Geophysical Research Abstracts
Vol. 12, EGU2010-5213, 2010
EGU General Assembly 2010

Direct observations of the ACC transport across the Kerguelen Plateau from the 2009-2010 TRACK cruises

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The Kerguelen Plateau is considered as a major barrier to the eastward flowing Antarctic Circumpolar Current (ACC), diverting about 2/3 of its transport to the north of the plateau and the remaining transport across the vast plateau developed between the Kerguelen Islands and Antarctica. However, due to the lack of systematic high-quality observations especially across the Fawn Trough, our knowledge of ACC branches and associated transports across the Kerguelen Plateau has been largely indirect and debated, with previous transport estimates ranging from 30 to 100 Sv. In order to fill this knowledge gap, we undertook full-depth CTD and LADCP measurements in the Fawn Trough area and moored three lines of a total of 9 current-meters across the Fawn Trough in February-March 2009 during the TRACK-1 cruise.

The TRACK-1 data have permitted us to document for the first time a detailed vertical current structure especially across the Fawn Trough as well as the Deep Western Boundary Current (DWBC) on the eastern flank of the Kerguelen Plateau at 58°S. The Fawn Trough Current appears as a principal across-plateau jet associated with the Southern ACC Front, concentrating the majority (43 Sv) of the eastward transport passing to the south of the Kerguelen Islands (58 Sv), compared to ∼92 Sv at the Subantarctic Front as estimated previously to the north of the islands. This yields a total transport of ∼150 Sv for the ACC transiting through the Kerguelen longitude, consistent with other independent estimates in the other sectors of the Southern Ocean, but with an up-to-date partition of ∼60% of the transport passing to the north of the Kerguelen Plateau and ∼40% across the plateau. The DWBC transport at 58°S is estimated as 43 Sv, of which 36 Sv come from the northward turning of the westward flowing Antarctic Slope Current and the rest (7 Sv) originates from the southernmost branch of the ACC passing through the northern Princess Elizabeth Trough. Two other transport branches associated with the Polar Front are also estimated: 6 and 2 Sv on the nearshore slope immediately south of the Heard-McDonald Islands and Kerguelen Islands, respectively.

The TRACK-2 cruise has just been finished at the moment of this writing, with a successful recovery of all moored current-meters, together with complementary CTD and LADCP sections extended up to the Kerguelen Islands. Preliminary results from this recovery cruise will be presented.