

Interpreting variability of deep waters in the Irminger Sea

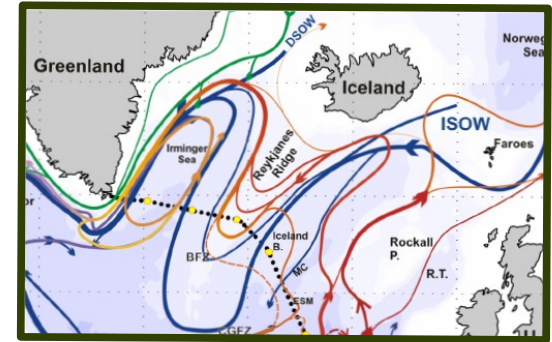
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EGU21-3070

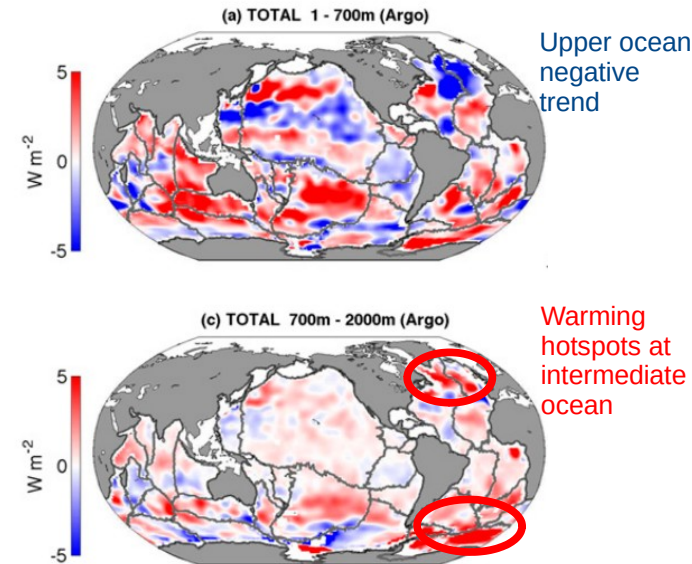
30th April 2021

1. Motivation

- North Atlantic **Subpolar Gyre (SPG)**, potential candidate for heat storage at the deep ocean (Palmer et al. 2011; Robson et al. 2018).
- Difficult estimation of trends at the deep ocean due to the lack of observations and no complete understanding of processes driving changes below 2000 dbar.
- Quantify and understand deep water (> 2000 dbar) variability in the Irminger Sea (ISOW/DSOW) using repeated hydrography and Deep Argo data (2002-2021).
- Build timeseries of property anomalies => Choose the appropriate climatology to refer changes (region of large temporal and spatial variability, water mass distribution constrained by bottom topography).



Daniault et al; 2016



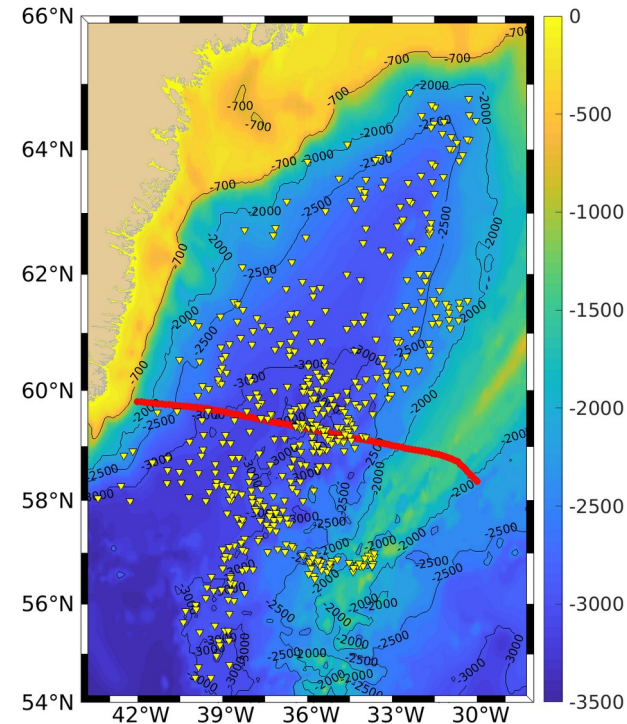
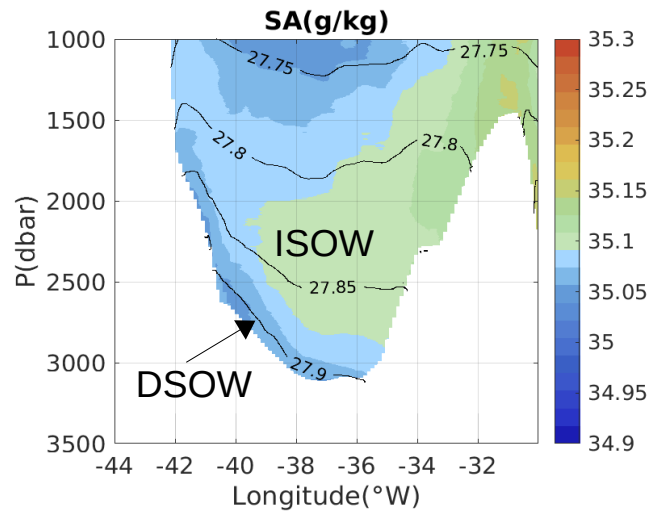
Argo OHC trends (2006-2014)

Desbruyères et al 2017

2. Data and Methods

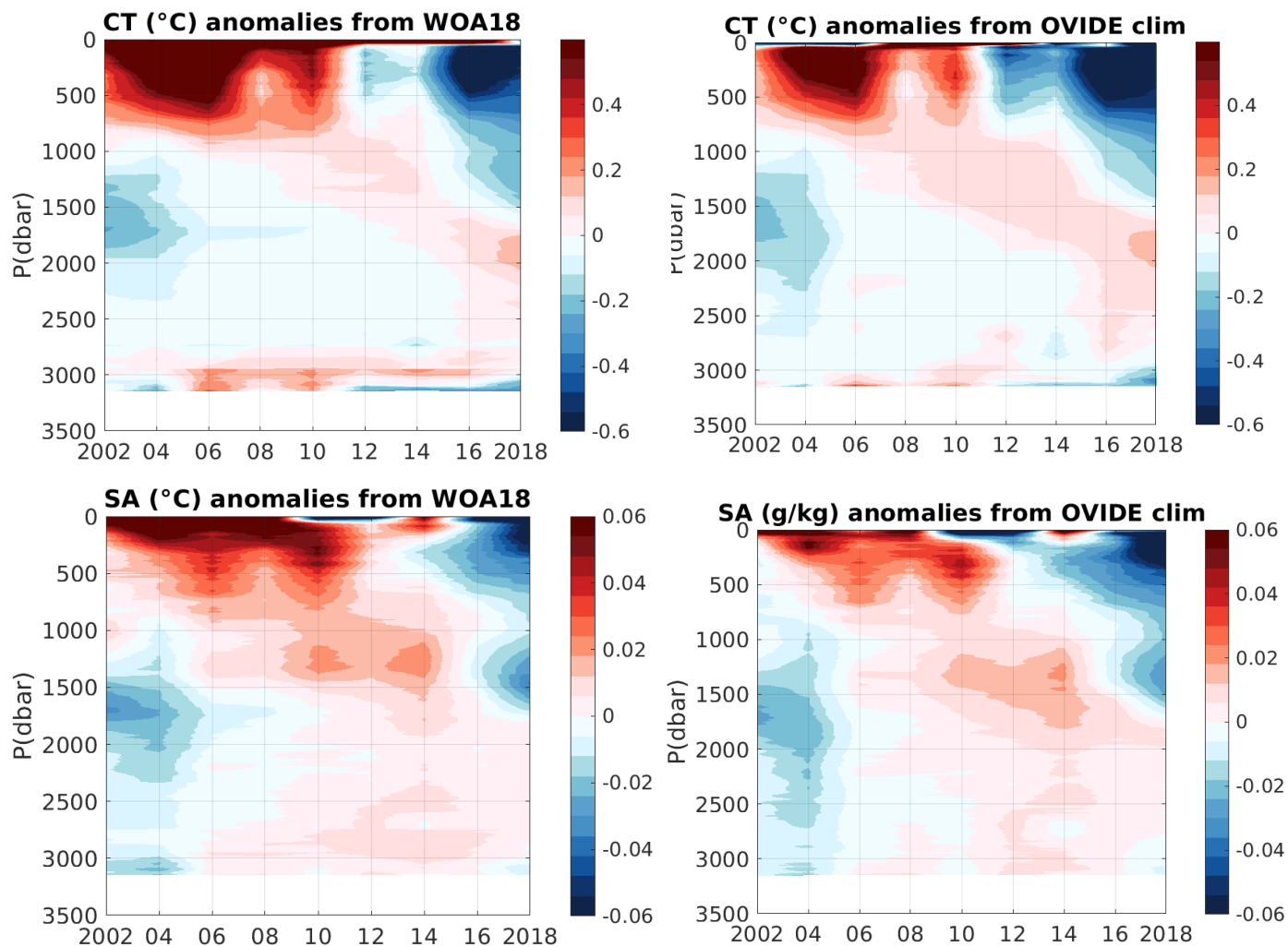
Hydrography: 9 repetitions (2002-2018) of OVIDE section (TS gridded fields)

Deep Argo: 5 yr (2016-2021) of DMQC TS data from 8 floats (Cabanès et al. 2016)



→ Global, coarse-resolution (1/4°) World Ocean Atlas (WOA18) TS annual means 2005-2017
(<https://www.nodc.noaa.gov/OC5/woa18/>)

Lagged-response of the deep ocean to surface anomalies (OVIDE 2002-2018):
WOA18 vs OVIDE clim



2. Data and Methods: Building OVIDE - based climatology (KOBA18)

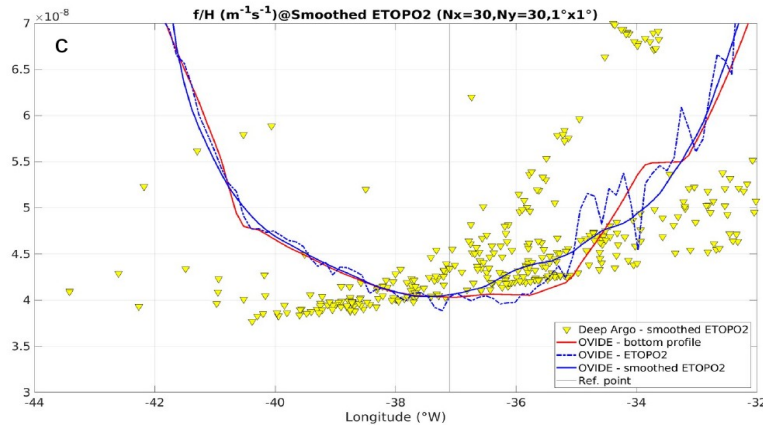
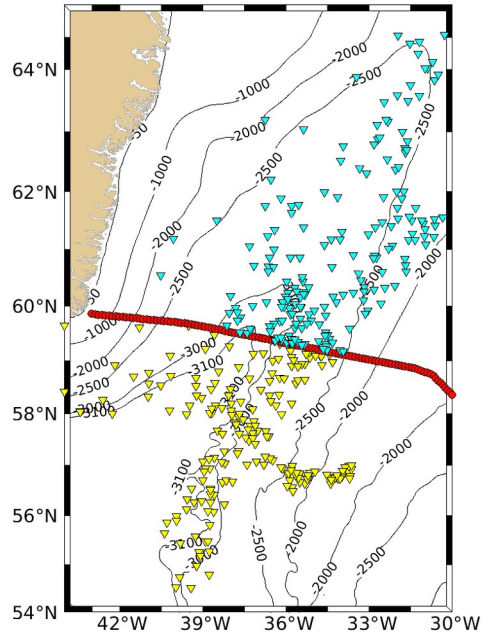
Objective: Propagate OVIDE Mean TS fields along f/H contours
Kobayashi et al. 2018 (KOBA18)

Why?

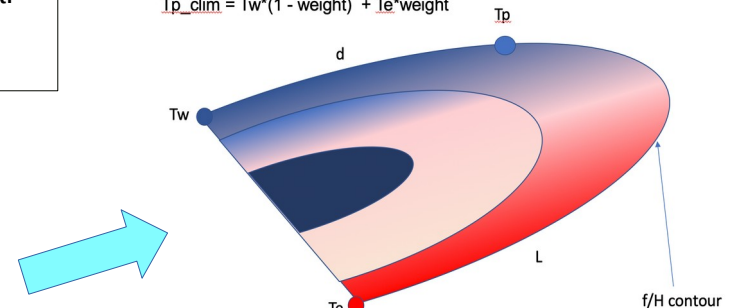
Obtain timeseries of anomalies from any scattered data set, avoiding biases due to decadal variation of data distribution in WOA18

How?

Finding Equivalent LONGITUDE along OVIDE (equal f/H) and remove the corresponding climatological TS value to get anomalies.

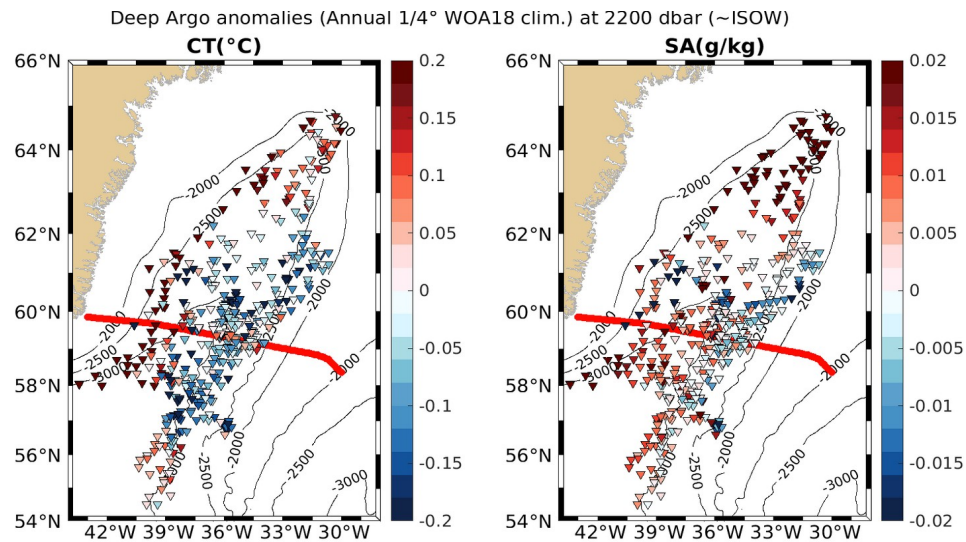
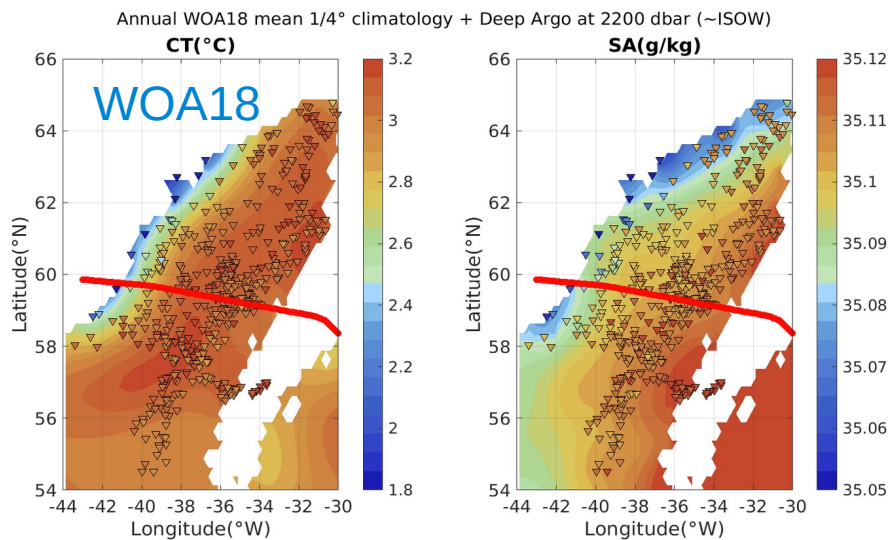
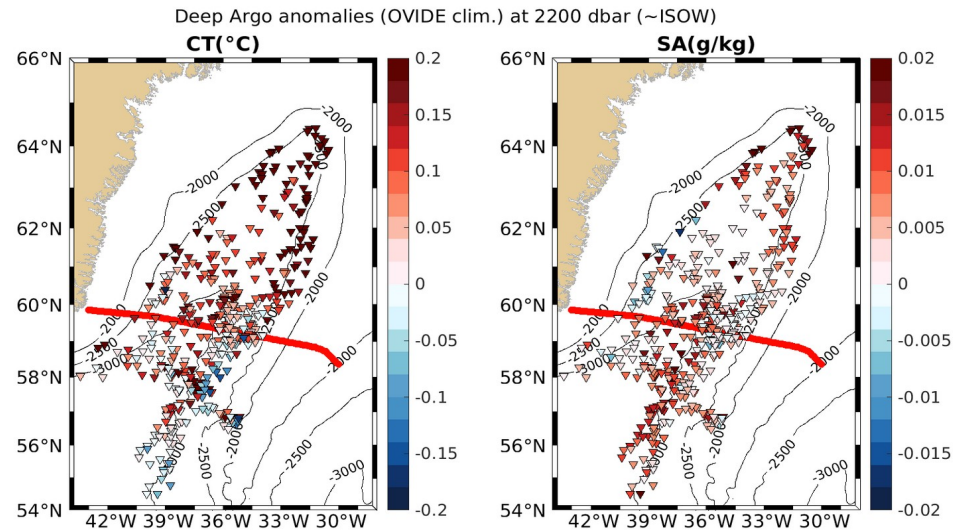
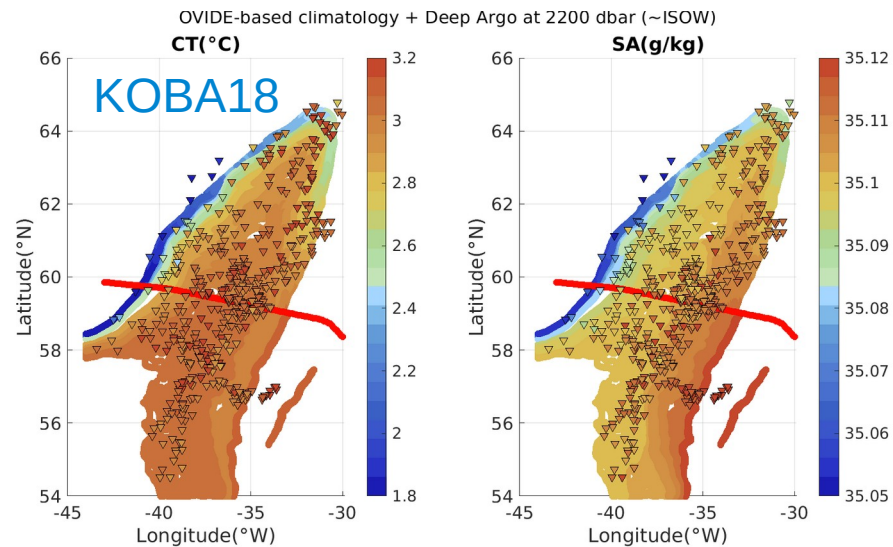


$$\text{Weight} = d/(d + L)$$
$$\text{Tp_clim} = \text{Tw} * (1 - \text{weight}) + \text{Te} * \text{weight}$$

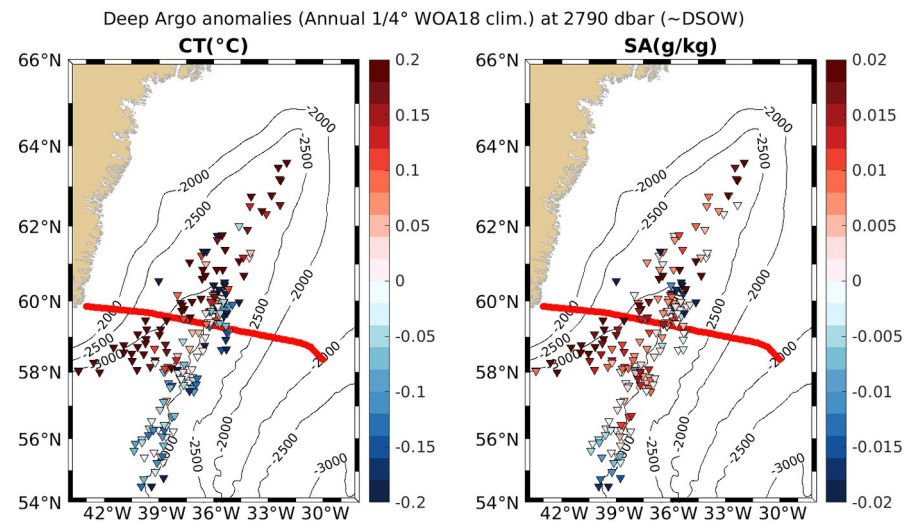
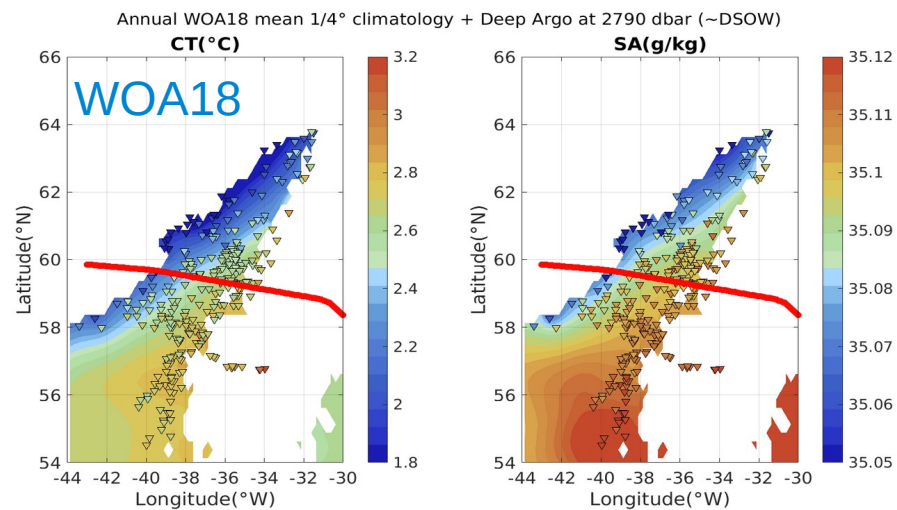
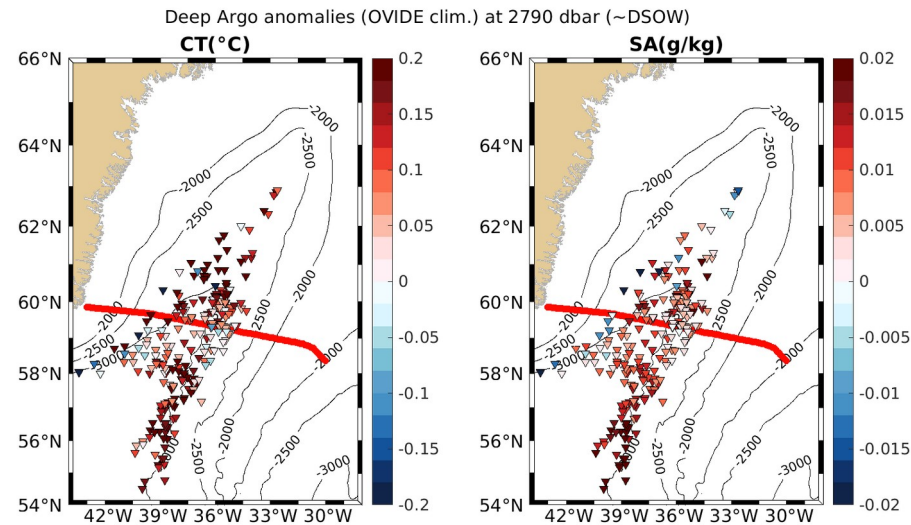
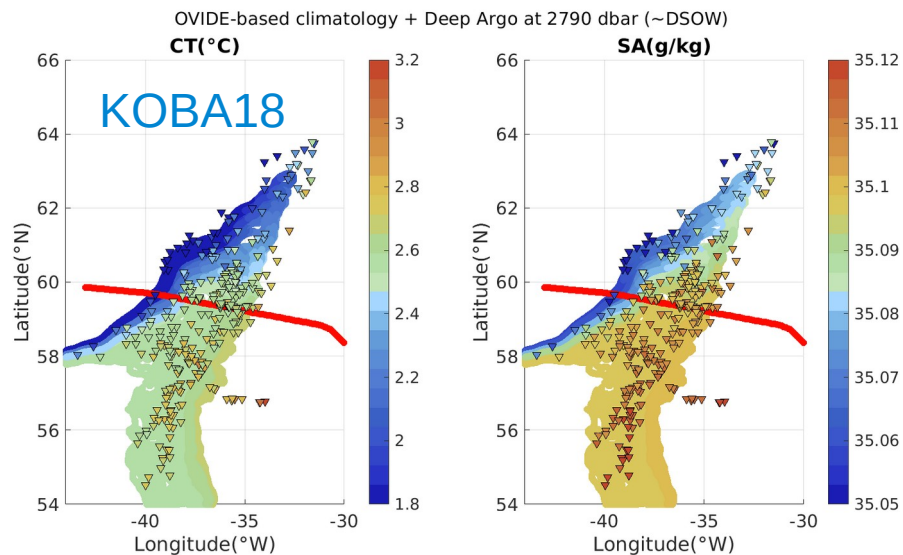


Apply a weight to ensure continuity between eastern/western side along a given f/H (Floats to the north of OVIDE, cyan)

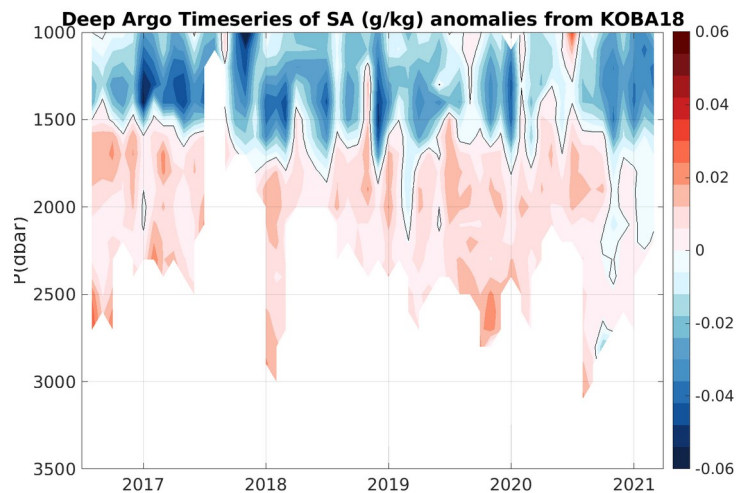
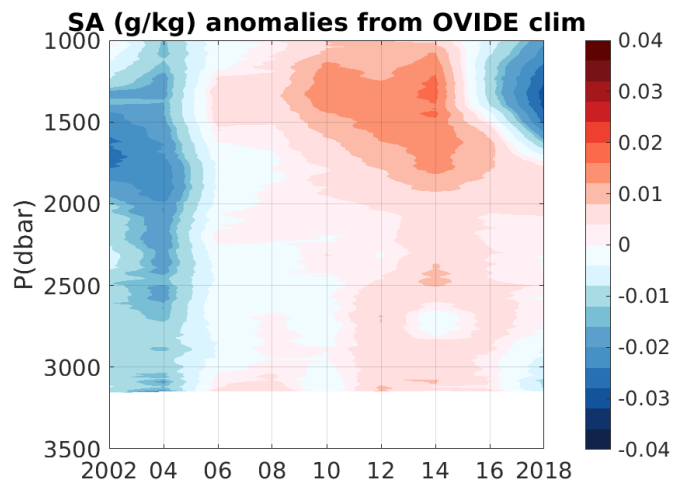
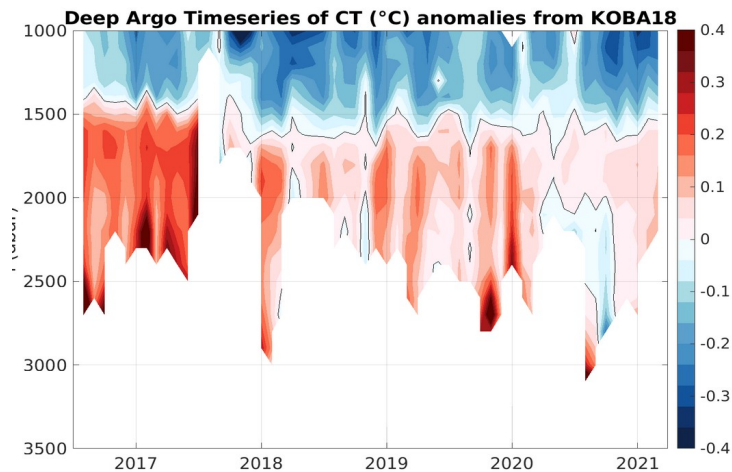
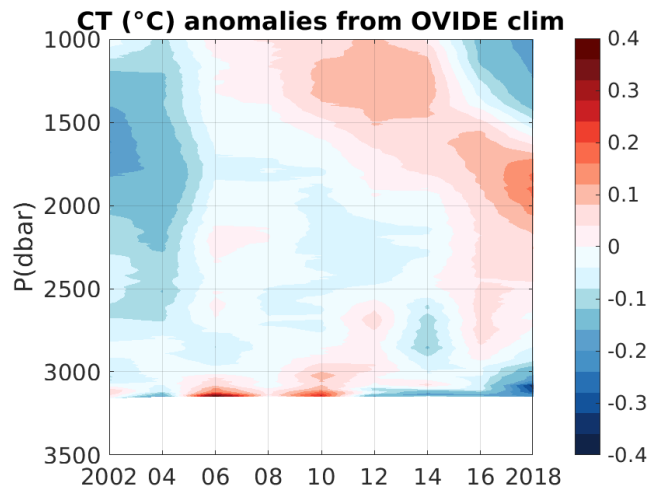
3. Results (ISOW ~ 2200 dbar)



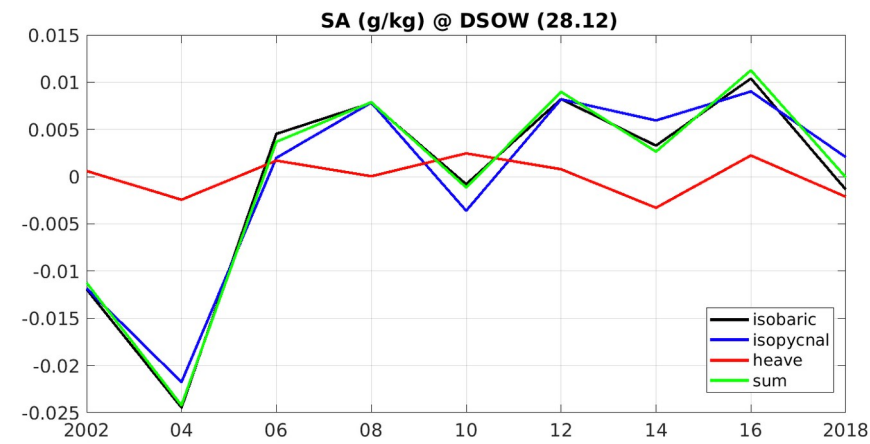
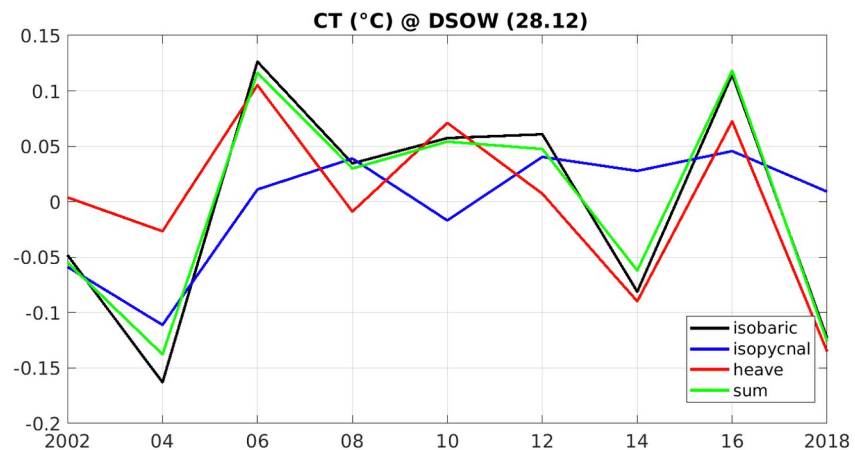
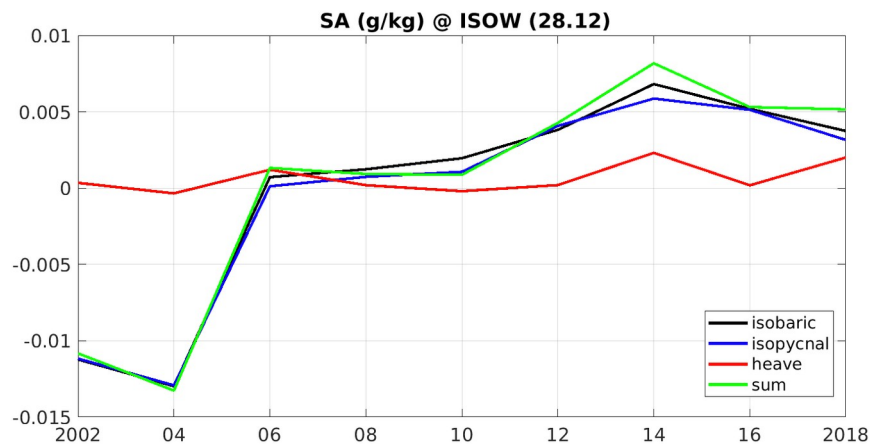
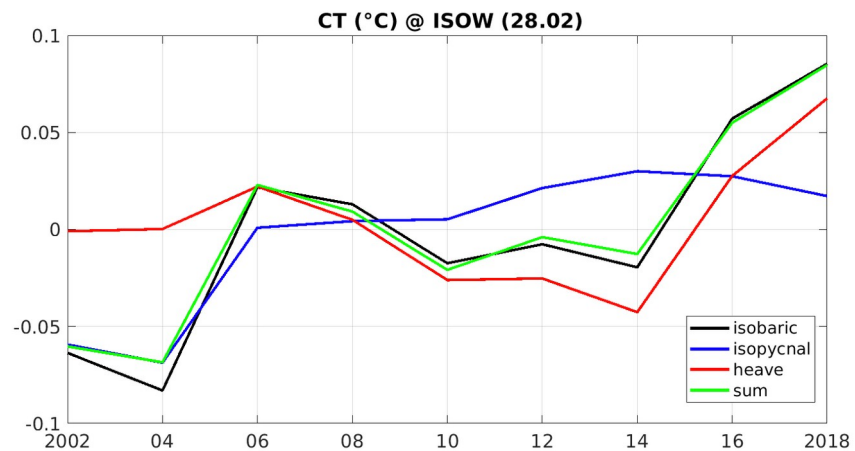
3. Results (DSOW ~ 2790 dbar)



3. Results



3. Results: long-term changes decomposition



4. Conclusions

- Differences arise in the boundary depending on the climatology used: warmer/saltier ISOW/DSOW are observed from OVIDE-based climatology. A pattern of cooler/fresher waters along the western flank of Reykjanes Ridge is observed from WOA18 annual means.
- A long-term isopycnal warming of ISOW is revealed by repeated hydrography, whereas a short-term cooling trend is captured by Deep Argo in recent years. A lagged-relationship is observed between deep ocean and surface anomalies, whose link and involved mechanisms need to be investigated , separating the contribution from horizontal advection of anomalies from remote areas and vertical injection of anomalies due to local processes.
- Warming and salinification of ISOW and salinification of DSOW in the 2002-2018 period is mainly driven by isopycnal change. The heave component play also an important role on temperature interannual variability.