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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Oxygenated volatile organic carbon in the western Pacific convective centre: ocean cycling, air–sea gas exchange and atmospheric transport" *by* Cathleen Schlundt et al.

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Response to the anonymous referee #2

We thank the referee #2 for the effort to help improve our paper.

Referee #2: General comments: The authors reported shipborne observations of a series of oxygenated VOCs (OVOCs) in the western tropical Pacific. The spatial and temporal distributions and the air-sea fluxes of five OVOCs were presented and discussed. For some species, these data were published for the first time. I appreciate their effort. The authors also tried to explore the uplifting of these OVOCs to the upper

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Discussion paper

troposphere by using the FLEXPART model. I found the paper well organized and written in general, putting both atmospheric and oceanic perspectives. This paper would be a nice piece of work contributing to the groups looking at the air-sea exchange of organics. In addition to the comments from another reviewers (with which I agree on most comments), I only have several minor and/or technical comments that the authors can consider before publication, as listed below.

Minor comments:

Referee #2: FLEXPART analysis, Fig 6-9: To be honest I found the analysis with FLEXPART is a bit premature and resulting implications are speculative, as the data number is so limited and the authors cannot deal with mixing with the Lagrangian model, while the authors noted it (P11, L26-28). My question here is how well the Lagrangian-type model works in this hot and humid atmosphere in the tropics. Backward trajectories often fail in tropical MBL, so I wonder if there is the same issue or not.

Authors: The Lagrangian-type models work well for the meteorological conditions found during the SHIVA campaign. A perfluorocarbon tracer system, specifically designed for Lagrangian aircraft experiments, has been successfully applied during the SHIVA campaign (Ren et al., 2015). The atmospheric distribution of the tracer, released from the RV Sonne, was simulated with the Lagrangian model HYSPLIT and probed by the research aircraft Falcon giving a good agreement with some differences in the plume dispersion. FLEXPART backward trajectories are in good agreement with the HYSPLIT trajectories from Ren et al. (2015) suggesting an overall realistic simulation of the computed air mass transport over the 24 hour time period. This information has been added to the manuscript. It is true that the Lagrangian-type models cannot deal with mixing between air parcels throughout the boundary layer. On the other hand, we have only very limited OVOC source data and, therefore, have to exclude mixing in our approach. However, we do not agree that the results are speculative. This study does not aim to estimate the exact horizontal OVOC distribution, but only the maximum atmospheric mixing ratios that could result from the observed oceanic sources. To answer

this question, the indirect assumption of constant fluxes over time and space (equivalent to no mixing) can be made. The question of how well the simulated trajectories described the air mass transport is only important for the analysis of the backward trajectories, which agree well with the above mentioned tracer experiment,

Ren, Y., Baumann, R., and Schlager, H.: An airborne perfluorocarbon tracer system and its first application for a Lagrangian experiment, Atmos. Meas. Tech., 8, 69-80, https://doi.org/10.5194/amt-8-69-2015, 2015.

Referee #2: P1, L32: "relatively" high

Authors: We changed it.

Referee #2: P8, L36: Did Whelan et al. test both macroalgae and phytoplankton, and find that only macroalgae produced VOCs? Or did they only test macroalgae? Please clarify.

Authors: They tested both macroalgae (4 species in total, Ulva lactuca, Ascophyllum nodosum, Gracilaria tikvahiae, Hypnea musciformis) and phytoplankton (4 species in total, Thalassiosira sp., Gymnodinium sp., Emilinia huxleyi, Skelotenema costatum) using the same technique for all cultures. They found only in macroalgae cultures significant production of VOCs such as acetone, propanal, butanal and 2-butanone. We clarified this in the text.

Referee #2: P11, L1: The "on" average

Authors: We rewrote this part of the paper to clarify the apparent contradiction between the abstract and this paragraph, as requested by the other referee. We wrote instead: “The fluxes into the ocean are caused by localized, strong sinks such as observed in the Balabac Strait . . .”

Referee #2: P11, L23: "release trajectories" sounds a bit odd to me, perhaps say "release particles" or "start trajectories"? Anyway consider to rephrase.

Authors: We have changed the text to ‘start trajectories’, thanks for the suggestion.

Referee #2: P11, L6-8; Table 3: One literature data is missing here. There is a literature data of acetone flux in the western North Pacific by the gradient method. Tanimoto et al. (2014) reported the acetone flux to be 2.7 _ 1.3 _mol/m2/day, for the western North Pacific (15-20N, 137E) in 2010. Please add it into here. Reference: Tanimoto, H., S. Kameyama, T. Iwata, S. Inomata, Y. Omori, Measurement of air-sea exchange of dimethyl sulfide and acetone by PTR-MS coupled with gradient flux technique, Environ. Sci. Technol., 48, 526-533, 2014.

Authors: We included this reference in table 3. Thanks for advising us of this reference.

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