Response to reviewer #1.

Authors response: We thank the reviewer #1 for the constructive comments and suggestions. We have addressed all points raised and revised the manuscript accordingly. In particular, we carefully revised the manuscript to improve clarity and readability to ensure that it can be easily understood by researchers from both the atmospheric and oceanographic communities. Our detailed responses to each comment are provided below, with the reviewer comments depicted in black, the author reply in blue.

The manuscript is mostly clear and well written and should be published subject to minor revisions. In general, the manuscript should be reread to make sure that people from both communities (atmosphere and ocean) fully understand each other parts and that all measurements are well presented. Below, I underline the points that I think would improve the manuscript.

p4 l143 "To convert the relative concentrations (ppm) reported by the GGA to absolute concentrations (nmol L-1), discrete water samples were collected at least once per hour (Bussmann et al., 2024)." can you please detail a bit this part? Why the temporality is needed to get the conversion from ppm to nmol/L?

Authors response: The following sentence was added: "A correlation between the methane concentration of the water samples and the simultaneous GGA readings was used to convert all GGA measurements into concentrations of dissolved methane. To test the lower sensitivity of the setup, aerated freshwater with an equilibrium concentration of 2.9 nM was measured in the laboratory, and the instrument readings gave a concentration of 2.3± 0.3 nM."

p5 l149 what value is used for ceq?
Authors response: The following sentence was added: "C_{equ} represents the equilibrium concentration with the atmosphere and was calculated based on the equation from Wiesenburg and Guinasso (1979) with the respective water temperature and salinity."

p5 l159 Can you shortly define the Schmidt number?
Authors response: The following sentence was added: "The Schmidt number (Sc) describes the gas transfer velocity and is gas and temperature specific. It offers the means to determine the gas transfer velocity for different soluble gases over a range of temperatures."

p5 l165 please define CTD (also in Figure 1)
Authors response: The following sentence was added: " Fig. 1 ….., orange dots were stations for water sampling and CTD-casts to measure temperature and salinity profiles. …. CTD60M, Sea & Sun Technology, Germany, a sensor to measure conductivity, temperature and depth)"

In 2.4, can you add the actual number of samples taken for the headspace measurements and for the isotopes? Listed only in 3.4, you say you have 4 stations but 11 samples. please clarify.
Authors response: Lines 176-181: Section 2.4 has been revised to clarify the sampling numbers and to explicitly differentiate between surface transect and depth profile sampling. We modified to: "Surface water samples were collected at 11 locations along the transect, and depth profiles were obtained at 4 locations: location #1 at 3 depths and locations #2–#4 at 2 depths each. At all sampling locations and depths three 1 L glass bottles were filled to

the brim with seawater. Each glass bottle was used to obtain one gas sample for the measurement of CH_4 concentration, $\delta^{13}C\text{-}CH_4$, and $\delta^{2}H\text{-}CH_4$ values (n = 1). Surface samples were collected via a tap connected to the shipboard pump system (no filters or desalinators), while depth profile samples were filled directly from the Niskin bottle."

In Figure 5, can you add the location of the atmospheric isotopic samples? Also, check the legend, 1a and 1b are only blue not black and blue (or clarify)
Authors response: We have now added in Figure 5 the locations of the atmospheric isotope samples and clarified the legend for Regions 1a and 1b. In addition, we included the following sentence in the caption of Figure 5: "The seven sampling locations for atmospheric air isotope analyses are indicated together with their sample numbers (see Section 3.6 for further details)."

In Figure 7, can you add the location of the 11 isotopic samples (1 to 11)?
Authors response: New close-ups for figure 6 and 7 have been made, which now also include symbols for the water sampling stations. We added following sentence in the figure captions: "The dots in the close up indicate the stations from figure 1."

p12 3.6 you only describe the location of 4 bags, what about the others?
Authors response: We revised the text describing Figure 10 to ensure that all seven sample bag locations are now included in the description. We modified the description to :" . Bag HD3-52 was sampled during the transect from dredging area 1b to dredging area 1a using the hand-held line. Bags HD3-55 and HD3-54 were filled above the dredging area 1b using the mast-mounted sampling line. During the transect across the mud track generated by the actively dredging hopper dredge, two additional sampling bags were filled. The first sample (HD1-122) was collected using the mast-mounted sampling line. During a second transect, HD1-123 was taken directly over the mud track with the hand-held sampling tube. Bags HD3-56 and HD3-57 were sampled outside the dredging area and therefore represent background samples."

Minor corrections:
p1 l23 please define AWI: done
p2 l48 replace gromers by groomers: done
p4 l118 replace ICOS-Cal by ICOS-FCL: done

p14 l407 "Dissolved CH4 concentrations have been measured in the area south of our study area, but with the same method." Should it no read "but with a different method"?
Authors response: We changed this sentence to "**With the same method** dissolved CH_4 concentrations have been measured in the area south of our study area."

p16 l480 replace non et all by none at all: done
p18 l523 a parenthesis is missing: done