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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of climate variability and land use changes on global biogenic volatile organic compound emissions" *by* J. Lathière et al.

Anonymous Referee #2

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Review of paper "Impact of climate variability and land use changes on global biogenic volatile organic compound emissions." by J. Lathiere et al.

Overview:

This paper describes the estimation of the emission fluxes of a number of important species from vegetation. The emission fluxes were estimated using a global vegetation model forced with appropriate climate data. Most of these types of studies focus on isoprene and monoterpenes, but the authors have also included acetone, methanol, formic and acetic acids, which has not been done in an explicit way before. The authors

have also examined the potential impact of land use changes on the emissions of these compounds, which is an important first. They highlight the important fact that, on a global scale, the changes in emission fluxes resulting from land use changes are small, but are very important on regional scales. This paper should be published, but I would like the points and corrections given below to be considered beforehand.

General comments:

The authors include the effect of CO2 on photosynthesis, but have not considered the effect of CO2 on isoprene emissions. Some studies (e.g. Rosenstiel et al., Nature, Vol.421, pp.256-259, 2003) show that isoprene emissions decrease with increasing CO2. Could the authors estimate how much of an impact the change in CO2 they used for their simulation (1983-1995) might have on their calculated isoprene emissions?

The authors model emissions of methanol, yet they have not referred to the paper on the global methanol cycle by I.E. Galbally, and W. Kirstine, "The production of methanol by flowering plants and the global cycle of methanol", J. Atmos. Chem., Vol.43, No.3, pp.195-229, 2002. I would suggest the authors include a reference to this paper, and compare the results with their own estimate of the emission flux.

The authors calculate emissions of formic and acetic acid, yet do not discuss the modelled fluxes anywhere in the paper. Are they significant? A quick estimation of the yield of formic acid from the reactions of isoprene and methacrolein with ozone, using the mechanism of Poschl et al. [J. Atmos. Chem., Vol.37, pp.29-52, 2000] and some modelled chemical fluxes gives about 6 TgC / yr, which is four times the direct emission modelled in this paper. The authors should discuss the formic/acetic acid emission fluxes, or remove them from the paper.

Section 4. The authors have compared their estimated VOC emissions with the southern oscillation index (SOI). However, the correlation coefficients obtained are very small, and indicate that changes in the SOI have little if any impact on the VOC emissions. Much of this section, and figures 4 and 5 could be removed from the paper.

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Interactive Comment

Specific comments:

Abstract, line 1. Change 'is incorporated' to 'has been incorporated'.

p.10615, lines 7-8. Change to "Global VOC emissions by vegetation are ..."

p.10616, line 8. "... 30 and 270 Tg/yr." Should the units be TgC / yr? If not, how did the authors calculate these masses ?

p.10617, line 12. Could these numbers be converted to TgC/yr to be consistent with other emission values quoted in this paper ?

p.10628, lines 10-11. "... number of grasses species emitter..." needs rephrasing, "number of species of grass that emit isoprene..."

p.10628, line 27. Change to "Considering the difficulty in estimating leaf temperature..."

p.10630, lines 17-20. Sentence is very long and needs rephrasing.

p.10631, lines 19-23. Rephrase sentence. "In the tropical regions with low precipitation, such as the southern part of Brazil, the LAI is quite small in the control run (1 - 3 m2/m2). Deforestation leads to a small increase in LAI in this region between 1 and 1.5 m2/m2. In significant parts of Amazonia, Central Africa and Indonesia, a large decrease in LAI in the range 2 - 4.5 m2/m2 is modelled."

p.10632, lines 11-15. Rephrase sentence. "A decrease in zonal mean methanol emissions is also modelled north of the equator in March, and south of the equator in September (...). This reduction in methanol emissions is due to the large decrease in LAI in these regions, and occurs despite the significantly larger methanol emission factors of crops compared to tropical trees (Table 1)."

p.10633, lines 12-14. Are these fluxes the wrong way round? They show that the methanol emissions increase, not decrease.

p.10638, lines 8-13. Split this sentence into two.

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Figures 5 and 7 seem to be "squashed" horizontally, and are difficult to interpret; expanding them in the horizontal direction would make them clearer.

The different vertical bars for each region in Figure 6 are almost impossible to distinguish. Could this figure be redrawn in colour?

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 10613, 2005.