Transports of freshwater and heat at 26N in the subtropical North Atlantic

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Introduction

The climate of northwest Europe and indeed the whole of the Northern Hemisphere is profoundly influenced by the oceanic transport of freshwater and heat from the tropics to the subpolar regions. At 26.5°N the circulation carries about 1.3 PW (1 PW = 10^{15} W) of heat northwards and about 1.2 Sv (1 Sv = 10^6 m^3 s^{-1}) of freshwater southwards. The meridional heat and freshwater transports are dominated by the meridional overturning circulation (MOC), in which the northward surface waters are transformed into North Atlantic Deep Water formed primarily by cooling in the subpolar regions. The quantity of the deep water formation is strongly influenced by the meridional heat and freshwater transports. Estimates of the transports of freshwater and heat are calculated using observations from the RAPID-MOCHA-Western Boundary Time Series (WBTS) array and Argo floats every 10 days since April 2004. The southwards mean freshwater transport implies a freshwater convergence between the Bering Strait and 26.5°N, consistent with a freshwater loss from this region.

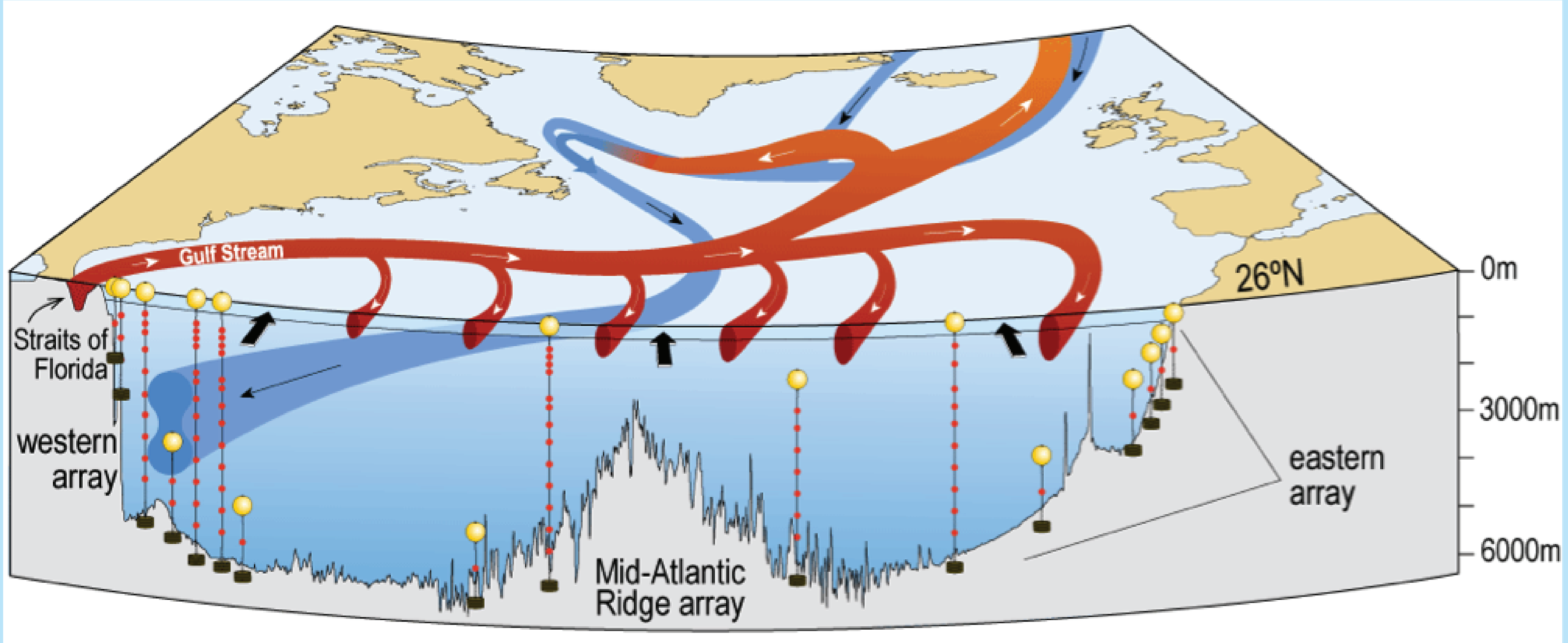

Figure 1. A schematic of the main currents in the North Atlantic with the location of the RAPID moorings illustrated.

The UK-US funded RAPID project began in 2004 with the aim of providing continuous, full-depth, basin wide measurements of the AMOC. The measurements are based on moored CTD (for deriving geostrophic currents) and current meter measurements. These are combined with cable-based measurements in the Straits of Florida and reanalysis estimates of the Ekman transport.

Southward Freshwater (FW) transport at 26N (Sv)

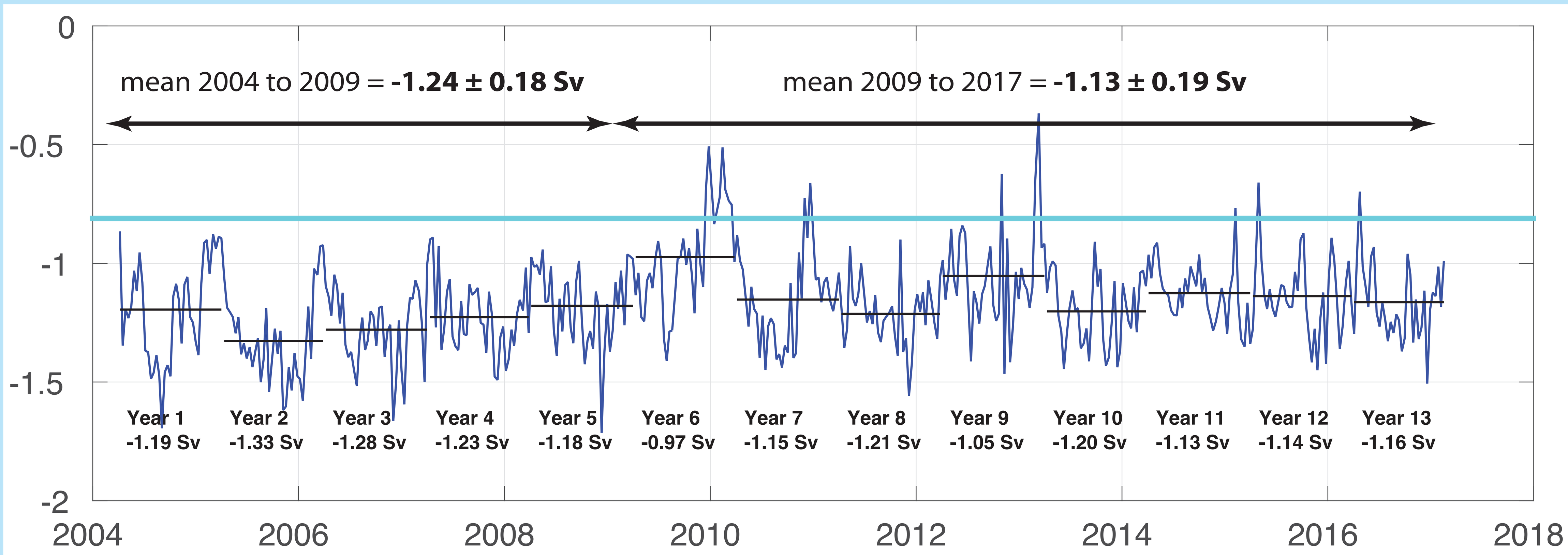

Figure 2. 10 day average (blue) and annual average (black) of the total freshwater transport for each year. The difference between the freshwater transport and the volume transport through the Bering Strait (-0.8 Sv; cyan line) is the freshwater divergence between the Bering Strait and 26.5N (after McDonagh et al. (2015)).

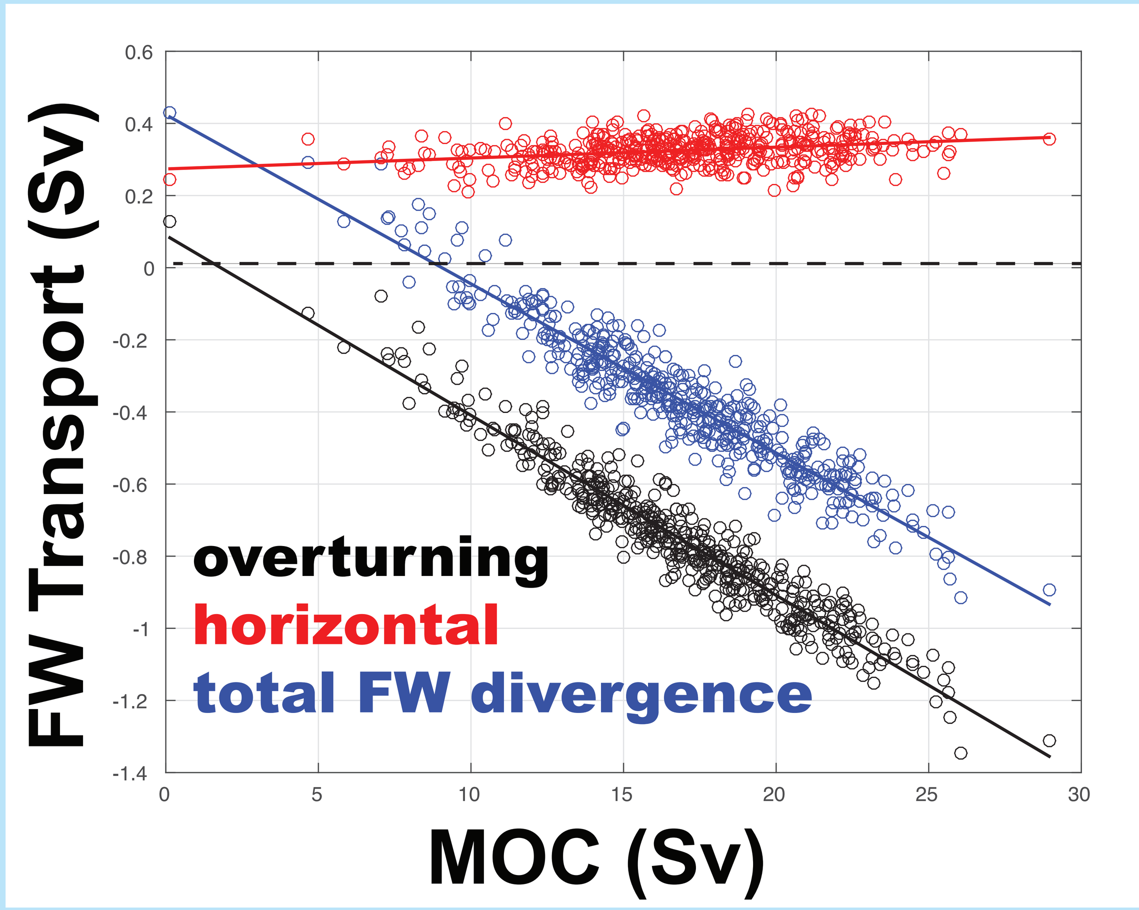

Figure 3. Correlations of the components of the total freshwater divergence, it's components and the MOC.

Northward Heat transport at 26N (PW)

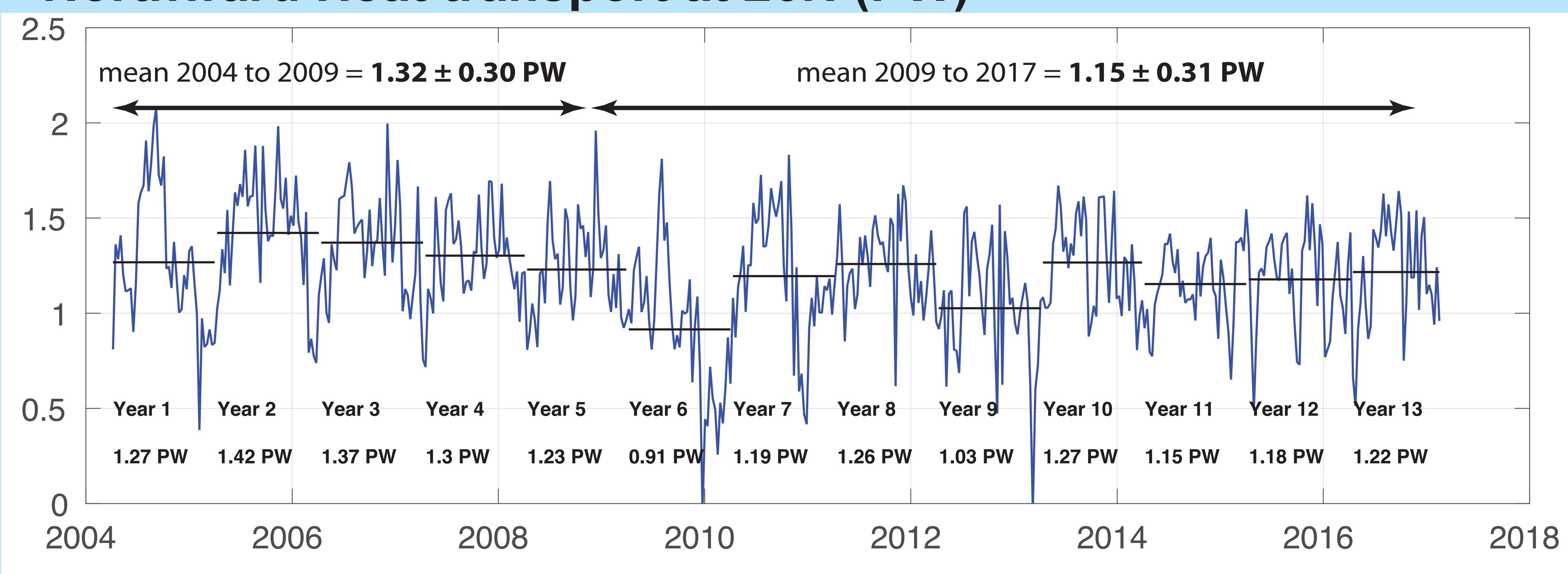

Figure 4. 10 day (blue) and annual average (black) of the heat transport (PW) for each year. (after Johns et al., (2011))

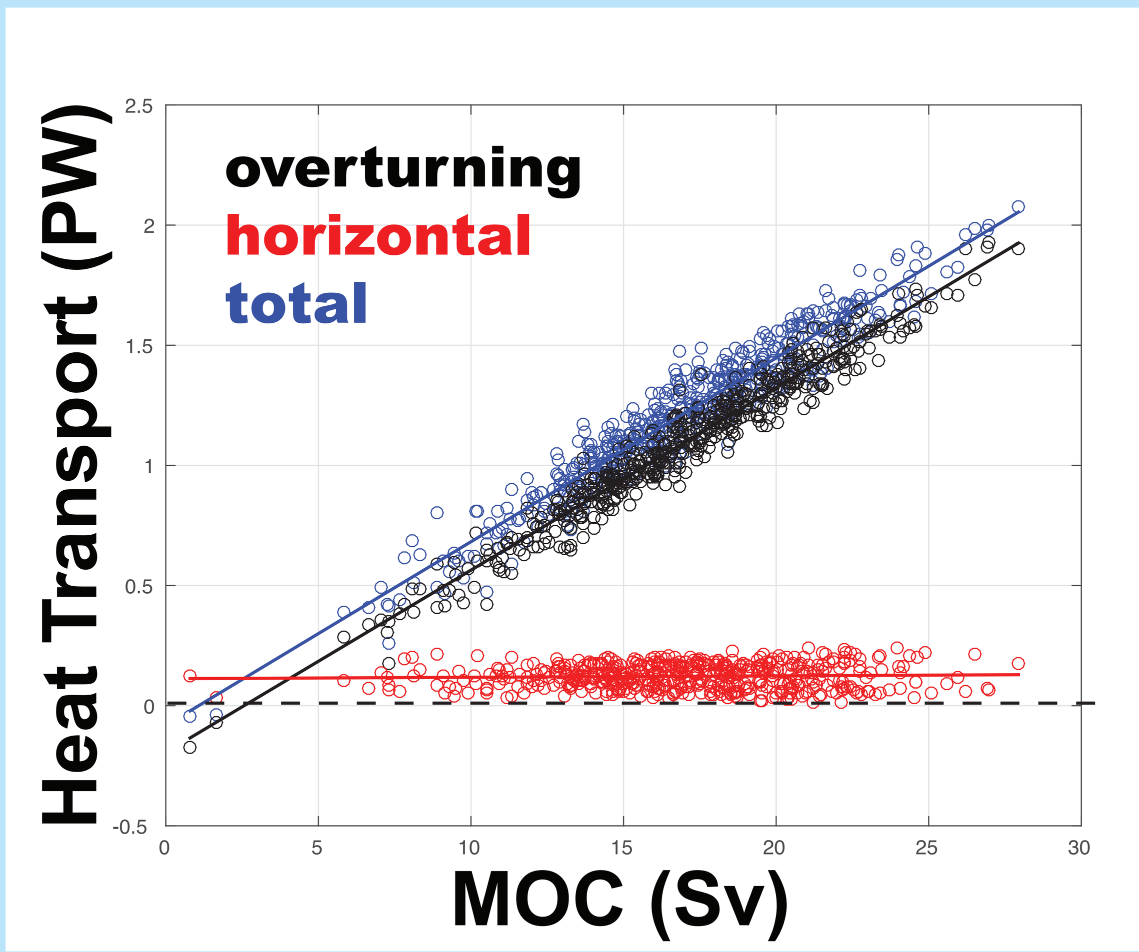

Figure 5. Correlations of the components of the total heat transport, it's components and the MOC.

Results

Southward freshwater transport -1.24±0.18 Sv (2004 to 2009) and -1.13±0.19 Sv (2008 to 2017). **Reduction of 0.11 Sv.**

Northwards heat transport 1.32±0.30 PW (2004 to 2009) and 1.15±0.31 PW (2009 to 2017). **Reduction of 0.17 PW.**

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References

1) McDonagh et al, 2015, 2) Johns et al., 2011

DATA DOWNLOAD

RAPID AMOC: http://www.rapid.ac.uk/rapidmoc

RAPID HEAT TRANSPORT: http://www.rsmas.miami.edu/users/mocha/mocha_results.htm

Contact: bim@noc.ac.uk

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