**Atmospheric
Chemistry
and Physics
Discussions**

Interactive
Comment

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 #1

Received and published: 22 May 2008

In this manuscript, the authors present a much needed review of how global biogenic isoprene and monoterpene emissions are determined, with the view to answer the question posed in their title. They make some clear conclusions and (necessarily) bold recommendations for the terrestrial modeling community. The authors describe and analyze several published studies that have reported global estimates of isoprene and monoterpenes, covering 3 different emission algorithms as well as a study using satellite data to provide a top-down isoprene emission estimate. With the proliferation of atmospheric chemisty model studies it is important that modelers have the information to critically review how emissions are parameterized, especially if the same emission algorithms are used to conduct future or past atmosphere experiments. Therefore, I welcome the appearance of this manuscipt and would be happy to recommend its

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publication after the points below are addressed.

Main scientific points:

With regards to the emission capacities (Section 3.2): Is the seasonal cycle of the emissions more significantly affected than the total? This would have consequences for atmospheric chemistry, if it changes the coupling between BVOC emissions and (e.g.) biomass burning. This point also applies throughout the discussion in Section 3, and perhaps especially to 3.7 where the authors comment on the effect of leaf growth stage and the seasonality of regional emissions.

At the beginning of Section 3, the authors mention that it is unfortunate that LAI, GPP and NPP are not reported in model studies, yet they do not report these terms here. Is it be possible to generate a figure/table that illustrates the relationship of isoprene/monoterpene emissions with these quantities from data that they have available?

Also at the start of Section 3, the authors mention that 3 estimates lie outside +/- 1SD from the model mean. Can the authors offer any explanation as to why these studies in particular lie outside of the specified range? One of these studies (Valdes et al., 2005) is an estimate of PI isoprene emissions. As this paper is addressing present day emissions, what is the rationale for including this study (and that of Kaplan et al., 2006)? Lathiere et al. (2005) also includes a PI emission estimate (albeit with static vegetation and present day climate).

Would it be possible to summarize the global E_i and E_m estimates in Table 1 graphically? Perhaps a plot color-coded by the five groups of estimates?

Technical and typographical corrections:

Throughout:

- Where multiple citations appear, they not consistently ordered alphabetically or temporally.

S2895

- The paragraphs are quite long in many cases. It would improve the readability of the manuscript if the longer ones were split up (some highlighted below).

p7018

line 12 - "The models also differ..."

p7019

The ennumerated list of isoprene/monoterpene impacts is not introduced as such - I would recommend to just write as continuous prose.

line 2 - remove quotation marks from "relief"

line 2 - "their analysis, and draw..."

line 7 - "biogenic volatile organic compounds" is what BVOC stands for

line 8 - "recognised" (else change all similar words to have 'z')

line 14 - reactions also require sunlight to produce O3

line 16 - low BVOC/NOx ratios reduce ozone production mainly due to the NO2+OH reaction and is not a result of BVOC chemistry

line 16 - replace "consume O3" with something like "result in net ozone destruction"

line 24 - comma after "Velikova et al., 2005)"

line 26 - replace "are important constraints on... OH" with something like "can have an imporant influence on". OH is 'constrained' by many processes, e.g. NOx, humidity, temperature, O3 concentration. BVOC chemistry will only dominate OH levels close to relatively clean source regions; the chemistry may result in OH increases in more polluted areas.

p7020

line 1 - delete extra space after "OH" before the comma

line 4-9 - "Since biochemical..." This line is very long and could perhaps be split into 2 sentences.

line 10 - comma after "scales"

line 13 - delete "over this period"

line 15 - comma after "climate"

line 16 - delete "notably"

line 19 - "SOA affects..." (else change definition to be secondary organic aerosols)

line 23 - delete "However"; comma after "recently"

line 24 - full stop after "particles", start next sentence from "While..."

line 26 - "expected" is too strong a word. This assertion is based on one modeling study, which had to make several assumptions about the SOA chemistry of isoprene. Whilst it may indeed be the case that this proves correct, I would suggest using "might"/"may"

p7021

line 19 - "learned" is not really the word to use here. Atmospheric chemistry models have evolved significantly since the IPCC TAR, including more detailed treatment of NMVOC chemistry for instance (e.g. see discussion in Wu et al. [2007], JGR, 112, D05302, doi:10.1029/2006JD007801). Therefore, I would suggest using "evolved".

p7022

line 16 - comma after "activity"

line 17 - comma after "(NPP)"

p7023

line 22 - "...many conifers." Is there a reference for this?

p7024

line 23 - change to "(the MEGAN model..."

line 25 - delete "also"

p7025

line 1 - change to "T and Q, including standard LAI, ..."

line 16 - full stop after "Eq. (2))", then new sentence "Further details are provided in Arneth et al. (2007b; 2008)"

line 25 - change "as emitting" to 'to emit'

line 25 - put "in an 'isoprene-like' fashion" in brackets

p7026

line 8 - change "by using inversions of remotely sensed properties" to "by using satellite remote sensing".

line 11 - GOME is not defined until section 3.8

p7027

line 2 - comma ater "isoprene"

line 5 - new sentence for "Three of the 14..."

line 15 - split paragraph at "Curiously..."

line 19 - Brackets for "(37Tg C a-1)"

p7029

This is a long paragraph - can it be split?

line 21 - citation required, e.g. Rosensteil et al. (2003) or Possell et al. (2004/5)

p7030

The second paragraph is very long. Also, I think it would be clearer to sumarize the emission capacity information from different studies in a table.

line 7 - commas and plural: "...for which, by the mid 1990s, field..."

p7031

line 14 - The LPJ-GUESS model has not been introduced or defined. This could be done is Section 2 (IV).

p7032

line 1-5 - I'm not quite sure what the authors are getting at here - are they saying that people tune emission capacities to reach a particular global total?

line 15-16 - the clause beginning "since they will lead...." could be written more clearly.

line 20 - Split into 2 paragraphs from "On the global scale..."

p7033

line 11-12 - "for instance...." This should be put in brackets to make the sentence easier to read

line 26 - comma after "climate"

p7034

line 4 - Split into 2 paragraphs at "Overall..."

line 14 - Comma after "cover"

line 15 - Full stop after "area" and change "which" to "This"

line 17 - Change "were thus discussed" to "have been discussed"

line 22 - Change to "Unsurprisingly, due to the dependence of isoprene emission on

light, the total amount of radiation absorbed by the canopy has also been found to have a..."

line 25 - Change to "Some studies have shown that the number of horizontal layers in the canopy only has a small influence on the emissions (G95)" (Do the authors mean vertical levels?)

line 25 - The authors state 'studies' but only cite G95.

line 27 - comma after "scaling"

p7035

line 21 - comma after "1981-2000"

line 25 - comma after "leaf" would make the sentence read more clearly

p7036

line 14 - what is the % range of th LPJ-GUESS 1981-2000 simulation about the mean (for comparison to the other studies)?

line 16 - comma after "emissions"

line 16 - change "that" to "their effect"

p7037

line 14 - Reference for GOME?

p7038

line 10 - "broadly consistent with the current understanding..." As this manuscript is reflecting on the whether there is any understanding of isoprene emission currently, perhaps this sentence should say "consistent with the estimated emissions of G95 (etc)"

line 14 - BEIS2 is undefined

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p7040

line 17 - commas: "Adopting her views, that were developed....modelling,"

line 18 - change to "modelling of isoprene emissions is in the illusion phase: lack of..."

line 25 - I would argue that monoterpenes are not seen of "lesser importance" to chemistry, just that isoprene is more important for gas-phase chemistry and many models still lack parameterizations for monoterpene/SOA chemistry.

p7041

line 2-8 - This is a very long sentence that could be split into 2-3 sentences.

References

- Journal issue numbers are provided inconsistently - leave them out altogether (?)

p7042

line 23 - The display of the authors of this reference is wrong

p7043

line 25 - Capitilization needed in this reference (e.g. Intergovernmental Panel on Climate Change)

Table 1

Many of the abbreviations and acronyms are not defined: SiB, CTM, ISAM, MODIS, CRU, Sea-WiFS, GMOA, GEOS-STRAT

The authors need not define all the model algorithms, but they could make it clear that many of the entries in columns 5 and 6 are model names, to distinguish them from data sets (e.g. CRU)

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

S2901