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Why are estimates of global terrestrial isoprene emissions so similar (and why is this not so for monoterpenes)?

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Abstract. Emissions of biogenic volatile organic compounds (BVOC) are a chief uncertainty in calculating the burdens of important atmospheric compounds like tropospheric ozone or secondary organic aerosol, reflecting either imperfect chemical oxidation mechanisms or unreliable emission estimates, or both. To provide a starting point for a more systematic discussion we review here global isoprene and monoterpene emission estimates to-date. We note a surprisingly small variation in the predictions of global isoprene emission rate that is in stark contrast with our lack of process understanding and the small number of observations for model parameterisation and evaluation. Most of the models are based on similar emission algorithms, using fixed values for the emission capacity of various plant functional types. In some cases, these values are very similar but differ substantially in other models. The similarities with regard to the global isoprene emission rate would suggest that the dominant parameters driving the ultimate global estimate, and thus the dominant determinant of model sensitivity, are the specific emission algorithm and isoprene emission capacity. But the models also differ broadly with regard to their representation of net primary productivity, method of biome coverage determination and climate data. Contrary to isoprene, monoterpene estimates show significantly larger model-to-model variation although variation in terms of leaf algorithm, emission capacities, the way of model upscaling, vegetation cover or climatology used in terpene models are comparable to those used for isoprene. From our summary of published studies there appears to be no evidence that the terrestrial modelling community has been any more successful in "resolving unknowns" in the mechanisms that control global isoprene emissions, compared to global monoterpene emissions. Rather, the proliferation of common parameterization schemes within a large variety of model platforms lends the illusion of convergence towards a common estimate of global isoprene emissions. This convergence might be used to provide optimism that the community has reached the "relief phase", the phase when sufficient process understanding and data for evaluation allows models' projections to converge, when applying a recently proposed concept. We argue that

there is no basis for this apparent relief phase. Rather, we urge modellers to be bolder in their analysis, and to draw attention to the fact that terrestrial emissions, particularly in the area of biome-specific emission capacities, are unknown rather than uncertain.

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