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Interactive comment on "Recent past (1979–2014) and future (2070–2099) isoprene fluxes over Europe simulated with the MEGAN-MOHYCAN model" *by* Maite Bauwens et al.

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This paper presents a series of present-day and future high-resolution simulations of isoprene fluxes over Europe. Isoprene emissions from vegetation are calculated using the MEGAN-MOHYCAN model forced with meteorological fields derived from ECMWF ERA-Interim reanalysis for the recent period, and from future ALARO regional climate model simulations following several representative concentration pathways (RCPs) scenarios. The effects of changing climate (mainly temperature and solar radiation), CO2 fertilization, and CO2 inhibition on the distribution and variability of isoprene emissions are tested and discussed. Isoprene emission estimates for the recent period are

evaluated against field campaign measurements at several European sites, showing the reliability of the model to reproduce the observations.

The manuscript is well written and clearly structured. The methodology and results are described very comprehensively. The overall results appear reasonable and are well discussed. I therefore warmly recommend the publication of the present manuscript in Biogeosciences after addressing minor comments listed below.

Specific comments:

Section 2, lines 26 – 30: Could you please give the SEFs attributed to each of the seven PFTs used here (maybe in a table in the main text or in the supplement material) and explicit how they have been obtained. I think it is relevant to mention them here, as you discuss the SEF values in section 4.2. I suppose you worked with the SEFs of the 7 PFTs used in MEGANv2.0 (Guenther et al., 2006). Why didn't you use the more recent MEGANv2.1 (Gunther et al., 2012) 15 PFTs distribution and corresponding SEFs, which give you more details than the 7 PFTs of the previous version?

Section 2.2: I suggest to split the subsection into two subsections: first "2.2 Input data and assimilation" regrouping the lines 6 to 34 of page 5 and 1 to 8 of page 6, and to describe the meteorological forcings, and "2.3 Leaf area index" regrouping the lines 22 to 25 of page 4 and 1 to 5 of page 5, to describe the leaf area index.

Section 2.3, lines 15 – 19: Could you please give explicitly the CO2 concentration for which γCO2 is equal to 1 with the WI parameterization, as it is slightly higher than with the PH parameterization.

Section 3, line 10: How is it possible to distinguish between the contributions of Oak species in the isoprene emission you obtain, as you work at the PFT level? The broadleaf deciduous tree PFT regroups several Oak species, including the low and high Oak emitters, and a mean SEF is used for this PFT. Aren't the temperature and radiation effects mainly responsible for the higher isoprene emissions in the in the

Mediterranean regions?

Section 4.1, lines 11 – 20: Could you please discuss why you have significantly lower isoprene emissions with MEGAN-MOHYCAN in comparison to previous MEGAN and satellite-based estimates? What are the factors that can explain the differences between your results and previous estimates?

Section 4.2, Line 16, Page 9: Could you please make explicit the unit mentioned here (μg g-1DW h-1) ?

Section 4.3, lines 15 – 34, page 10: Why did you choose to validate the model using the Stordalen site, as the MEGAN algorithms are not correctly adapted to the type of vegetation found in the site? Isn't it another site (forest site) with available isoprene flux measurements to validate the model, without strong bias induced by the vegetation type?

Section 4.3, lines 26 – 28, page 10: You argue that the value of SEF used in the model for C3 arctic grasses can be underestimated and lead to lower calculated emissions. However, the basal emission rates of the dominant vegetation types of the site (given in line 20 of Section 4.3) are lower than the SEF used in the model. How do you explain this?

Section 5.2, lines 11 – 22, page 13: Including the impact of land-use change in your simulation set (e.g. using the ALARM scenarios (Settele et al., 2005)), with additional simulations accounting only for land-use change would have been very interesting. I understand that implementing the land-use change scenarios to obtain vegetation maps is a hard work to do. As you discuss this effect here, could you also add some perspectives in the conclusions about land-use impact on isoprene emissions with MEGAN-MOHYCAN?

Conclusions, line5, page 14: Where does the 65% of increase come from. Could you explain how, from which simulation you obtain it?

Figure S2: How do you explain the strong negative trend in July LAI for southeastern Europe (Ukraine, Romania,. . .)?

Technichal comments:

Abstract, line 2: Replace "aerosol" by "aerosols"

Abstract, line 3: Replace ". . .solar radiation: in addition. . ." by ". . .solar radiation. In addition. . ."

Abstract, line 5: Delete "also"

Abstract, lines 11-12: "as a result of climate change" could be deleted

Line 28, Page 3: Replace "and consider" by ". Seven PFTs are considered: . . ."

Line 26, Page 4, EQ. (6): The equation is split into two lines, maybe an error in the latex code

Line 1, Page 7: Rephrase "ecosystem models, a widespread increase in LAI . . ." by "ecosystem models, Zhu et al. (2016) obtained a widespread increase in LAI . . .", and delete the reference at the end of the sentence

Line 7, Page 9: Replace "In other to" by "In order to"

Line 32, Page 9: Replace "trees species" by "tree species"

References

Guenther, A., Karl, T., Harley, P. et al., Estimates of global terrestrial isoprene emissions using MEGAN (Model of Emissions of Gases and Aerosols from Nature), Atmos. Chem. Phys., 6, 3181–3210, 2006.

Guenther, A. B., Jiang, X., Heald, C. L. et al., The Model of Emissions of Gases and Aerosols from Nature version 2.1 (MEGAN2.1): an extended and updated framework for modeling biogenic emissions, Geosci. Model Dev., 5, 1471–1492, 2012.

Settele, J., Hammen, V., Hulme, P. et al., ALARM: assessing LArge-scale environmental risks for biodiversity with tested methods. Gaia - Ecological Perspectives for Science and Society, 14, 69–72, 2005.

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