Author's response to editor comment:

# "Isoprene and monoterpene simulations using the chemistry-climate model EMAC (v2.55) with interactive vegetation from LPJ-GUESS (v4.0)"

5  by Ryan Vella et al.

We thank the editor for taking the time to handle our paper submission and we appreciate his comments to further improve our manuscript. We would also like to thank the third referee for the time to review the revised version of our manuscript and recommending our work for final publication. Here, the editor's comment (from October 19, 2022) is reproduced in black, while our comments are presented in
10  blue.

**From the editor's response:**

Thank you very much for your valuable contribution to our journal. Despite encouraging comments from reviewers, my own evaluation suggests major revision for our journal publication as a model description paper. This is a model description paper, and the manuscript must provide clear and full information
15  on what you did for the model development and originalities of the study accordingly. But you are emphasizing the coupling of a process based-model for BVOC emission to the ESM in Intro and abstract. Based on this clear understanding, I may be able to decide if your sensitivity experiments provide relevant information for scientific progresses.

We thank the editor for the feedback and his acknowledgement of positive comments form the reviewers.
20  We understand that editor expects some clarifications about our model development efforts to make this work more fitting in the category of *"model description papers"* within the journal GMD. The manuscript was updated to clarify that we only used the built-in LPJ-GUESS "process-based" BVOC module for comparing our new emissions from ONEMIS and MEGAN with dynamic vegetation states (see Fig. 9). Emissions from the LPJ-GUESS module are not integrated in EMAC and are only limited to LPJ-GUESS'
25  daily output. Process-based models were mentioned in the introduction to give an overview of different modelling approaches. It should however be clear that in this study we utilised empirical models i.e. ONEMIS & MEGAN.

Most of all, it is hard to catch up what this study improved the BVOC emission. It is confusing if your work provides the process based-model by Niinemets and Arneth with the EMAC ESM or not. It seems

30  to me that your model development enables to provide the vegetation related parameters (e.g., LAI) from LPJ-GUESS to ONEMIS and MEGAN based on Fig. 1 (e.g., see direction of arrow to LPJ-GUESS from EMAC) and description in 2.3.1.

Fig. 1 was updated to better explain our contribution in this paper. The arrow from EMAC to LPJ-GUESS refers to the one-way coupling between EMAC and LPJ-GUESS, done by Forrest et al. (2020). In Forrest
35  et al. (2020), the atmospheric states needed in LPJ-GUESS where taken from EMAC but no vegetation information was passed back to EMAC. In this work, we replaced offline vegetation information needed in ONEMIS and MEGAN with interactive vegetation states from LPJ-GUESS, which is already coupled with EMAC. This is indeed a significant improvement in the representation of BVOC emissions in EMAC because the emissions are now vegetation-sensitive. In our sensitivity studies we showed for instance that
40  BVOC emissions are now sensitive to vegetation changes in doubling $CO_2$ scenarios. Fig. 11 and 12 show that changes in BVOC emissions in the Bio×2 case only occur in the improved coupled system.

The manuscript was updated to clarify that the process-based model by Niinemets and Arneth is only used in the LPJ-GUSS *built-in* module and is not integrated in EMAC. We used such emissions in Fig. 9 for comparison only. Now, we also highlighted that BVOC emissions from the LPJ-GUESS module are
45  limited to daily means in contrast to our new vegetation-sensitive emissions from ONEMIS and MEGAN which run on the model's time-step and thus give diurnal variations. This is one more improvement enabled by our work.

Before moving to the next step, I kindly ask you to provide full revision on the model description part so that the model communities can get benefits from your study by easy understanding what you did. Here
50  I did not give specific comments but please also make sure that all abbreviations are provided properly in the texts. Also please give us more specific words instead of "some", "the sensitivity"(of what), "the functionality"(of what), "limited two-way" (limited?).

We agree that the editor raised valid concerns about our model description section and the feedback provided improved the quality of our manuscript. We think that this version of the manuscript further
55  clarifies our approach and model development efforts to advance the integration of the EMAC ESM with LPJ-GUESS. We hope that the updated model description section addresses the editor's concerns.

We also updated our manuscript accordingly making sure that all abbreviations are explained in the text the first time they appear and we also provide more precise descriptions replacing any ambiguous remarks.