

Interactive comment on “A novel approach to emission modelling of biogenic volatile organic compounds in Europe: improved seasonality and land-cover” by D. C. Oderbolz et al.

Anonymous Referee #1

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The authors investigate the use of different landcover products on modelled BVOC emissions from Europe, incl. the effects of applying correction factors in the BVOC algorithm to adjust for tree fractional cover and for the potential seasonal variation in emissions due to variable activity of the BVOC-forming enzymes. Detailed BVOC emission inventories are important for present-day air quality studies, since BVOC are involved in tropospheric O₃, OH and SOA chemistry. The authors do a thorough job in their inventory analysis, particularly regarding the attribution of emissions to countries or vegetation type. There is thus value in the work as it should be of interest for the air quality community. I do have, however, a number of issues with the manuscript that will need to be fixed if the paper is to be accepted at ACP.

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1) Contrary to what the title implies, the presented approach of modelling BVOC emissions is not novel. Basically, what is being done here is an adaptation of the fairly standard approach of combining a “Guenther-type” algorithm with a canopy model and vegetation cover map. In stating this, I do not want to belittle the presented work; the authors provide indeed a very detailed analysis of such an approach regarding some of the uncertainties (type of vegetation map, inclusion/exclusion of different multipliers in the algorithm, modifying some of the typically used multipliers, etc.) - but I do not judge the work as being really “novel” in a sense of providing fundamentally new conceptual ideas to the modelling of BVOC emissions.

2) While quite some effort is directed at examining some of the known uncertain aspects of BVOC emission inventories (see (1)) nothing is mentioned on leaf emission capacities (also called basal rates; the emission at standard environmental conditions). This is despite of emissions scaling linearly with the basal rates in emission models. Values of basic rates need to be assigned to plant species or vegetation cover types. And, the basal rates of species (let alone averages imposed on vegetation cover types) are basically unknown, for reasons related to the measurement techniques, genetic variability as well as a variety of plant physiological and environmental influences that are difficult to control when taking the measurement (see a set of papers by Niinemets et al. 2010 and 2011, for reviews on the subject).

3) Related to the basal rates, I am highly critical of the rather uncritical calculation of total emissions for BVOC emissions beyond isoprene and monoterpenes. The available observations, data-base and process understanding for sesquiterpenes and/or OVOC does not allow an even remotely robust assignment of basal rates. Table 3 & cited sources for the basal rates do clearly reflect this; except for a few tree species the basal rate for sesquiterpenes and OVOC are constant and no clear justification is being made on what observational basis these values were chosen. What is more, the shape of the temperature and/or light dependency of emissions for these BVOC is also not known and I wonder how strong the observational basis really is for the emission

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algorithms that were used for calculating varying sesquiterpene and OVOC emissions during the day and year.

I am perfectly aware of the needs of the air quality community to have variable BVOC emissions as input to their models, beyond isoprene and monoterpenes. In absence of sufficient observations and synthesis of leaf emission measurements, the BVOC modelling community has to resign to providing very poor emission estimates. But at the very least I expect the authors to be much more open to this fact. The numbers they simulate beyond isoprene and monoterpenes are close to pure guess-work. And to my view it remains questionable whether guess-work should be given such a prominent place in a scientific paper as it is in the current version of the ms.

4) The work presented is mainly a detailed inventory of European emissions. There is only relatively little room given to the analysis of processes and variability (restricted to section 3.3). Which makes me wonder whether as it stands at the moment, ACP is thus really the most appropriate outlet for the work. Despite my criticism voiced above, I think the work done by the authors is valuable (once the above aspects have been fixed), but perhaps a more air-quality-oriented journal would be the more appropriate place?

Niinemets, U. et al. (2010), Mild versus severe stress and BVOCs: thresholds, priming and consequences, *Trends Plant Sci.*, 15(3), 145-153.

Niinemets, U. et al. (2010), The emission factor of volatile isoprenoids: caveats, model algorithms, response shapes and scaling, *Biogeosciences*, 7, 1809-1832.

Niinemets, U., et al. (2011), Estimations of isoprenoid emission capacity from enclosure studies: measurements, data processing, quality and standardized measurement protocols, *Biogeosciences*, 8, 2209-2246.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 12, 19921, 2012.

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