Atmos. Chem. Phys. Discuss., 8, S8437–S8440, 2008
www.atmos-chem-phys-discuss.net/8/S8437/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evaluation of the global oceanic isoprene source and its impacts on marine organic carbon aerosol" *by* S. R. Arnold et al.

S. Shaw

sshaw@epri.com

Received and published: 22 October 2008

General Comments

This manuscript reports estimates of isoprene fluxes for the global oceans that were determined by combining laboratory measurements of isoprene production by phytoplankton (to be reported in detail in a future manuscript) with satellite observations of oceanic phytoplankton and chlorophyll. The advances over previous work on this topic are 1) the use of satellite maps of several phytoplankton functional types (PFT), 2) incorporation of additional laboratory data on isoprene production rate which suggest a variable relationship between isoprene production and cellular chlorophyll content, and

3) application of probability distribution functions (PDFs) of the laboratory production rates (rather than mean values) to the satellite chlorophyll and PFT fields to represent variability in ambient values.

The estimated fluxes were then input into the GEOS-Chem atmospheric chemistry model for comparison of modeled isoprene concentrations with measured ambient concentrations. The potential contribution of oceanic isoprene to organic carbon aerosol of oceanic origin was also estimated.

In general, the work reported here is very interesting, was performed thoughtfully and carefully, incorporates some of the best currently known information, and significantly advances the field. In particular, the addition of PFT to the flux calculations is an important and necessary next step, and the use of PDFs is an ingenious way to address the expected large variability in situ from a variety of species and growth conditions. Reasonable assumptions were made in the estimation of SOA resulting from ocean emissions of isoprene. This paper is very worthy of publication, although I suggest a few minor additions.

Specific Comments

A variable relationship between isoprene production and chlorophyll-a is a reasonable possibility, as few phytoplankton species have as yet been tested for their production rates. I look forward to seeing the upcoming manuscript which reports these experiments and additional data. Despite their inclusion in a separate manuscript, it is important that the number of replicates and experimental series are reported in the current manuscript so the reader can evaluate their repeatability. (Perhaps as additional columns in Table 1?) This is particularly important here as the production rates are statistically combined into PDFs for further use.

A listing of other common PFT that are not included in the estimates due to the available satellite products could be included for those readers not familiar with phytoplankton types. Mention of any of these whose production rates have been measured would

ACPD

8, S8437–S8440, 2008

also be helpful.

P16449, L24: How are the isoprene production rates related to chlorophyll-a concentration (e.g. linear, otherwise)? Please state briefly in advance of the separate manuscript.

Combining the measured production rates into PDFs is a creative idea, and one that should be used in future work as additional production rate data becomes available. An interesting possibility would be to include additional published production rate data into a second set of PDFs for each PFT as a comparison case to what is already reported here. Several papers have been published in the last few years which may or may not be useful for this purpose depending on the units of the reported production rates. This could be useful as a sensitivity study for the ensemble simulation and flux calculation. It would also be a simple way to increase the robustness of the values within each PFT.

Please mention if the general shapes (e.g. half-width) of the PDFs within each PFT are dramatically different from each other.

In my opinion, the factor of 6 between the bottom-up and top-down estimates is not a large difference given the lack of species tested for isoprene production, and could easily be due to that reason alone. For example, the differences between reported production rates from cyanobacteria for different growth conditions are of that same order (P16450, L2). It is not clear which type of laboratory growth conditions, if any, best estimate in situ production rates. Production rates from same species at different light and temperature levels varied by a factor of 4 at least (Shaw et al 2003), and that was just in one of several types of culturing apparatus that could be used. Factors of more than 10 would not be surprising as we do not yet know the biological reason for isoprene production by phytoplankton, and thus we can not be sure we are measuring what and how we should be measuring. The additional reasons mentioned in the manuscript (e.g. limited ambient data, difficulties with satellite data) are also possible very important contributors.

Capitalize and italicize proper species names (e.g. *Skeletonema sp.*, *Emiliania huxleyi*)

ACPD

8, S8437–S8440, 2008

P16461, L5: Why is the secondary formation of OC from other precursors (volatile or semi-volatile) not a possibility?

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 16445, 2008.

ACPD

8, S8437–S8440, 2008

Interactive Comment