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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A new physically-based quantification of isoprene and primary organic aerosol emissions from the world's oceans" *by* B. Gantt et al.

Anonymous Referee #2

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General comments

The present manuscript aims to derive the global oceanic budget of isoprene (based on new laboratory isoprene emisions rate determination) and its impact on the OC global budget. This subject is of importance because, as pointed out by the authors, although minor at the global scale and on a yearly basis, the marine source of isoprene can have regionally an impact on the secondary formed OC. The paper presents a complete study which includes new laboratory isoprene emissions, use of phytoplankton distribution satellite derived data to globalise these emissions and finally an estimation of primary and secondary organic carbon. The paper is clearly written and the different

steps used for the global source determination are generally well explained. However, as papers have been published very recently on very similar subjects (see Spracklen et al. (2008), Roelofs et al. (2008) and especially Arnold et al., ACP, 2009), it is suggested that the current manuscript should provide a thoroughful comparison with these papers before publication in ACP (see main comments).

Main comments

A very recent paper (Arnold et al., ACP, 2009) also aims to derive a global budget of oceanic isoprene and its impact on organic carbon (OC). Although this paper by Arnold et al. is quoted in the present manuscript, similarities and discrepancies are only superficially commented. The derived emissions (from scaled up laboratory emissions) is similar to the bottom-up approach of Arnold et al. (using a different dataset of new laboratory emisions but a similar way to scale up using an approach based on remote sensing- one of the method used -PHYSAT- is the same for both papers). Therefore each step of the global source estimation (the emission rates for the different phytoplankton groups from laboratory experiments, the PHYSAT phytoplankton distribution -which should be the same if the same version of the method is used- and finally the resulting global isoprene source) should be compared in more details and carefully discussed. Improvments should be clearly pointed out (ex separation between WIOC and WSOC). The global source of OC is estimated as well in this paper (20 TgC/yr) and compared in table 1 with previous estimates but almost no comment is made on the significant differences observed between these results. As the present paper comes after the study of Spracklen et al. (2008) and Roelofs et al. (2008) it should gives the reader the necessary information to compare the different approaches and results.

The global oceanic source of isoprene is given as ranging from 0.31 to 1.09 Tg C yr-1 and is 'within the range of estimates of 0.19-1.68 TGC yr-1 proposed by previous studies'. Examining the budget proposed by Arnold et al. (from 0.31 Tg yr-1 with the 'bottom-up' approach and 1.9 Tg yr-1 with the 'top-down' approach), it seems that the statement would be right if the same units were used but once it is Tg C yr-1 and once

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9, S961–S964, 2009

Tg yr-1. Please clarify.

P2939 Studies have shown that there is a significant variability of isoprene emission rates from phytoplankton from a same group (see Table 1 from Arnold et al. 2009). Therefore values given here as 'emission factors' representative for diatoms, coccolitophorids and which are based on measurements on a limited number of species) are certainly associated with a significant uncertainty which should be given/estimated. This would help to know if the difference of emission factors between the phytoplankton groups is significant or not.

P2936 Terpenes can as well be emitted by phytoplankton (see Yassaa et al., 2008, Colomb et al. 2009)

Section 2.1 Please explain how the studied species were chosen (Three diatoms species were studied although this specific group is only dominant in certain regions as high latitudes and upwelling regions)

P2938 L29 What was the background ? (value and uncertainty) What were the typical mixing ratios measured? Were they well above the detection limit?

P2939L23 The estimation of the isoprene production (emission factor) in function of the light intensity is not completely convincing to me. It is almost uniquely base on the diatoms variations (considering the uncertainty on the first point for coccolitophorid the isoprene production could be as well independant of the light intensity above a certain value).

Section 2.3. The scale-up of the isoprene emissions is based on two different remote sensing methods which according to the authors show 'similar spatial and seasonal distribution of phytoplankton speciation'. A figure would help to better identify similaritites and differences of the two methods. Then it is stated that 'the PHYSAT model is used as a default for the assesments of the global marine-isoprene emissions', why ? Finally it is said that sensitivity calculations using NTD method have been performed

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9, S961–S964, 2009

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to estimate how distinct methods and the uncertainties in phytoplankton composition can affect results for total global oceanic emissions of isoprene;this is in contradiction with the previous statement that both methods show 'similar spatial and seasonal distribution of phytoplankton speciation'. If these two approaches are used for sensitivity analyses purposes, then a more detailed discussion on PHYSAT and NTD methods should be provided.

P2948 Figure 7 It is somehow surprising to observe on figure 7 almost no seasonality in this 'snapshot' midday impact. Does it mean that the seasonality of isoprene emissions play almost no role on the midday production? If so, it contredicts the statement 'figure 7 highlights the need for improved assessments of the marine isoprene emissions'

Technical comments

Section 2 Where were the laboratory experiments performed ?

P2941 L 5 'Photosynthetically'

Section 3.1 is named 'global isoprene emissions' and begins with 'global production of SOA' It should be clearer to focuss first on the isoprene emissions (figure and text)

P2950 L 7 'performed'

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 2933, 2009.

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9, S961–S964, 2009