The Filchner Ice Shelt Water Overflow

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In this speech I will give a status report for our research on processes, fluxes and circulation in the southern Weddell Sea where about 50% of the bottom water in the Antarctic is believed to be formed (Orsi et al. 2001, Foldvik et al. 2004). Cooling and freezing on the shallow shelves are producing HSSW at the freezing point. Some of the HSSW will cascade down the continental slope and contribute directly to bottom water production. In addition, some of the HSSW penetrates underneath the floating Ronne - Filchner Ice Shelf in the Southern Weddell Sea (Foldvik et al., 2001), see Fig.1. Here it becomes super-cooled, Ice Shelf Water (ISW) and is observed to overflow the sill of the Filchner Depression at a rate of about 1.6 Sv (Foldvik et al., 2004). As it flows down the continental slope it forms a bottom plume which is deflected westwards because of the Coriolis force, see Fig.2. Here we believe that the bottom topography may give rise to different pathways; the upper part will descend at a moderate angle with the isobaths due to friction (Killworth, 2001). Deep canyons and ridges (Fig.3) provoke other branches to descend more rapidly towards the deep Weddell Sea.

On its path down the slope the ISW plume mixes with overlaying water masses. These mixing processes are not well understood, but supercritical plume speeds and associated hydraulic jumps are believed to be important (Holland et al., 2002). On its way down, the cold bottom plume increases its volume transport to more than 4 Sv. This is an upper estimate of the total production of WSBW believed to be formed in the whole region. WSBW is a precursor to the AABW, so our study area is a key location for processes with global impact.

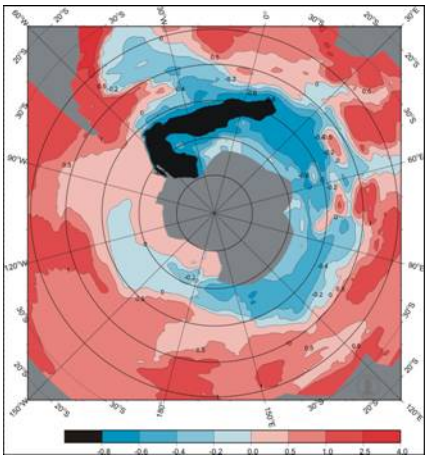

Figure 1. Potential temperature for the bottom water in the Southern Ocean.

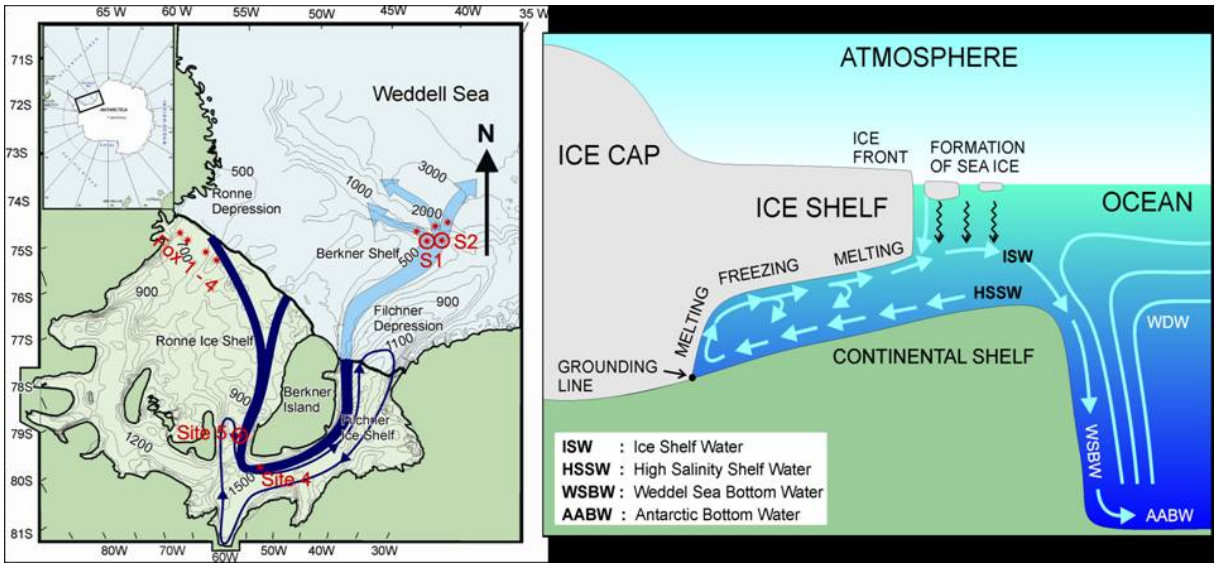

Figure 2. Left: Bathymetric map of the southern Weddell Sea, Antarctica showing the vast shallow shelves in the Southern part. The arrows indicate simplified circulation in the cavity beneath ice shelf and the pathways for the ISW. The monitoring sites Site 4 and 5, Fox 1 to 4, and the S2 CLIVAR/OceanSITE mooring on the Filchner sill. Right: Schematics of the dense water production and circulation.

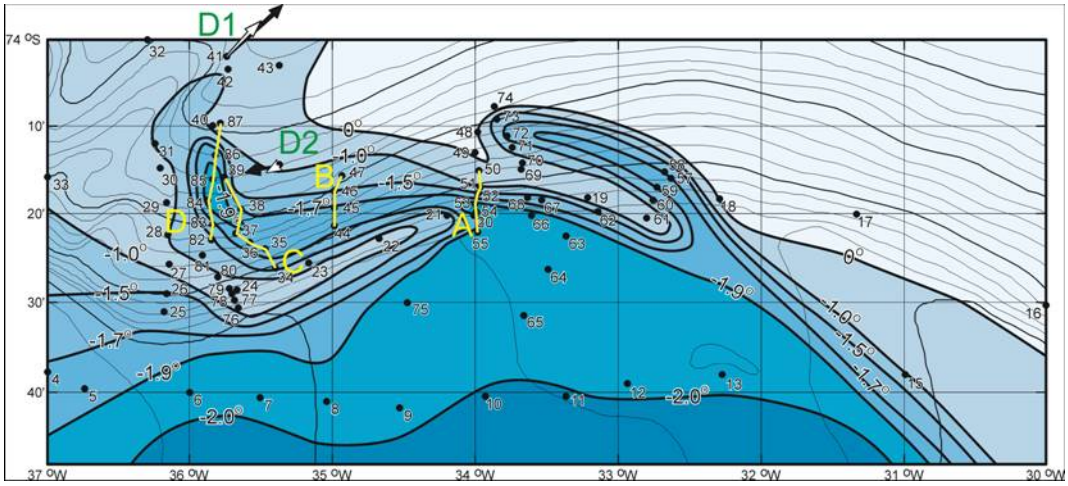

Figure.3 Bottom temperatures obtained in 1985 with K/V Andenes indicating the ISW overflow over the Filchner sill and how it is deflected towards the left as it penetrates down slope.