

## ***Interactive comment on “A numerical evaluation of global oceanic emissions of $\alpha$ -pinene and isoprene” by G. Luo and F. Yu***

**G. Luo and F. Yu**

ganluo@asrc.cestm.albany.edu

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The authors thank the referee for the helpful comments. Our responses to the comments are given below.

### Major Comments

*1. Section 1 2: no information is provided on assumed sizes for oceanic OC in previous studies. Presumably this would have important implications for mass emissions (if say, a fraction were in the coarse mode). A sentence detailing this would be helpful.*

The present manuscript focuses on the gaseous (or secondary) OC emissions from ocean. OC mass emission estimations reported in some previous studies

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include primary OC particle emission. The sizes of these primary OC particles, which determine the particle number flux for a given mass flux, are unclear and remain to be investigated. We have pointed this out in the revised manuscript.

*2. Page 20726, line 25 and page 20730 line 17: “full organic chemistry” seems like a bit of an overstatement. Global models include only simplified descriptions of chemistry. Please be specific here about the mechanism used, and/or the relevant chemical processes included for your study.*

We used “full organic chemistry” in order to differentiate our online organic chemistry simulation with offline organic chemistry parameterization. The “full chemistry” simulation is a choice in GEOS-Chem chemistry checklist which represents the NO<sub>x</sub>–O<sub>x</sub>–Hydrocarbon–aerosol simulation with SMVGear solver. To avoid the misunderstanding, we use “online organic chemistry” in the revised manuscript instead of “full organic chemistry”. The specific chemistry mechanisms of  $\alpha$ -pinene and isoprene in GEOS-Chem v8-2-2 have also been provided in the supplement.

*3. Section 3: There was no discussion here of the scales of variability in the observed VOC concentrations. It seems that both concentrations, as well as driving factors such as winds, chl-a, etc. could vary substantially on the 4x5 model grid scale used here. Please comment.*

The variations in the observed VOC concentrations have been discussed by Yassaa et al. (2008) and can be roughly seen from the scattering of the data points given in Fig. 1a of this paper. As shown in Table 4 of Yassaa et al. (2008), the minimum and maximum of the observed isoprene and  $\alpha$ -pinene concentrations in different regions are generally within a factor of 2-5 of the averaged values. We agree with the referee that both the concentrations and driving factors could vary substantially on the 4° × 5° model grid scale used here. Our present modeling studies

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aim to drive average emissions over a grid box and it is clear from Table 1 and Fig.1 that there exist differences between simulated and observed values. Further modeling studies with higher spatial and temporal resolutions and improved emission schemes are needed to reduce the uncertainty in the estimations of oceanic VOC emissions. Nevertheless, the present dominant issue in the emission calculations is the scarcity of the measurements (both spatially and temporally). These points have been added in the revised manuscript.

*4. Section 3 Figure 3: It's not at all clear why the authors include SOG in their discussion here. I recommend changing all values and figures to show only SOA concentrations.*

In the GEOS-Chem, the summary of SOG and SOA represents the total semi-volatile reactions productions of VOCs with OH, O<sub>3</sub> and NO<sub>3</sub> (Chung et al., 2002). Due to the current uncertainty in the scheme to partition the semi-volatile reactions productions into gas phase (SOG) and aerosol phase (SOA), we include SOG in our discussion in Section 3 and Figure 3 in order to show the impacts of  $\alpha$ -pinene and isoprene on total condensable secondary organic matters in the marine boundary layer over the Southern Ocean.

#### Minor Comments

*1. Abstract, line 12: grammar, "the importance of carrying out"*  
Corrected.

*2. Figure 2: It would be helpful to show the OOMPH cruise tracks on one of these panels so that the reader has a better understanding of the region sampled.*  
Added in figure 2 of revised version.

*3. Page 20730, line 12: grammar, replace "yielding of" with "yield from"*

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Done.

4. Page 20730, line 13-14: grammar, “Experimental studies estimate that the SOA yield from  $\alpha$ -pinene.”, rather than “Experiment studies implicated”

Revised as suggested.

5. Page 20731, line 3: grammar, “which are produced from” instead of “which are yielded from”

Accepted.

6. Page 20731, line 8: grammar “the marine boundary layer”

Corrected.

#### References:

Chung, S. H., and Seinfeld, J. H.: Global distribution and climate forcing of carbonaceous aerosols, *J. Geophys. Res.*, 107, 4407, doi:10.1029/2001JD001397, 2002.

Yassaa, N., Peeken, I., Zöllner, E., et al.: Evidence for marine production of monoterpenes, *Environ. Chem.*, 5(6), 391-401, 2008.

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