General comments :

The study by Sun et al reports the column and partial columns of HCN, a known biomass indicator, along with the column CO from Heifei in China. The authors compare their data with other similar measurements from the NDACC community, and use the standard agreed protocol for retrieve these columns. They derive emission ratios of HCN with respect to CO, and also use back trajectory analyses to trace where the air masses originated. The trajectories from various global sectors are discussed and compared in the context of the seasonality in the HCN to CO enhancements, which the authors conclude is consistent with the same sources. Finally global fire counts are used to show that fires from various sources explain the observed seasonality in the HCN column enhancements.

In general the paper is well written, organised, and follows NDACC recognised analysis procedures. The skill level of this group Heifei is very good, and improves all the time. The paper is therefore recommended for publication in ACP subject to the list of mainly minor corrections, but also a few not so minor points for the authors to correct/address.

Response: This paper has been subjected to a revision based on the comments from two referees. All your comments are appreciated and have been addressed in the revised version. Main changes/improvements are listed as follows:

Specific comments:

1) P2 line 41: replace "in polluted troposphere in eastern China at middle latitude . . ." with "in the polluted troposphere over eastern China at middle latitudes . . ."

2) P2/3 line 57/1:   suggest replacing last sentence on page 2 with "Both HCN and CO are regularly measured at Hefei (32N) using the FTIR observations, where influences from biomass burning occurring at long distances or locally can be assessed."

3) P3, line 12: ". . . evaluation of global .." => ". . .evaluation of the global . . ."

4) P3, line 30/31: spelt out the "&"

Response: We have done above corrections in the revised version

5) P3 line33: The field stop is employed to maximise the S/N consistent with the maximum frequency possible for the wavenumber range that is selected. Is this is what adapt means? Explain.

Response: We have changed this sentence to "The entrance field stop size ranging from 0.80 to 1.5 mm was employed to maximise the SNR consistent with the maximum frequency possible for the selected wavenumber range."

6) P3 caption of figure 1: what is significant about these star spots? Refer to the text for an explanation (just a simple, see section xx). Even so it is not clear on page 16 where this is mentioned, exactly why these points were chosen. Are they the middle of the selected source regions?

Response: We have included a new Figure 1 in the revised paper, where the star spots are replaced by six rectangles for tagged CO definitions. It looks more clear than the old ones. Please check.

7) P5, fig 2: Why show the averaging kernel plot of HCN with these two layers when the actual partial column used in this study is from 0 to 15 km? HCN has a dof of 1.3 so there are not 2 independent layers, unlike CO. Perhaps it would be better to plot two averaging kernels for HCN, the total column and the 0-15 km layer?

Response: We have done this as your suggestion and plotted two averaging kernels for HCN, the total column and the 0-15 km layer.

8) P5 table 2: I am not sure about the tabulated error for the line intensity for CO and HCN, they seem to be the wrong way around? The reported uncertainty for the line intensity in hitran2008 for CO and HCN is 2-5% and 5-10% respectively. So why is the reported % error for the CO line intensity higher than HCN?

Response: In the error analysis, we assume *a priori* error covariance of line intensity as 5% for both CO and HCN. The error in table 2 randomly selected from all measurements shown that the resulting % error for the CO line intensity in the troposphere is higher than HCN.

Some remarks should be clarify: 1, the error analysis may site, measurement, and

layer dependent. For the selected retrieval, the tropospheric AK uncertainties of CO used for error analysis (Rodgers, 2000) are larger than HCN. 2, the error analysis were performed after retrieval, the error in line intensity estimation for either CO or HCN would not impact the time series and thus would not alter the point of this paper. In the revised version, we still set *a priori* error covariance of line intensity to 5% for both CO and HCN, and don't make any revision.

9) P6 line 16: Combine these sentences to read ". . .September > December, while for the tropospheric CO column, ..."

10) P6 line 18: perhaps "phase" is a better word than "timing"? This word is used elsewhere as well.

Response: We have done above corrections in the revised version

11) P7, line 6: type in the word "Fig. A"

Response: We have moved this figure to supplement. Now Fig.A1 is Fig. S2 in the supplement.

12) P7, line 27: be more specific about what timeframes you are actually comparing, what exactly do you mean by "counterpart"?

Response: In the revised version, the "counterpart" has been replaced by "concurrent". The timeframes of NDACC selected for comparison are the same as that of Hefei. This sentence has been changed to " Enhancements of both tropospheric HCN and CO columns between September 2015 and July 2016 at Hefei (32°N) were observed compared to the measurements in other years."

13) P7, line 32: combine these sentences to read ". . .2016, while. . ."

Response: We have done this in the revised version.

14) P7/8: Maybe summarise all this information in this paragraph in a table? It is otherwise tedious for any reader.

Response: We have condensed all this information to "The enhancements of both tropospheric HCN and CO columns within the same period were also observed at the selected NDACC stations except Ny Alesund (79°N) and Kiruna (68°N). The winter enhancements were not shown over Ny Alesund (79°N) and Kiruna (68°N) because of the polar night in the Arctic which interrupted the observations in winter. The

magnitude of the enhancement in tropospheric HCN column at the selected NDACC stations between September 2015 and July 2016 ranges from 3 to 213%, and for CO ranges from 4 to 62%."

15) P9, line 2,: "proceed" is not the correct word here. Should be something like "using a linear ..."

16) P10, line 28: "seasonal" => "seasonally"

17) P10, line 31: ". . .occurred before the timing of tropospheric HCN enhancements within one month period. Then, we" replace with "occurring before the timing of tropospheric HCN enhancements within a one month period. Finally, we . . ."

Response: We have done above corrections in the revised version.

18) P13, fig 8 caption: What is the ratio in fig 8a, what is being ratioed against what?

Response: In the revised version, this figure has been replaced by Fig. 11.

19) P13, fig 8 caption, line 5: Do you mean the each red dot is a fire over the 10 day period. What is written here implies a fire that occurred 10 days before. So this is cumulative over the 10 days, yes?

Response: Correct. In the revised version, this figure has been replaced by Fig. 11.

20) P14, fig 9b: These plots are really hard to make out. Perhaps explore another way of plotting so it clearly shows the different datasets. My suggestion is to try different plotting symbols as the one you use seem too large.

Response: In the revised version, this figure has been replaced by Figs. 13 and 14. Now it should be more clear.

21) P15, line 13, "Particularly," => "In particular, "

Response: We have done this in the revised version.

22) P16, line 8: "cause"

23) P16, line 15: "lifetimes ..." => "where lifetimes ..."

24) P17, line 7: These numbers from other studies though should be entered as a range in table 5, that is, a column that says "literature values" to give the reader a sense of where the emission ratios in this study fall.

Response: We have removed this paragraph in the revised version. Instead, a tagged CO simulation was included as response to referee # 2's request. Please check.