Text S1: Processing of Seaglider data

Seaglider measurements of salinity, temperature, pressure, and dissolved oxygen were collected down to 1000 m depth. Salinity, temperature, and pressure were collected at a vertical resolution of approximately 1 m, while dissolved oxygen and optical backscatter data were collected with a vertical resolution of 2–3 m. 500 dives were performed, each with an upcast and a downcast. The raw glider data were processed using the GliderTools toolbox (Gregor et al. [2019]). The data were then mapped onto a regular grid with 5 m vertical spacing and 2.5 km horizontal spacing, which corresponds to a temporal scale of approximately 2.4 hours following the GliderTools routine. With this gridding, each 5 meter depth bin holds approximately 10-15 measurements made by the glider. When transformed into neutral density bins, there are approximately 20 glider measurements in near-surface density bins and up to 100 glider measurements in deep density bins. The interpolation uses a Gaussian weighting function with vertical and horizontal scales of 10 m and 4 km, respectively.

Optical backscatter data on the gliders was measured 532 nm. Backscatter data was only collected to 300 m depth, and only in the first third of the deployment. Raw sensor counts were calibrated using the manufacturer-supplied scale factor and dark counts. The resulting volume
scattering function includes scattering signal from pure seawater and particulate scattering (Zhang et al. [2009]; Vaillancourt et al. [2004]). The scattering by seawater was calculated using a function described in Zhang et al. [2009] and subtracted from the volume scattering function. The resulting particulate volume scattering function was converted into particulate optical backscattering coefficient, bbp (Bol et al. [2018]; Briggs et al. [2011]). Finally, following Briggs et al. [2011], the backscatter data were filtered using a seven-point minimum filter followed by a seven-point maximum filter in order to remove spikes, which often occur in profiles of bbp due to aggregate material.

Supplemental Figures

**Figure 1.** Temperature-Salinity diagrams for the June northward transect by the second Seaglider. Points are colored by the latitude at which they were collected. (a) shows data for the entire transect; (b) shows data only in the region immediately surrounding the PF (approximately 1 degree of latitude). The core of the PF was located at approximately 58.5°S.
Figure 2. Glider track with various definitions of the Polar Front in (a) June and (b) July. Gradient of Absolute Dynamic Topography [ADT] on the date of the PF crossing is shown in color with ADT definitions of the major fronts of the ACC by Kim and Orsi [2014] in black dashed contours. Glider transects are shown in light red with the location of the PF crossing based on hydrographic definitions by Orsi et al. [1995] at the red star. SACCF = South ACC Front. PF = Polar Front. SAF = Subantarctic Front.

References


Figure 3. Surface forcing over Drake Passage over the deployment, from ECMWF ERA5 reanalysis. Drake Passage is taken as the box bounded by 55°S, 65°S and 60°W, 70°W. (a) Histogram of wind directions. The winds are primarily westerly and south-westerly, as is typical of Drake Passage. (b) Surface heat flux, with the diurnal cycle removed. The dotted black line denotes zero surface heat flux. (c) 10-meter wind stress. In (b) and (c), the dashed blue and red lines indicate the start and end, respectively, of the glider deployment.


Figure 4. Histogram of mixed layer depths from glider data, using the criterion of $\Delta \sigma_0 = 0.125 \text{ kg m}^{-3}$ from the surface [Monterey and Levitus, 1997].