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Zonal currents over the mid-Atlantic ridge north of 50N observed with RAFOS floats

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In the late 1990s, over 100 acoustically-tracked RAFOS floats were deployed at the thermocline level between 45 and 55N in the North Atlantic to investigate the warm water pathways from the subtropical to subpolar regions. This was part of the U.S. WOCE Atlantic Circulation and Climate Experiment (ACCE). The trajectories of floats released upstream (west) of the Mid-Atlantic Ridge (MAR) are analyzed here to determine how and where the various branches of the North Atlantic Current cross the MAR. They show relatively strong eddy activity upstream and downstream of the ridge axis, and the presence of several long-lived, quasi-stationary meanders and eddies immediately upstream of the ridge. In spite of this, the float trajectories generally collapse into narrow bands over the ridge axis as they are funneled over several deep gaps in the MAR, especially the Charlie-Gibbs Fracture Zone and the Faraday Fracture Zone. The high-resolution trajectories also illustrate the influence of smaller-scale features of the MAR (including seamounts and the rift valley) on the current pathways, even though the floats are up to 1500 m above the ridge crest. Comparison with satellite altimetry from the Modular Ocean Data Assimilation System (MODAS) indicates strong correlations between the float trajectories and surface currents, and the latter exhibit similar patterns around higher topography and through gaps. These results raise interesting questions concerning the ability of gaps in the ridge to possibly constrain the warm water pathways from the western to eastern basins (and then on to the subpolar and Nordic seas) in the face of long term changes in atmospheric forcing.