and  $C_2H_6$  need to be improved, and the FTIR measurements suggest that the  $C_2H_6$  emission is about 2.2 times larger than the  $C_2H_2$  emissions.

p23, l2010<sup>19</sup> should be 10<sup>18</sup>.

Corrected.

0.92 --> 0.91?

Corrected.

p24 l5-7 Is this sentence important conclusion? I think it is enough to put this sentence in section 3.1.

Done.

l14-15 come from local anthropogenic emissions' is explained in the next sentence.

Corrected.

Appendix A

p26 l3 'Since' should be removed.

Done

Figure A1

Dashed line is hard to see.

Added the explanation: 'the dashed line is almost overlapped with the red solid line'