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Long-term observing system for the oceanic regime of Filchner-Ronne Ice Shelf, Antarctica

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Long term observations of the flow of dense waters from their area of formation to the abyss of the World Ocean, and the return flow of warm waters, are central to climate research. For the Weddell Sea an important component of such a system entails monitoring the formation of High Salinity Shelf Water (HSSW) on the continental shelf north of Ronne Ice Front, the transformation to Ice Shelf Water (ISW) beneath the floating Filchner-Ronne ice shelf, and the flux of ISW overflowing the shelf break to the deep Weddell Sea. Equally important is the return flow of warm water toward the Filchner-Ronne Ice Shelf system.

AWI, BAS and UNI/UIB operate a number of monitoring stations in the southern Weddell Sea. The systems build upon techniques and methods developed over several decades and have a proven record of high data return. Here we present plans for extending, integrating and operating the existing long term observatories to increase our knowledge of the natural variability of the ocean-ice shelf system, and to allow early identification of possible changes of regional or global importance.

The S2 observatory at the Filchner sill was established in 1977 and continues to deliver the longest existing marine time series from Antarctica. As a key site for monitoring the ISW overflow S2 is a part of the global net of monitoring sites under CLIVAR Southern Ocean Observing System (SOOS) and OceanSITES. The existing S2 observatory consists of a sub-surface mooring carrying sensors for current velocity, temperature, salinity and dissolved oxygen measurements.

Observations at the Filchner sill also show a seasonal inflow of relatively warm water that is able to reach Filchner Ice Front. New model results indicate that this flow of water might increase in the future and we have deployed a number of instrumented moorings in the Filchner Depression to estimate the heat flux towards the ice shelf.

In 1999 we established Site 5 on Ronne Ice Shelf using a hot-water drill to access the 402 m of water underlying the 763-m thick ice. Results from the multiyear time series show the sensitivity of the sub-ice shelf circulation to changes in conditions over the continental shelf and highlight the importance of monitoring the ice shelf cavity. We will reoccupy Site 5 in the 2014/15 season to deploy a suite of observing systems for long time monitoring of the circulation below Ronne Ice Shelf. The systems will consist of sub-ice shelf oceanographic moorings instrumented with high quality sensors. They will transmit in real-time and are designed to operate for more than 10 years. In 2015/16 we will extend the observing network by deploying observatories on Filchner Ice Shelf.

The Filchner-Ronne Ice Shelf and S2 observatories will provide the first ever concurrent observations from the ice-shelf cavity where ISW is formed, and the sill where it starts its descent towards the deep Weddell Sea, and will provide a unique dataset allowing us to link processes and variability within the cavity directly to overflow properties and deep water formation.