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Glider observations of oceanic conditions in the Fram Strait, 2008-2012

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The Fram Strait is the deepest gateway to the Arctic Ocean (2600 m sill depth), and a crucial pathway for exchange of heat and freshwater between the Arctic and the rest of the world ocean. The region is important for studying changes in the Arctic Ocean and possible feedback mechanisms between the ocean and sea ice. In order to monitor volume, heat and freshwater exchanges between the North Atlantic and the Arctic Ocean, the Alfred Wegener Institute and the North Polar Institute have been maintaining an oceanographic mooring array along 78°50'N since 1997.

The Fram Strait is characterized by strong variability in temperature, salinity and currents on time and spatial scales corresponding to oceanic mesoscale phenomena. This makes estimation of long-term fluxes difficult. In order to improve monitoring the Fram Strait ocean observing system was extended by a multi-purpose acoustic system for thermometry, passive acoustics, and glider navigation between 2008 and 2012 as part of the ACOBAR project. Acoustic thermometry provides depth range averaged ocean temperature at a high temporal resolution. To improve the spatial resolution of the monitoring system Seagliders were deployed in Fram Strait for a few months at a time following a quasi-zonal transect and profiling down to 1000 m.

We present analysis of hydrographic data from the Seagliders operated by the Alfred Wegener Institute in the Fram Strait between 2008 and 2012. During eight glider missions physical oceanography data were collected along repeated sections south of the mooring array. In addition to the directly measured hydrographic data (conductivity, temperature, and pressure), depth-averaged current velocities are derived from glider displacements. Data from the five summer (July-September) and three autumn (September-November) glider missions are used to make year-to-year comparisons of vertical temperature and salinity profiles in the upper 1000 m of the water column.

Glider section data show a high level of eddy variability, with vertical isopycnal displacements of sometimes more than 300 m over less than 20 km. Using the high spatial resolution data from the gliders we investigate mesoscale eddies and meanders along the frontal zone in the Fram Strait, in order to better understand the eddies, their contribution toward heat and freshwater transports, and their importance for the Arctic climate system.