

## ***Interactive comment on “A physically-based framework for modelling the organic fractionation of sea spray aerosol from bubble film Langmuir equilibria” by S. M. Burrows et al.***

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In this study, Burrows and colleagues describe a novel method for estimating the organic matter in sea spray aerosol via competitive Langmuir adsorption equilibrium and advanced biogeochemical modeling of the ocean. Using this method, they predict that the dominant marine organic compound for predicting the organic fraction is region specific and that the organic fraction of sea spray aerosol is not simply a function of chlorophyll-a concentration for all regions. This novel framework may help better explain regional differences in the factors controlling marine primary organic emissions and lead to the more accurate simulation of these emissions on a global scale. How-

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ever, better evaluation of the predicted marine biogeochemistry, microlayer enrichment, and organic fraction of sea spray aerosol is needed to justify the increased complexity of this framework. I recommend publication in ACP after addressing the comments listed below.

Major Comments: 1) Ocean organic concentration: Although the focus of this study is on the air-sea flux of organic compounds, the predictions are largely dependent on the marine biogeochemical modeling. Please show or provide references for the ability of CESM to predict the magnitude and seasonal cycle of the observed organic concentrations in the ocean.

2) Enrichment: Please describe this process in more detail, including details such as whether the enrichment factor is calculated within the CESM model or offline and whether it is more dependent on the bulk organic concentration or composition. Also, please evaluate the predicted enrichment factor against observations if available.

3) Organic fraction: In order to justify the increased complexity of this framework, predictions of the organic fraction of sea spray aerosol and surface organic aerosol concentration must be improved relative to other parameterizations. Please expand Figure 12 to include observed and predicted surface concentration of marine primary organic aerosol and show additional regions for evaluation.

4) Sensitivity simulations: While interesting, these additional tests also increase the length and number of figures of an already complex study. I would recommend combining Figures 13-16 into one supplemental figure with two (or three) columns (enrichment ratio, organic mass fraction, and chlorophyll-a vs organic mass fraction for example). Also, please expand Table 3 to give the global marine primary organic aerosol emission rate (in a unit like Tg/yr) for the BASE and sensitivity cases.

Minor Comments (page,line):

5) 5378,4: "Potential mechanisms for ??? include..."

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- 6) 5382,15-28: Provide references for the various description of marine organic compounds.
- 7) 5397,25: Equation should look something like  $C1 = 1/3 * SDOC$
- 8) 5398,10: Provide a reference to the value of the lower limit of the concentration of processed compounds.
- 9) 5400,7: Should read "Although lipids contribute very little..."
- 10) 5401,16: Figures need to be numbered in the order they are referred to in the text. See Comment 4 which may help address this issue.
- 11) 5409,5: Should be "inspired".
- 12) Figure 6: Please show either the annual average or multiple months representing different seasons
- 13) Figures: Please increase the font of the figures, especially Figures 6-8 and 10-17.
- 14) Figure 12: Please begin x-axis with January. Caption should say "bottom panel"
- 15) Figure 17: Please move x-axis show that it intersects y-axis at 0.1 to improve clarity.

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 5375, 2014.