USA AMOC
25th April 2022

National Oceanography Centre

Sustaining observations at 26°N: A new design for the RAPID array and recent variability of the Atlantic Meridional Overturning Circulation

Ben Moat, David Smeed,
Eleanor Frajka-Williams, Darren Rayner
National Oceanography Centre, UK

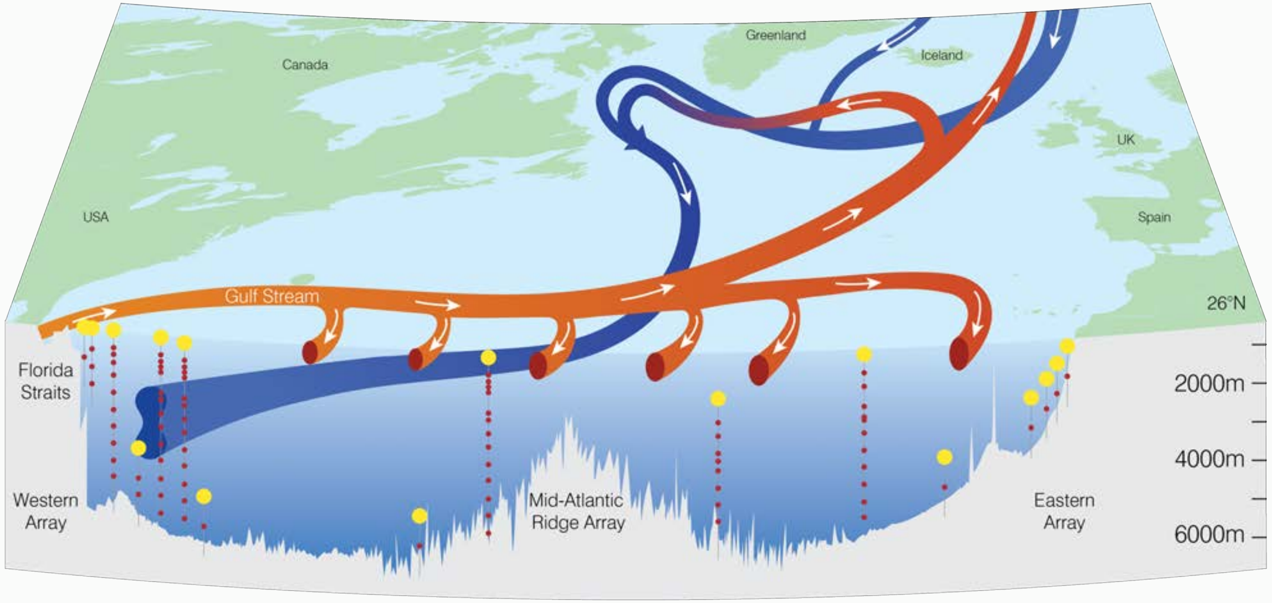
Denis Volkov, Molly Baringer
NOAA, Miami, USA

William Johns, and Shane Elipot
University of Miami, USA

Introduction

RAPID-MOCHA-WBTS array is located at 26°N in the subtropical gyre

- Updated time series April 2004 to February 2020 (v2020.1) https://rapid.ac.uk/rapidmoc/
- Modifications to the array design introduced since 2020

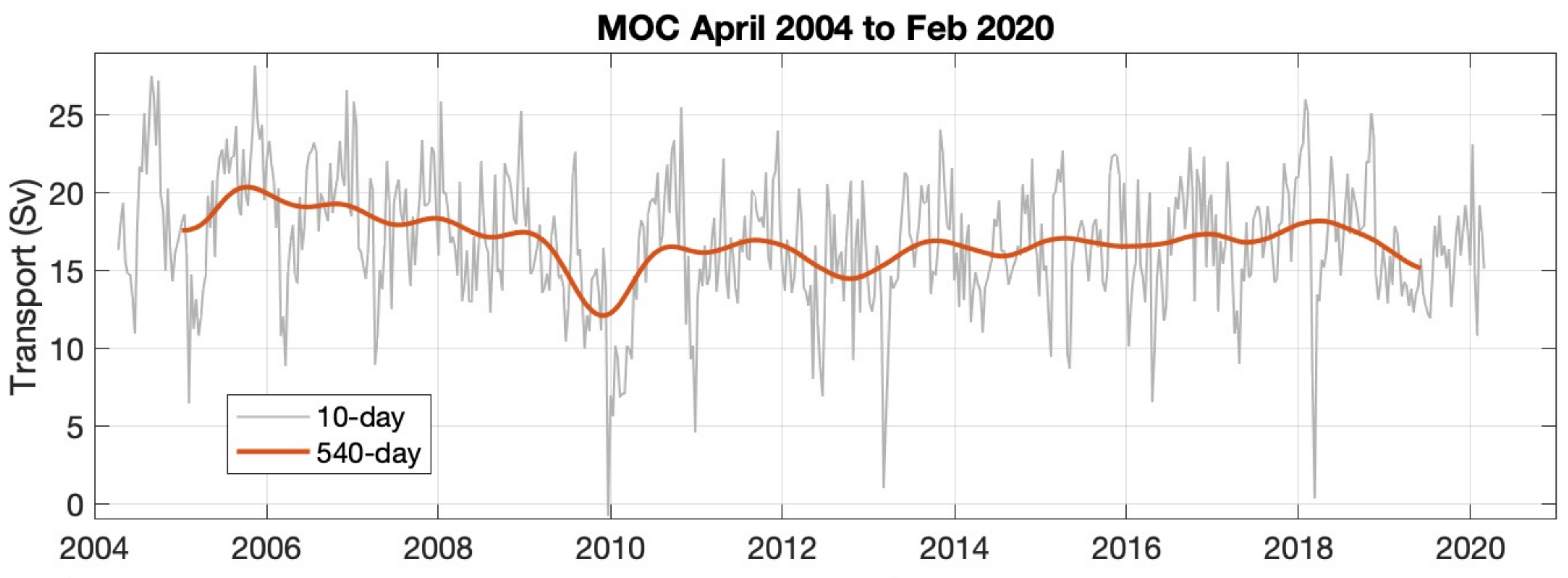


Natural Environment Research Council

AMOC time series

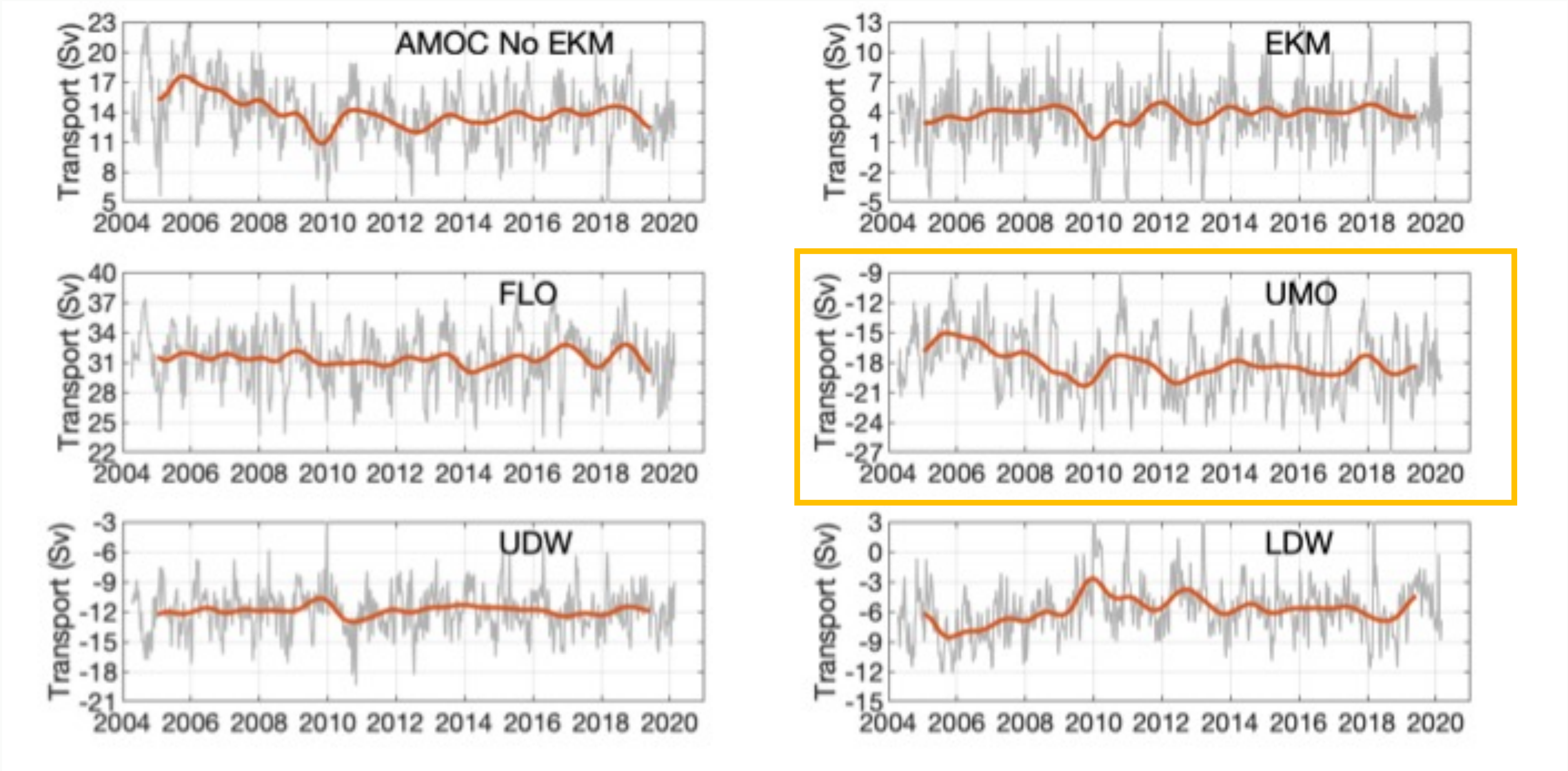
- September 2021: released v2020.1 (2004 to March 2020)

- When compared with the first 4 years of observations, the AMOC appears to have remained in a relatively low state since 2009



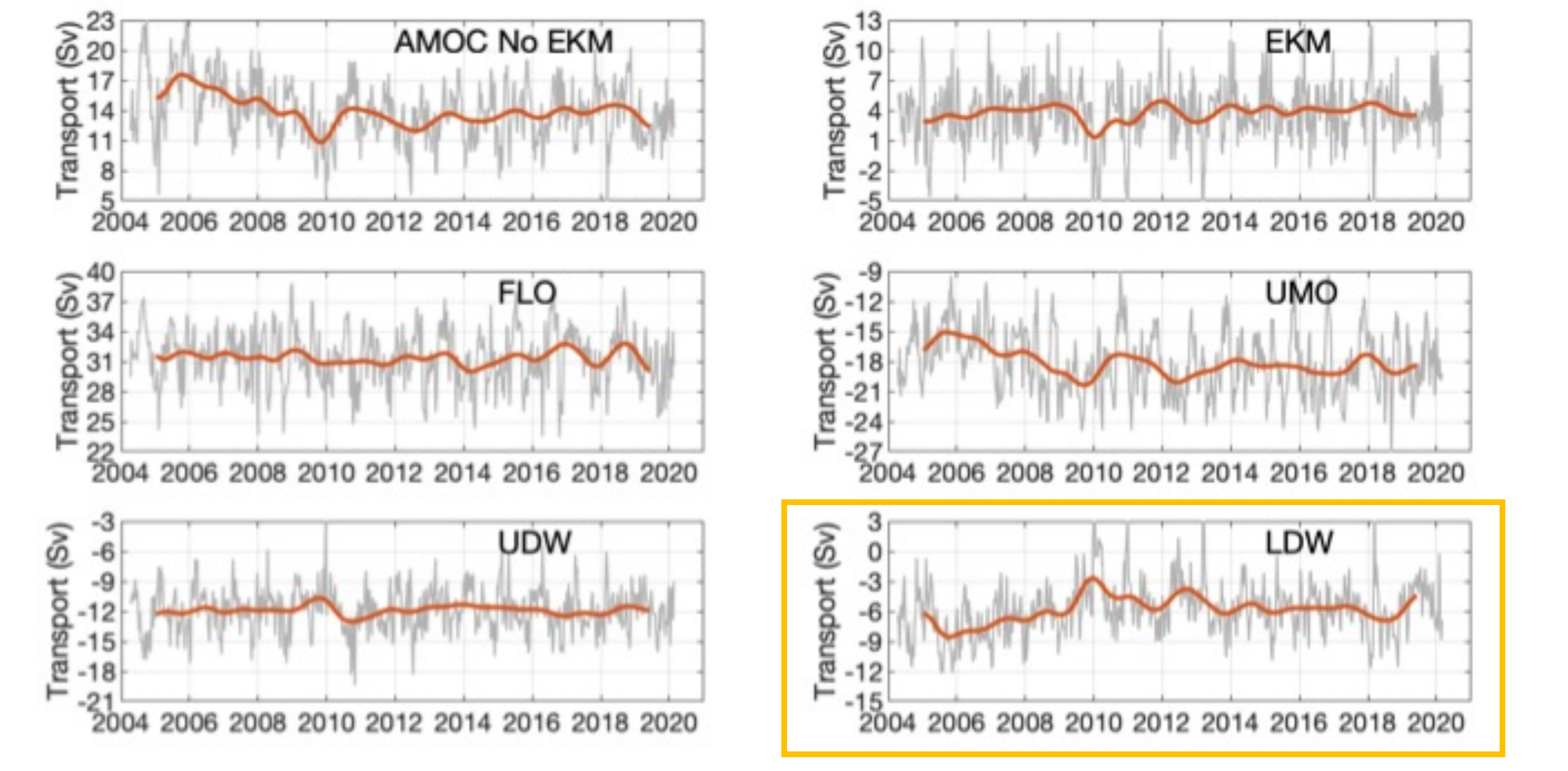
- Next update will be **August 2022** : April 2004 to December 2020.

AMOC time series



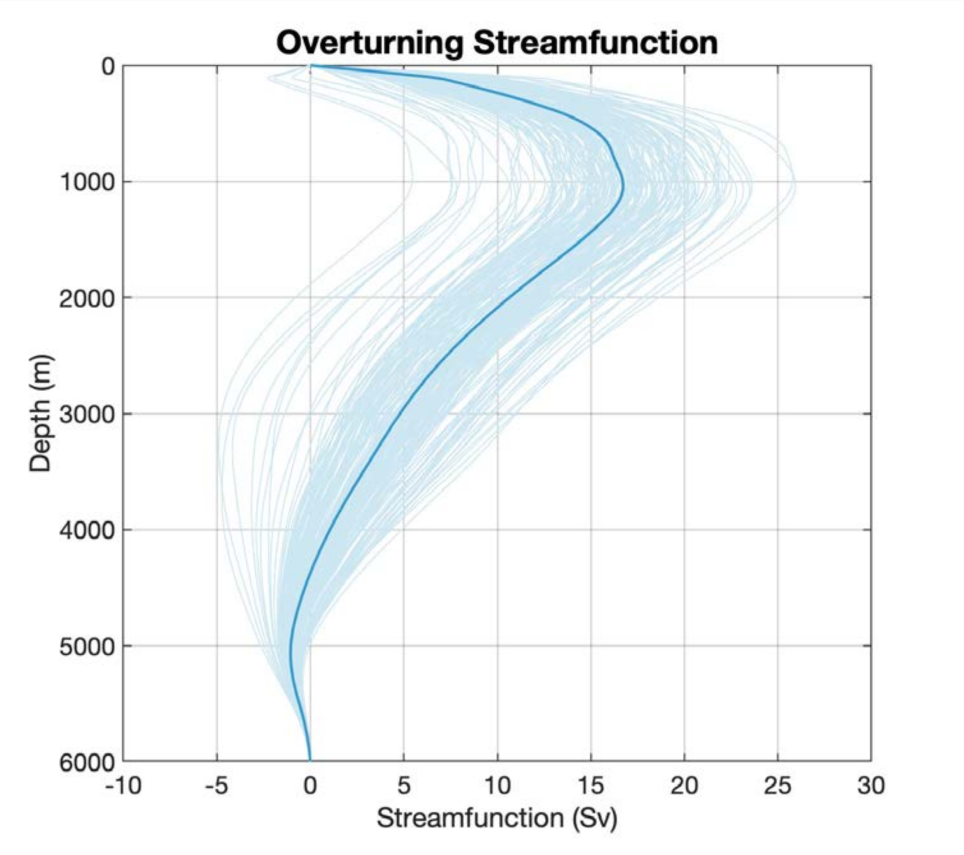
Inter-annual variability in the upper limb of the AMOC occurs primarily in the flow east of the Bahamas

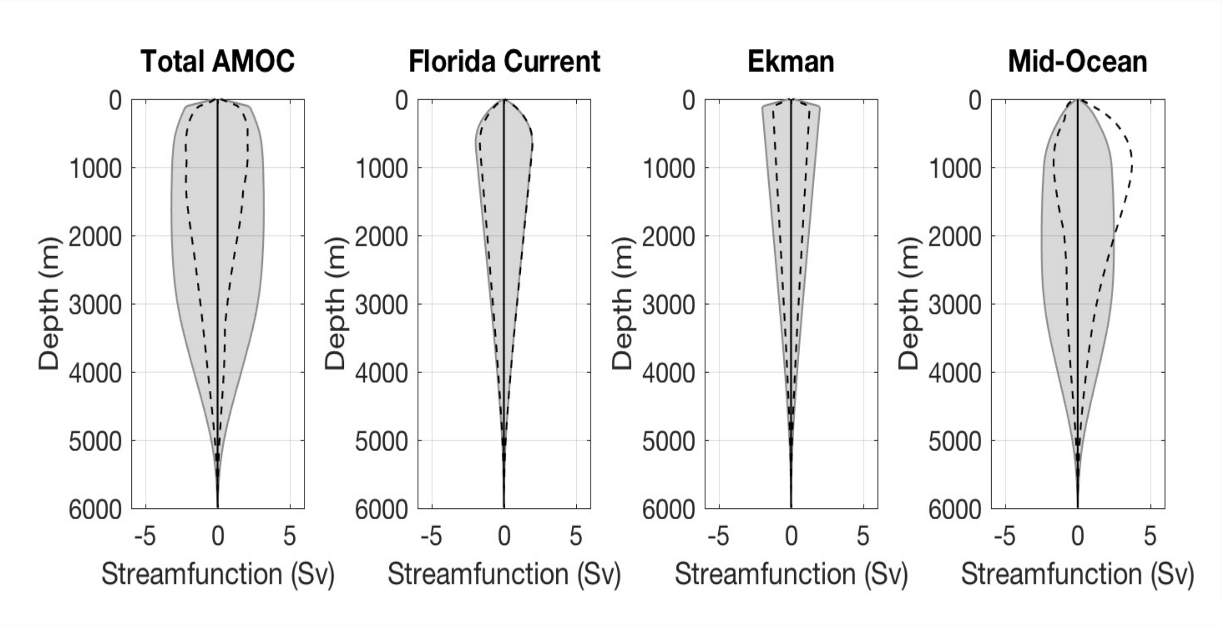
AMOC time series



Inter-annual variability in the lower limb of the AMOC occurs primarily in the Lower Deep Water below 3000m

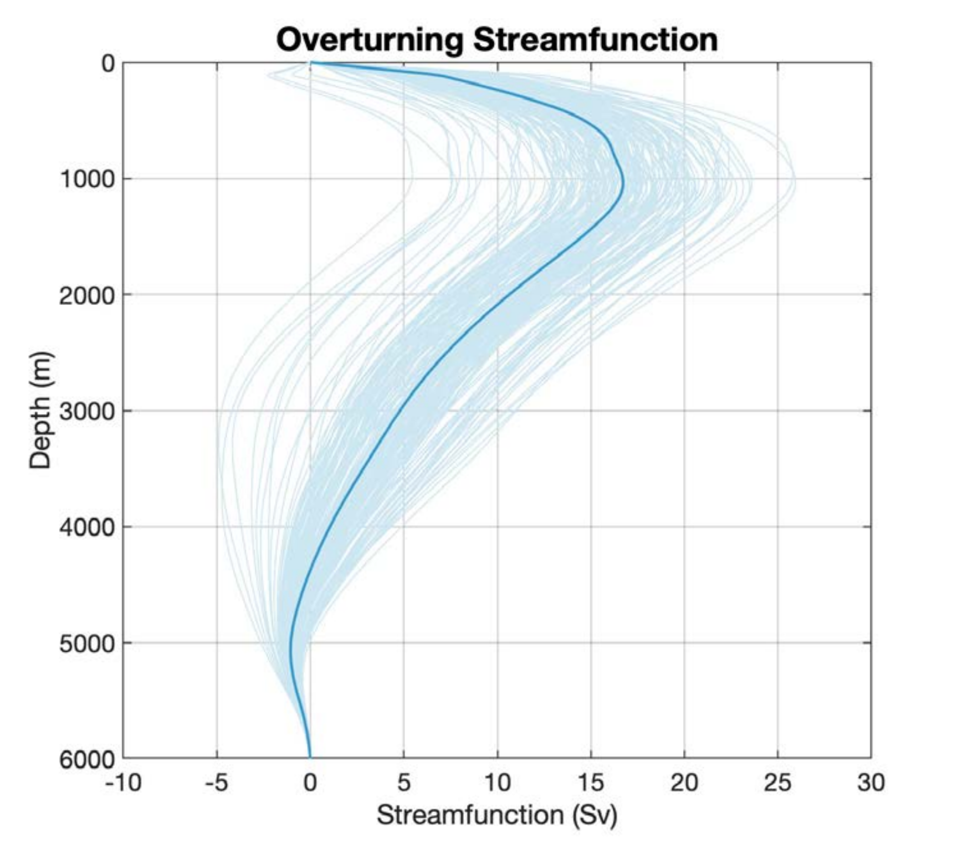
AMOC time series update

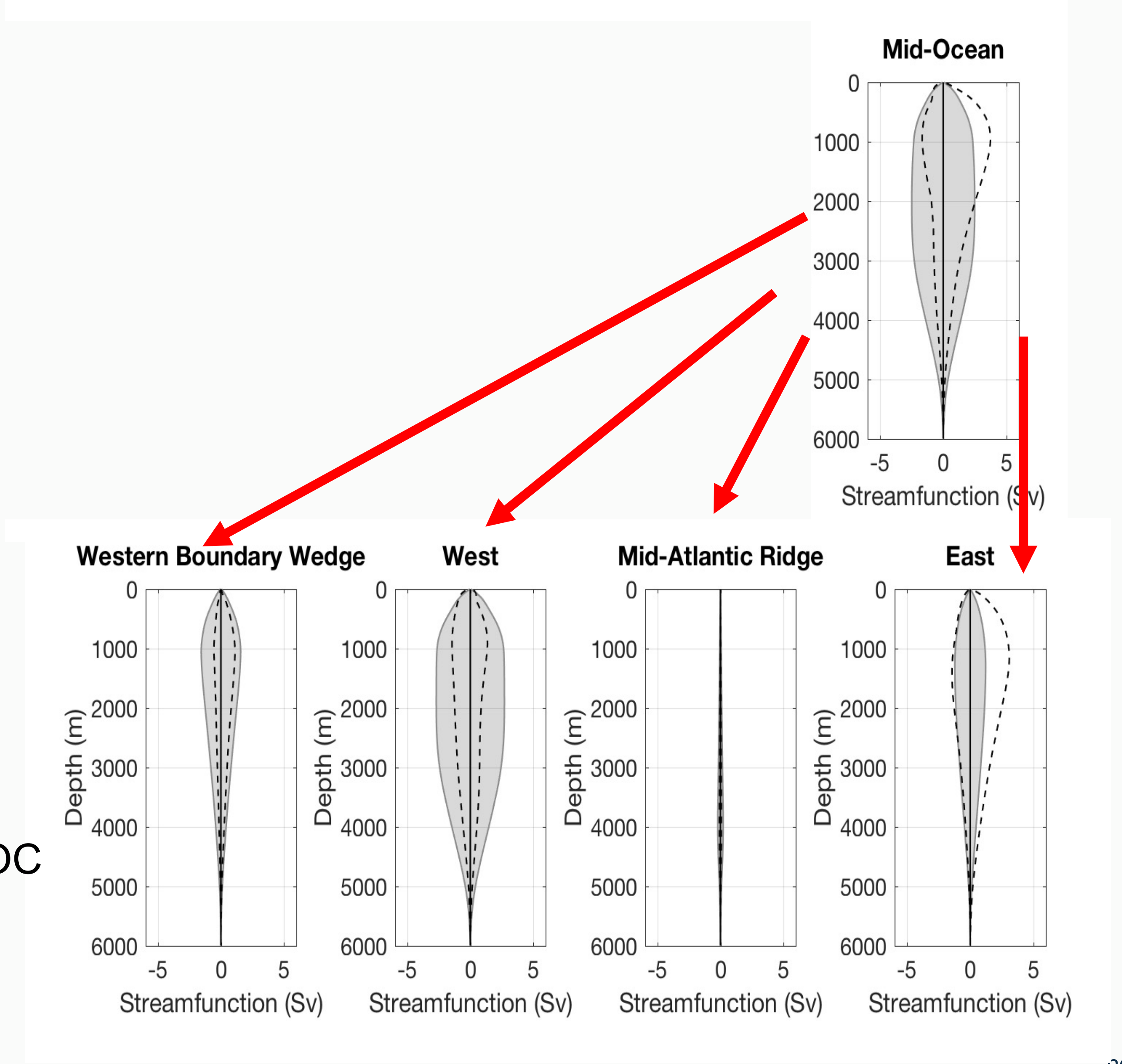




- Largest contribution to the AMOC variability is from the mid-ocean transport

AMOC time series update



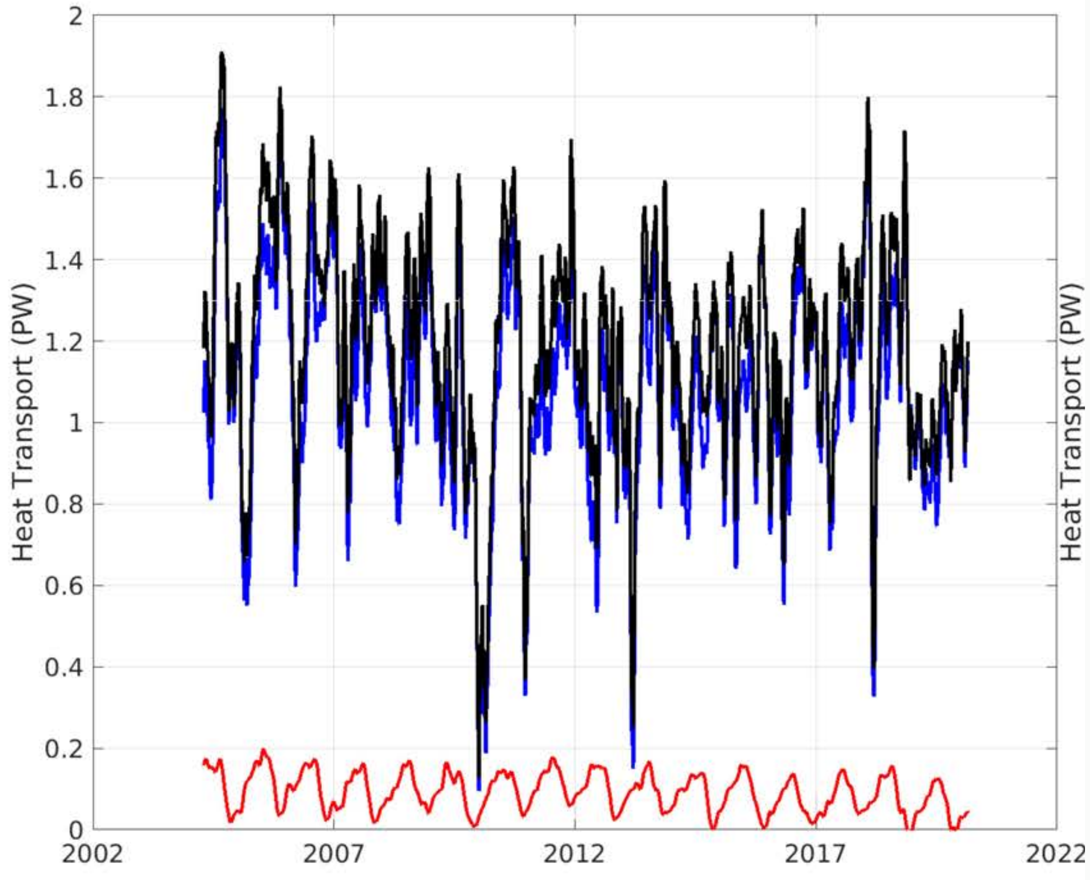


- Largest contribution to the AMOC variability is from the mid-ocean transport
- Mid Atlantic ridge contributes little to the AMOC variability
- Largest signal is in the West

AMOC and heat transport at 26N

- **the overturning component is the largest component and exhibits the most variability**

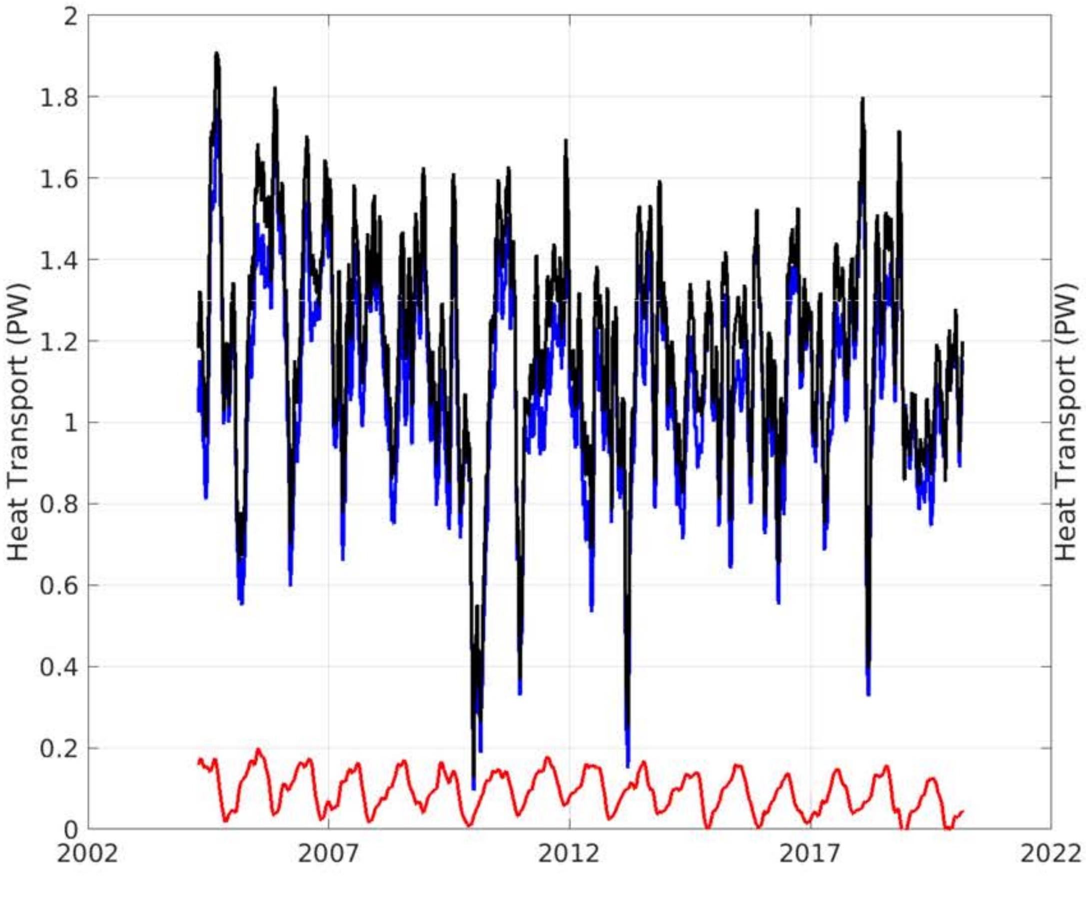
Total = 1.2 ± 0.3 PW
Overturning = 1.1 ± 0.3 PW
Gyre = 0.1 ± 0.04 PW

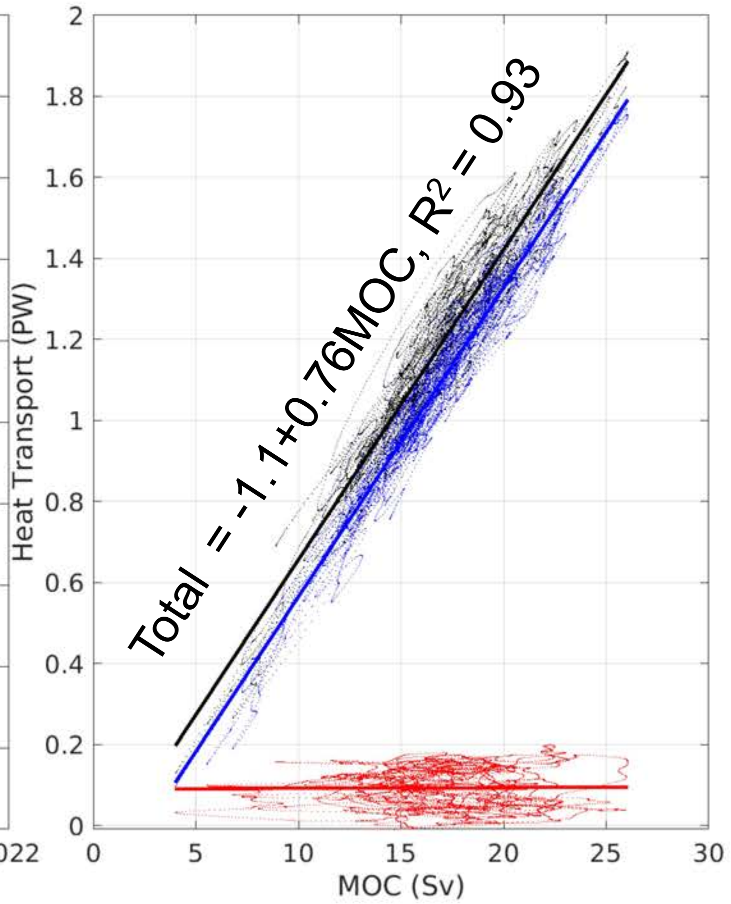


AMOC and heat transport at 26N

Total = 1.2 ± 0.3 PW
Overturning = 1.1 ± 0.3 PW
Gyre = 0.1 ± 0.04 PW

- the overturning component is the largest component and exhibits the most variability.
- **Strong relationship between MOC and the heat transport**
- **96% of the variance in heat transport is explained by the MOC**



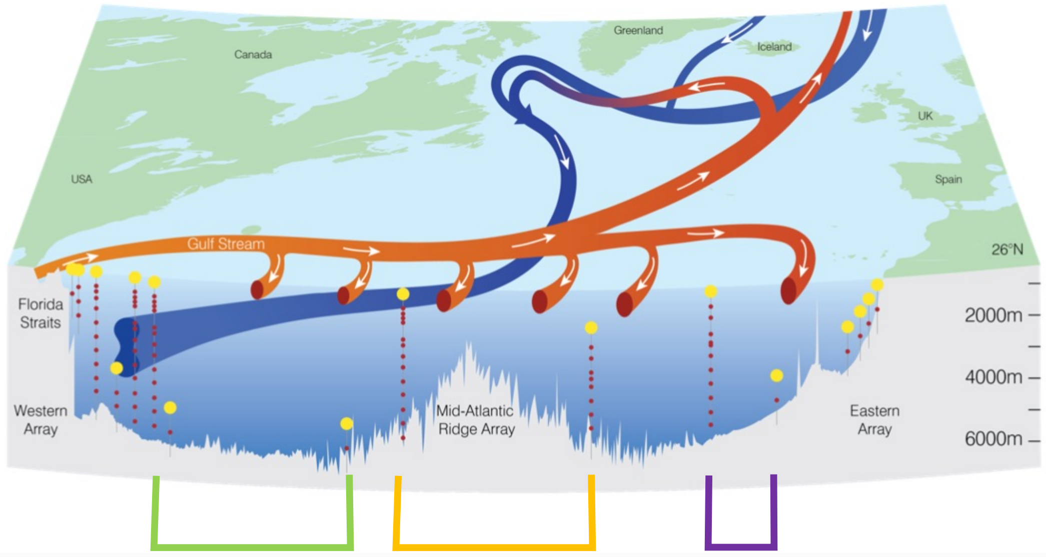


Changes to the Array

- In December 2020 removed moorings from:
  A. either side of the Mid-Atlantic Ridge (MAR)
  B. the deep western basin that monitored the flow of AABW

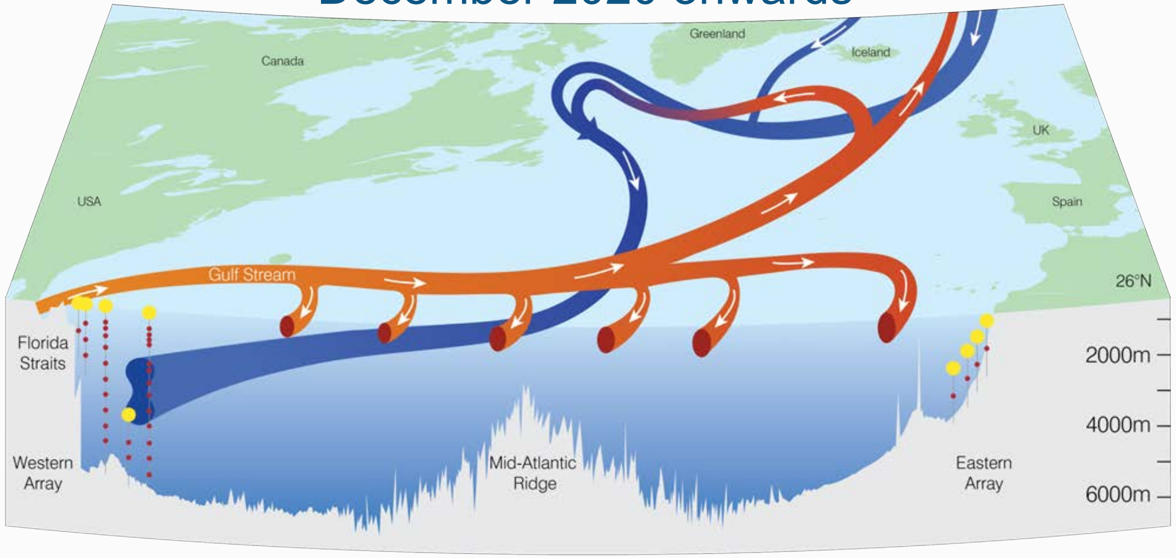
- In February 2022 removed moorings
  C. from the deep eastern boundary

April 2004 to December 2020



B A C

December 2020 onwards

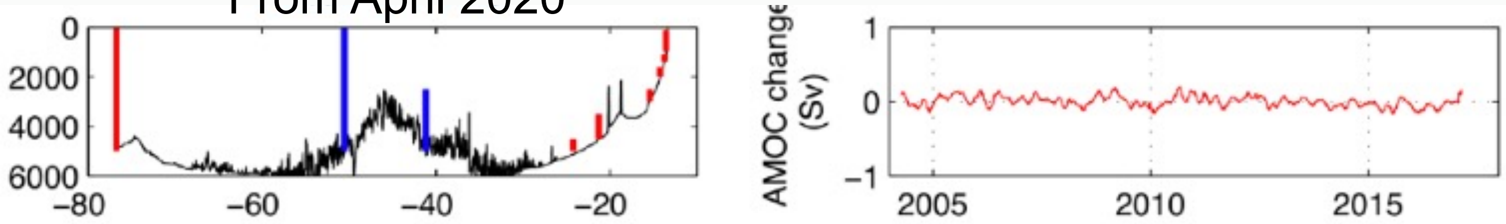


Impact of array changes on AMOC calculation

In each test, data from the “blue” moorings were replaced with long-term mean values.

The change when removing the MAR mooring data had a standard deviation of 0.07 Sv

From April 2020



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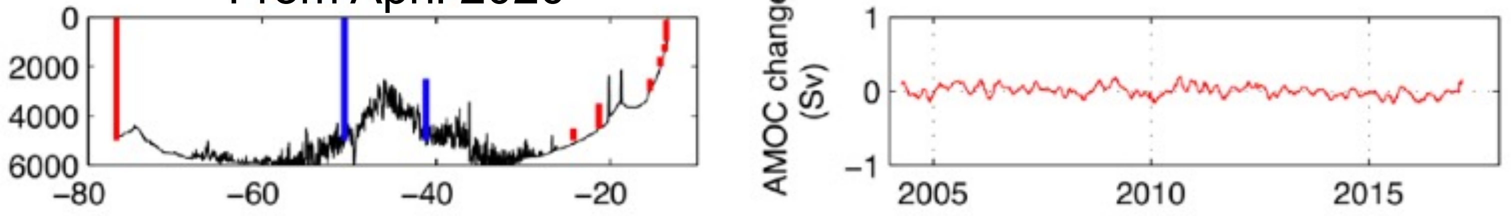
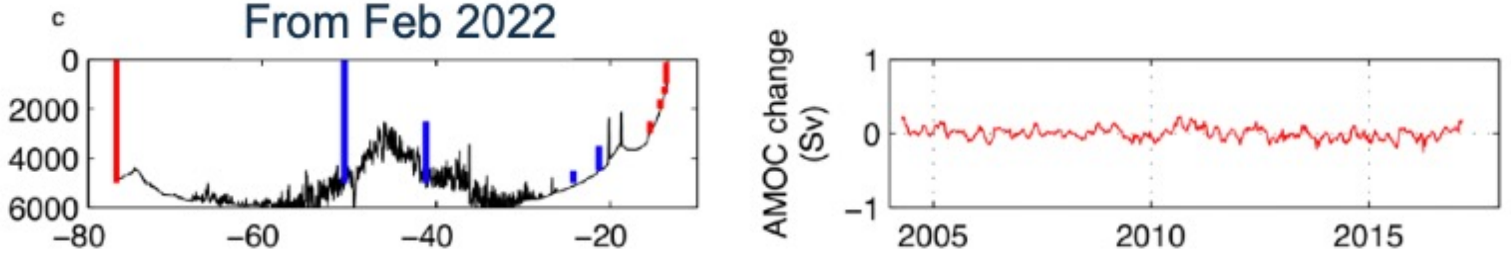


Removing also data from the deep eastern boundary (> 3000m) increased the s.d. or the difference only slightly

From Feb 2022



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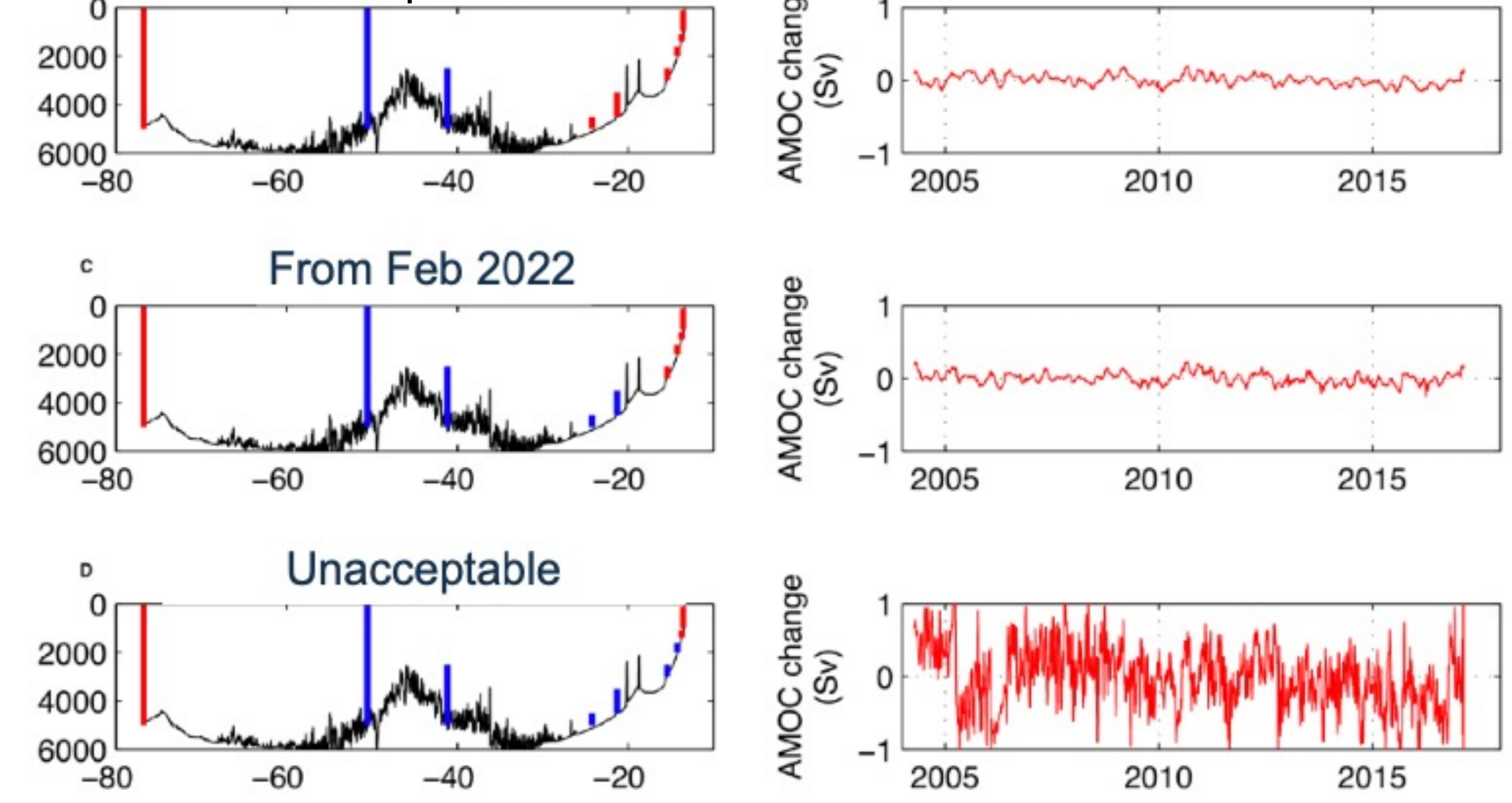
However, removing data below 1500m on the eastern boundary significantly increased the errors

From April 2020



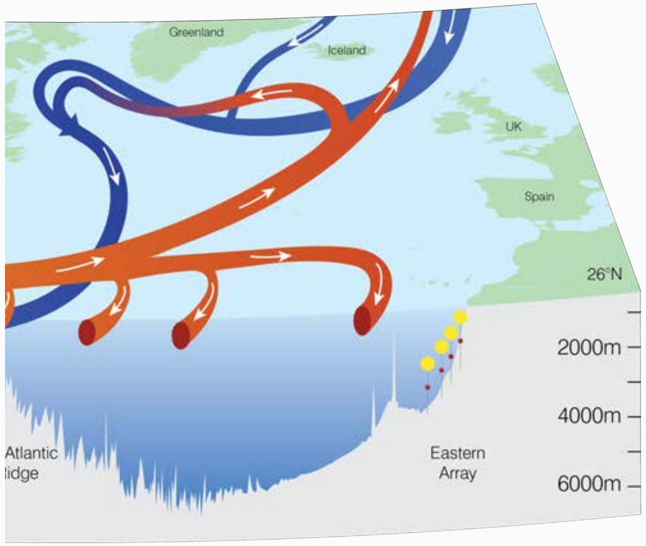
BGC array deployed in the Eastern Boundary

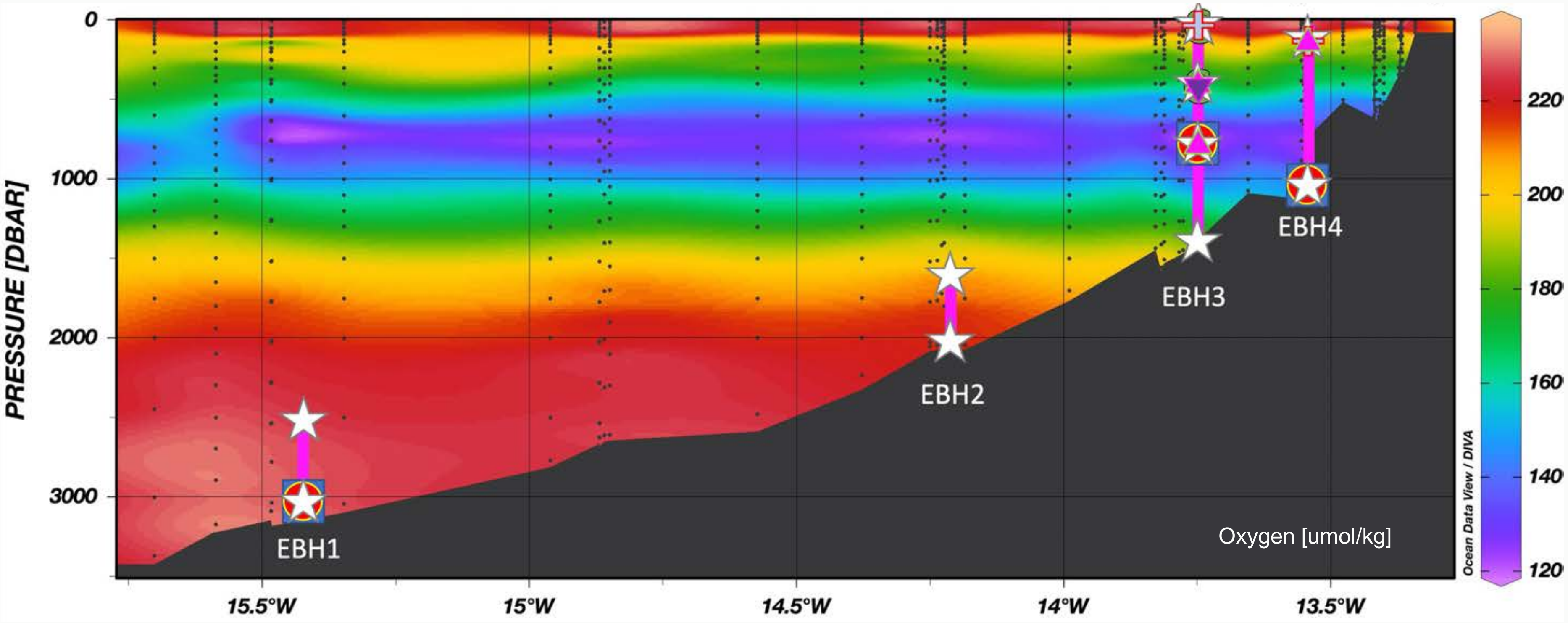
March 2022 to March 2024

Pete Brown (PI)

24 month deployment

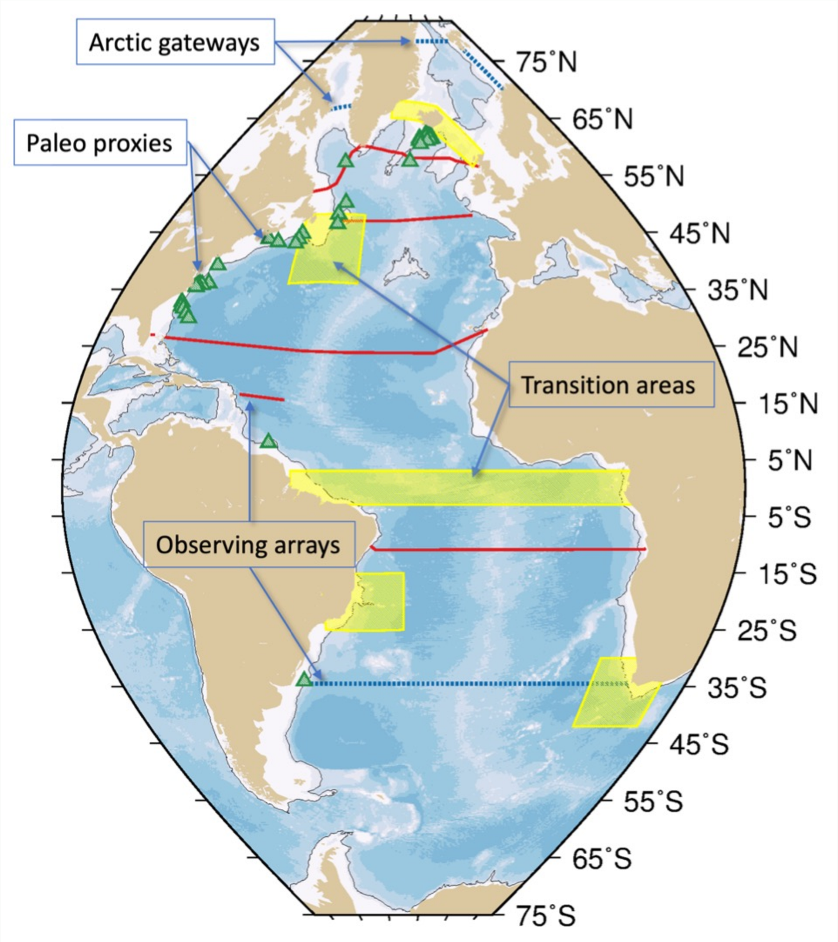
NOC sensors (10)		Commercially-available sensors (14)	
●	pH	☆	ODO (10, of which 2 attached to seaphox)
■	alk	✚	SeapHOx (2)
▲	nit	C	CONTROS pCO2 (2)
▼	phos		





Horizon Europe: Explaining & Predicting the Ocean Conveyor

- **€8M project, planned for 2022 –2027**
- **Observing & modelling the AMOC** using multi-observational datasets, paleo proxies, models.
- **High resolution coupled models** (e.g., 10km ocean/10km atmos, and 5km ocean/5km atmos) from CNRS, Reading, MPIM, Met Office, GFDL, and idealised forcing experiments.
- **New observational process study** to link RAPID and OSNAP (at 47°N).
- **Observing system design** using new approaches (drift-free bottom pressure, altimetry, BGC sensors, gliders) + observing system experiments to optimise AMOC observing.



Conclusions

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- The RAPID 26°N array has been modified - no change to the accuracy of the estimate of the maximum of the overturning streamfunction.

- It is hoped that the reduced cost of the array will enable measurements to be sustained in the future