PROJECT SUMMARY REPORT - 2013 SERF CAMPAIGN

Subproject: Project 1: What is the net flux of CO2 between atmosphere, ice and ocean during ice growth and melt, in a lead (artificially cut hole in SERF ice)

Actual field dates: January 1-31, 2013
Field site: Sea-ice Environmental Research Facility (SERF), University of Manitoba, Winnipeg, Canada
Number of man-days in the field: 420

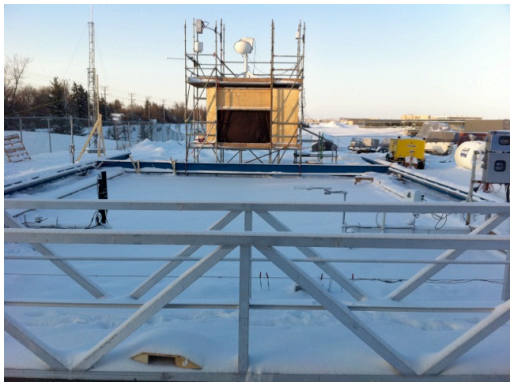

Figure 1

Summary:

We discovered evidence for highly dynamic ikaite precipitation and dissolution in sea ice grown at an out-door pool of the Sea-ice Environmental Research Facility (SERF). During the experiment, ikaite precipitated in sea ice with temperatures below −3◦C, creating three distinct zones of ikaite concentrations: (1) a mm to cm thin surface layer containing frost flowers and brine skim with bulk concentrations of > 2000 µmol kg−1, (2) an internal layer with concentrations of 200–400 µmol kg−1 and (3) a bottom layer with concentrations of < 100 µmol kg−1. Snowfall events caused the sea ice to warm, dissolving ikaite crystals under acidic conditions. Manual removal of the snow cover allowed the sea ice to cool and brine salinities to increase, resulting in rapid ikaite precipitation. The modeled (FREZCHEM) ikaite concentrations were in the same order of magnitude as observations and suggest that ikaite concentration in sea ice increase with decreasing temperatures. Thus, varying snow conditions may play a key role in ikaite precipitation and dissolution in sea ice. This will have implications for CO2 ex-change with the atmosphere and ocean.

Figure 2

Photos:

Fig.1: SERF during snow coverage
Credit: Søren Rysgaard
Fig. 2: SERF during snow removal experiment
Credit: Søren Rysgaard
Fig. 3: Recovering the HARP
Credit: Rosina Grimm

Figure 3

Participants:

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