

An itemized response (blue words) to reviewer's comments and suggestions

We sincerely thank the reviewer for valuable comments on our manuscript entitled “Impact of anticyclonic eddies on the spatial distribution and emission of non-methane hydrocarbons in the northern South China Sea” [Paper # egusphere-2026-1212]. In the revised manuscript, we have corrected the unit inconsistencies in the equations, clarified the calculation methods for the photochemical production rates in different spectrum, and calculated the LOH of DMS along with a comparison to NMHCs. All modifications are highlighted in blue, and our specific responses to the reviewer's comments are presented as follows.

This paper reported the observation results of NMHCs in the south China Sea. Observation was well organized. NMHCs were lower concentration within the eddy-controlled region. This would be precious observation results.

Reply:

We sincerely thank the reviewer for the positive and encouraging evaluation of our work. We have carefully addressed all the comments.

OH reactivity, Ozone formation potential, and particle formation from the atmospheric light NMHCs were discussed. But the calculated values (L_{OH} , OFP, P_{SOAP}) were just compared with other observation sites. I think if the estimation of these values of DMS would be informative, especially P_{SOAP} . If DMS observation was not available, just assume suitable DMS concentration and compare these values. Then we can evaluate the importance of light NMHCs over the surface ocean.

Reply:

Thanks for this insightful suggestion. Based on the sea-to-air flux of DMS ($3.66 \pm 4.30 \mu\text{mol m}^{-2} \text{d}^{-1}$) reported by Wu et al. (2025) and applying the same atmospheric lifetime approach used for NMHCs, we calculated the L_{OH} of DMS in the marine boundary layer. The calculation shows that the average L_{OH} of the eight NMHCs (0.00863 s^{-1}) is approximately 10.5% of that of DMS (0.0825 s^{-1}). However, due to the absence of *MIR* and *SOAP* values for DMS in the existing literature, we were unable to further calculate the *OFP* and P_{SOAP} for DMS using the same methodology applied to NMHCs. Thus, we added a comparison of L_{OH} between NMHCs and DMS in the revised manuscript.

Line 413-418:

“To evaluate the relative importance of NMHCs in MBL chemistry, we compared their $\bullet\text{OH}$ reactivity with that of dimethylsulfide (DMS), the most abundant biogenic sulfur compound emitted from the ocean. Based on the DMS sea-to-air flux ($3.66 \pm 4.30 \mu\text{mol m}^{-2} \text{d}^{-1}$) reported by Wu et al. (2025) for the northern SCS and applying the same atmospheric lifetime approach used for NMHCs, we calculated the average L_{OH} of DMS to be 0.0825 s^{-1} .” In comparison, the average L_{OH} of the eight NMHCs measured in this study was 0.00863 s^{-1} , which is approximately 10.5% of the DMS value.”

References:

Wu, J. W., Xu, F., Yan, S. B., Xu, G. B., Jiang, Y. C., Li, X. R., Zhai, X., Zhou, L. M., Zhang, H. H., and Chen, Z. H.: Effect of anticyclonic eddies on the production and emission of marine dimethylsulfide in the northern South China Sea, *Glob. Planet. Change*, 252, 104883, <https://doi.org/10.1016/j.gloplacha.2025.104883>, 2025.

Line 164-167: In the explanation of Eq. (1), units of F_{ux} , k , C_w , C_a , (and H) are given (pptv etc.). These are correct for dimension. But these are not directly to use for calculation.

Reply:

We thank the reviewer for this technical comment. We have revised the manuscript by converting all parameters into consistent units that can be directly used in the calculation. Specifically:

C_w (seawater concentration): $1 \text{ pmol L}^{-1} = 1 \text{ nmol m}^{-3}$, so C_w in pmol L^{-1} is numerically equal to C_w in nmol m^{-3} .

C_a (atmospheric mixing ratio): C_a (pptv) is converted to nmol m^{-3} using the ideal gas law ($PV = nRT$). Under standard atmospheric conditions ($P = 1 \text{ atm}$, $T = 298.15 \text{ K}$), $1 \text{ pptv} = 0.0409 \text{ nmol m}^{-3}$. Thus, $C_a (\text{nmol m}^{-3}) = C_a (\text{pptv}) \times 0.0409$.

H (Henry's law constant): When C_w and C_a are both expressed in nmol m^{-3} , H must be dimensionless. The dimensionless Henry's law constant (H) is calculated as $H = H_0 \times R \times T$, where H_0 (M atm^{-1}) is the original Henry's law constant, $R = 0.082057 \text{ L atm mol}^{-1} \text{ K}^{-1}$, and T is temperature (K). For $T = 298.15 \text{ K}$, $H = H_0 \times 24.465$.

k (gas transfer velocity): k (cm h^{-1}) is converted to m d^{-1} by multiplying by 0.24 (since $1 \text{ cm h}^{-1} = 0.01 \text{ m h}^{-1} \times 24 \text{ h d}^{-1} = 0.24 \text{ m d}^{-1}$).

With these conversions, Eq. (1) becomes: $F (\text{nmol m}^{-2} \text{ d}^{-1}) = k (\text{m d}^{-1}) \times [C_w (\text{nmol m}^{-3}) - C_a (\text{nmol m}^{-3}) \times H]$, where all units are directly compatible for calculation.

Line 183-184:

“where k (m d^{-1}) is the gas transfer velocity; C_w (nmol m^{-3}) is the seawater NMHC concentration; C_a (nmol m^{-3}) is the atmospheric NMHC concentration; and H (dimensionless) is Henry's law constant.”

This is also for Eq. (6). (NMHC concentration would be molecules/ cm^3 for calculation.)

Reply:

Thanks for this comment. We have revised the manuscript by converting the NMHC concentration from mol m^{-3} to molecules cm^{-3} . The conversion is performed as follows: $1 \text{ mol m}^{-3} = 10^{-6} \text{ mol cm}^{-3} = 10^{-6} \times 6.022 \times 10^{23} \text{ molecules cm}^{-3} = 6.022 \times 10^{17} \text{ molecules cm}^{-3}$.

Line 204-205:

“ $NMHC_i$ (molecules cm^{-3}) is the concentration of atmospheric NMHCs”

Also same for Eq (7), Eq (8). (the unit of NMHC concentration should be micro g/m^3 for OFP etc.)

Reply:

Thanks for this comment. We have revised the manuscript by converting the NMHC concentration from mol m^{-3} to $\mu\text{g m}^{-3}$. The conversion is performed as follows: $1 \text{ mol m}^{-3} = M \text{ g m}^{-3} = M \times 10^6 \mu\text{g m}^{-3}$, where M represents the molecular weight of each individual NMHC species.

Line 213:

“where $NMHC_i$ ($\mu\text{g m}^{-3}$) is the concentration of atmospheric NMHCs”

Question about Deck incubation experiments.

In Table 1, there are four “Photochemical production rates”: natural light, UVB, UVA, PAR

“natural light” seems to be the sum of UVB + UVA + PAR.

There are four experiments (Line 144-148).

(1) Natural light

(2) PAR + UVA

(3) PAR

(4) (dark)

Do you deduce the “Photochemical production rates” as follows?

Natural light: (1)-(4)

UVB: [(1)-(4)] – [(2)-(4)]

UVA: [(2)-(4)] – [(3)-(4)]

PAR: (3)-(4)

Reply:

Thanks for the question regarding the calculation of photochemical production rates from the deck incubation experiments. We confirm that the reviewer's understanding is exactly correct. We have added a clear description of this calculation method in the revised manuscript.

Line 172-175:

“Specifically, the visible light production rate was obtained as (iii) – (iv); the UVA production rate was obtained as (ii) – (iii); the UVB production rate was obtained as (i) – (ii); and the full spectrum production rate was obtained as (i) – (iv).”