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Glider Observations as part of an AMOC monitoring array

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Since 2004 the RAPID project has been making direct measurements of the Atlantic Meridional Overturning circulation (AMOC) at 26.5N using a purposefully designed array. The array includes Gulf Stream transports from the Florida Straits cable, Ekman transports from ERA-Interim wind data and internal transports from a transatlantic moored array. The internal transports come from a combination of dynamic height moorings at the eastern boundary, western boundary and the mid-Atlantic ridge. Shallow and deep western boundary currents at the western boundary are measured with a moored array of current meters. The focus of this study is on the eastern boundary element of this array off Africa.
Density fluctuations at the eastern boundary dominate the seasonal variability of the AMOC. Mooring operations in the east are problematic due to high losses from trawling. Given the importance of the observations and the vulnerability to losses, the RAPID program has used ocean autonomous gliders as virtual moorings in the area since 2008. Gliders offer data security on two fronts: firstly, via real-time transmission of data and, secondly, due to them being less likely to be trawled. Here, we examine the gliders' effectiveness at reproducing the results of the moorings.

Compared to the vertical profiles of density obtained from discrete CTD data on the moorings, we show that gliders can replicate the AMOC transport anomaly caused by density fluctuations at the eastern boundary. Gliders obtain a higher resolution of data in the vertical, capable of producing data at 2-3m intervals as opposed to the moored instruments, which typically have a 100m separation. The glider also produces data in the top 100m, above the shallowest moored instrument. However, the glider has poorer temporal sampling at the depth levels in comparison to moored CTD data. The gliders typically sample a given depth level four times less than the moored instruments. The differences between the glider data and the moored instruments are compared in this study.

We conclude that gliders can accomplish the work of moored instrumentation for calculation of dynamic height in this region. The potential to use gliders for real-time generation of an AMOC measurement at 26.5N is considered, as is the potential for applying gliders to this type of calculation elsewhere. This study highlights the usefulness of gliders as part of a long-term monitoring program