



[d\(13\)C-CH4 reveals CH4 variations over oceans from mid-latitudes to the Arctic.](#)

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Abstract: The biogeochemical cycles of CH₄ over oceans are poorly understood, especially over the Arctic Ocean. Here we report atmospheric CH₄ levels together with d(13)C-CH₄ from offshore China (31°N) to the central Arctic Ocean (up to 87°N) from July to September 2012. CH₄ concentrations and d(13)C-CH₄ displayed temporal and spatial variation ranging from 1.65 to 2.63 ppm, and from -50.34% to -44.94% (mean value: -48.55±70.84%), respectively. Changes in CH₄ with latitude were linked to the decreasing input of enriched d(13)C and chemical oxidation by both OH and Cl radicals as indicated by variation of d(13)C. There were complex mixing sources outside and inside the Arctic Ocean. A keeling plot showed the dominant influence by hydrate gas in the Nordic Sea region, while the long range transport of wetland emissions were one of potentially important sources in the central Arctic Ocean. Experiments comparing sunlight and darkness indicate that microbes may also play an important role in regional variations.

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