

## Estimates of the Southern Ocean general circulation improved by animal borne instruments

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[1] Over the last decade, several hundred seals have been equipped with conductivity-temperature-depth sensors in the Southern Ocean for both biological and physical oceanographic studies. A calibrated collection of seal-derived hydrographic data is now available, consisting of more than 165,000 profiles. The value of these hydrographic data within the existing Southern Ocean observing system is demonstrated herein by conducting two state estimation experiments, differing only in the use or not of seal data to constrain the system. Including seal-derived data substantially modifies the estimated surface mixed-layer properties and circulation patterns within and south of the Antarctic Circumpolar Current. Agreement with independent satellite observations of sea ice concentration is improved, especially along the East Antarctic shelf. Instrumented animals efficiently reduce a critical observational gap, and their contribution to monitoring polar climate variability will continue to grow as data accuracy and spatial coverage increase. **Citation:** Roquet, F., et al. (2013), Estimates of the Southern Ocean general circulation improved by animal-borne instruments, *Geophys. Res. Lett.*, 40, doi:10.1002/2013GL058304.

### 1. Introduction

[2] Evidence is accumulating that the Southern Ocean is changing rapidly [Jacobs, 2006], and there is an urgent need for comprehensive in situ observations to document the spatial and temporal variability of these changes [Rintoul et al., 2010]. Since the 2000s, the global upper ocean has been continuously sampled by the Argo array [Gould et al., 2004], including the Antarctic Circumpolar Current (ACC) region. South of the ACC, however, the presence of sea ice is a major obstacle for Argo profiles, and until recently, the only observations available were a small number of summertime ship-based profiles.

[3] Since 2004, novel observations of the Southern Ocean have become available through the use of instrumented seals. Conductivity-temperature-depth satellite relay data loggers (CTD-SRDLs) were developed in the early 2000s to sample temperature (T) and salinity (S) profiles during marine mammal dives [Lydersen et al., 2002; Fedak, 2004]. While their principle intent was to improve understanding of seal foraging strategies [Biuw et al., 2007; Fedak, 2013], they have also provided as a by-product a viable and cost-effective method of sampling hydrographic properties in many regions of the Southern Ocean [Charrassin et al., 2008].

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