Annual dynamics of CO_2 partial pressure within bulk sea ice and related CO_2fluxes at Cape Evans (Antarctica)

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Sea ice is a biome actively participating in the regional cycling of CO_2 as both a source and a sink at different times of the year.

In the frame of the YROSIAE project (Year-Round Ocean-Sea-Ice-Atmosphere Exchanges), annual dynamics of sea ice pCO_2 was compared with CO_2 fluxes measured by automated accumulation chambers at Cape Evans (Ross Island, Antarctica). Results confirmed a general trend of brine pCO_2 supersaturation with respect to the atmosphere during the late winter (concentration of dissolved inorganic carbon - DIC - in brine and brine expulsion in the brine skim) leading to CO_2 degassing, and undersaturation during the spring (carbon-uptake by autotrophs and brine dilution) leading to atmospheric CO_2 uptake. Despite high primary production at the bottom of the ice in spring, DIC profiles suggest that sea ice as a whole appears to be net heterotrophic. Still, sea ice absorbs CO_2 from the atmosphere, as a result of physical processes.

Some variability in the CO_2 fluxes (both in magnitude and sign) could not be explained by variability in sea ice pCO_2 but rather seemed driven by variability in atmospheric conditions and sea ice surface properties. For instance, in late spring, CO_2 fluxes showed a diurnal variability (from CO_2 degassing to uptake) related to atmospheric temperature variations. Large and episodic CO_2 fluxes were systematically positively correlated with strong wind events, and large CO_2 degassing was observed over thin, wet and salty snow cover.

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