Diary 3 - 22 March 2012

Wrestling with marine research in the winter

Daneborg

Performing marine research during the high-Arctic winter is a hassle! We are an international team of 15 scientists from 8 different nations who are trying to decode some of the secrets behind the dramatic climate change that is occurring in the Arctic! In March the sea here in Young Sund is covered by a 1,10 metres thick layer of ice and 0,8 metres of snow. The air temperature changes between -25º and -35ºC but the sea temperature is only -1,6º C and the ice is unusually warm – no more than -6ºC on the surface. Huge amounts of the ice are melting! When we started our research here some twenty years ago, the ice was 1,8 to 1,6 metres thick in March – which confirms the general observations from the Arctic; the ice cover and the thickness of it are declining. One of the main questions we are attempting to answer is: how will the changed ice condition influence the exchange of CO_2 between the sea and the atmosphere? Our research so far indicates that through a number of biological, chemical and physical processes, the formation and melting of the ice stimulates the sea's capacity to absorb CO_2. All processes are influenced by the extent of the ice and interact with the global climate systems.

The snow scooter works it way across the ice, the sledge is closely packed with three scientists and equipment. Having reached the centre of the fiord, the scientists unload the equipment and start drilling holes in the ice. Sophisticated measuring devices are unpacked, checked and mounted below the ice. This is not an easy task in minus 30ºC and with the equipment playing tricks due to driving snow. The cables freeze, plastic get brittle, keyboards are filled with snow, batteries loose power and the equipment cuts out. The fingers won't function properly, the stubble is sprinkled with ice and the metal burns your skin the minute you take off your gloves to get a better grip. Much of the equipment is designed for considerably milder climate and is pushed to its limits. We have to improvise in order to fix the gear with primitive tools and lacking the correct spare part, while snow and ice crystals cover everything.

Prior to mounting the equipment below ice, we have to remove the snow and drill holes in the ice which is hard physical work. Frustration and fatigue start to show as the drill once again get stuck. As soon as the new equipment is mounted, we relocate cables and communication boxes that were mounted earlier in the week and we begin downloading data. Now the scene shifts - the enthusiasm and ardour is rising as we learn the equipment has functioned and that new unique data have been obtained. We head for one of the tents for a spot of cover and to browse the data. People are laughing, patting each other on the shoulders and share a bar of chocolate before returning to the hut for a closer look on the data. The fatigue is long forgotten – our efforts paid off!

When sea ice is formed, salts – also known as "brine" - is concentrated in pockets and channels in the ice. Our hypothesis is that the CO_2 that was originally found in sea water is gathered in this brine. Various chemical and biological processes influence the CO_2 conditions in the brine-pockets, but in short the CO_2 sink with the heavy salts towards the deep sea. This means that in the spring melt water from sea ice is extremely short of CO_2 and absorbs it from the atmosphere. We believe this to be a decisive process for the sea's capacity to buff the continuously increasing concentrations of CO_2 in the atmosphere and as such the capacity to counteract the greenhouse effect. This is the reason why we analyze the formation, the transport and the chemistry of the brine.

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