GORDON AND BETTY MOORE FOUNDATION

Team Karl Highlight

Dissolved methane time-series measurements at Station ALOHA

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Methane supersaturation in the upper water column is a widespread feature of the global oceans. Until recently, methane production in the upper ocean was exclusively attributed to anaerobic methanogenesis in reduced microenvironments, such as sinking particles, but the discovery that methylated compounds (*i.e.* methylphosphonates) can be metabolized to methane under aerobic conditions has transformed our understanding of the upper ocean methane cycle. To further understand the mechanisms responsible for the oceanic methane supersaturation and investigate long-term trends in upper ocean concentrations, dissolved methane has been analyzed at Station ALOHA, in the North Pacific Subtropical Gyre for the past seven years (2008-present), alongside the long-term Hawaii Ocean Time-series (HOT) program.

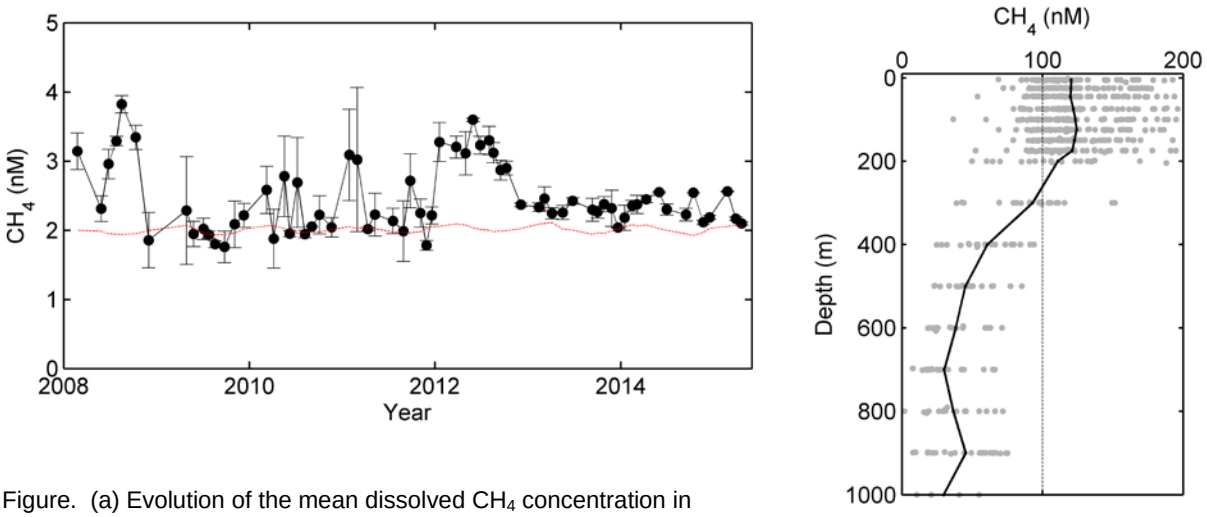

Figure. (a) Evolution of the mean dissolved CH_4 concentration in the mixed layer at Station ALOHA. Solid line represents the concentration in equilibrium with the atmosphere. (b) CH_4 saturation individual (gray dots) and mean (solid line) profiles.

Mean methane concentrations in the mixed layer at Station ALOHA do not show a clear seasonal trend with no evident correlation to other measured biochemical parameters. Dissolved methane revealed large month-to-month and inter-annual variability (Figure 1a), with concentrations ranging from near or slightly below atmospheric equilibrium, to >200% saturated. The water column is supersaturated down to 300 m depth (Figure 1b), and below 200 m saturations start decreasing, indicating that net methane production is limited to the euphotic zone (Figure 1b). In ~60% of the profiles there was low variability in the upper 200 m of the water column. A subsurface methane maxima in the upper pycnocline, which is considered to be associated with methane profiles in oceanic environments, was not a frequent feature at Station ALOHA, and it was only observed about 20% of the times.

In addition to this methane time-series we have a comparable data set for nitrous oxide at Station ALOHA. Ongoing experiments are also addressing the dynamics of these pools including but not limited to controls on microbial production.