CO_2 MEASUREMENTS IN SEA ICE

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The impact of sea ice on the interactions between the atmosphere, the ocean and the biosphere is well known in the polar area. However, sea ice has been assumed to be an impermeable and inert barrier to air sea exchange. But Golden *et al.* (1998) showed that sea ice is a highly permeable medium for gases under some conditions (T= -5°C, Salinity = 5). Accordingly, uptake of atmospheric CO_2 over the sea ice cover in the Arctic and Southern Ocean were recently reported.

Data on gas composition in sea ice are scarce and analytical methods are thought to be sensitive to CO_2 contamination in relation with carbonates system in the brines of sea ice. A new analytical method has been tested on experimental abiotic sea ice. It consists in equilibrating sea ice with a standard atmosphere (Verbeke, 2005).

These measurements were carried out at different temperatures in order to follow the carbonates system displacement in bulk sea ice.

When temperatures increase, the partial pressure of CO_2 (pCO_2) remains stable up to a temperature threshold and then decreases down to values below to pCO_2 of the standard atmosphere.

This can mainly be explained by the dilution of brine during the increase of temperatures. Pure ice crystals melt and lead to the dilution of brine and related decrease of pCO_2.

References

Golden K.M., S.F. Ackley and V.I. Lytle. 1998. The percolation phase transition in sea ice. Science 282:2238-2241.

Verbeke V. 2005. Concentration en gaz dans la glace de mer: développements techniques et implications environnementales. Université Libre de Bruxelles. 305p.