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Near-bottom temperature and salinity evolution around Iceland, 1975-2007

Kerstin Jochumsen (1), Sarah Schnurr (2), and Detlef Quadfasel (1)

(1) University of Hamburg, ZMAW, Hamburg, Germany, (2) Senckenberg am Meer, German Center for Marine Biodiversity Research (DZMB), c/o Biocentrum Grindel, Hamburg, Germany

The near-bottom water masses in the deep basins of the northern North Atlantic and the Nordic Seas hold major temperature differences due to the barrier formed by the Greenland-Scotland-Ridge (GSR). Deep water exchanges across the ridge are prohibited, and only limited water mass exchange in intermediate layers is possible through deep channels, where the flow is southwestward (the Nordic Overflows). The shallow surface layers exhibit warm and saline water flowing north-eastwards across most of the ridge, only at the western GSR (along the east Greenland coast) cold and fresh water is transported southwestward. Several studies have indicated that the GSR or the environmental conditions connected to the influence of the ridge system shape the species distribution and composition of particular benthic groups in this region.

Species distribution models (SDMs), which use spatial environmental variables, can lead to a better understanding of species distributions within the marine environment. Additionally, these models provide an estimate of the response of the marine ecosystem and species distributions to climate change. Hence, spatial environmental variables, known to have an influence on the distribution of species (e.g. temperature, salinity, sediment type), are needed to create realistic SDMs.

Here we use near-bottom measurements of about 88,000 CTD (conductivity-temperature-depth) and bottle profiles, collected in the period 1975-2007. The data is gridded into regular boxes of about 11 km size and interpolated following isobaths. We derive average spatial temperature and salinity distributions in the region around Iceland, showing the influence of the GSR on the near-bottom properties. The spatial distribution of standard deviation is used to compare local variability, which is enhanced near water mass fronts. These spatial property distributions can provide the basis for SDM modelling.

Finally, property changes within the last 30 years are presented using time series analysis techniques for a collection of grid boxes with sufficient data resolution. Seasonal and decadal scale variability, as well as long term trends are discussed for different bottom depth classes, representing varying water masses.