Geophysical Research Abstracts
Vol. 14, EGU2012-1904, 2012
EGU General Assembly 2012

On the Antarctic Slope Front and Current crossing of the South Scotia Ridge

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To unveil the contorted path followed by the Antarctic Slope Current connecting the Weddell and Scotia Seas, hydrographic stations with unprecedented spatial resolution were occupied on a series of sections across the slope and multiple channels in the double-pronged western portion of the South Scotia Ridge. Fieldwork consisted of two cruises from the ESASSI (January 2008) and ACROSS (February 2009) programs, the Spanish and USA/Argentina components of the International Polar Year core project SASSI (Synoptic Antarctic Shelf-Slope Interaction study). In this region the Antarctic Slope Current can be located by the pronounced in-shore deepening of isopycnals over the continental slope, rendering the strong subsurface temperature and salinity gradients characteristic of the Antarctic Slope Front. Before reaching the gaps in the southern Ridge near 51°W and 50°W, the ASC carries about 3 Sv of upper layer waters, but it splits into shallow and deep branches upon turning north through these two gaps. The shallower branch enters the Hesperides Trough at 51°W, then shows a tight cyclonic loop back to that longitude roughly following the slope's 700-m isobath, and turns again westward through a similar gap in the northern Ridge. In the Scotia Sea the westward-flowing Antarctic Slope Current is found as far west as the Elephant Island along slightly deeper levels of slope (1100 m) before it is blocked by the Antarctic Circumpolar Current south of the Shackleton Fracture Zone (56ºW). The deeper branch of the ASC in the Powell Basin crosses the southern Ridge near 50°W and roughly follows the 1600-m isobath before entering the Scotia Sea through the Hesperides Gap farther to the east (49°W). Thereafter the deeper waters carried westward by this branch become undistinguishable from those circulating farther offshore. Repeat cross-slope sections at both southern and northern flanks of the South Scotia Ridge showed significant temporal variability in the characteristics of the Antarctic Slope Front/Current system.