



Measuring CO₂ in sea ice: caveats and improvements

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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). Uptake of atmospheric CO₂ 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 CO₂contamination in relation with carbonates system in the brines of sea ice. A new analytical method has been developed at the laboratory of glaciology of the Free University of Brussels. It consists of equilibrating sea ice with a standard atmosphere of the known concentration of CO₂ (Verbeke, 2005).

To assess the reproducibility of the method, a standard sea ice, with reproducible and homogeneous physical properties, is produced and the pCO₂ is measured at different temperatures.

Above -8°C, the results are linearly correlated with the temperature within 14%. The results coming from the same standard ice and even those coming from different standard ice are consistent.

Lower than -8°C, the results show a large scattering of pCO₂.

The reproducibility above -8°C gives some confidence in the overall method. However, some improvements need to be done at lower temperature.

References

Golden, K.M., Ackley, S.F., Lytle, V.I., 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. +pp 305. Université Libre de Bruxelles.