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.

Specific comments:

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.

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?

L64: Please add a reference.

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.

L130: (Wanninkhof 2014) should be cited here.

L132: In (Wanninkhof 2014), the gas transfer velocity is given as:

$$k = 0.251 \times \langle U^2 \rangle \times (Sc/660)^{-0.5}$$

where, $\langle U^2 \rangle$ 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.

L139-L145: What does "The flux due to σ_{DMS}" mean? Please also correct similar expressions as they are confusing.

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.

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.

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.

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.

References

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.

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.

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

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.