Abstract

Sara Jutterström, *Dissolved inorganic carbon in the Arctic Ocean and the Nordic Seas*
Department of Chemistry, Göteborg University, SE-412 96 Göteborg, Sweden.

The increasing amount of carbon dioxide in the atmosphere and its possible impact on the earth's climate has put a focus on anthropogenic carbon uptake in the ocean. Deep and intermediate water formation in the Arctic Ocean and the Nordic Seas brings down carbon from the surface waters into deeper layers. In this thesis, two novel methods of estimating anthropogenic carbon are presented. One method was used for evaluating the inventory of anthropogenic carbon in the Nordic Seas, and the estimated anthropogenic carbon content below 250 meters was 1.2 ± 0.1 Gt C. This is about 1% of the total anthropogenic carbon content in the world's oceans. The other method was used to calculate the concentration of anthropogenic carbon in the waters of the East Greenland Current (EGC) and annual transport of anthropogenic carbon to the Denmark Strait Overflow via the EGC was estimated to be ~0.04 Gt C. This is less than 2% of the annual uptake of anthropogenic carbon by the ocean. These numbers might seem small, but one also has to considering the small area of the Nordic Seas compared to the entire ocean.

The deep water formation in the Nordic Seas is an important part of the global thermohaline circulation. In the past, the deep water formation has shown sensitive to increased freshwater content of the waters. The liquid freshwater content of the EGC was investigated and the fractions of river runoff, sea ice melt and pacific water were deduced in order to see which source of freshwater was most likely to impact the deep water formation. The conclusion was that although the EGC carries a great deal of freshwater, it is likely that it is sea ice that has the greatest possibility to impact deep water formation in the Greenland Sea due to its mobility. Another study presented in this thesis found that extent of river runoff in the Eurasian Basin in Arctic Ocean, is following the trend of the Arctic Oscillation, but with a delay of about five years.

It is difficult to say what impact a climate change would have on the carbon fluxes in the Polar region, but it seems likely that the uptake of carbon would increase due to increased primary production and increased air-sea exchange. One process that could have a greater importance is the observed increase of CO_2 uptake during freezing of seawater and the subsequent brine formation.

The saturation of calcite and aragonite in the deeper waters of the Arctic Ocean is currently surprisingly high, most likely due to the relatively small amount of remineralisation occurring. This might change very rapidly if i.e. the production and sedimentation of organic matter would increase.

KEY WORDS: anthropogenic carbon, freshwater, $p\text{CO}_2$, calcite, aragonite, Arctic Ocean, Nordic Seas, East Greenland Current

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