Response to Reviewer 2 comments for manuscript ID egusphere-2024-175. The comments are given in an italic typeface, and the responses are given in a bold typeface. The corresponding changes in the revised manuscript are highlighted in red.

2.1) ***General comments:***

The manuscript provides a comparison of DMS emission field using three seawater DMS climatology and seven gas exchange parameterizations. The author then discusses the contribution of the differences in seawater DMS, gas exchange velocity, and wind speed to the DMS emission flux. Finally, the monthly emission estimates are validated using in-situ flux measurements. While DMS emission is an important topic and the results are useful, there are some issues that should be addressed to enhance its usefulness to the community.

Response: We thank the reviewer for thoroughly reviewing the manuscript. The answers to the detailed comments are given below.

2.2) ***Specific comments:***

2.1.1) L25: The ocean is the dominant source of global DMS emissions. However, DMS has also been found to be emitted from vegetation on land (e.g., (Vettikkat, et al. 2020)). The author should explore the literature and list the emission sources on land, which will give readers a broader perspective on DMS emissions across the Earth's surface.

Response: Yes, a line related to the DMS sources from vegetation on land is added and a reason why the ocean is a dominant source of DMS is given along with the relevant references (L36 – L39).

2.1.2) L58: Some other studies (e.g., (Blomquist, et al. 2017)) use equations which consider the bubble injection by breaking waves. Could you show some results using such equations and discuss the differences?

Response: Bubble bursting is an important process, but its impact on DMS emissions is not clear. It does affect sea salt aerosol formation, but describing these other processes, which are not directly relevant to DMS emissions, is beyond the scope of our topic.

2.1.3) L64: Please add a reference.

Response: Added (L85).

2.1.4) L76: Most of the transfer velocity parameterizations in this manuscript use transfer velocities measured for gases other than DMS. However, there are parameterizations derived directly from wind speed and DMS measurements (e.g., (Yang, et al. 2011)). It would be interesting to show the results using this kind of parameterization.

Response: Section 2.1.5 contains the Goddijn-Murphy et al. parametrization (GM12), which is a synthesis of k_{DMS} using (at that time) all available eddy covariance DMS flux observations. The data from Yang et. al. (2011) is included in this synthesis.

2.1.5) L130: (Wanninkhof 2014) should be cited here.

Response: Now included (L163).

2.1.6) L132: In (Wanninkhof 2014), the gas transfer velocity is given as: $k=0.251\times\langle U2\rangle\times(Sc/660)^{-0.5}$ *where,* $\langle U2\rangle$ *is the average of neutral stability winds at 10-m height squared, or the second moment. In the manuscript, the author uses monthly averaged* *wind speed. However, the difference between the two and the associated uncertainty in DMS emissions is not discussed.*

Response: The discussion regarding the difference and its associated uncertainty is now in section 4 –'*The gas transfer velocity equation of W14 uses the square of the average neutral stability winds at 10 m height or second moment i.e., average of the quadratic windspeed. In this study, we used monthly average windspeed, i.e., the quadratic average windspeed for W14. The first method of calculation will estimate higher k values than the second one due to the averaging of the winds. We checked the differences between the two and found that the maximum difference is not more than 4.3 cm h^{-1} for June, July and August months and it is less than 2 cm h^{-1} for rest of the year, which does not contribute pointedly to the large uncertainty*.'.

2.1.7) L139-L145: What does "The flux due to σDMS" mean? Please also correct similar expressions as they are confusing.

Response: σ_{DMS} is calculated by calculating the standard deviation between H22, W20 and G18. This σ_{DMS} is used along with N00a parametrization, windspeed and SST data to get standard deviation in flux, which is shown in the monthly and annual σ_{DMS} plots (Fig. S10)." This standard deviation in calculated flux is the flux due to σ_{DMS}. The similar expressions are corrected for the other standard deviation parameters. This is now explained in the revised manuscript (L178 - L185).

2.1.8) The title of the manuscript is "Dimethyl sulfide (DMS) climatologies, fluxes, and trends – Part B: Sea-air fluxes", but no trend analysis is performed in this study. In L53, you mentioned that emission during 1948-2022 were used to calculate the DMS emission flux. However, no trend analysis is performed on the DMS emissions.

Response: Trend analysis is performed for DMS seawater concentration in Joge:Part A. An increasing trend of seawater DMS concentration is obtained, which also indicates that sea-air flux will increase. In this manuscript, Part B, the focus is on sea-air flux parametrization.

2.1.9) Introduction section: The author should add more on the sources and sinks of DMS in the ocean, and the chemical processes after it is released into the atmosphere. Then explain why DMS can affect climate.

Response: This information is now added in the introduction section (L25 - L35).

2.1.10) In addition to Table S1, a figure should be added in the main text to show the locations of the in-situ measurements used for DMS flux validation, with a legend showing two methods: eddy covariance and gradient flux technique.

Response: The suggested figure is added in the supplementary text as Figure S12. The text is also added in the data and methodology section (L70 - L72).

2.1.11) In Supplement, a figure should be added to show the locations of in-situ seawater measurements used to create the three seawater DMS climatologies (G18, W20, H22). This helps to determine in which regions the seawater concentrations in the climatology are more confident.

Response: This figure is available in part A of this manuscript.

References

1. *Blomquist, B. W., S. E. Brumer, C. W. Fairall, B. J. Huebert, C. J. Zappa, I. M. Brooks, M. Yang, et al. 2017. "Wind Speed and Sea State Dependencies of Air-Sea Gas Transfer: Results from the High Wind Speed Gas Exchange Study (HiWinGS)." Journal of Geophysical Research: Oceans 122 (10): 8034-8062.*

2. *Vettikkat, L., V. Sinha, S. Datta, A. Kumar, H. Hakkim, P. Yadav, and B. Sinha. 2020. "Significant emissions of dimethyl sulfide and monoterpenes by big-leaf mahogany trees: discovery of a missing dimethyl sulfide source to the atmospheric environment." Atmospheric Chemistry and Physics 20 (1): 375-389.*

3. *Wanninkhof, R. 2014. "Relationship between wind speed and gas exchange over the ocean revisited." Limnology and Oceanography Methods 12 (6): 351-362.*

4. *Yang, M., B. W. Blomquist, C. W. Fairall, S. D. Archer, and B. J. Huebert. 2011. "Air-sea exchange of dimethylsulfide in the Southern Ocean: Measurements from SO GasEx compared to temperate and tropical regions." Journal of Geophysical Research 116 (C4): c00f05.*

Response: All the above references are cited in the revised manuscript.