Biogas (CO2, O2, dimethylsulfide) dynamics in spring Antarctic fast ice

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ABSTRACT: We studied the temporal variations of CO_2, O_2, and dimethylsulfide (DMS) concentrations within three environments (sea-ice brine, platelet ice-like layer, and underlying water) in the coastal area of Ade´lie Land, Antarctica, during spring 1999 before ice breakup. Temporal changes were different among the three environments, while similar temporal trends were observed within each environment at all stations. The underlying water was always undersaturated in O_2 (around 85%) and oversaturated in CO_2 at the deepest stations. O_2 concentrations increased in sea-ice brine as it melted, reaching oversaturation up to 160% due t the primary production by the sea-ice algae community (chlorophyll *a* in the bottom ice reache concentrations up to 160 µg L'' of bulk ice). In parallel, DMS concentrations increased up to 60 nmol L21 within sea-ice brine and the platelet ice-like layer. High biological activity consumed C and promoted the decrease of partial pressure of CO_2 (pCO_2). In addition, melting of pure ice crystals and calcium carbonate ($CaCO_3$) dissolution promoted the shift from a state of CO_2 oversaturation to a state of marked CO_2 undersaturation (pCO_2 < 30 dPa). On the whole, our results suggest that late spring land fast sea ice can potentially act as a sink of CO_2 and a source of DMS for the neighbouring environments, i.e., the underlying water or/and the atmosphere.