Wintertime sea-ice chemistry and influence of glacial freshwater discharge during two contrasting years in a Spitsbergen fjord

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We investigated the sea-ice carbonate (or CO_2) chemistry in Tempelfjorden (West Spitsbergen) and the influence of different processes such as brine rejection from sea-ice formation, calcium carbonate precipitation and glacial freshwater discharge during two winters in March/April 2012 and 2013 [1].

March/April 2012 was milder than April 2013 with later sea-ice formation and thinner ice. The two contrasting years clearly showed how the influence of freshwater affected the chemical and physical characteristics of the sea ice. We found large variability of sea-ice total alkalinity (AT), total dissolved inorganic carbon (CT), pCO₂, dissolved inorganic nutrients, oxygen isotopic ratio (δ^{18} O), and freshwater fractions, from the glacier front to the outer part of the fjord.

Processes within the sea ice such as calcium carbonate formation (ikaite) and brine rejection also affected the sea-ice carbon chemistry. The variability in the sea ice showed the lowest AT in March/April 2012 near the glacier front coinciding with the highest freshwater fractions (glacial water). Relatively high AT in relation to salinity was observed mainly in March/April 2012, which could either be a result of ikaite precipitation in the sea ice (dissolved during analysis) or calcite and dolomite minerals originating from the bedrock/glacial freshwater. We found crystals of ikaite, calcite and aragonite (forms of calcium carbonate) in the snow/frost flowers in April 2013 as a result of to seaice processes.

[1] Fransson et al. (2015) J. Geophys. Res. Oceans, **120**, doi:10.1002/2014JC010320