

Progress Report: Southern Ocean Modern Observations/Weddell Sea Moorings

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Project Summary

The world's deep oceans are filled with water masses formed at the continental margins of Antarctica. The Weddell Sea is a major source of these so-called Antarctic Deep and Bottom Waters. Relatively warm, saline Circumpolar Deep Water enters the Weddell Gyre to the east of the Greenwich Meridian. As it traverses the gyre, it feeds bottom water-forming processes on the continental shelves, and interacts with floating ice shelves to produce a variety of Weddell Deep and Bottom water types.

This project maintains three deep and bottom water focused moorings south of the South Orkney Islands in the Northwest Weddell Sea to provide a time series of the combined outflow (currents and temperature/salinity) of Antarctic Deep and Bottom Water drawn from various sites within the Weddell Sea. The moorings were initially installed and maintained as part of the Consortium on Oceans Role in Climate: AbRUpt climate CHange Studies (CORC-ARCHES) Southern Ocean Modern Observations program.

First installed in April 1999, the moorings are serviced using ship time made available by other programs, primarily through the National Science Foundation Office of Polar Programs (OPP), and principal investigators funded by OPP who graciously allow our team to sail on their cruises. As time and resources allow during the mooring maintenance cruises, CTD/tracer stations are occupied at the mooring sites and at stations distributed along a line between the mooring locations (Figure 1).

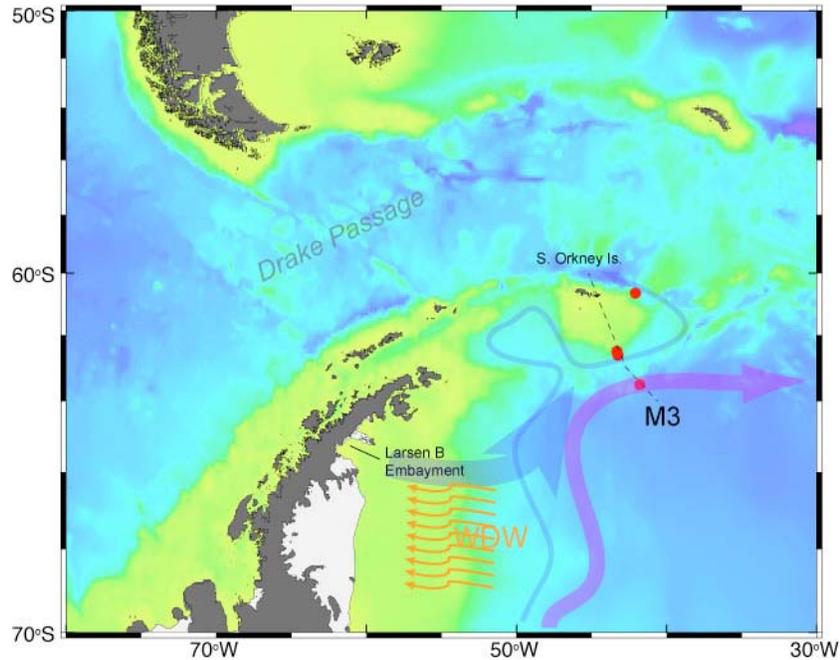


Figure 1. Location of the Weddell Sea moorings (red dots) and repeat CTD/Tracer line (dashed line). Shown schematically are the pathways of deep and bottom waters formed by interaction of WDW with continental and ice shelf waters.

Continuing a collaboration that began in 2004, we were invited to join Eugene Domack and his co-investigators on cruise NBP0603 (N B Palmer) to the western Weddell in April-May 2006. Time was set aside at the end of the cruise to service the ARCHES moorings near the South Orkney plateau. Funding for the ARCHES-related ship time was provided by OCO.

As part of the ongoing collaboration with Domack et al., we had deployed instrumented sediment trap moorings in the Larsen B embayment in 2005 (during cruise LMG0502) which we attempted to recover in 2006. Two of the moorings could not be recovered, presumably because they were carried away by large ice shelf calving events which had occurred just prior to the cruise. Ice, weather, and time limitations prevented attempts to recover the other 3 moorings. While in the Larsen B embayment, CTD stations were occupied. Preliminary analysis of the data from these stations, in combination with data collected in 2005, resulted in two poster presentations at the Geological Society of American meeting in October 2006 (Philadelphia).¹

¹ “Deep Access to the Larsen Ice Shelf-B Embayment: an International Geologic and Geophysical Expedition (E. Domack, A. Leventer, B. Huber, G. Halverson, R. Gilbert, S. Brachfeld, V. Wilmott, A. Rathburn, M. Rebesco, S. Ishman) and

“Transport of suspended particulate material by Ice Shelf Water cold tongues: a new observation from Spillane Fjord (Crane Glacier), Antarctica (A. Mention, E. Domack, B. Huber, A. Leventer, S. Brachfeld, L. Padman

At the conclusion of the Larsen B science program the vessel transited to the ARCHES work site, where we attempted to deploy a mooring at site M2. Severe weather and ice conditions during the transit reduced the working time available to only 8 hours on site. The mooring was successfully deployed, but a catastrophic flotation failure at depth caused the release to trigger, returning the mooring to the surface. All instruments were recovered, but we were unable to redeploy the mooring as there was insufficient time remaining.

We have established a cooperative arrangement with colleagues at the British Antarctic Survey (BAS) to continue servicing the ARCHES moorings, and to expand the array in conjunction with the BAS program in the region. We are sending one member of our group to join a BAS cruise on board RRS Ernest Shackleton in February-March 2007, during which the BAS and LDEO ARCHES moorings will be serviced.