



Inferring the baroclinic transport of the Antarctic Circumpolar Current south of Africa from upper ocean temperatures

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The baroclinic transport of the Antarctic Circumpolar Current (ACC) in the region south of Africa is estimated using expendable bathythermograph (XBT) sections, following a method proposed by Rintoul et al. (2002; Journal of Geophysical research, 107, C10, doi: 10.1029/2001JC000787).

Empirical relationships between the upper ocean temperature and the baroclinic transport referenced to 2500 dbar are first established using a set of five hydrographic sections, three along 0°W (nominal), and two along 30°E. The relations are identical for the two longitudes in the deep and bottom waters, but diverge in the upper layers due to different properties of the Antarctic Intermediate Water in the Atlantic and Indian sectors. Bounding the ACC by the Subtropical Front and the Southern Boundary Front (to the north and south), bottom-referenced transport estimates of the current range between 135 Sv and 170 Sv, with typical uncertainties of 10 Sv, and no apparent difference between the western and eastern sites.

Using the empirical relationship at 0°W and fourteen XBT lines near this longitude, the ACC baroclinic transport was estimated to be 97 ± 6 Sv relative to 2500 dbar, and 164 ± 12 Sv when bottom-referenced. This transport is mostly contributed by the Subantarctic Front ($30 \pm 13\%$), the Polar Front ($34 \pm 11\%$), and the Southern ACC Front ($21 \pm 11\%$).

ACC transport estimates south of Africa, obtained from the CTD and XBT data, are between 10 and 15 Sv higher than those reported in other studies to the south of

Australia and in the Drake Passage. This difference, observed at depths higher than 2500 m, may be explained by the addition of (newly formed) Antarctic Bottom Water from the Weddell Sea and diluted North Atlantic Deep Water joining in the ACC in this sector of the Southern Ocean.