

Interactive comment on “FTIR time series of tropospheric HCN in eastern China: seasonality, interannual variability and source attribution” by Youwen Sun et al.

Anonymous Referee #2

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The authors presented a multi-year timeseries (2015-2018) of HCN partial columns observed at a densely populated Chinese city, Hefei, using a ground-based high spectral resolution Fourier transform infrared (FTIR) spectrometer. CO columns were also presented for comparison. The authors identified the seasonal maxima of tropospheric HCN columns at this site and compared their seasonality and interannual variations to the HCN columns obtained from other NDACC sites. Drivers of HCN seasonality and interannual variations at Hefei were determined through GEOS-Chem tagged CO simulations, as well as the global fire maps and a back-trajectory analysis technique. They also used CO measurements to estimate the HCN/CO emission enhancement ratios to quantify biomass burning emissions.

This version (manuscript-version2) has been significantly improved from the original submission in terms of analysis and presentation. The results are valuable to the community. I suggest some minor corrections, which are detailed below. The authors should perform a thorough proof-reading of the manuscript to further improve the presentation in order to meet the publishing standards of ACP.

- 1) Page 1, Line 35: Are these values multi-year mean or are they the maximum values throughout the whole period? Please clarify.
- 2) p2, line 34-35: Could you also point out where these regions are located in China?
- 3) p2, line 53: add “where” before “influences from biomass . . .”
- 4) p3, line 6: replace “can improve” with “aims to improve”
- 5) p3, line 17: replace “it is planned to” with “plan to”
- 6) p3, line 20: replace “a highest” with “the highest”
- 7) p3, line 22: “to ensure a higher signal to noise . . . and a faster . . .” compared to what?
- 8) p3, line 26-27: can you spell out “&” as appropriate here.
- 9) P4, line 8: change to “Whole-Atmosphere Community Climate Model (WACCM) v6”
- 10) P4, line13-15: spell out all species names when they first appear.
- 11) P4, line 24: did you calculate the tropopause height from the NCEP reanalysis data? If so, replace “deduced” with “calculated”.
- 12) P5, line 19: please spell out GEOS-FP.
- 13) P6, line 5: the order should be “Global Fire Assimilation System (GFAS) v1.2”
- 14) P6, line 9: change to “period of”
- 15) P6, line 11: Please be consistent in placing acronyms. Should be “the Multi- resolution Emission Inventory for China (MEIC)”.

16) P6, line 18-19: It is confusing here, as the GEOS-Chem OH shown in Shindell et al. (2006) is lower than the multi-model mean (Table 1). Could you clarify?

17) P6, line 31-33: this sentence can be modified as “In this study, we only investigate the influence from the biomass burning sources. The regional definition. . .”

18) P6: at the beginning of section 2.3, could you briefly say the purpose of using PSCF in this study? Just add some context.

19) P7, line 37: delete “total” before “troposphere”

20) P8, line 6-10: these few lines can be re-organised to make the statements clearer. For example, “Note that the largest seasonal peak of HCN occurs in May which is 3 months later than that of CO which occurs in February, but the other two seasonal peaks for both species occur in the same months, i.e., in September and December respectively. Otherwise, their seasonal cycles show similarities.”

21) P10, line 11-17: could you elaborate a bit more on possible mechanisms why correlations between CO and HCN are negative or weak at these sites, especially at Bremen? Have you checked the seasonal correlation between CO and HCN at Bremen?

22) P10, line 24: how about “. . .is an effective quantity to identify biomass burning emissions. . .”?

23) P10, line 31: should be “indicating that these. . .”

24) P10, line 32: change to “throughout the year”

25) P11, line 1: change to “is located . . ., therefore emissions. . .”

26) P14, line 22: change to “both the first and the second half of the year”

27) P14, line 24: change to “in the second half of the year”

28) P14, line 25: same as above “in the first half of the year”

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- 29) P14, line 27: change to “As shown in Figs. . .”
- 30) P14, line 34: replace “Drives” to “Driven”
- 31) P15, line 3: “meteorological conditions”
- 32) P15, line 7-8: change to “through large-scale atmospheric circulation”
- 33) P17, line 2: replace “driven” with “drove”
- 34) P17, first paragraph: Are these elevated fire counts related to ENSO? Can you discuss the possible ENSO link here, rather than at the end of the section?
- 35) P17, lines 28: should it be “Zhao et al. (2000) or (2002)” here?
- 36) P17, line 30-31: please re-phrase this sentence as “There is a close correlation between ENSO and HCN columns at Lauder (45oS) (Zeng et al., 2012; Schaefer et al., 2018), and Schaefer et al. (2018) quantified a detectable ENSO influence on biomass burning of up to 51-55%”.
- 37) P17, line 32: replace “presumably” with “very likely”.
- 38) P17, line 37: delete “amounts” and “s” to “HCN column”
- 39) In Conclusion, could you provide some further remarks on the long-term outlook of FTIR observations at this site.

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