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Circulation of deep and bottom waters in the region of the Shackleton Ridge, Drake Passage, based on the research in 2003-2008

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Four expeditions were carried out onboard Russian research vessels "Akademik Sergey Vavilov" and "Akademik Ioffe" in December 2003, November 2005, November 2007, and October 2008 in the region of the Shackleton Ridge, Drake Passage. Four sections across the Drake Passage and one survey in its central part were occupied during these cruises. Quantitative properties and circulation of deep and bottom waters in the region of the Shackleton Ridge were investigated using the data of LADCP and CTD-measurements in these expeditions, climatic dataset (Gouretskii, Koltermann, 2004), and historical hydrographic data (database WODB2005). It is shown that Weddell Sea Deep Water (WSDW) is efficiently transferred across the Antarctic Circumpolar Current (ACC) from the regions on the southern side of this current where WSDW penetrates into the Scotia Sea. This transfer results in the abyssal water cooling and freshening in the Yaghan Basin, north Scotia Sea. It is shown that additional pathway exists for WSDW transport to the north passing through the western Scotia Sea due to blocking westerly WSDW flow by the Shackleton Ridge. The existence of some quasi-isolated circulations of deep and bottom waters in the regions adjacent to this ridge are demonstrated. It is shown that the flow of abyssal waters with neutral density gamma_n>28.23 (theta<0.4°C) over the Shackleton Ridge (both eastward and westward) propagates mainly in the passage between the ridge and the Antarctic slope. Estimates of water exchange in this passage yield a few tenths of Sverdrup unit. Measurements in 2008 indicate that the Shackleton Ridge is probably an even more essential topographic barrier.