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Dramatic Interannual Variability in the Atlantic Meridional Overturning Circulation (AMOC) at 26°N

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Since 2004, the RAPID/MOCHA project has made purposeful observations in the Atlantic to estimate the strength of the Meridional Overturning Circulation at 26°N. Mid-ocean interior transport is estimated as the geostrophic transport between end point moorings which measure profiles of density, and supplemented by an array of current meters in the shallow and deep western boundary currents. The Gulf Stream transport through Florida Straits is estimated using a telephone cable, and Ekman transport is estimated from satellite-derived winds. The initial calculation of overturning strength showed that there is large subannual variability with a mean and standard deviation of 18.7±5.6 Sv (Cunningham, et al 2007).

We have understood sources of variability at subannual and seasonal timescales, but from the timeseries to date (now 6.5 years), the spectrum of transport variability shows that the interior, geostrophic transport is responsible for most of the interannual AMOC variability, while the relative variability due to Ekman and the Florida Straits at longer time scales is reduced. With the most recent update, in 2009 the seasonal cycle of the AMOC disappeared and the AMOC dropped from a 5-year mean of 18.1 Sv to an annual mean of 12.2 Sv (April 2009–2010). This strong reduction of the AMOC was seen in multiple components (the Gulf Stream, upper mid-ocean transport), and present both in the barotropic term and the vertical shear structure. By fixing the Ekman and eastern boundary variability in our calculation of the AMOC, we can demonstrate the lower frequency, longer term changes that are occurring in the deep ocean and in the deep western boundary current.