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Overturning Circulation and mesoscale eddies in the first GO-SHIP section at 34.5ºS across the South Atlantic during January 2017

Gaston Manta[1], Sabrina Speich[1], and Johannes Karstensen[2]
[1]Laboratoire de Meteorologie Dynamique, LMD-IPSL, UMR 8539, Ecole Polytechnique, ENS, CNRS, Paris, France (gastonmanta@gmail.com)
[2]GEOMAR Helmholtz Centre for Ocean Research Kiel, Kiel, Germany

The variability of the Atlantic Meridional Overturning Circulation (AMOC) is known to have considerable impacts on the global climate system. In particular, the South Atlantic is thought to control the stability of the AMOC. That's why significant resources have been invested in measuring the AMOC in the South Atlantic since 2009 mainly through mooring deployments accompanied by yearly cruise campaigns in the eastern and western boundaries. In January 2017, the RV Maria S. Merian conducted the first hydrographic (GO-SHIP) transect along the SAMOC-SAMBA line located at 34.5°S in the South Atlantic. In this study, we present analyses of the data obtained during the cruise. Volume and heat transports were calculated using the slow varying geostrophic density field and Ekman transport from daily satellite wind stress data. The general structure of these transports is in close agreement with other estimations at near latitudes. Two defined overturning cells are distinguished with differences in the abyssal circulation between the west and east. While the west shows Antarctic Bottom Waters flowing northward ($\gamma > 28.27$ kg.m^{-3}) and Lower Circumpolar Deep Waters (LCDW, 28.10 kg.m^{-3} < γ < 28.27 kg.m^{-3}) above flowing southward, only LCDW are found in the east, flowing northward and southward from 6°E, respectively. The section presented a positive mass imbalance. By assuming the latter to be the barotropic transport component we equally distributed it along the vertical in order to satisfy a net-zero transport. The overturning maximum is located at 1250 meters deep and is 18 Sv with net northward heat transport. Moreover, by using the Laxenaire et al., (2018) eddy detection method, we identified the various mesoscale eddies crossed during the cruise. This analysis provided evidence of the presence of 13 cyclonic and 12 anticyclonic eddies. Among the anticyclonic eddies, three were identified as Agulhas rings. One of these eddies was located close to the Brazilian slope and was more than 5 years old since its first detection. During the cruise, a particularly intense cyclonic eddy was crossed near the African coast. The upper layer velocity within the eddies exceeded 1 m.s^{-1}, with an asymmetric stronger northward flow. Although mesoscale eddies dominate the upper 1000 meters circulation, no significant differences were found in the overturning circulation when replacing the upper 1200 meters layer of 34.5°S observed section with a climatology generated with the ARGO profiles located outside eddies.

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