**Atmospheric
Chemistry
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Discussions**

Interactive
Comment

Interactive comment on "Why are estimates of global isoprene emissions so similar (and why is this not so for monoterpenes)?" *by* A. Arneth et al.

A. Arneth et al.

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We would like to thank the reviewer for the encouraging comments on our manuscript and for the constructive suggestions to improve it. We will consider these carefully when preparing a revised version. The changes to be made will be summarized in a detailed letter to the editor. Specifically, the following will be addressed

RC: Principally, there is no overall summary of the findings in section 3, making it difficult to know what the most relevant conclusions are. Perhaps a table summarising each factor (e.g. driving data, values of EI/EM, etc) and the impact on the emissions would be useful.

AC: This is a very good suggestion, although unfortunately in reality difficult to fully address. When preparing this manuscript we realized that the information provided in the

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published literature in itself is not sufficient to quantitatively discuss the uncertainties in isoprene or monoterpene emission estimates that may be introduced by a certain factor. In fact, one of the outcomes of writing this paper was to initiate a simple intercomparison exercise to provide a better assessment of model-to-model uncertainty (currently under way). However, the point of the reviewer is well taken: some form of summary should be attempted. In the revised version we will look into providing a more systematic summary, likely in the form of a table that indicates the signs of changes in factors and emissions

RC: I don't think the last 2 paragraphs of the paper are really necessary.

AC: The paper is intended to be a review paper as much as an opinion paper. The last two paragraphs address mostly the latter objective. We hope to stimulate discussion in the emission and atmospheric modelling community with the paper and therefore would like to retain these paragraphs.

Scientific Questions RC: However, if the authors have access to measurements of isoprene emissions and the appropriate meteorological data for some locations, could they do a sensitivity test on the G95 algorithm? I haven't seen any estimation of the uncertainties in the constants required by the G95 algorithm (alpha, CL1, CL2 etc.). If the authors could obtain such estimates, they could easily vary the parameters within their uncertainty limits, singularly or multiply, and investigate the impact on the predicted emissions, and similarly for the driving data. The constants that are most critical in determining the magnitude of the modelled emissions could then be identified. It may be that the G95 algorithm will always produce similar emission estimates for a wide range of driving data, and that the emission estimates are controlled principally by the values of the constants. Such an analysis would be a very useful addition to this paper.

AC: We are not aware of a published systematic analysis of uncertainties in the parameters G95 algorithms. However, there is a limited number of studies published where

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the G95 model seemed to fit observations better when some of the parameters were varied. These could be used as a guide-line for a simulation experiment at a cool and warm (e.g., boreal and tropical) location calculations with each of the constants varied separately, as well as varying all of them at once. Results could be presented as a tabular overview, specifying effects on maximum and daily total emission rates, as well as possibly a simple Figure with simulated diurnal courses. We will look into this for the revision.

RC: For monoterpene emissions, which depend only on temperature, and exponentially, it is clear that a small change in temperature will have a large impact on projected emissions. Surely this is one of the main reasons why there is much greater variation in global monoterpene emission estimates than those for isoprene?

AC: The reviewer is right, and this aspect will be made clearer when preparing the revised version of the manuscript.

RC: Could the light dependence of isoprene emissions be the factor which most strongly controls the emissions? According to the G95 paper, sunlit leaves emit much more isoprene than shaded leaves. Is it possible that most models estimate the same amount of sunlit leaves, and so their isoprene emission estimates are also similar?

AC: This aspect surely contributes in parts to the observed simulation results but we do not think it to be the chief reason. The way that canopy light transfer is represented in models is too dissimilar (ranging from Beer's law to a relatively detailed treatment of canopy as a number of leaf layers) to assume a comparable amount of sunlit leaves in most models. More likely the light response provides a "cap" that dampens the emission temperature response to some degree. We will add a comment on this issue in the revised version.

RC: Finally, again from the G95 paper, many of the basal emission rates seem to increase with factors of 2, which strikes me as a little odd. Could the authors comment on this? Many of the basal emission rates used are the same for a variety of ecosystems,

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so it is not surprising that the number of PFTs used has little impact on the published emission estimates.

AC: The reviewer raises an important point. The relatively regular "spacing" of the emission capacities may look indeed odd, and we will clarify this aspect in the revision (also based on comments received from Alex Guenther): The emission factors in fact represent average emission categories and an emission factor of (for instance) 8 means that the literature values may range from 6 and 12. This simplifies the process of combining different emission factor databases with various levels of uncertainty and number of samples and simplifies the emission modelling process by allowing us to group sources into finite number of categories.

RC: Technical Corrections: AC: The reviewer has provided a very helpful list of minor technical corrections required in the manuscript to improve readability and clarity of our text. We will take care to take these into account.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 7017, 2008.

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