Circulation in the Eastern Subpolar North Atlantic Based on Three Years of Mooring Measurements

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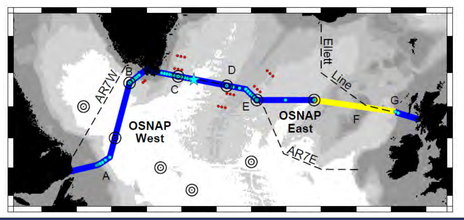
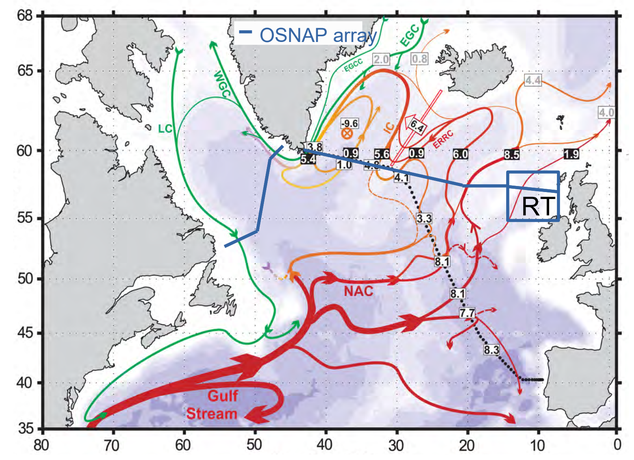


1) Upper-ocean circulation in the subpolar North Atlantic

The AMOC (northward flux of warm upper-ocean waters and a compensating southward flux of cold deep waters) plays a fundamental role in the global climate system and its variability



Upper-ocean circulation, *from Daniault et al., 2016*

About 60% (12.7Sv) of the upper-ocean water recirculates in the North Atlantic Subpolar Gyre (SPG). The other 40% (7.5/8.5 Sv) is carried poleward by the NAC between Greenland and Scotland [*Sarafanov et al., 2012*].

Holliday et al. [2015] estimated the total transport in Rockall Trough (RT) of 2.8+/-0.8 Sv from eleven ("summer") Extended Ellet Line occupations (97-14)

2) A mooring array to continuously measure the transport of Atlantic Water to the Nordic Seas

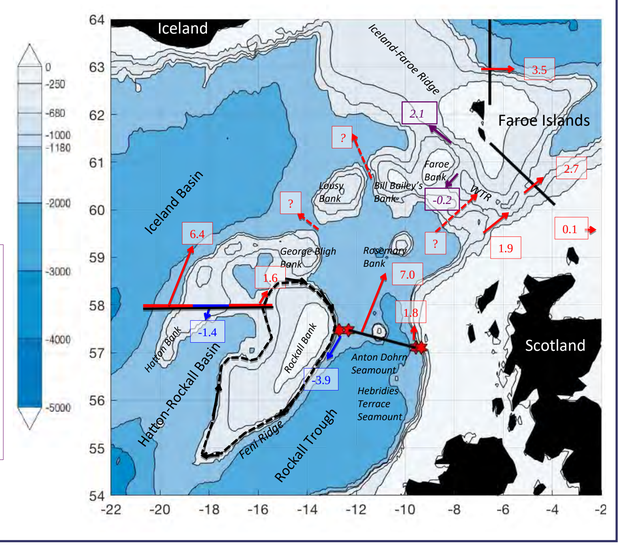
Gary et al. [2018] discuss seasonal cycle of volume flux in the RT, however little is known about the intra- and inter-annual variability, and until recently no continuous transport observations were available.

As part of OSNAP, a mooring array was deployed in July 2014 to measure the transport of warm Atlantic Water to the Nordic Seas.

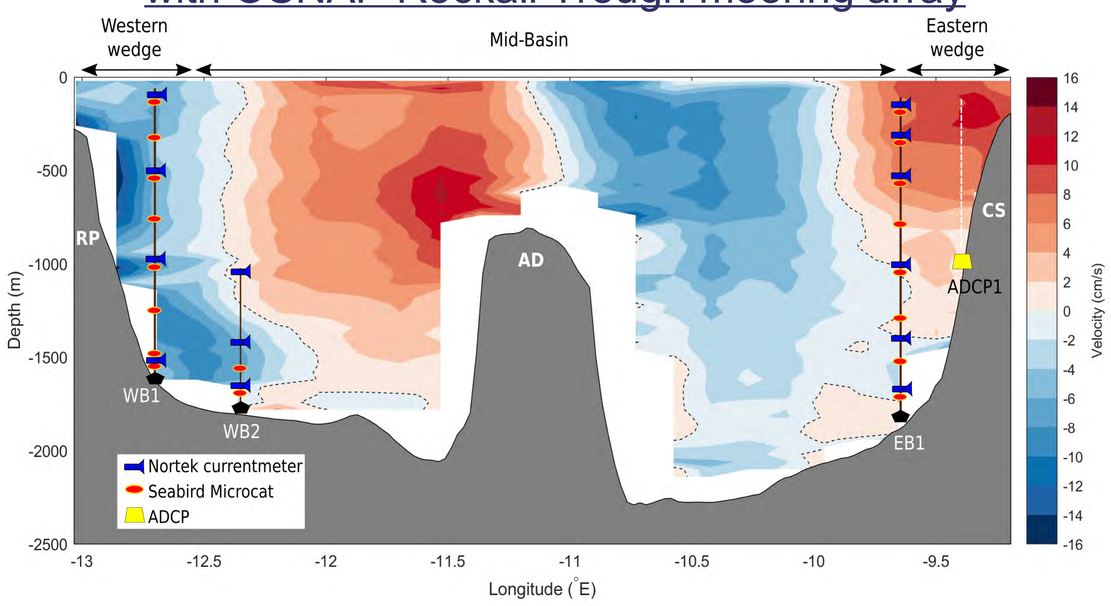
Wyville-Thomson Ridge (WTR)
GBB-RB
GBB-LB-BBB

RT closed contour to north

1. Observed Northward/Southward Fluxes.
2. *Overflows (Purple).*
3. Dashed: Inferred circulations from Glider Depth Average Currents and Argo Float Trajectories.



3) Mean cross-section velocity from Extented Ellet Line LADCP data with OSNAP Rockall Trough mooring array



4) Transport calculation

The total transport (T_{TOTAL}) through the RT region can be decomposed as follows:

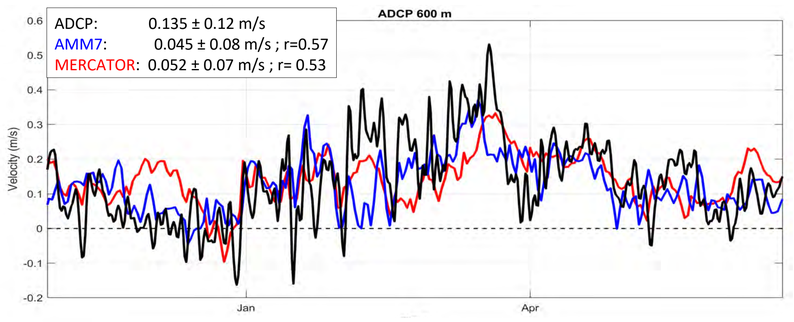
$$T_{TOTAL} = T_{WB} + T_{EB} + T_{MB}$$

Where T_{WB} is the transport in the WB wedge, T_{EB} is the transport in the EB wedge, T_{MB} is the Mid-Basin transport calculated from the dynamic height moorings (WB1 and WB2).

$T_{MB} = T_{BC} + T_{BT}$ where T_{BC} is the baroclinic shear referenced to 1780 m and T_{BT} is the barotropic transport deduced from the baroclinic shear and absolute geostrophic current from altimetry

T_{WB} is calculated from WB1 current meters

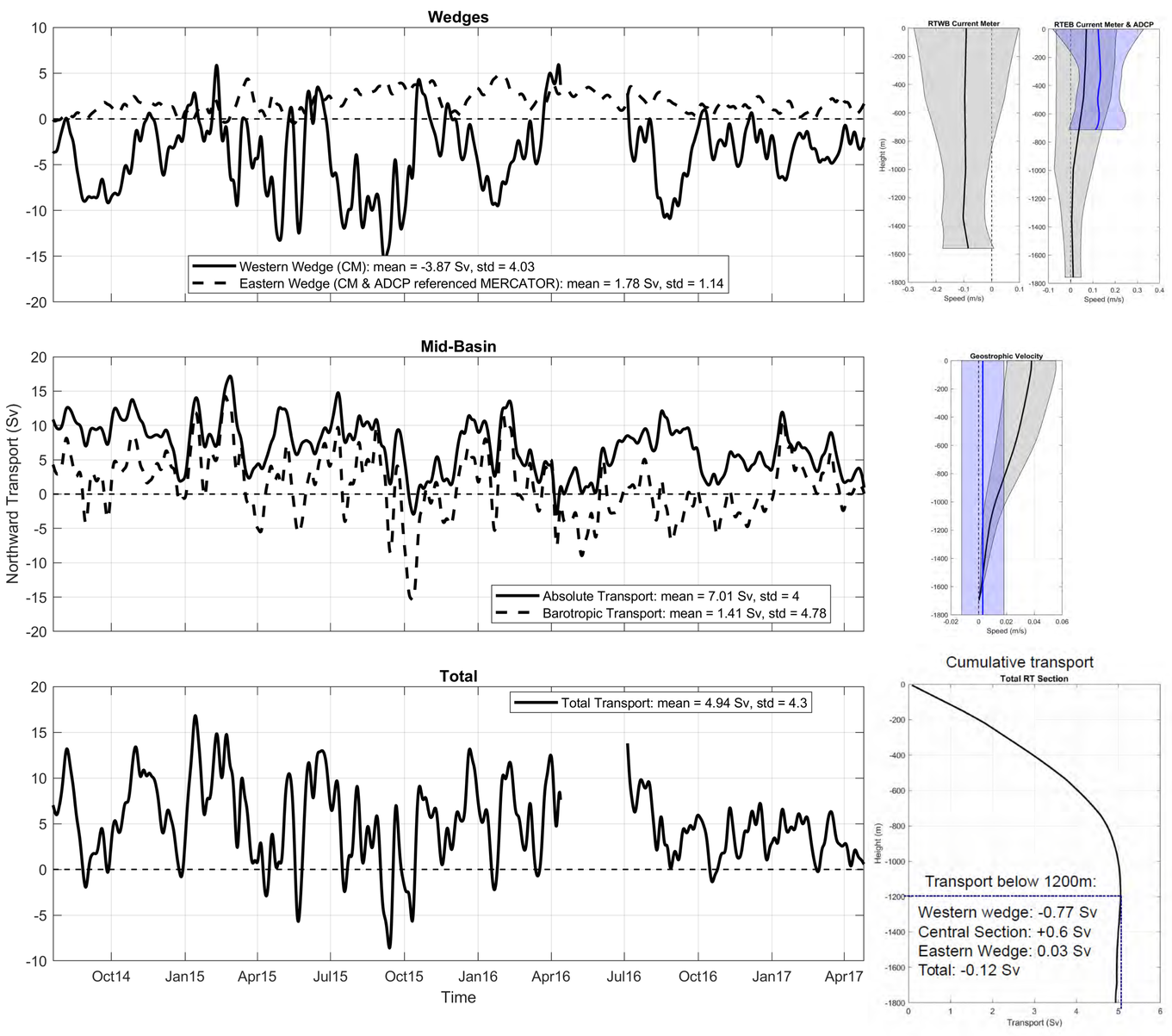
T_{EB} is calculated from AMM7 model due to the loss of ADCP1 in 2015-17 (after comparison in 2014-15)



Date Oct 2014- July 2015 [8-months of observations]

Model velocities have been adjusted to the same mean as the ADCP

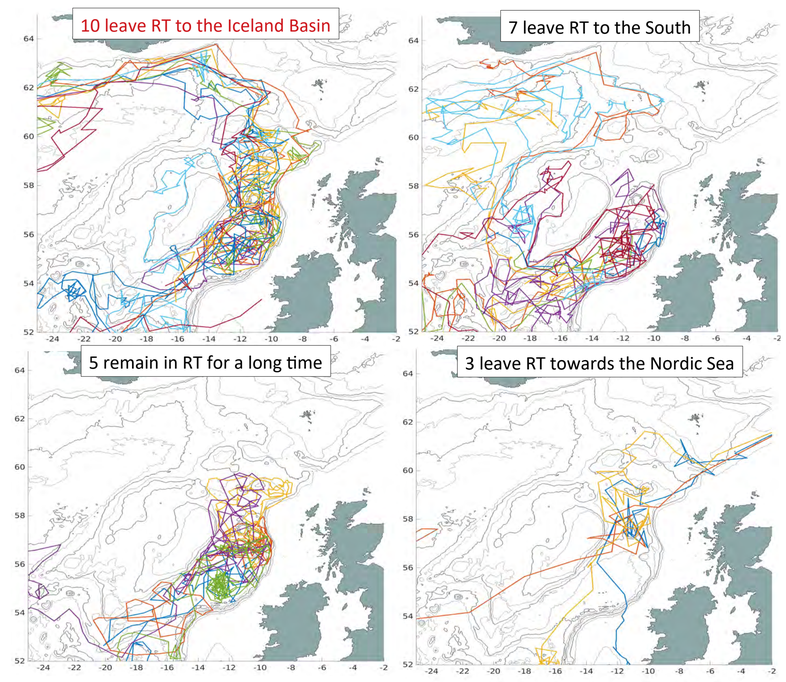
5) Mean Transport and Variability



6) Pathways towards the Iceland Basin

Circulation patterns in the Rockall Trough as seen by Argo Trajectories: Fifty Argo Float Trajectories Encounter the Rockall Trough (2001-2018)

→ exit pathways in the Iceland Basin between George Bligh Bank - Lousy Bank and Lousy Bank – Bill Bailey Bank



Main statistics for the total transport and the individual contributions

Transport	Mean	Std	Min	Max	Range
Total obs	4.9 Sv	5.1 Sv	-12.3 Sv	22.5 Sv	34.8 Sv
WB (obs)	-3.9 Sv	4.6 Sv	-17.9 Sv	12.0 Sv	29.9 Sv
MB (obs)	7.0 Sv	4.2 Sv	-7.1 Sv	19.2 Sv	26.3 Sv
EB (model +obs)	1.8 Sv	1.2 Sv	-1.4 Sv	5.3 Sv	6.7 Sv

Summary

Large transport variability across RT (min = - 12.3 Sv, max = 22.5 Sv).

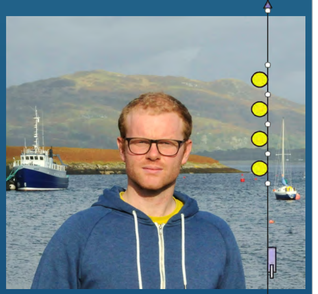
3-yr mean transport (**4.9 ± 5.1 Sv)** is ~100% higher than previous estimates.

The majority of the transport occurred in the mid-basin (7.0 ± 4.2 Sv) and is mostly explained by the baroclinic shear (5.6 Sv).

90% of the transport is in the upper 1000 m.

On-going work to quantify the uncertainties of our estimates (e.g. interpolation methods, accuracy of measurements & ADT).

Future works: Understand the drivers of the high frequency variability observed in the transport timeseries (e.g. mesoscale eddies activity, wind stress, subpolar mode water formation / buoyancy forcing).



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