



Pacific Water Pathways through the Arctic Ocean

Paul A. Dodd (1), Michael Karcher (2), Tore Hattermann (1), and Colin Stedmon (3)

(1) Norwegian Polar Institute, Research Department, Tromsø, Norway (paul.dodd@npolar.no), (2) Ocean Atmosphere Systems GmbH, Hamburg, Germany, (3) Technical University of Denmark, Charlottenlund, Denmark

The volume, characteristics and sources of freshwater exported from the Arctic Ocean through Fram Strait vary in time and are expected to change under a declining sea ice cover. Relatively fresh ($S = 32$) Pacific Water, which enters the Arctic Ocean via the Bering Strait makes up a significant part of the liquid freshwater exported from the Arctic Ocean through Fram Strait. If transported to the Nordic Seas and North Atlantic via the East Greenland Current, Pacific Water could affect convection and dense water formation in those regions.

Regular sections of nutrient measurements have been collected across Fram Strait since 1980. The fraction of Pacific Water along these sections can be estimated from the ratio of nitrate to phosphate. The time-series of repeated Fram Strait sections indicates that the fraction of Pacific Water passing out of the Arctic Ocean through Fram Strait has changed significantly since 1980. Pacific Water fractions remained high from 1980 to 1998, but in 1999 Pacific Water almost disappeared from Fram Strait, reappearing only briefly from 2011 to 2012.

Simulated tracers in two numerical models (NAOSIM and ROMS) reveal the pathways that Pacific Water followed through the Arctic Ocean before reaching Fram Strait in different years. In 2011 and 2012 there was good agreement between simulated back trajectories of Pacific Water and back trajectories of sea ice calculated from NASA Polar Pathfinder sea ice motion vectors, which indicate that both Pacific Water and sea ice were advected to Fram Strait from an unusually westward position in the Canadian Basin.

The total volume of freshwater exported from the Arctic Ocean through Fram Strait was elevated in 2011 and 2012 due to the presence of relatively fresh Pacific Water. Investigating Pacific Water pathways at different times and the processes that determine those pathways is an important step towards understanding variability in the observed volume of freshwater exported from the Arctic Ocean.