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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impacts of different plant functional types on ambient ozone predictions in the Seoul Metropolitan Areas (SMA), Korea" *by* H.-K. Kim et al.

Anonymous Referee #1

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General comment: The authors investigated how the plant functional type (PFT) distributions affect the results of biogenic emission modeling as well as O3 simulating using chemistry-transport models (CTM). Of particular, they studied about the impact of different PFT on ambient ozone predictions in the Seoul Metropolitan Areas, Korea. They used three different PFT datasets, (1) KORPFT, (2) CDP, and (3) MODIS. Through the contents, the authors addressed that a KORPFT is a good representation of isoprene and O3 modeling from the results of the statistical MR method. A lot of details about three different PFT and a comprehensive works the authors have done are well described in the content, but I couldn't see the main points clearly in the abstract. My first

suggestion is that the authors should make the main points clear in the abstract (e.g., is KORPFT is better than two others or KORPFT can be used one of the PFTs?).

Through the contents, the authors mentioned that the KORPFT is better than two other PFTs because O3 and isoprene mean differences are smaller than the other two (Figure 9), compared with model-averaged O3 and isoprene from three different CMAQ runs. I think that it is hard to say that the KORPFT is better than the others. Rather, the authors could say that the mean values from the CMAQ including KORPFT are between those from two others. It is simply caused by that the O3 and isoprene concentrations from CMAQ with MODIS based PFT are larger than those with KORPFT and the concentrations from CDP based CMAQ are smaller than those from those with KORPFT. I think that Figure 7 suggests that isoprene from the MODIS based simulations are better than the other two regarding on similar R2 values and better slopes. Thus, I want to see how the authors conclude that the KORPFT is better than two others.

In the CMAQ system, the NOx concentrations are significantly overpredicted and O3 and isoprene are underpredited compared with the in-situ measurement. With the large overpredictions of NOx concentrations, it is risky to evaluate the O3 sensitivity to the changes in the isoprene emissions. As the authors indicated, O3 chemistry is complicated and the ratio of NOx/VOC really matters in the O3 formation. The authors also addressed that the simulated high NOx biases are caused by high NOx emissions. Ideally, in the system, in order to see the sensitivities of O3 and isoprene to the different PFTs, the simulated NOx should be fixed by changing the NOx emissions (e.g., using an inverse method or using the ratios of in-situ measured NOx and corresponding simulated NOx concentrations).

Specific comments: 1. In abstract, the authors say, "Multiple regression analyses with the different PFT data (delta O3 vs. delta PFTs) suggest that KORPFT can provide reasonable information to the framework of MEGAN biogenic emissions modeling and CTM O3 predictions".

What does this mean? Can KORPFT be used like other PFTs or is KORPFT better than two others. Make it clear.

2. In abstract, the authors says, "Exponentially diverging 5 hourly BVOC emissions and O3 concentrations with increasing ambient temperature suggest that the use of representative PFT distributions becomes more critical for O3 air quality modeling (or forecasting) in support of air quality decision-making and human health study".

As the author addressed, three different PFT make large differences with increasing ambient temperature. Can the author make another scatter plot like Figure 7 for O3. Again, to me, from Figure 7, the MODIS-based PFT looks better than two others for simulating surface isoprene.

3. Page 24946, The authors say, "The over-prediction of NOx concentrations is primarily due to the overestimation of anthropogenic NOx emissions, and the under-prediction of isoprene concentrations is due to the combined effects of the overestimations in NOx and underestimations VOC and ambient temperature (i.e., under-predictions)".

Probably, the authors could make better NOx concentrations by changing NOx emissions using the ratio of in-situ measured and corresponding NOx concentrations. After the NOx simulations are fixed then, the authors could do some sensitivity of isoprene and O3 to the changes in the PFT. I think that it is critical for this study, but it depends upon how the authors feel about this suggestion.

4. Page 24948, the authors say, "Among the three CMAQ isoprene results, the CMAQ provided values closer to the observations with MODIS (MB = -0.02 ppb and NMB =-7.78 %) than with the others (MB = -0.05 and NMB = -22.62% with KORPFT; MB =-0.08 and NMB = -32.82% with CDP). However, the CMAQ shows noticeably better performance for isoprene time variation with KORPFT (r = 0.622) than with the others (r = 0.598 with MODIS and r = 0.591 with CDP) (Fig. 7)."

How do you conclude that the KORPFT CMAQ shows noticeably better performance

for isoprene? Is it because the r value from the KORPFT has higher than others?

5. Page 24929, the authors say, "Thirdly, we changed only PFT datasets without changing any other model input configurations, such as LAI, meteorological or chemical variables, in order to isolate the impacts of the different 15 PFTs on atmospheric chemistry (or O3 concentrations)." The MEGAN computes emissions for plant functional types as a function of temperature, solar radiation, leaf area index (LAI), and leaf age, which means that PFTs are dependent upon the LAI data. For example, Pfister et al. (2008) used three different sets of LAI and PFT input data. The authors need to justify how they use three different PFT values with the same MODIS LAIs. Does using the same MODIS LAI affect the analysis that the authors have performed on?

6. In Section 3.1, the authors say, "This artifact (i.e., PFT area missing) can occur in the process of the LAIv calculations due to the geo-locational disparity between the PFT and the LAI distributions".

As the author indicated, the artifact such as PFT area missing affect the LAI calculations. Again, the PFT and LAI are closely associated when they are estimated in the preparation of the data. The authors need to give some justifications on their approach to change only PFT.

Technical comments:

8. Page 25495, typo ....are very strogn 9. Page of 24953, typo ....Figure 8 (Figure 9?) 10. From Figure 4, the red-dotted regions were not clearly shown. 11. From Figure 5, the reactive missing region were not clearly shown. 12. Figure 9 was never called in the content.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 24925, 2013.