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RELATIONSHIP BETWEEN CH₄ AND CO₂ IN THE SURFACE SEAWATER IN THE WESTERN ARCTIC OCEAN

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Measurements of the partial pressure of CO₂ (pCO₂) and CH₄ (pCH₄) in surface seawater and overlying air were made continuously in the western Arctic Ocean during the cruise of the R/V Mirai (JAMSTEC) in September-October 2012 as a part of GRENE Arctic Climate Change Research Project. The underway measurements were carried out with the system consisting of a WS-CRDS analyzer (Picarro Model G2301) combined with a shower-head-type equilibrator. Temperature, salinity, dissolved oxygen, fluorescence and dissolved inorganic carbon (DIC) were also measured simultaneously.

Throughout the cruise track, CH₄ in near-surface water has been supersaturated with respect to the CH₄ in the atmosphere. However, spatial distributions of CH₄ and CO₂ and their correlation were controlled differently by the biological activity and the topographical feature between coastal and off shore zones. In the coastal zone in the Barrow Canyon where primary production is high due to local upwelling, high pCH₄ hotspots (up to 6.13 μatm) were found in the shelf water. The spatial variation of pCH₄ positively correlated with that of pCO₂ in this region. This correlation suggests that the surface seawater was largely affected by the seawater upwelled from near-seafloor that would contain high level of CH₄ discharged from sediment as well as high level of CO₂ due to remineralization. The positive correlations between pCH₄ and pCO₂ were also found in the shallow Chukchi Sea and the Bering Strait. In contrast, the negative correlation was found in offshore deep sea region. This negative correlation is explained by the large biological activity; active primary production causes drawdown of CO₂ through photosynthesis while it provides productive environments for CH₄ such as organic particles or guts of zooplankton. There, it is likely that the surface water had not been affected by the shelf water that contains high level of CH₄.

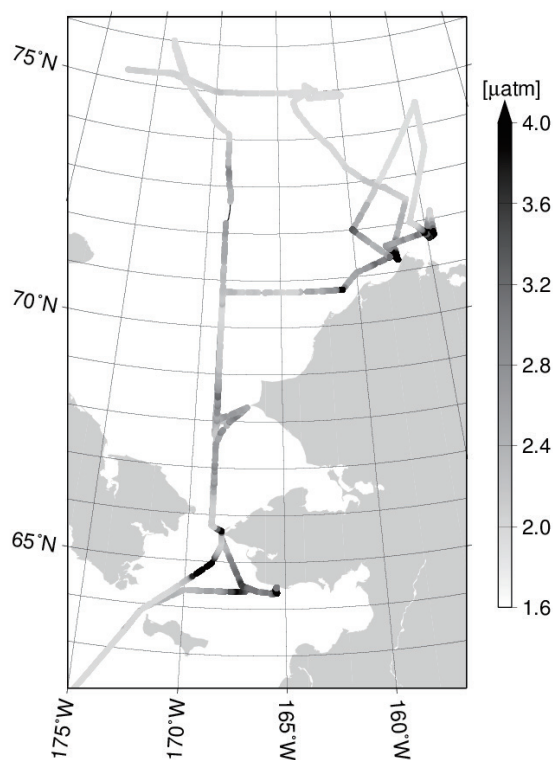


Figure 1. Spatial distribution of pCH₄ in the surface water