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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Isoprene emissions modelling for West Africa using MEGAN" *by* J. Ferreira et al.

Anonymous Referee #2

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Overview:

This manuscript presents a detailed analysis of isoprene emissions calculated by MEGAN for the West African region. Sensitivity of model results to emission factors, radiation, temperature and spatial resolution are presented, together with comparison with isoprene mixing ratios measured on board aircraft as part of the AMMA field campaign. This original work gives important insights on the sensitivity of isoprene emissions to model parameters or inputs. It illustrates the difficulty to represent the high resolution spatial and temporal variability of natural VOC emissions, which are key compounds for biosphere-atmosphere interactions, and therefore definitely addresses relevant scientific questions within the scope of ACP. This study also provides an evaluation of the MEGAN capability, comparing calculated emission fluxes with measured

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mixing ratios. The paper is well written and the scientific method clearly outlined. I therefore recommend this paper for publication in ACP, taking into account the comments and suggestions given below.

General comments:

- Title: The title doesn't clearly reflect the content of the manuscript. Indeed, this work is not only a modelling exercise, with the objective to provide isoprene emission estimates for one particular region, but really focuses on emission sensitivity and model evaluation, which I think is important to underline in the title. I would therefore suggest to reinforce the title to include these aspects of your study.

- Abstract: Comparing calculated emission fluxes with measured mixing ratios provides a qualitative, rather than a quantitative, model evaluation, and though valuable, also has some limitations. This kind of exercise on its own can't be a complete model evaluation, but is definitely an important step, complementary from other methods. I think it is important to include these aspects in the abstract. On the other hand, the sensitivity of isoprene emissions to changes in LAI and EF is demonstrated in the study, but could be quantified (in the abstract, and also in the text and conclusion when addressed), so that the abstract does not only reflect the general objectives of the study but also the important results (how much change related to LAI/EF, compared to temperature and radiation, min/max and mean for example).

- Section 2, page 6927, lines 14-26: the discussion about how reasonable it is to compare observation distribution of isoprene concentrations with calculated emission fluxes is confusing, mixing altogether different aspects of the problem, and not completely convincing, to me. I think it is really important to make this discussion clearer, as it justifies the approach used later on in the study. For example, lines 21-24: "isoprene was transported around 1°…., but that its mixing ratios had declined to around a third": what does that imply for the comparison? Which range of uncertainty?

- Section 3, page 6928, lines 8-9: which other gases and aerosols are calculated by

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MEGAN? Which MEGAN version and parameterisation have been used for this study?

- Section 3, page 6928, lines 20-23: for this study, did you use for PFT-specific emission factors or pre-determined standard EFs? Crops are mentioned several times in the paper but doesn't appear in the EF category: have they not been taken into account specifically for EF?

- Section 3.1, page 6929, lines 18-24: what is the MCDP LAIv datasets based on? Again crops are not mentioned for the PFT distribution: were they not considered?

- Section 3.1, page 6930, lines 15-16: I don't understand the sentence "High values of EF are given for some northern parts of this region, consistent with the LAIv fields": to me there's no reason why EF and LAI should vary the same way along the region studied, but is this linked to the way average values are calculated?

- Section 3.1, page 6931, lines 1-5: were nocturnal measurements also considered for this comparison? If transport, in this case, doesn't affect strongly isoprene concentrations, what about other parameters mentioned such as dilution and chemical transformation?

- Section 3.1, page 6931, line 10-11: which LAI is used by Muller et al. (2007) and how can you explain the differences between both studies?

- Section 3.1, page 6931, line 24-27: Shorten or cut the sentence to make it clearer. You mention processes or factors that could affect the comparison: which ones for example?

- Section 3.2: page 6932, line 10-15: "The EFs and the LAI clearly have the greatest impact. . .": as it is not very clear to differenciate different percentages from the figure, could you give min/max/mean (some of them) values for the impact of the different variables on emissions?

- Section 3.3, page 6932, line 21-27: What are the main differences between WRF and MM5 meteorological conditions for this region? As temperature and radiation

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are strong drivers in isoprene emissions, any change in meteorological conditions and model could strongly affect the emissions, and therefore make any emission change more difficult to understand. Why not using the same model to provide meteorological conditions at every different resolution, to by-pass the emission change related to meteorological model change? Couldn't WRF be run at higher resolution of MM5 at lower?

- Section 3.3, page 6934, lines 8-23: To add quantitative information, could you precise the total isoprene emissions for the whole region studied in the different simulations, for July and August?

Specific comments:

- Introduction page 6926, line 2: remove "the" in the sentence "a relatively clean environment in which to the study biogenic emissions"

- Section 2, page 6927, line 3: replace "5 research aircraft" by "5 research aircrafts"

- Section 2, page 6927, line 7: remove fullstop in "measured above the UK. Facility"

- Section 3, page 6928, line 17: replace "LAI values are needed for the months of the model simulation and the preceding month" by "LAI values are needed for the month of the model simulation and for the preceding month"

- Section 3, page 6929, line 5-6: replace "isoprene emissions estimates" by "isoprene emission estimates"

- Section 3.1, page 6931, line 11: replace "Further MEGAN gives slightly..;" by "Furthermore, MEGAN gives slightly. . ."

- Conclusion, page 6938, line 8: replace "provides insight into the model behaviour" by "provides insight on the model behaviour"

- Conclusion, page 6938, line 16: replace "which point to the need for improvements to the emission factors" by "which point out the need to improve the emission factors"

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Tables and Figures:

- Figure 2: right-hand of the figure replace “PTF” by “PFT”

- Figure 4: make sure the figure appears bigger when published

- Figure 9: To make it easier to analyse, could you add the flight track in the temperature and radiation figures as well?

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 6923, 2010.