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Observations of the Antarctic Slope Undercurrent in the Southeastern Weddell Sea

Cedric Chavanne (1), Karen Heywood (1), Keith Nicholls (2), Ilker Fer (3), Colin Griffiths (4), and Mark Inall (4)

(1) University of East Anglia, School of Environmental Sciences, Norwich, UK (c.chavanne@uea.ac.uk), (2) British Antarctic Survey, Cambridge, UK, (3) Geophysical Institute, University of Bergen, Bergen, Norway , (4) Scottish Association for Marine Science, Dunstaffnage Marine Laboratory, Oban, UK

An array of five moorings was deployed in February 2009 across the Antarctic shelf and slope in front of the Riiser-Larsen Ice Shelf, in the southeastern Weddell Sea, as part of the multi-national Synoptic Antarctic Shelf-Slope Interactions (SASSI) study. The moorings have been instrumented to quantify the components of the freshwater transport on the continental shelf and slope, in an area located upstream of the regions of deep water formation in the southwestern Weddell Sea. When recovered in February 2010, the moorings will provide the first year-round observations of the upstream processes influencing the formation of Antarctic Bottom Water and the melting of ice shelves in the Weddell Sea.

Here we present the two hydrographic transects undertaken during the mooring deployments, along with measurements of currents from lowered ADCPs. These observations confirm the existence of surface-intensified southwestward currents associated with a downward-sloping of isopycnals toward the coast, a nearly circumpolar feature called the Antarctic Slope Front. During the first transect on January 31, the vertical shear did not change sign with depth, the southwestward surface currents reversing to northeastward currents near the bottom. As a result, the isopycnals sloped downward until they intercepted the bottom, preventing the intermediate layer of Warm Deep Water from reaching the shelf. In contrast, during the second transect on February 23, a northeastward undercurrent was observed at mid-depth a few kilometres offshore of the shelf break, surrounded below and above by southwestward currents. The reversal of the vertical shear below the undercurrent was associated with an upward-sloping of isopycnals toward the coast, bringing the Warm Deep Water closer to the shelf break, past which it could be transported and mixed with the colder and fresher Shelf Water by tides, topographic waves and eddies.

Similar undercurrents have been observed on past hydrographic sections in the southeastern Weddell Sea, but have never been continuously monitored. Preliminary analyses of data from the moored instruments will also be presented to characterise the temporal variability and dynamics of the undercurrent.