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Interactive comment on "The emission factor of volatile isoprenoids: caveats, model algorithms, response shapes and scaling" *by* Ü. Niinemets et al.

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I admit I wasn't certain what I would find when I went back to read the old papers but can now report that Guenther et al. JGR (1991) says that "The results described in this paper show that significant variability in hydrocarbon emission rates can be associated with both the measured rate at standard conditions (i.e. leaf-to-leaf variability and fluctuations with time) and changes in environmental conditions" and the associated emission factor paper (Guenther et al. 1994 Atmos Env) says that "Therefore, instead of assigning one emission rate to each genera, we defined discrete emission categories with a representative rate and a range of +/- 50%". There are studies that have

modeled emissions by representing emission factors as a range of values (for example Hanna et al. 2005, J. Geophys. Res., 110, D01302, doi:10.1029/2004JD004986) but Russ is right that this is rarely the case. It is not difficult to see why- there are dozens of uncertain parameters in an isoprene emission model alone and hundreds in an air quality model so this would require a prohibitively large number of simulations to represent all of these parameters (which interact in a non-linear manner) as a range in an air quality model simulation. In any case, I agree with Russ and Ulo that more effort is needed to accurately characterize the range associated with an emission factor.

Guenther et al. (1991) also states that "We focused our efforts on developing a leaf emission model with a strong foundation in the physiological processes of a leaf" and goes on to say that the algorithms attempt to describe the influence of temperature and light on electron transport. The result is an admittedly simple model but still "mechanistic", it just doesn't describe all of the mechanisms. In any case, my comments on the manuscript under review were not intended as arguments against mechanistic research. On the contrary, I strongly support research focused on developing a more mechanistic understanding of biogenic VOC emissions and also using this information to reduce the uncertainties associated with emission model estimates. Whether we prefer using leaf level enclosure measurements or above canopy flux measurements to parameterize emission factors, we can still advocate efforts to couple these emission factors to numerical algorithms that are based on robust descriptions of the mechanisms controlling variations in emissions. I consider the emission factor (a population average and a range) to be the component of the model for which we presently can't describe the emission variability (and so we use the measured population mean) and the emission activity algorithms are the part that we can describe (always with room for improvement). Future progress in emission modeling should include both improved emission factor estimates, based on measurements in various ecosystems, as well as mechanistic studies of the processes controlling emission variations. These advances, especially if they add computational complexity, should be accompanied by efforts to demonstrate that they actually result in more accurate emission estimates and not just

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added complexity.

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