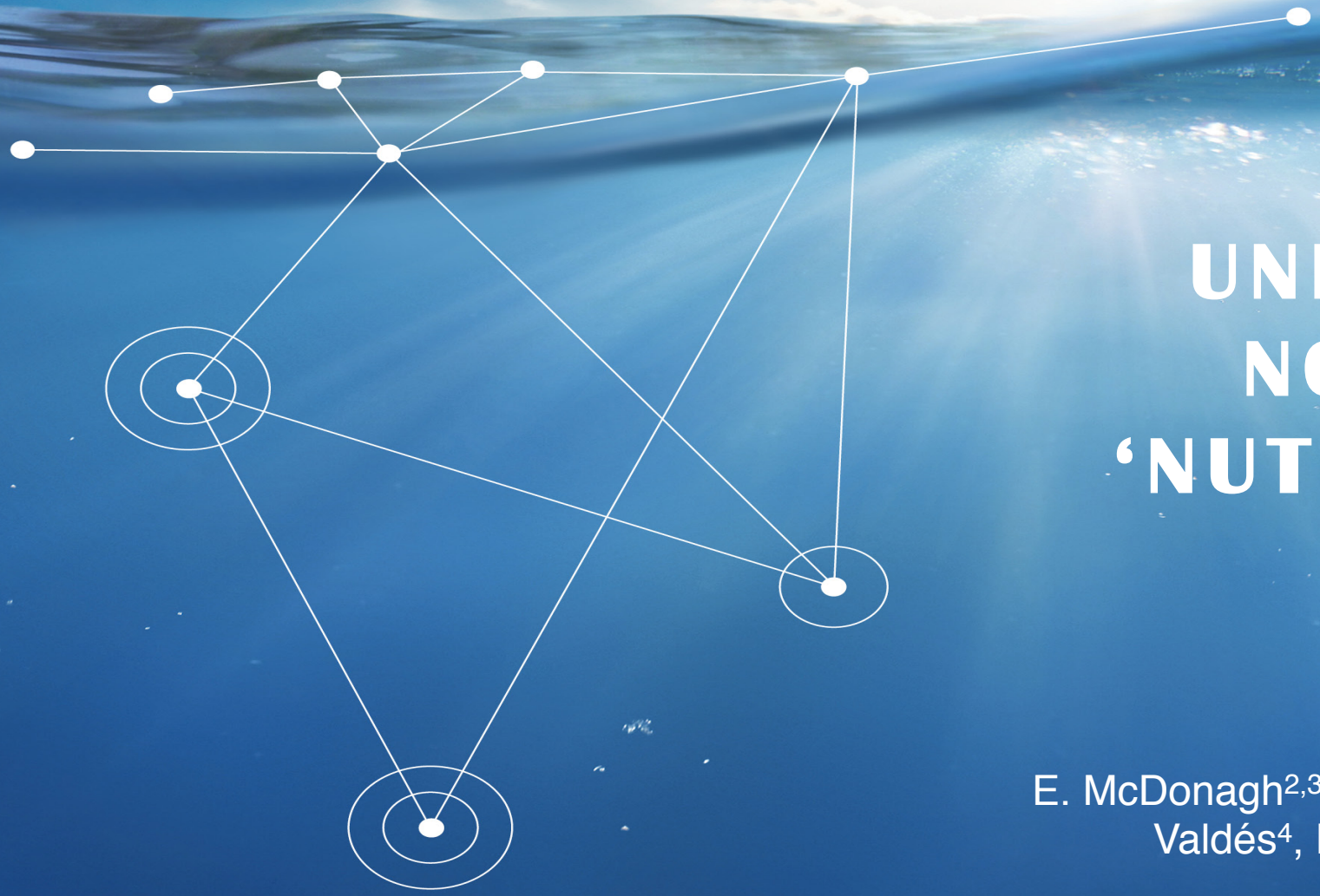

UNRAVELLING THE NORTH ATLANTIC 'NUTRIENT STREAM' VARIABILITY

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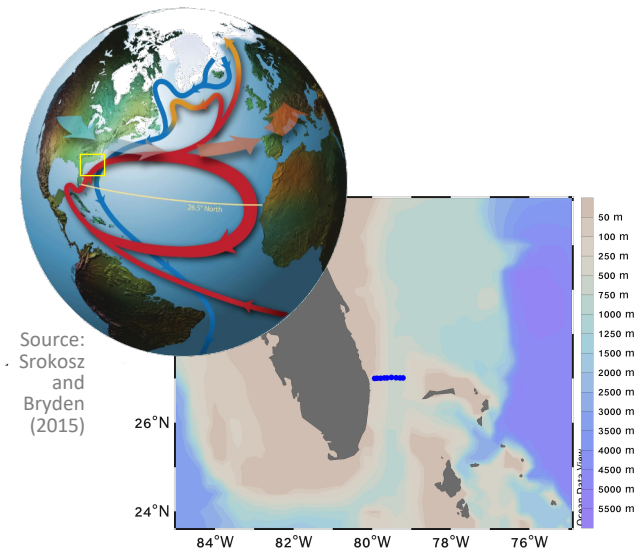
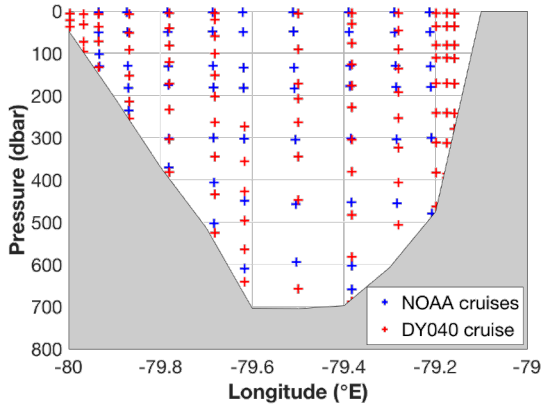
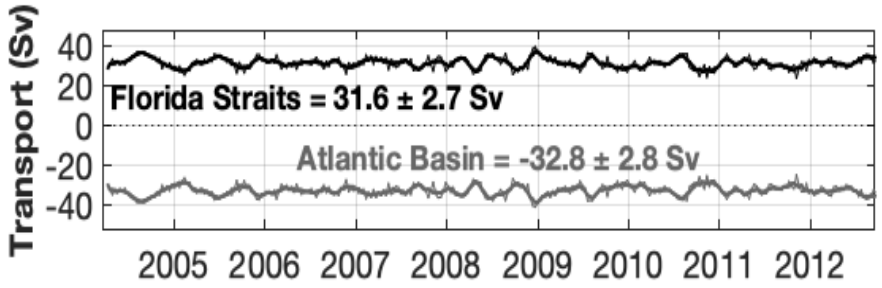
THE FLORIDA STRAITS DATA





Hydrographic cruise-based seasonal sampling strategy (T, S, O_2, nutrients)



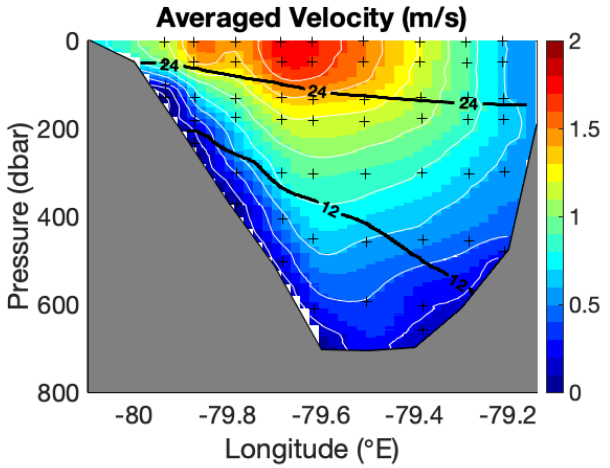
ABC fluxes Florida Straits data base

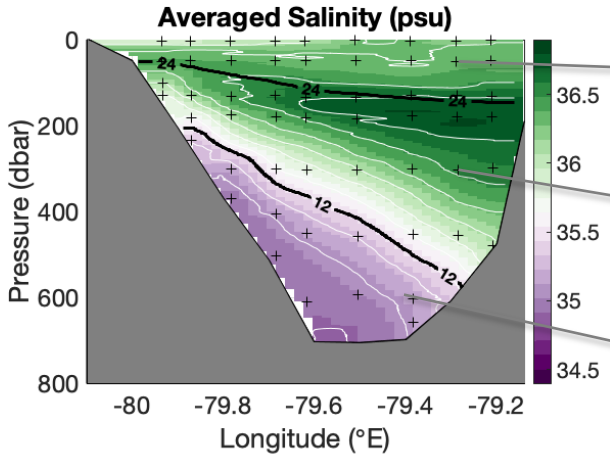
Cruise no.	Cruise ID	Day	Month	Year	Vessel	P.I.	#St
1*	NOAA FC1505	26-27	May	2015	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
2*	NOAA FC1507	14-15	Jul	2015	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
3*	NOAA FC1509	8-9	Sep	2015	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
4*	NOAA FC1511	10-11	Nov	2015	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
5	DY040	10-12	Dec	2015	*RRS Discovery*	B. King	13
6*	NOAA FC1603	23-24	Mar	2016	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
7*	NOAA FC1605	16-17	May	2016	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
8*	NOAA FC1607	13-14	Jul	2016	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
9	NOAA FC1609	15-16	Sep	2016	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
10	NOAA FC1612	12-13	Dec	2016	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
11	NOAA FC1702	7-8	Feb	2017	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
12	NOAA FC1706	15-16	Jun	2017	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
13	NOAA FC1707	20-21	Jul	2017	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
14	NOAA FC1710	17-18	Oct	2017	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
15	NOAA FC1712	20-21	Dec	2017	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
16	NOAA FC1804	24-25	Apr	2018	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
17	NOAA FC1806	27-28	Jun	2018	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
18	NOAA FC1808	5-7	Sep	2018	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
19	NOAA FC1810	23-24	Oct	2018	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
20	NOAA FC1902	12-14	Feb	2019	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
21	NOAA FC1904	23-25	Apr	2019	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
22	NOAA FC19xx	3-4	Jun	2019	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
23	NOAA FC19xx	25-26	Jul	2019	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
24	NOAA FC19xx	4-5	Oct	2019	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
25	NOAA FC20xx	4-5	Feb	2020	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
26	NOAA FC20xx	-	Apr	2020	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
27	NOAA FC20xx	-	Jun	2020	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9
28	NOAA FC20xx	-	Aug	2020	*R/V Walton Smith*	J.A. Hooper, M.O. Baringer	9

* Cruises for which absolute gridded velocities are already available

- **Why the Florida Current?:** At 26°N, the Florida Current (FC), upstream extension of the Gulf Stream, is confined to a very narrow passage (~90 km width, ~700 m depth, the Florida Straits). The FC (~ 32 Sv) comprises the bulk of the upper northward limb of the MOC transporting heat, carbon and nutrients to the North Atlantic.
- **Why nutrient transport?** Since the biological sequestration of carbon (Biological Carbon pump, BCP) is limited by the presence of nutrients in the upper ocean, the FC can be seen as precursor of the nutrient inventory downstream feeding the subtropical gyre productivity.

AVERAGE VELOCITY AND PROPERTY SECTIONS

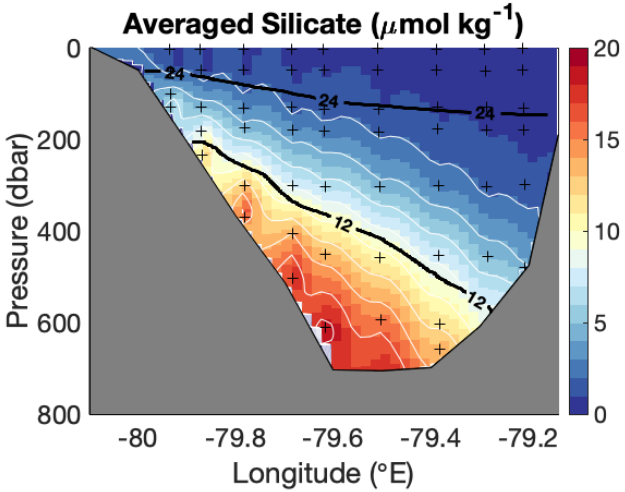


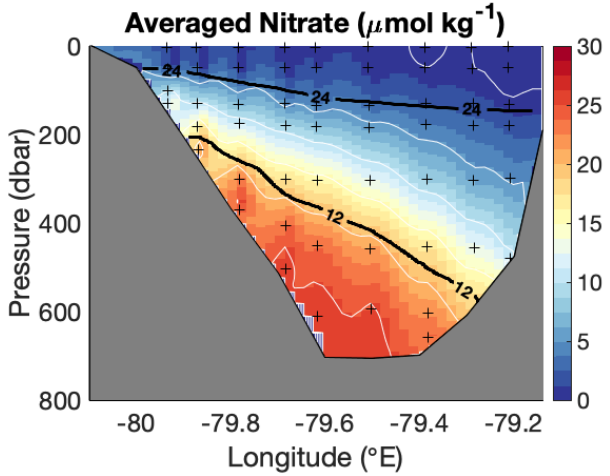


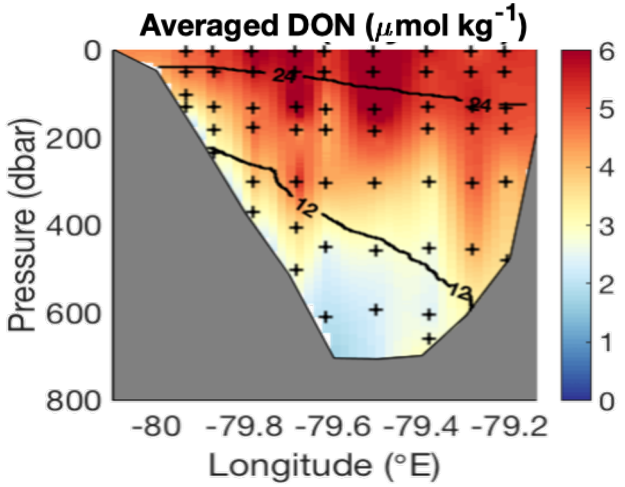
Surface waters, >24°C, 11.0 ± 1.8 Sv
Central waters of South Atlantic origin

Upper thermocline waters, 12-24°C, 16.8 ± 2.8 Sv
Saltier Central waters of North Atlantic origin

Lower thermocline waters, <12°C, 4.5 ± 0.8 Sv
Fresher mixed Antarctic Intermediate Water





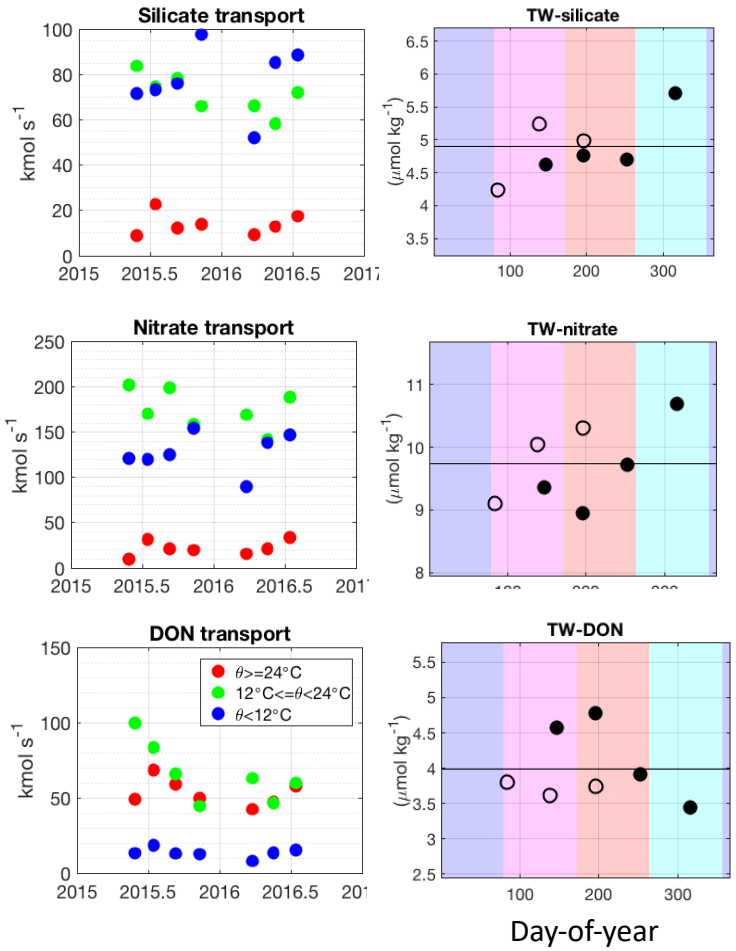


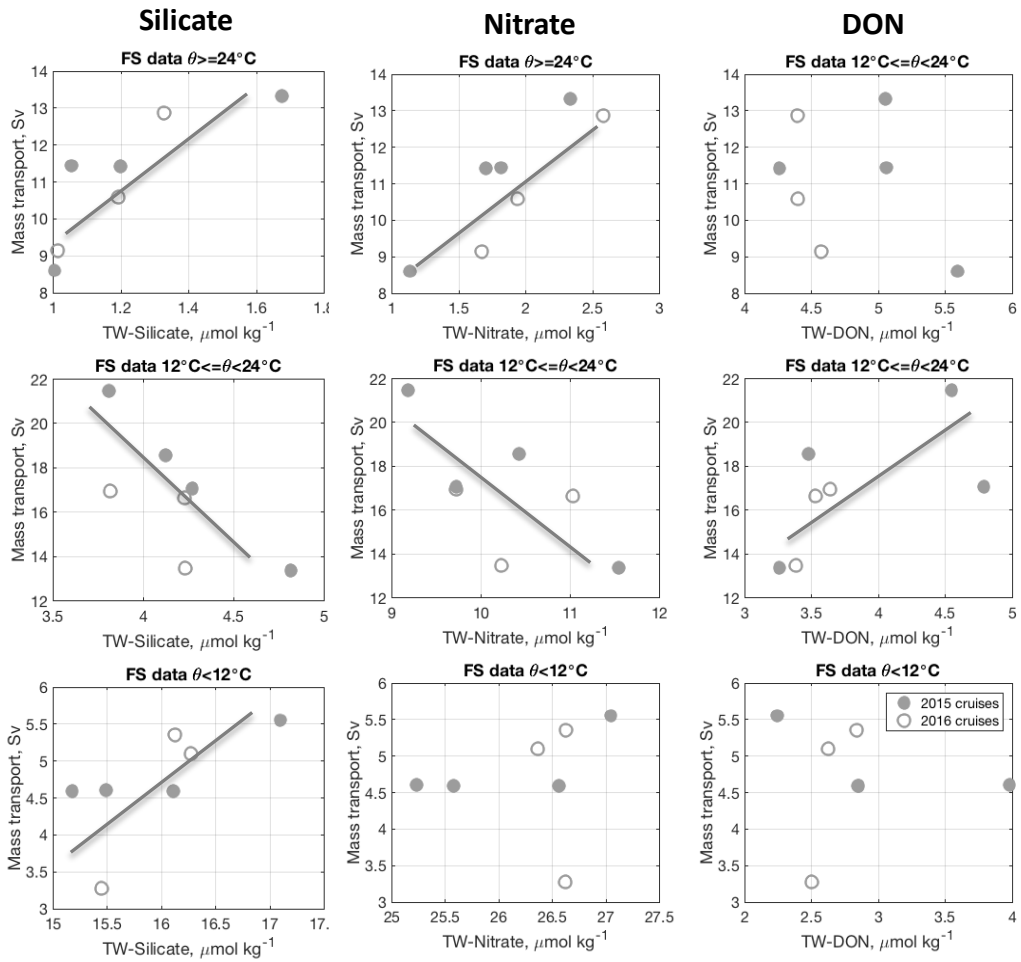
Florida Straits velocities and properties have a (non-homogeneous) vertical structure

- **Maximum surface core velocity.** FS velocities are not homogeneous vertically nor horizontally, but there is a surface core of maximum speed towards the westernmost part of the Strait.
- **3 main water masses.** Water masses are not spatially homogeneous either: three main water masses of different origin (Schmitz & Richardson, 1991) and patterns of variability cross the Florida Straits.

* Averages shown here correspond to the 7 repeats for which velocities are available

NUTRIENT TRANSPORTS AND TRANSPORT-WEIGHTED PROPERTIES BY TEMPERATURE CLASSES





> 24°C S-Atlantic

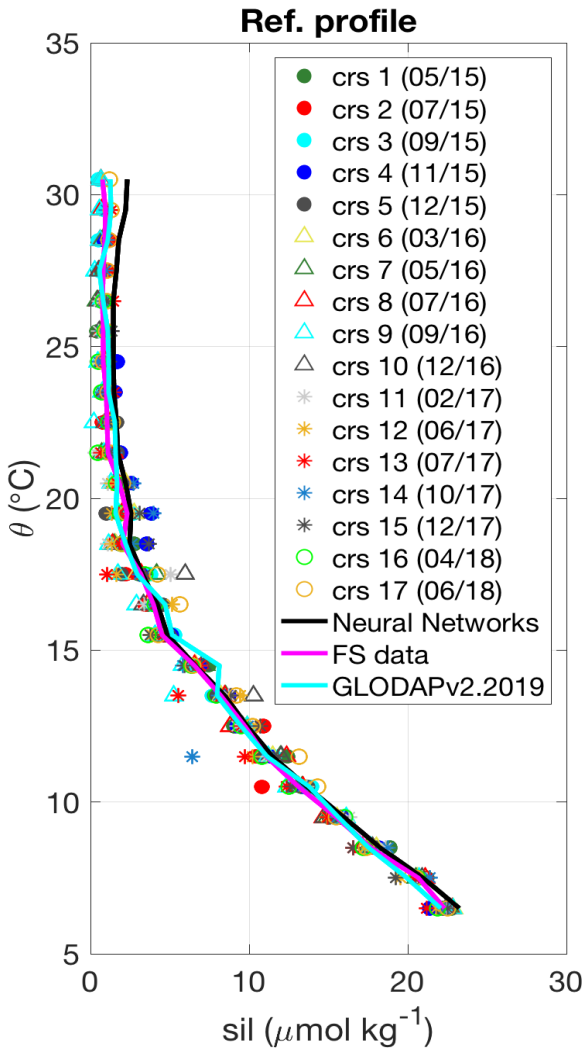
12-24°C N-Atlantic

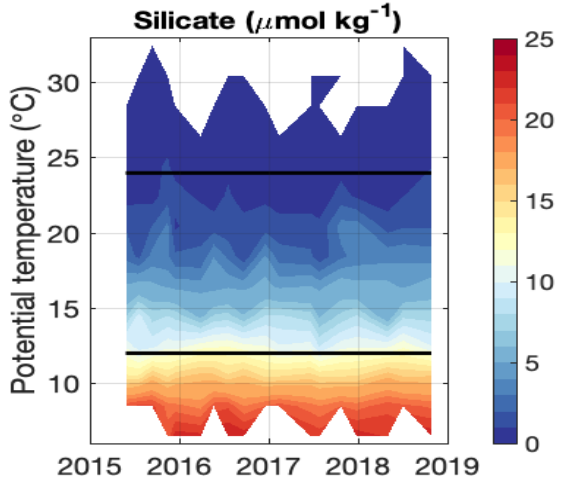
< 12°C S-Atlantic

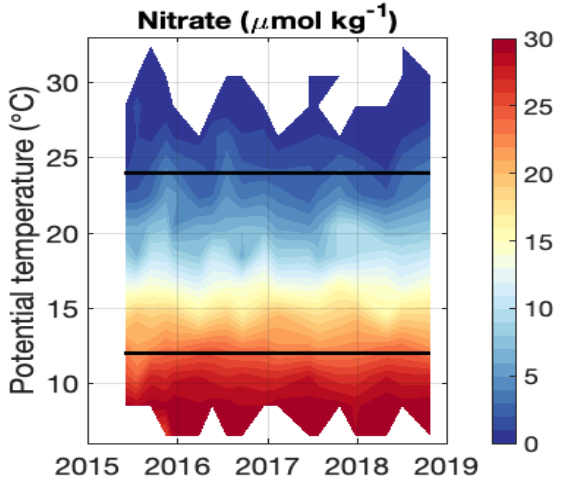
- **Inorganic nutrients (nitrate, silicate):** mainly transported by upper and lower thermocline waters (peaking end-of-year)
  TW nutrients correlate + with transport in surface and lower thermocline waters of South Atlantic origin
  TW nutrients correlate – with transport in lower thermocline water of North Atlantic origin (gyre recirculation)
- **Organic nutrients (DON):** mainly transported by surface and upper thermocline waters (peaking spring & autumn)
  TW organic nutrients show certain positive correlation with transport in upper thermocline water (gyre recirculation remote origin)

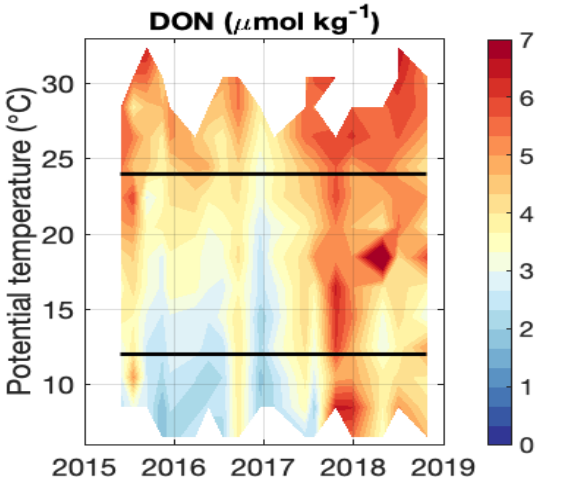
* Results shown here correspond to the 7 repeats for which velocities are available

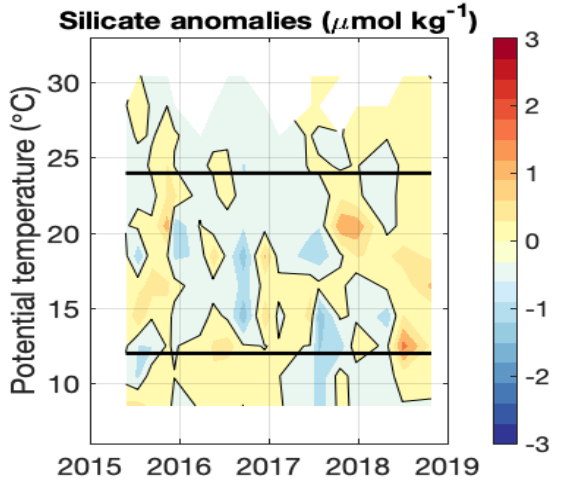
TEMPORAL VARIATIONS BY TEMPERATURE CLASSES

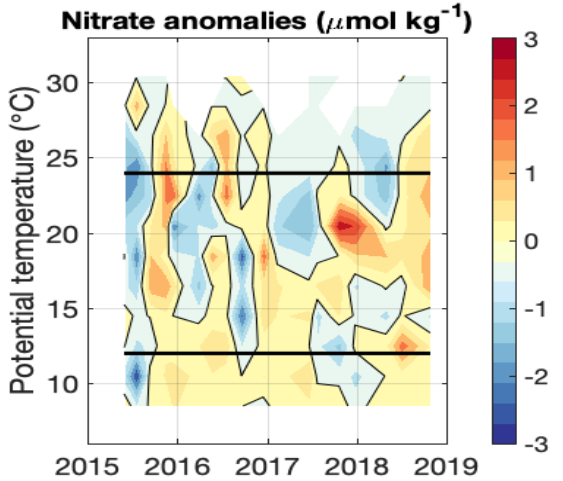


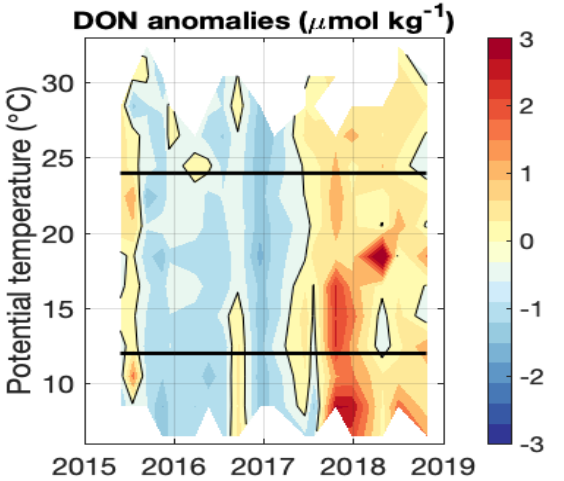












- **Isothermally averaged nutrient anomalies.** A single nutrient anomaly profile per cruise is computed by subtracting the whole-period averaged vertical mean profile. For comparison and reference, two other mean profiles are used, one obtained from GLODAPv2 data and the other one reestimated from temperature, salinity and oxygen data by means of neural networks (Bittig et al. 2018).

* Results shown here correspond to the first 17 cruises for which nutrients have been already analyzed

Take-away messages:

1. Great potential of the ABC database. Analysis of the existing database is still ongoing. Full hydrographic database (28 cruise repeats) will be completed this year (6 full years, 4-5 cruise/year).

2. Seasonal range of variability. We aim to assess the seasonal cycle on the nutrient transports by temperature classes, and deconvolute the signal into transport vs. nutrient seasonal patterns.

3. Interannual signal, observed trends? Interannual anomalies on the nutrient fields are observed. Their impact on the total nutrient transports, and the potential correlations with nutrient inventories downstream will also be assessed.

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