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Methane dynamics in Antarctic sea ice

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The contribution of the ocean to the atmospheric methane (CH_4) budget is poorly understood. In Polar Regions, this contribution is further influenced by the sea ice cover. Sea ice has long been considered as an inert and impermeable barrier, but recent studies have highlighted the existence of gas fluxes at the atmosphere-sea ice and sea ice-seawater interfaces. These fluxes are to date poorly characterized and quantified, so that the role of sea ice as a net sink or source of CH_4 is still unclear. Furthermore, sea ice cover is strongly impacted by global climate change. It is thus crucial to refine our understanding of its contribution to the atmospheric CH_4 budget in order to improve climate predictions.

To unravel the impacts of the Antarctic sea ice physical environment on biogeochemical cycles, the AWECS (Antarctic Winter Ecosystem Climate Study) expedition was conducted during winter 2013 in the Weddell Sea. Ice cores were collected at ten different stations to investigate how gas dynamics are affected by sea ice type and spatial variability.

Here, we present and discuss our results of CH_4 concentration and isotopic composition ($\delta^{13}C$ and δD) measured on sea ice cores from the AWECS project. Additional analyses such as characterization of ice texture and physical properties, dimethylsulfoniopropionate (DMSP) concentration and lipid biomarkers were conducted on these cores. This multiparametric dataset allows us to determine the origin and the fate of the CH_4 entrapped in Antarctic sea ice during the winter AWECS cruise.