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Coherent finescale temperature structures characterised at high resolution by a fast thermistor on an ocean glider

Callum Rollo, Karen J. Heywood, and Rob A. Hall
Centre for Ocean and Atmospheric Sciences, ENV, University of East Anglia, Norwich, UK

During the EUREC4A field campaign in 2020, three ocean gliders were deployed to the tropical North Atlantic, upwind of Barbados. We present preliminary results from this three week deployment, focusing on the finescale temperature and salinity variability below the pycnocline.

The three gliders completed a total of 580 dive cycles to 750 m in virtual mooring and bowtie patterns around a 10 km square. A research vessel occupied a 250 km meridional transect 2 km east of the glider square. The gliders and research vessel observed staircases in temperature and salinity from 300 m to 500 m depth, with a typical vertical scale of 50 m and temperature steps of 0.5 to 1.0 C. The staircase structure was observed by all three gliders' temperature/salinity sensors and the research vessel's main CTD. The finescale (O 10 cm) vertical structure of the steps, was clearly resolved by a FP07 fast thermistor mounted on one of the gliders. The finescale layers of uniform temperature appear also to be uniform in salinity. These large stairsteps persisted for an average of two days before eroding, and were observed to be spatially coherent over at least 10 km. Smaller stairstep structures at the base of the pycnocline (O 10 m, 0.2 C) persisted throughout the observational period.

Halfway through the deployment, a density-compensated front moving through the region increased temperature at 400 m by 2 C. Simultaneous observations from the three gliders and research vessel enabled analysis of the evolution of this structure. The temperature change was greatest at 400 m, tapering to the limit of detectability at 200 m and 600 m. Along the edge of the front on the warm side, staircase structures were observed. These structures persisted for over a week before eroding.