## **Response to the comments of Anonymous Referee #2**

General Comments:

This manuscript reports the VOC measurements using an Ionicon Q-PTR-MS at both urban and suburban sites of Beijing, China during the wintertime of 2014-2015. Emission ratios (ER) of major VOC species with respect to CO were evaluated and the Chinese New Year effects has been investigated in this study. Wintertime is a typical haze season in China due to the adverse atmospheric dynamic conditions and increasing demands for domestic heating. Therefore, air pollution abatement can be extremely difficult, especially for the Megacities, hosting millions of residents that are vulnerable to air pollutants. VOC have been well recognized to be responsible for the swift development of air pollution events. However, the speciation and emission strength of these VOC have been demonstrated to be hard to acquire due to the fact that VOC can be emitted from a diversity of domestic and industrial activities. Therefore, field measurements of VOC emissions are critically needed in China. This work can be a significant contribution to the atmospheric research community. The methodology (PTR-MS) of this work is well established and the experiments were well conducted. The unit mass resolution of the Q-PTR-MS is the only drawback of this work and I am glad to see that the author has realized this fact and has taken this into account in the data analyses. Overall, the manuscript is fairly well written and I would recommend the manuscript for publication after minor revisions.

Response: We thank Anonymous Referee #2 for the review and the positive evaluation of our manuscript. We have fully considered the comments and made revisions to our manuscript. The response and changes are listed below.

## Specific Comments:

1) P4, L4: The author may want to specify the operating mode of the PTR-MS, i.e., continue scanning mode or single ion monitor mode.

Response: The operating mode of the PTR-MS is multiple ion detection (MID) mode, which is monitoring selected single ions. We added "using the MID (multiple ion detection) mode" in Page 4, Line 6 the revised manuscript.

2) P4, L9: m/z 47 also could be ethanol since most gasoline may contain 10% ethanol in China and it can be emitted into the air from automobile gas tanks. Since no gas-stations were around the observation sites, ethanol emission may be not that important though.

Response: We thank the reviewer for the kind remind. We are aware that ethanol may influence the m/z 47. However, as we have mentioned in the manuscript, the sensitivity of ethanol at m/z 47 is very low (because of fragmentation), and may influence little on formic acid.

We added the possible interferences of formic acid in the method section (Page 4, Line 21-23): "There is also interference at m/z 47, which is mainly from ethanol emitted from solvent or gasoline evaporation. However, the influence of ethanol to formic acid is likely small because the sensitivity of ethanol at m/z 47 is very low as a result of fragmentation (Yuan et al., 2017)." 3) P4, L11: "Supelco" background check may not the best option for PTR-MS operation. However, it may be OK for the particular dry conditions encountered during wintertime of Beijing.

Response: Thanks for pointing this out. The Supelco background check was tested before each campaign by comparing with zero air (generated by AADCO zero air generator), which gave similar background signals. Hence we believe that this is not a big issue.

4) L5, L11: "...the urban site is 3.8 times of that at the suburban site..."

Response: Thanks for the kind remind. In the revised manuscript, "the suburban site is 3.8 times of that at the suburban site" was changed to "the urban site is 3.8 times of that at the suburban site".

5) P7, L22: "interference of ethanol" very likely. Response: Revised in the new version of manuscript.

6) P8, L23-24: "These high...strong photochemical process during the day at the urban site...". The author is most likely right about the photochemical process. In fact, the NOx and VOC levels were substantially higher in urban than in suburban sites. The author may also want to check out the ozone concentrations at both sites, since ozone is secondary in nature and can well represent the photochemical activity in the atmosphere.

Response: Agreed. We added the following statements in Page 9, Line 11-13:

"This can be further proved by the ozone diurnal variations at the urban (Period I only) and suburban sites (Figure S5). The daytime increment of ozone at the urban site (~15 ppb) are ~1.5 times of those at the suburban site (~10 ppb), which indicates stronger daytime photochemical processes at the urban site."

Figure S5 was added in the SI:



Figure S5. Diurnal variations of ozone in urban (Period I only) and suburban sites.

7) P9, L8-9: I think it should be "million".

Response: Yes, "billion" was changed to "million" in the revised manuscript.

8) P10, L14: remove "were" before "all increased". Response: Removed in the revised manuscript.

9) P10, L15: remove "were" before "increased". Response: Removed in the revised manuscript.

10) P10, L16: Change "didn't" into "did not". Change "obviously" into "significantly" Response: We made the corresponding changes in the revised manuscript.