Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2018-1328-RC2, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Taehwa Research Forest: A receptor site for severe pollution events in Korea during 2016" *by* John T. Sullivan et al.

Anonymous Referee #2

Received and published: 14 February 2019

This manuscript provided an interesting study about two air pollution episodes at the remote Taehwa Research Forest (TRF) site during the 2016 KORUS-AQ campaign. Surface observations, ozonesonde data, and aircraft measurements are used to investigate the characteristics of these two events with elevated ozone. This study suggests the outflow of air pollutants from the Seoul Metropolitan Area (SMA) plays a more important role in air pollutant at the receptor TRF site, compared with long-range transport from China. This manuscript points out the importance of domestic emissions to the local air pollution in South Korea. The topic is applicable for Atmospheric Chemistry and Physics. The text is concisely written and well documented. This study has comprehensive analysis and detailed explanation/discussion. However, the current abstract did not emphasize the major findings such as domestic emissions may have

more important impacts than the trans-boundary emissions which were believed to be the major sources of air pollution in South Korea. Re-writing the abstract is suggested. Also, lots of references are missing or not in the ACP reference format in the current manuscript, which should be added and corrected in the revised version. In summary, minor revisions as indicated in the comments and remarks below are needed before consideration of publication in ACP.

Detailed Remarks/Suggestions for Revision

Page 2 Line 6 & 7: Kim et al. (2012) and Ghim et al. (2007) are missing. Line 9: The citation should be "Duncan et al. (2016)". Please use "()" for ACP format. Line 11: Wang et al. 2015 is missing. Line 20: My understanding is that Olympic Park is also in the urban area of Seoul. Why list this reference here?

Page 3 Line 3: What is the road transport source? What is the difference than "mobile/vehicular emissions"? Line 5: Should be 'Herman et al., (2018)'. Line 7: Please add the definition of DU, i.e. "1 DU = 2.69 x 1016 molecules/cm2" here. Line 8: The statement of "O3 formation within the SMA is VOC limited, due to the overabundance of NOx" needs further discussion/explanation, such as the quantification of VOCs and NOx ratio observed in SMA urban area. Line 10: Should be "Miyazaki et al. (2018)" Line 12: Should "Kim et al., 2018" be "Kim et al., 2018a"? Line 16: Move "parts-per-billion by volume" to the first time appearance of "ppbv" Line 19-24: Using section number in "()" is hard to follow. Please use the format such as "(Section 3.1.1)".

Page 5 Line 3: Kim et al. (2014) is missing. Generally, the BVOCs emissions are elevated with higher temperature, but it depends on the plant type and stress information such as soil moisture. Just curious if Kim et al. (2014) discussed the characteristics of BVOCs emissions in South Korea.

Page 6 Line 6: Should "Lee et al., 2007" be "Lee et al., 2008"? Line 18: Huang et al. (2012) is not in the bibliography, should it be "Huang et al., (2018)"? Line 30-31: This conclusion may not be correct. During the "eastbound leg", the King Air aircraft

stayed at the same altitude of 1500 m, while the “south leg” observed air pollutants from 500-1500m over the Yellow Sea. So the “clean air” observed in “eastbound leg” may be caused by the higher altitude of King Air which could be higher than the shallow marine PBL height where the transport happens. The lower altitude like 500 m over the Yellow Sea under “eastbound leg” could have elevated concentrations of air pollutants which are not observed by King Air.

Page 7 Line 15: Should be “Figure 6” instead of “Figure 7” here. Line 24: Should “Kim et al., (2014)” be “Kim et al., (2015)”? Line 29: It is an important conclusion. Does King Air or DC-8 have NOy measurements to support this hypothesis?

Page 8 Line 22: Should “Kim et al., 2018” be “Kim et al. 2018b” in the bibliography? Line 32-33: Is it possible that due to high concentration of OH, the BVOCs concentrations are in the equilibrium and produce lots of O3, i.e., Ox?

Page 10 Line 11: “Figure 7” should be “Figure 10”.

Page 11 Line 15: Does ‘contributed more’ mean that the biogenic emissions contribute more than anthropogenic emissions in O3 photochemical production? Since the NOx concentrations are different in these two days, some discussion may be needed here.

Page 12 Line 14-15: Kim et al. (2004) and Ghim et al. (2007) are missing in the bibliography. Line 22: Liao et al. (2019) is missing. Line 27: “Cooper et al., 2016” should be “Cooper et al., (2014)”.

Page 18 Table 1: “Thompson et al., 2019” is missing.

Page 19-20 Figure 1&2: The inserted plots are too small and hard to read. May consider using individual figures.

Page 24&26 Figure 6 & 8: Numbers in color bar is blurry to read.

Page 29 Figure 11: The black, red, and blue dots covered each other. May consider using separated plots into a 3-panel figure.

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