

Interactive comment on “Why are estimates of global isoprene emissions so similar (and why is this not so for monoterpenes)?” by A. Arneth et al.

Anonymous Referee #2

Received and published: 16 April 2008

General Comments:

I am very pleased to have seen this paper. There are many estimates of global and regional emissions of isoprene and monoterpenes, yet no-one until now has examined all these estimates, and attempted to understand why they are all so similar (in the case of isoprene). The authors have examined different approaches (e.g., prescribed vs modelled vegetation, 'top down' vs 'bottom up' estimates), and compared two different models of isoprene emissions. They have also examined in detail the different processes and drivers that could impact on estimates of isoprene and monoterpene emissions. This paper definitely needs publishing, but does need some revisions beforehand. Principally, there is no overall summary of the findings in section 3, making it difficult to know what the most relevant conclusions are. Perhaps a table summarising

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each factor (e.g. driving data, values of EI/EM, etc) and the impact on the emissions would be useful. I don't think the last 2 paragraphs of the paper are really necessary.

Scientific Questions

In the Abstract, the authors state that the likely reason for the similar estimates of isoprene emissions is the use of the same algorithm (the G95 model). I'm sure this is correct. However, if the authors have access to measurements of isoprene emissions and the appropriate meteorological data for some locations, could they do a sensitivity test on the G95 algorithm? I haven't seen any estimation of the uncertainties in the constants required by the G95 algorithm (alpha, CL1, CL2 etc.). If the authors could obtain such estimates, they could easily vary the parameters within their uncertainty limits, singularly or multiply, and investigate the impact on the predicted emissions, and similarly for the driving data. The constants that are most critical in determining the magnitude of the modelled emissions could then be identified. It may be that the G95 algorithm will always produce similar emission estimates for a wide range of driving data, and that the emission estimates are controlled principally by the values of the constants. Such an analysis would be a very useful addition to this paper.

For monoterpene emissions, which depend only on temperature, and exponentially, it is clear that a small change in temperature will have a large impact on projected emissions. Surely this is one of the main reasons why there is much greater variation in global monoterpene emission estimates than those for isoprene?

Could the light dependence of isoprene emissions be the factor which most strongly controls the emissions? According to the G95 paper, sunlit leaves emit much more isoprene than shaded leaves. Is it possible that most models estimate the same amount of sunlit leaves, and so their isoprene emission estimates are also similar?

Finally, again from the G95 paper, many of the basal emission rates seem to increase with factors of 2, which strikes me as a little odd. Could the authors comment on this? Many of the basal emission rates used are the same for a variety of ecosystems, so it is

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not surprising that the number of PFTs used has little impact on the published emission estimates.

Technical Corrections:

Author name 'Lathiere' in the text. The accent on the first 'e' is often missing.

Page 7018, line 28, change to "allows models' projections to converge"

Page 7019, line 2, change to "their analysis, and to draw"

lines 13-16 reads confused. Do the authors mean: "... ozone production. Such reactions require the presence of NO_x. When the levels of NO_x are large, ozone production occurs. Conversely, when NO_x levels are small, ozone can react directly with BVOCs and their oxidation products, and so reduce ozone levels."

N.B. If NO_x levels are very high, ozone production is inhibited owing to removal of NO_x by reaction with OH directly to form HNO₃ which is readily removed; this loss route is not dependent on BVOCs.

Page 7020, line 16. Remove word 'notably'.

line 21, change to "considered to be an important"

line 24, change to "and while the SOA yield"

Page 7021, line 2, change to "dynamics of surface"

line 17, delete word modelled.

line 18, change to "mechanisms within models, although"

line 25, change to "isoprene emissions. Such a consensus would"

Page 7023, Eq.1 Is the 'X' a multiplication symbol?

line 8, change to "referenced to a standard"

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line 9, change units to "umol photons m⁻² s⁻¹"

line 10, change to "leaf temperature and R is the ideal gas constant"

Page 7024, line 23, change to "area basis (the MEGAN model"

Page 7025, line 16, change to "Arneeth et al. (2007b; 2008)."

Page 7026, lines 5-6, change to "residence times at temperatures T1 and T1-10 C respectively.

Page 7027, line 8, delete 'e.g.'

lines 22-24, change to "closely linked, and they are ... emissions." Delete rest of sentence.

Page 7028, line 9, change to "in the areas of important"

line 16, change to "models to variations in the"

Page 7029, line 13, delete comma after word photosynthesis.

Page 7030, line 8, change to "have since been updated, based .. that have become available"

line 11. Or perhaps, measurements are simply non-existent.

line 20, change to "activity, while the "

Page 7031, line 23, change to "potentials to C3 and C4 grasses"

line 24, change to "these two PFTs. They state that"

line 25, delete word relative. Reference to Nail et al is incomplete.

Page 7032, line 2, change to "on the estimation of global"

Page 7032, lines 2-5, sentence beginning "One reason that". I don't understand this sentence.

lines 11-12. Do the abbreviations "240h and 24h temperature" refer to average temperatures over this period? It is implied, but not stated that this is so.

line 15. A reference is needed for the CRU climatology. There are many different climatologies available on the CRU web site. I suspect many readers of the paper won't know what is meant by CRU either.

Page 7033, line 7, change to "emit significant amounts of isoprene"

line 9, delete "of isoprene emission"

line 14, change to "monoterpene emissions"

line 18, change to "Europe differ by a "

Page 7034, line 25. Change to "emissions only slightly in one study"

line 28, change to "critical step is the conversion of the incident"

Page 7035, line 3, change to "fQ=0.35"

line 10, change to "emission rates on"

line 21, change to "1981-2000, if the CO₂"

Page 7036, line 9, change to "less so than the"

line 12, change to "variations"

line 13, change to "covering 4 to 80 years"

Page 7037, line 4, change to "Including the seasonality"

line 6, change to "regional scale emissions are"

Page 7038, lines 9-10, change to "isoprene emissions derived ... HCHO measurements are"

line 11, change to "but there are also some"

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Page 7040, line 5, delete words "much rather"

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 7017, 2008.

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8, S1687–S1692, 2008

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