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Monitoring the variability of the Antarctic Circumpolar Current south of Africa

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Data from 21 hydrographic sections south of Africa are used to estimate the baroclinic transport of the ACC between Africa and Antarctica. Surface dynamic height (referenced to 2500 m) is derived from XBT data, by establishing an empirical relationship between vertically-integrated temperature and surface dynamic height calculated from CTD data. This temperature-derived dynamic height data compares closely (average RMS difference is 0.05 dyn m) with dynamic heights calculated from CTD data. A second empirical relationship between surface dynamic height and cumulative transport has been defined allowing to monitor a more extensive time series of transport, derived from all available upper ocean temperature sections. Over a period of 16 years, XBT data from 18 hydrographic transects of the ACC produce an average baroclinic transport estimated at 87.5 $\pm$ 3 Sv relative to 2500 m. This estimate is analogous with geostrophic transport values calculated from CTD data. Weekly maps of absolute dynamic topography (ADT) collate closely with the CTD dynamic heights. The ADT dataset is used to deduce ACC transport estimates by exploiting the relation between dynamic height and cumulative transport. The mean transport of the ACC is 101 $\pm$ 12 Sv. These transports agree well with simultaneous in-situ estimates (RMS difference in net transport is 8.3 Sv). This suggests that sea level anomalies largely reflect transport changes above 2500 m.

Dynamic heights derived using the methodology presented here may improve our ability to compare satellite sea surface height measurements with in-situ data, in a data

sparse region. Additionally, improved measurements of transport, using high density XBT sections, allow us to monitor the variability of the ACC's flow on improved spatial scales while altimeter derived transports greatly advance the temporal resolution, than could not be undertaken using CTD sections or current meter arrays alone.