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Atmospheric Chemistry and Physics Discussions

Interactive comment on "How have both cultivation and warming influenced annual global isoprene and monoterpene emissions since the preindustrial era?" *by* K. Tanaka et al.

Anonymous Referee #2

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SYNOPSIS

The paper examines the impact of climate change and cropland expansion on the global emission magnitude of isoprene and several (mono- and sesqui)terpene species between the pre-industrial era (1850s) and present-day (2000s). Aspects of climate change investigated include surface air temperature and direct solar radiation, arguably the most important parameters in the MEGAN BVOC emission model applied in this study. Other important factors (water stress, fertilization and emission impacts of CO2, increased diffuse radiation fraction in deep canopies) are not considered in this study but potential impacts to this study are examined in detail in the Discussions section.

GENERAL COMMENTS

Overall, I have very little to comment on this study. It appears well designed and executed and it is presented in a clear and concise way. Supporting information and figures are well designed and DO support the understanding of the findings (I wish this would always be the case). The science appears sound and methods and tools aplied seem appropriate and up to the task. Unceratinties are discussed, albeit mostly qualitatively. The results are interesting and useful and fit for publication in ACP.

Thus, I recommend publication after correction of some minor technical issues that I will outline below.

SPECIFIC COMMENTS:

p16517l4: The authors claim in the introductions that SOA "absorb solar radition". This is slightly missleading in that SOA do indeed absorb SW and LW radiation but to a far lesser extend than black carbon aerosl (SOA are refferred to as "brown aerosol"). The important difference lies in the fact that BC aerosols are climate warming agents (short-term climate forcers) with a single scattering albedo of 0.4 to 0.5 whereas SOA have a single scattering albedo around 0.95 0.98 and are thus generally considered to have a negative forcing (i.e., SOA are cooling the atmosphere). It would be good to be a bit more rigorous on these details to avoid confusion for the general reader.

p16523l20: To help the reader it may be good to restate the definition of LAIc and LAIp at this point. Maybe just "...vegetation type and cultivation in a grid, using LAIc (current month) and LAIp (previous month). So the reader does not have to go back to the previous page(s) to the original definition.

p16524l25: averaging over all monoterpene species is maybe not the best way of combining all species into one lambda_L(y) because the one extraordianry high value for ocimene may be overemphasised in the results. Other options are using the median or calculating an epsilon-weighted lambada_L(y) which may avoid overemphasising

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one species. Some sensitivity analysis could show whether this is really and issue or not. This is more a comment on my side than a request for change.

p16525l10-14: please rephrase this sentense and maybe even split up into two because I cannot make head or tale of it.

p16525l24: replace "east-northward" by "northeastward"

p16533l4: there is also a paper by C.L. Heald et al. investigating the impact of CO2 and worthwhile mentioning:

Response of isoprene emission to ambient CO2 changes and implications for global budgets Author(s): Heald Colette L.; Wilkinson Michael J.; Monson Russell K.; et al. Source: GLOBAL CHANGE BIOLOGY Volume: 15 Issue: 5 Pages: 1127-1140 DOI: 10.1111/j.1365-2486.2008.01802.x Published: MAY 2009

p16535l13: citation "Geron et al., 2006" in the text is actually "Geron et al., 2002" in the references

p16537l27: reference "Badan et al." does not seem to appear in the text

p16544l5: reference "Staudt et al." does not seem to appear in the text

p16546Table1: there are several problems here:

1) it is not clear whether the units are mg m-2 h-1 or mgC m-2 h-1

2) if the units are mg m-2 h-1 emission factors cannot be summed up easily because of differing molecular masses.

3) isoprne emission factors are given as mg m-2 h-1 while terpene emission factors are given as 1.0E-03 mg m-2 h-1 which leads to exceedingly high totals for the emission factors. Given that the global total emission magnitudes are reasonable for all species I presume the problem exists only in this table.

i reccommend using ngC m-2 h-1 for ALL (including isoprene) in which case totals can

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be calculated and have a meaning.

p16552Figure6: in figures a and b the lines are actually red and BLUE (and not green as stated in the caption). Furthermore, in figures c and d most of the lines are refurred to as being "dashed" while they in fact appear as "solid". either change line style or (more simple) the description in the caption

Otherwise OK.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 16515, 2012.