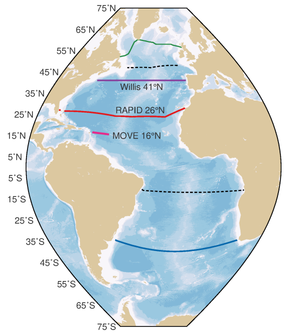
Meridional coherence of the AMOC in the subtropics

Eleanor Frajka-Williams, Shane Elipot, Matthias Lankhorst, Ben Moat, David Smeed

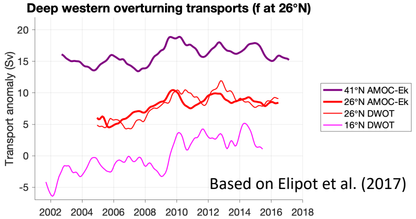
INTRO
- The Atlantic Meridional Overturning Circulation (AMOC) transports heat northwards in the Atlantic.
- Meridional coherence of transports results in 'throughput' of heat to higher latitudes
- Divergence results in ocean heat content change and/or heat flux to the atmosphere.



See also Frajka-Williams et al. (2019)

DATA
- Temperature & salinity profiles at the western boundary: 16N, 26N, 41N (Moorings & Argo)

RESULTS
- Increasing tendency of deep transports at all measured latitudes, consistent with decreasing AMOC since early 2000s.
- Salinification in the upper Labrador Sea Water layer (1200-2000 m, from moorings & Argo). Freshening beneath (only observed by moorings).



Based on Elipot et al. (2017)

DISCUSSION
- Longer timescale (annual+) transport changes are governed by deep property changes at the western boundary.

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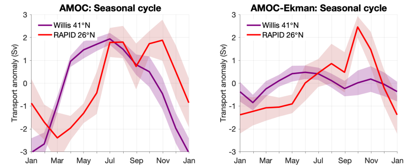
Decreasing AMOC in the subtropical Atlantic

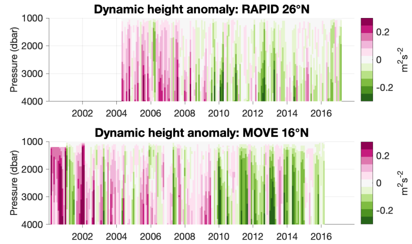
Take a picture to **download the poster & references**

Seasonal cycle (incoherent)



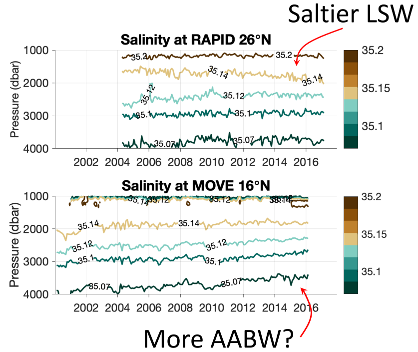
Updated from Mielke et al. (2013)

Dynamic height (west)

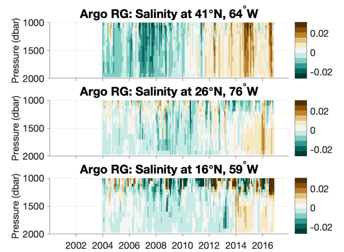


From Frajka-Williams et al. (2018)

Western boundary deep salinity changes (moorings)



Western boundary deep sainity changes (Argo)



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Meridional coherence of the MOC in the subtropical North Atlantic

Eleanor Frajka-Williams (1), Shane Elipot (2), Matthias Lankhorst (3), Ben Moat (4), and David Smeed (5)

(1) National Oceanography Centre, Marine Physics and Ocean Climate, Southampton, United Kingdom (eleanor.frajka@noc.ac.uk), (2) Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, (3) Scripps Institution of Oceanography, La Jolla, CA

The Atlantic Meridional Overturning Circulation (AMOC) extends from the South Atlantic to the high latitudes North Atlantic, transporting heat northwards in the upper 1000 m and storing carbon and other properties at depth. The AMOC has previously been referred to as the 'great ocean conveyor', with this nomenclature leading one to expect that when the AMOC speeds up at one latitude, it speeds up simultaneously and by the same amount at all other latitudes or, in other words, that the AMOC is meridionally coherent. Based on the expectation that changes to the AMOC both herald and drive climate shifts, intensive observational arrays have been put in place (from south to north: SAMBA 34.5°S, 11°S, 16°N, 26°N, 47°N, OSNAP) with additional efforts using satellite data and Argo to estimate ocean transport variability [1]. Observations of the large-scale circulation seem to contradict the expectation of meridional coherence. Here, we will synthesise the findings of meridional coherence of the AMOC on daily to interannual timescales using the long in situ observations between 16°N and 41°N. These are that the AMOC transports are out-of-phase on subannual timescales [2], linked to wind-forced variability [3] and (2) coherent with a time-lag on interannual timescales [4]. Using both in situ and satellite approaches, the phased and coherent variability will be traced back to wind- and buoyancy-forcing on ocean transport variability.

References (open access)

[1] E Frajka-Williams et al. "OceanObs19: Atlantic meridional overturning circulation: Observed transports and mechanisms". *Frontiers in Marine Science* (submitted).

[2] C Mielke et al. "Observed and simulated variability of the AMOC at 26°N and 41°N". *GRL* 40 (2013), pp. 1159–1164. DOI: `10.1002/grl.50233`.

[3] S Elipot et al. "Observed basin-scale response of the North Atlantic meridional overturning circulation to wind stress forcing". *J Clim* 30 (6 2017), pp. 2029–2054. DOI: `10.1175/JCLI-D-16-0664.1`.

[4] E Frajka-Williams et al. "Coherent circulation changes in the deep North Atlantic from 16°N and 26°N transport arrays". *JGR-Oceans* 123 (2018), pp. 3427–3443. DOI: `10.1029/2018JC013949`.

[5] S Elipot et al. "The observed North Atlantic MOC, its meridional coherence and ocean bottom pressure". *JPO* 44 (2014), pp. 517–537. DOI: `10.1175/JPO-D-13-026.1`.