Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC1
https://doi.org/10.5194/acp-2021-95-RC1, 2021


# Comment on acp-2021-95

Anonymous Referee #1

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Referee comment on "Global and regional impacts of land cover changes on isoprene emissions derived from spaceborne data and the MEGAN model" by Beata Opacka et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-95-RC1, 2021

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Beata Opacka et al., Global and regional impacts of land cover changes on isoprene emissions derived from spaceborn data and the MEGAN model

The manuscript by Opacka et al. assesses the impact of land use and land cover change on annual emissions of isoprene. This is done with three simulations with the MEGAN model, one with static land cover and two with dynamically varying land cover based on MODIS and GFW data on land use and land cover change. Results from these simulations are subsequently applied in a chemistry transport model to compare the impacts of land use change on modelled HCHO concentrations with those of meteorological drivers. Modelled HCHO is compared with satellite-derived values.

The paper provides a comprehensive analysis of (1) land use change; (2) its impact on isoprene emissions and (3) their impact on atmospheric chemistry. This wide range of topics makes that the paper contains several analyses that could stand on their own, but the overall structure makes that it works fine to have these different elements included in the study. My only concern would be that the analysis of different tree cover inventories may be of relevance as well to an audience outside the ACP community, and I hope that this audience will be able to find the study.

The manuscript is overall very well written and the analysis is done in a solid way, so I have only a few minor remarks (listed at the end) that the authors may want to address when revising the paper. I recommend publication of this manuscript in ACP.

Minor remarks and requests for clarification:

L. 103: "… at standard canopy conditions": Are these standard canopy conditions some sort of extension of the standard conditions (L. 97) used to define emission factors? From the equation, it appears that there should be standard LAI, phenology and age? Maybe this information can be added here.

L. 122: "this step is a cause of uncertainty" – I agree, but this also applies to the original PFT distribution (L. 111-116). Are you able to comment on possible differences between the method used for MEGANv2.1 and the new classification? Is the "PFT scheme" in L. 164 the one in MEGANv2.1?

L. 324 ff: The discussion about tree definitions is valuable to understand (part of) the differences between the datasets. How does this affect the application to simulation of isoprene later on in the manuscript? What is the difference in the emissions if plants e.g. are defined as tree or shrub? L. 369 attributes an important role to tree cover, but the difference in the emissions seems to depend very much on the type of tree/shrub (Table S1). I welcome the authors to extend the discussion towards the application of these data sets to isoprene emissions.

L. 343: "fire-over areas" – do you mean burnt areas?

Fig. 5: The emission maps for the three simulations are very similar. I would prefer to see the results from CTRL, combined with differences between ISOPMOD-CTRL and ISOPGFW-CTRL (as in the right-hand panels of Fig. S3). This would help to understand the differences between the three simulations.

L. 457: What is meant with "weakly dependent on variations in PFTs"? Does it mean that the variability is modulated somehow by the land cover sets used, hence leading to differences between simulations, or is there a variability within one of the simulations because of IAV of the cover fractions of the PFTs?

Table 6: I would suggest to remove "mitigating" from the last line of the table header, because LULC does not always reduce emissions.

L. 540: Why is the isoprene inhibition accounted for in the CTM simulations, but not in the results presented earlier? Given that the changes in CO2 are limited for the period used in the simulation, I do not expect it to have a large effect on the outcome, but it brings an inconsistency into the study.

Fig. 9: Maybe you could repeat the different land cover products in the figure caption (together with the A, B and C simulations).

L. 619 ff: The three CTM simulations show very similar results (Fig. 9), and I agree that it is meteorological drivers rather than LULC changes that are responsible for this. I would suggest to extend the statement that the GFWMOD-based simulation results in a better agreement (L. 619) - while formally correct - with a remark on this small difference.

The print quality of some of the maps could be increased by using a higher resolution or by using vector graphics, in particular Fig. 3, and for the stippling in Fig. 8.