Bipolar Atlantic Thermohaline Circulation

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Project summary

In BIAC the mechanisms, manifestation and impact of intermediate and bottom water formation originating from the bipolar Atlantic Ocean shelves will be explored. The overall goal is to evaluate the global ventilation through circum Arctic and Antarctic shelves and consequences for the climate by up-scaling results and knowledge gained from two key sites: the Barents Sea and the southern Weddell Sea. Proposed dedicated multidisciplinary field surveys of hydrography, bathymetry, currents, turbulence, biogeochemistry, and sea ice depend on the logistical opportunities provided by the IPY program. International collaboration, especially with Russian researchers in the Barents Sea, is crucial in achieving the overall goal. Observations will be used in concert with analysis from remote sensing and modelling tools to support the following

Working Themes (WT):
WT1. Regional circulation and forcing - preconditioning and variability
WT2. Sea ice freezing and high-salinity shelf water (HSSW) formation WT3. Downslope processes, pathways, cascading and mixing
WT4. Contribution to the thermohaline circulation (THC) and consequences for the climate
WT5. Sustainable monitoring system for dense water production on polar shelves

Integrated physical and biogeochemical studies will characterize the hydrography and carbon biogeochemistry of the source waters prior to dense water formation, the end products after cascading, and the anthropogenic carbon fluxes due to ventilation processes. The effects of unresolved processes such as mixing are parameterized in large scale conceptual models and in general circulation models (GCMs). Different parameterizations of the dense water formation on the polar shelves, including the violent entrainment as this water cascades into the deep ocean, will be evaluated. BIAC will thus investigate relationships between variability in deep-water formation, CO2 uptake rates and large-scale natural or anthropogenic climate forcing.