An observation-based detection variable for the meridional overturning circulation at 26N in the Atlantic

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We present an observation-based detection variable for the meridional overturning circulation (MOC) at 26N in the Atlantic. The detection variable is derived by projecting a climate signal onto a pattern of natural variability (Hasselmann, 1979; Baehr, 2007). For the MOC, this method so far not been tested with solely relying on observations. Here, we test the method relying existing/ongoing observations of the zonal density gradient at 26N. For the fixed spatial pattern of natural variability, we use the observations available from the hydrographic occupations of the zonal transect in 1957 and 2004. For the climate signal, we use observations from the RAPID/MOCHA array.

We find that the method can not only be meaningful applied to the observations, but yields similar results as in the model simulations. This opens the prospective of timely and reliable detection of MOC changes at 26N in the Atlantic based on the currently implemented observing system. It also results in increased confidence in the previous model results, which suggested that the method employed here reduces the time to detect MOC changes by 50 percent compared to the uni-variate analysis of a single MOC timeseries. In addition, the detection variable has the potential to provide the bounds of natural variability of the MOC at 26N at which models - eventually to be used for MOC predictions – could be tested against.