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Eastern boundary baroclinic variability and the meridional overturning circulation at 26.5˚N

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The RAPID-MOC array makes use of moored time series measurements of density at the western and eastern boundaries at 26.5˚N of the Atlantic to estimate the transatlantic, absolute zonally integrated mid-ocean geostrophic transport. Here we study the contribution of eastern boundary density to the meridional overturning circulation (MOC), based on mooring data between April 2004 and October 2006. It is generally expected that the density variability near the eastern boundary of the North Atlantic is smaller than near the western boundary. However, neither the amplitude nor the frequency distribution of eastern boundary densities contribution to MOC variability have been studied systematically. To highlight the eastern boundary variability, the MOC is calculated assuming that density at the western boundary is time-invariant. At the eastern boundary there are two methods of sampling density profiles: by two 5000 m long (full water column) moorings located at the base of the African continental slope, and with an array of small moorings distributed between the African shelf and the base of the continental slope. The eastern boundary contribution to the basin-scale meridional transports inferred from the inshore (small moorings) and offshore (tall moorings) data sets are investigated for potential redundancy.

There are considerable differences between the two data sets in terms of amplitude, vertical structure and frequency distribution of the resulting mid ocean geostrophic transport fluctuations. The vertical scale of the density anomalies that account for the major changes in the transports goes much deeper at the offshore site (throughout almost all the water column) with maximum density changes concentrated at $\sim$1000 m. For the inshore data set density anomalies are more intense but confined to depths

above 1000 m. Transports inferred from the inshore data show pronounced variance in the high frequency limit, with dominant periods of 3 and 13 days. Near boundary processes appear to play an important role in setting the time scale. The two transports signals are uncorrelated and mechanisms which are partly unrelated to the MOC may mask MOC related density signals in the offshore data set on the time scales under consideration. The contribution of eastern boundary density to MOC variability is ± 1.9 Sv if the offshore data are used, and ± 1.5 Sv if the inshore data are used (size of overall MOC variability is ± 5 to 6 Sv).