

Interactive comment on “Impact of biogenic hydrocarbons on tropospheric chemistry: results from a global chemistry-climate model” by G. A. Folberth et al.

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Specific Comments:

1) Isoprene photochemical mechanism.

The isoprene photooxidation scheme, as is the entire photochemical scheme, is based originally on the work of F. Brocheton, published in his Ph.D. thesis. We agree that this work is not widely available, however, the entire photochemical mechanism has been reworked and more recent parameters have been included wherever available. Hence, our photochemical mechanism as presented in this paper, as any other photochemical mechanism that is used in current chemistry-climate models, constitutes a

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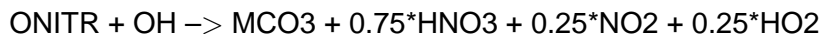
representation of the current knowledge derived by laboratory experiments as well as smog chamber experiments and field studies as far as it is open to the public. We have added a more thorough discussion to this effect in the model description section.

2) Hydroperoxides from isoprene

This point is well taken. We agree with the referee that this specific assumption will likely introduce a bias since hydroperoxides are soluble and, hence, are both subject to dry deposition and rainout. Furthermore, assumptions were made about both the photolytic decomposition and the reaction of XOOH with OH. On the other hand, our model distinguishes between methacrolein and methylvinyl ketone in the decomposition of isoprene, which is not the case, for instance, in the perhaps most developed condensed isoprene mechanism, MIM (Poeschl et al. 2000, von Kuhlmann et al., 2003a), in current global tropospheric chemistry models which constitutes a significant simplification as well. Specifically, the isoprene-O₂ reaction with HO₂ forms XOOH as well as MVK and MACR, the latter two species undergoing further decomposition with their own specific photochemical lifetimes. The bottom line seems to be that many aspects of the photochemistry and global impact of isoprene, in addition to its biological sources and physical sinks, still are highly elusive and much work is to be done. We have included a discussion of this uncertainty in the text.

3) Hydroxyalkyl nitrates

Actually, the lumped reactive organic nitrate class of species does produce reactive nitrogen in our mechanism, both via photolysis (j26) and thermochemical reactions (k175 and k176). Unfortunately, there is a typing error in the reaction rate table and we are very grateful to the referee for having pointed out this mistake. The correct form of these chemical equations in the model are:

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ONITR + NO₃ → MCO₃ + 0.40*HNO₃ + 0.80*NO₂ + 0.80*NO

Table 3 has been corrected accordingly. We apologize for this carelessness.

4) Indirect global warming potential of organic compounds

We would like to point out that we actually calculate the radiative forcing due to changes in ozone and not the Global Warming Potential (GWP). An attempt to quantify the indirect GWP of a number of organic compounds, including isoprene, has already been undertaken by Collins et al. (Climatic Change, Vol. 52, pp. 453-479, 2002.) In this work the authors have shown convincingly that organic compounds possess a non-negligible GWP and also presented estimates of their magnitude. On the other hand, their work required numerous runs of their chemistry climate model over a model time period of several years since the e-folding time of excess methane produced in response to a VOC perturbation extends well over a decade. Even though this specific issues is not yet well understood, an extended discussion is beyond the scope of the paper at hand and would be merely more than a repetition of previous work, even though this could help to confirm and extend to some degree the work of Collins et al. Hence, we would like to address this specific question in more detail in a separate study.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 10517, 2005.

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