

Interactive comments on « Implementation of the biogenic emission model MEGAN(v2.1) into the ECHAM6-HAMMOZ chemistry climate model. Basic results and sensitivity tests » by Alexandra-Jane Henrot et al.

Alexandra-Jane Henrot et al.

REFEREE #3

We thank Referee #3 for insightful and constructive comments on our paper, which have helped us to improve the manuscript. The suggested changes will be addressed in the revised version of the manuscript.

Referee #3's comments are quoted in blue. Authors' answers are in regular font and authors' changes in the manuscript are quoted in italic.

Specific comments

In the abstract it is written that "Isoprene emissions show the highest sensitivity to soil moisture impact", which to me is slightly confusing as soil moisture is taken into account only for isoprene, and not for other compounds. The sentence should be modified for instance to "The highest sensitivity of isoprene emissions is calculated when considering soil moisture impact."

We agree with Referee #3 that this sentence can be confusing. We have amended the sentence as suggested.

The leaf area index is a key driving variable in BVOC emissions, and I think a few more details should be given regarding this topic. Especially, how is the consistency between vegetation type and LAI given when switching from the 11 PFT classification to the 14 extended PFT one? Is the same LAI considered for all new categories?

According to the comments of Referees #1 and #2, we have added in the revised manuscript a detailed description of the calculation of the activity factor depending on LAI and its impact on emission estimates, as well as a discussion of the effect of changing LAI in an additional sensitivity test.

The LAI used in the biogenic module is the LAI of the grid-cell that is directly derived from the JSBACH model (Section 2.3.1, page 5, lines 1-3). The LAI is calculated in function of climatic conditions (temperature, soil moisture) and Net Primary Productivity for several phenology types (summergreen, evergreen, raingreen, grasses and crops). It is constrained by a maximum LAI value and a specific leaf area (leaf area per gram of leaf carbon) that are PFT-specific. The PFTs are thus merged into these broad phenology types for the LAI calculation.

When switching to the 14 extended PFTs, we kept the original 11 PFT-specific parameters for the LAI calculation, in order to not modify the standard PFT classification and setup used in JSBACH. Thus, switching to the 14 extended PFT classification only allows here a better representation of PFT-specific emission factors but does not affect the LAI nor the original PFT fractions calculated in JSBACH. This clarification has been added in the revised manuscript, in Section 2.3.2.

We agree with Referee #3 that to be fully consistent in terms of vegetation dependent parameters it would be better to use the refined PFT classification directly in the JSBACH model in order to calculate the PFT fractions and LAI. But this would require to modify the basic setup of the JSBACH model (providing the full list of specific parameters for each PFT of the new classification) and to re-calibrate the vegetation model in its full-mode (this needs very long simulations to allow the carbon stocks to reach equilibrium). This point could be addressed in a future study about the impact of land cover and land-use change on the atmospheric chemistry within the ECHAM6-HAMMOZ model.

Page 7, line 27: Please give more information regarding the biomass density calculation and relation with vegetation classification used, either here or preferably in the model description section.

The sentence pointed out here is a general sentence about the potential of emission of tropical regions. In the present model, the variation of the biomass is calculated by the vegetation model JSBACH and taken into account for the biogenic emissions via the corresponding changes in LAI. This precision has been added in the revised manuscript in Section 2.3.1.

Technical comments

We have taken into account all the technical corrections suggested by Referee #3.