7.–8. nóvember í Hörpu

Stjórnun fiskveiða

– svo miklu meira en kvóti

Copernicusar-áætlunin og aðrar fjarmælingar tengdar hafinu

Angel Ruiz-Angulo

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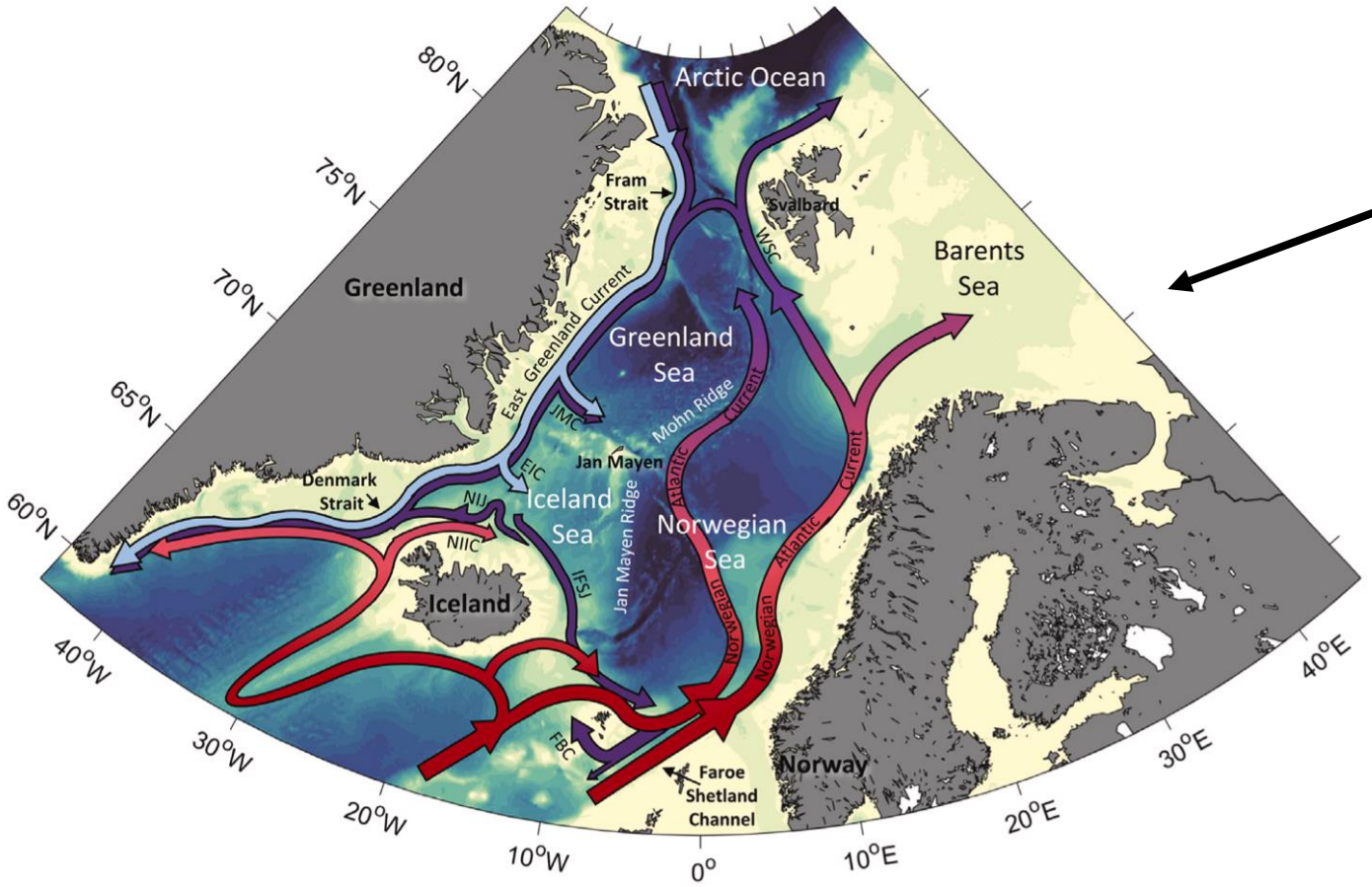
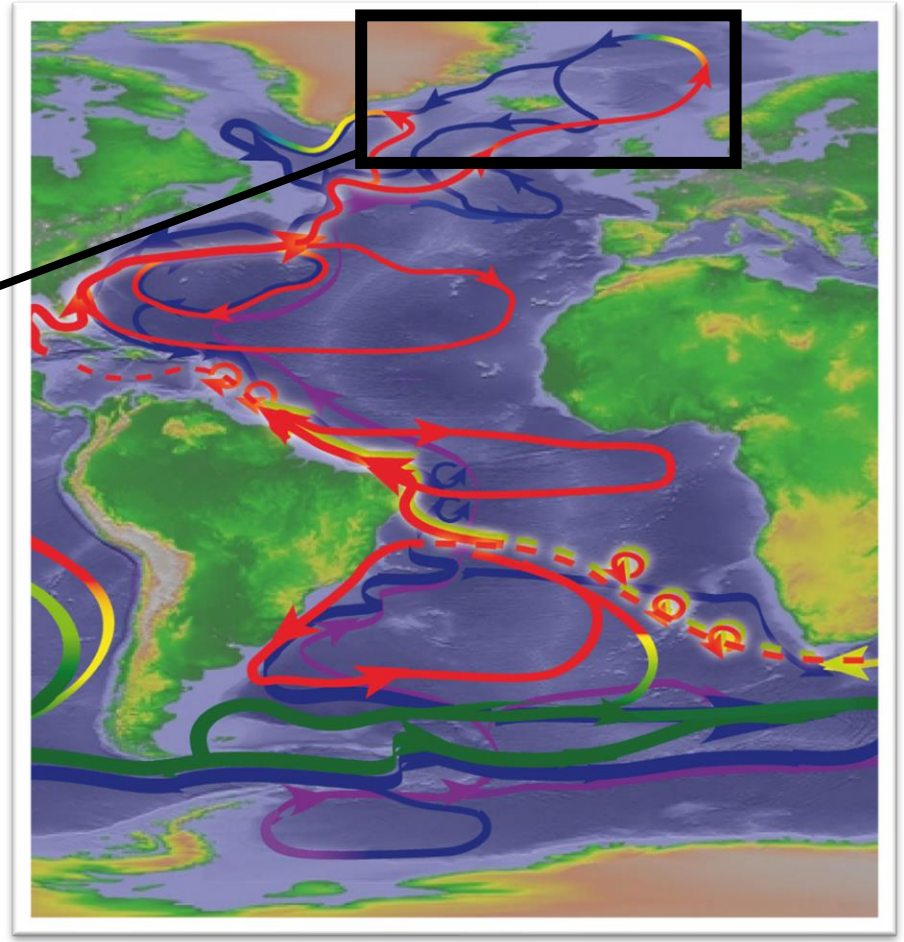
Iceland in the middle of the AMOC pathways

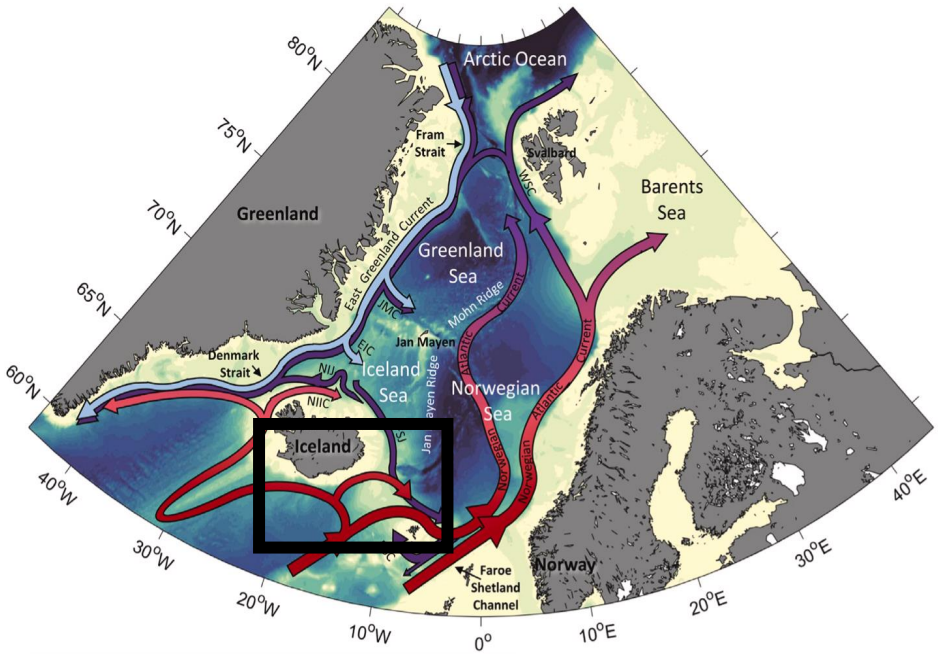


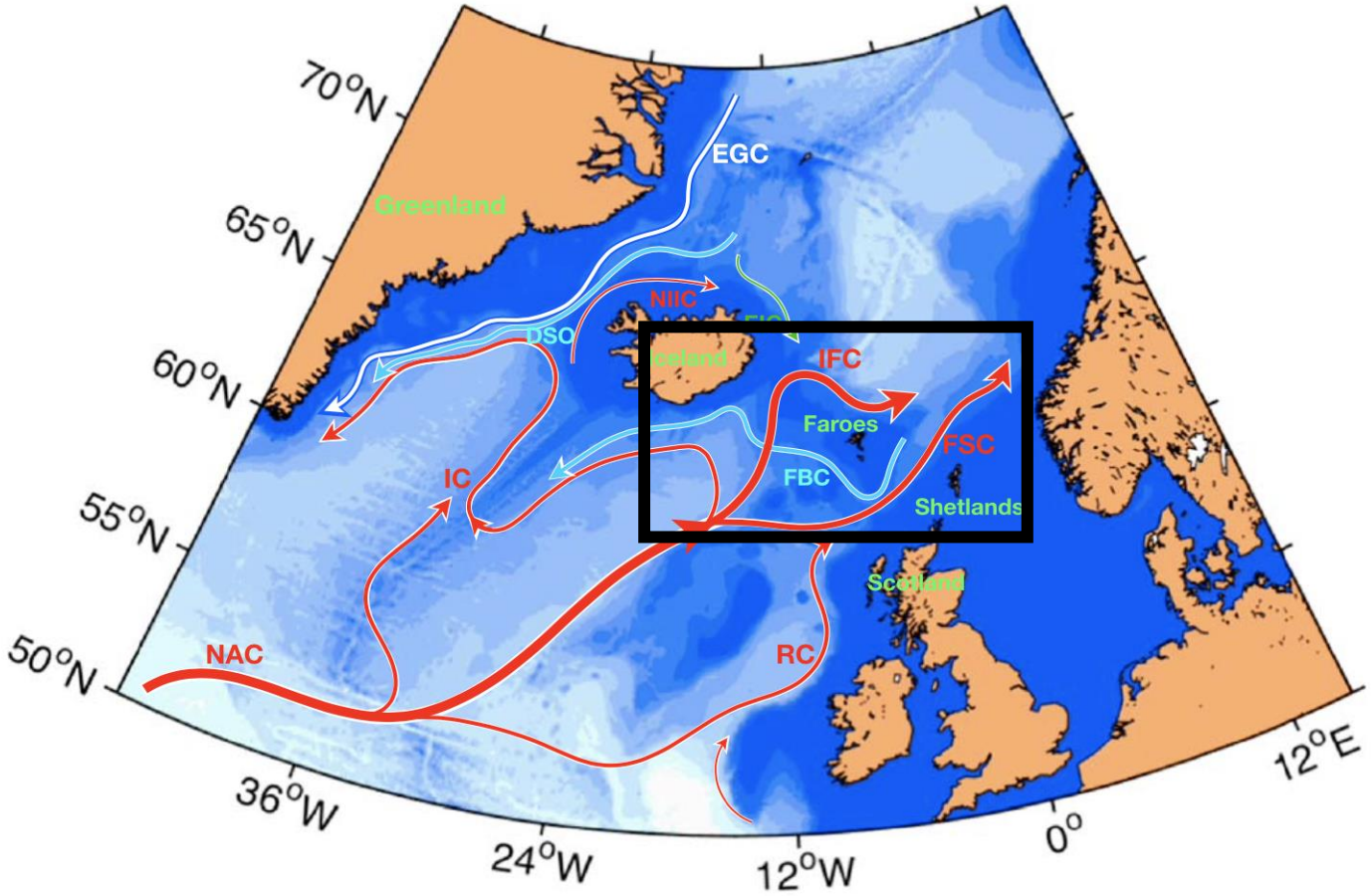


Schemes of oceanic circulation around Iceland

Brakstad et al., 2023, Speich 2009

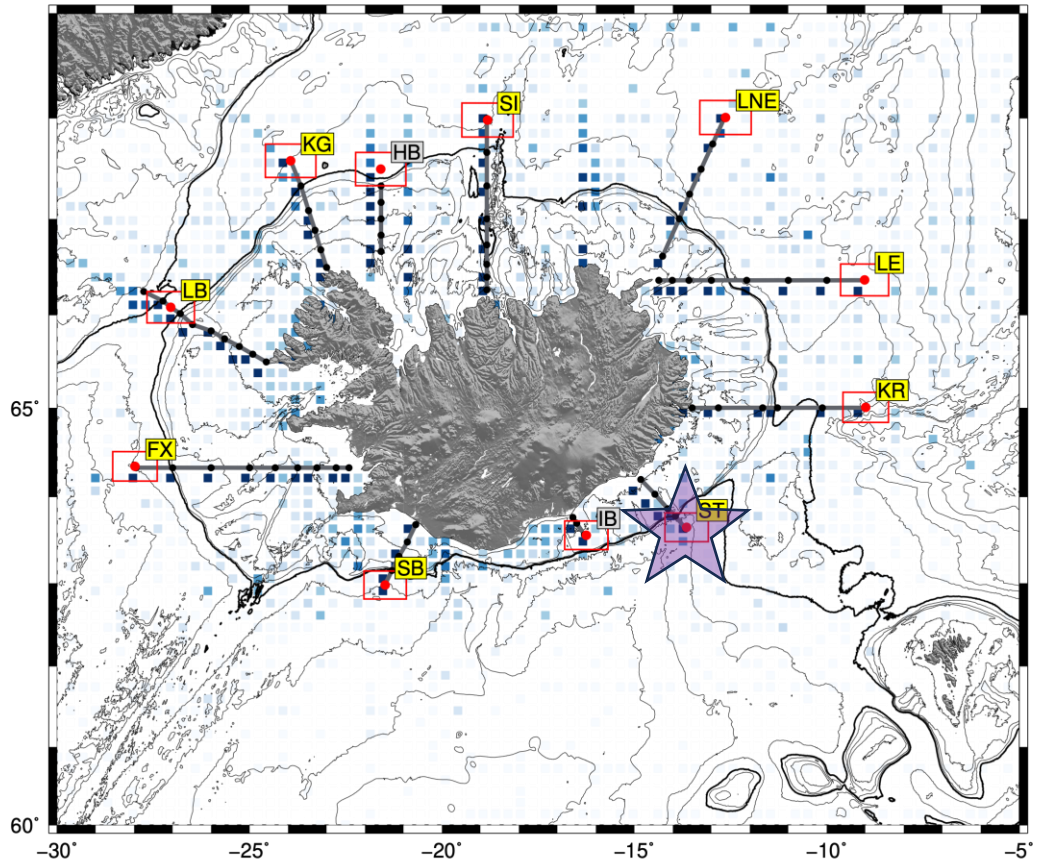
The saga of one particular deep current south of Iceland

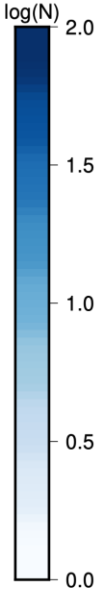


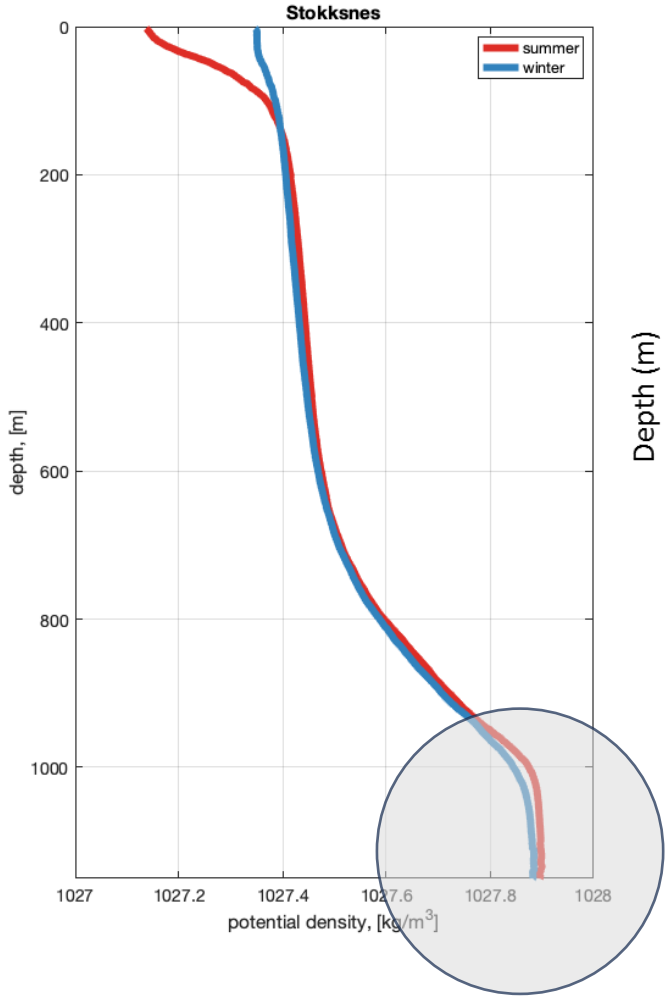


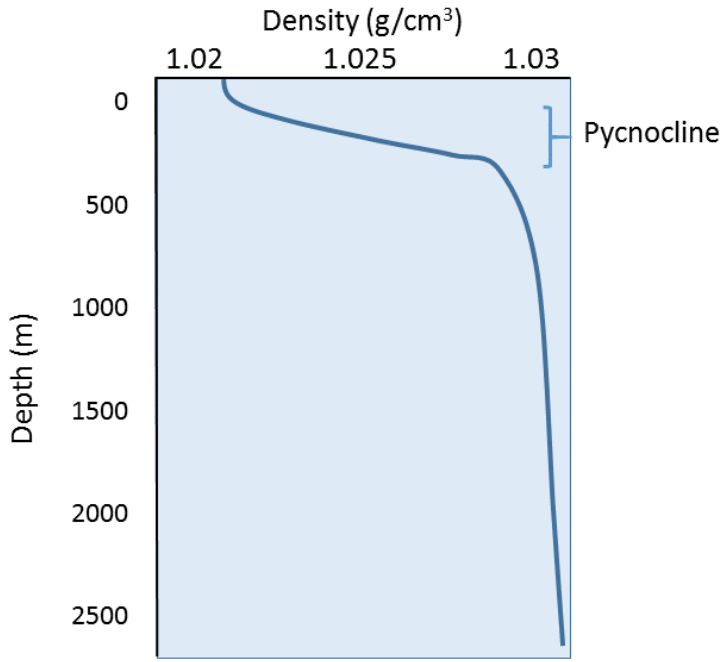
Brakstad et al., 2023, Koman et al., 2022, Rossby et al. 2018

Hafrannsóknastofnun (MFRI-Hafró)
Hydrographic Observations (CTD) (1990-2020)









?

Quarterly oceanographic surveys: February, May, August and November

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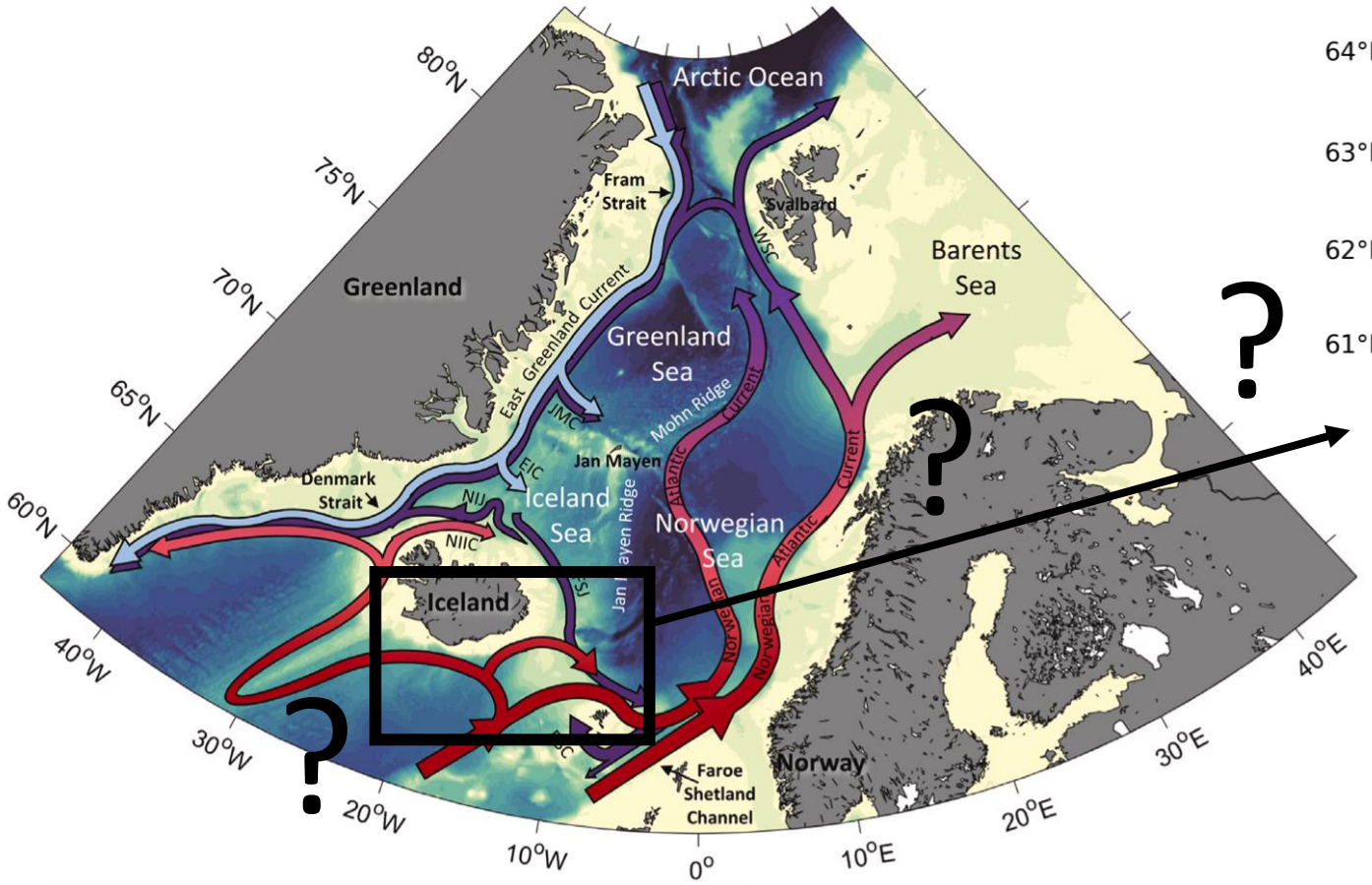
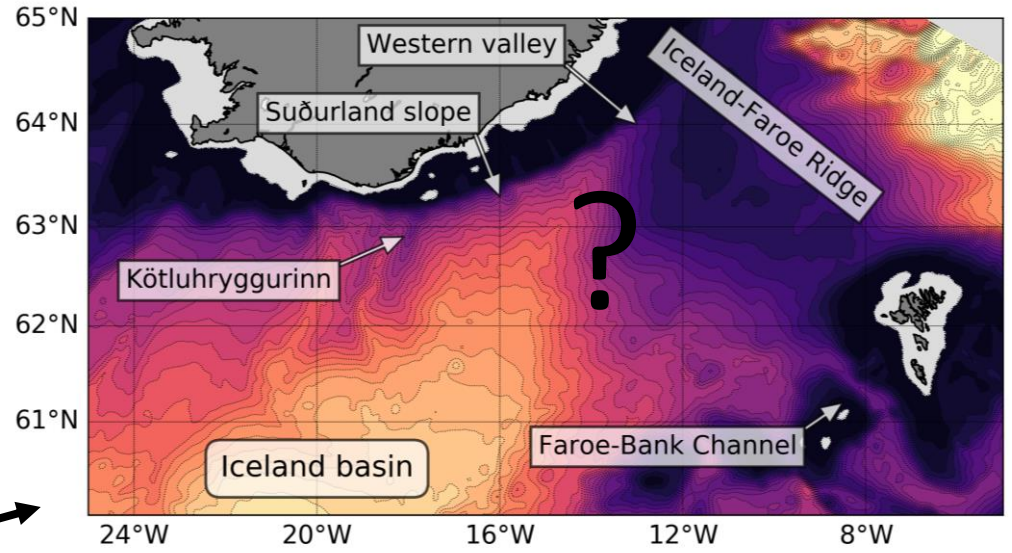
Building up a story from one profile?



Schemes of oceanic circulation around Iceland

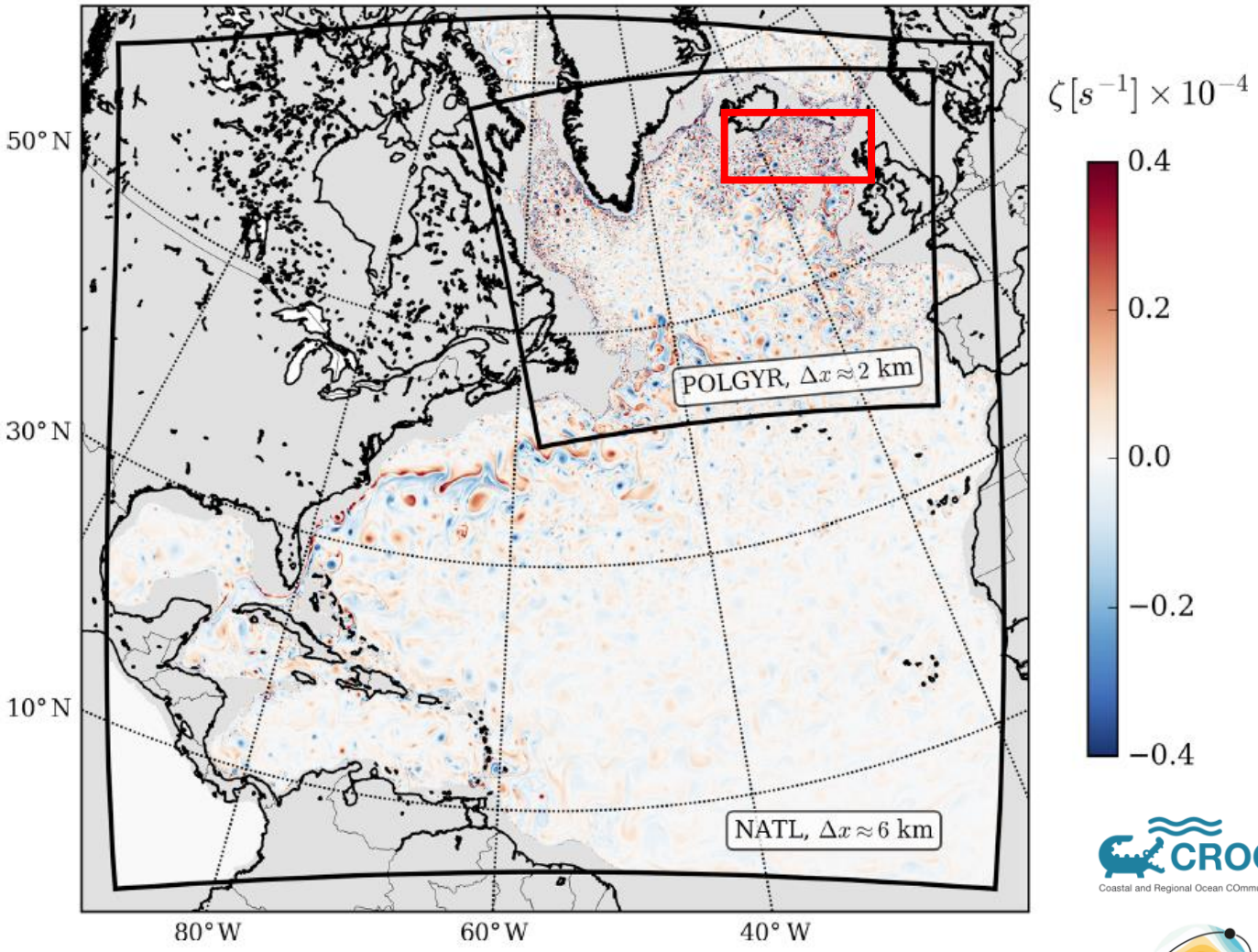
Brakstad et al., 2023



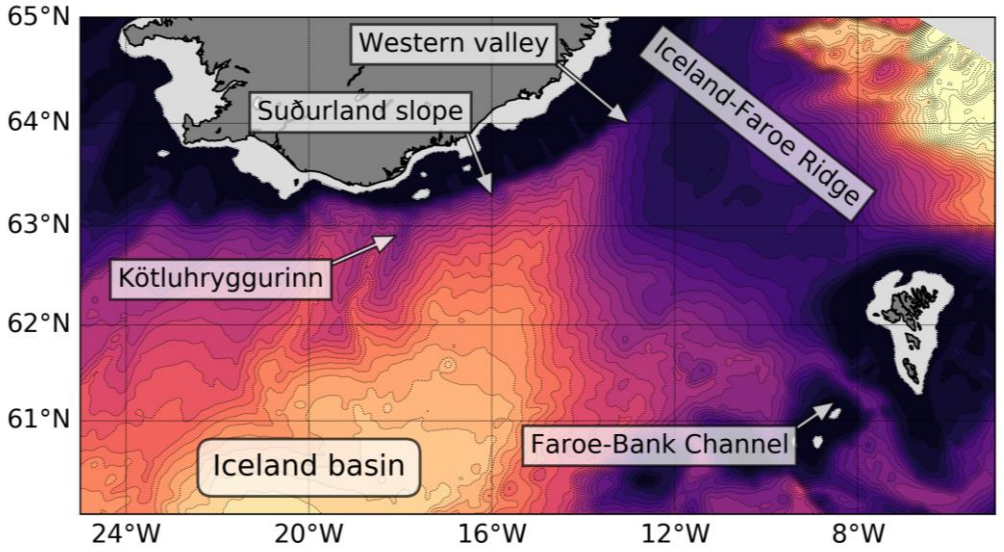
de Marez et al., 2024

FAQ: why is density so different here?

Numerical methods to the rescue!



6 km and 2 km resolution simulations for the North Atlantic[1]

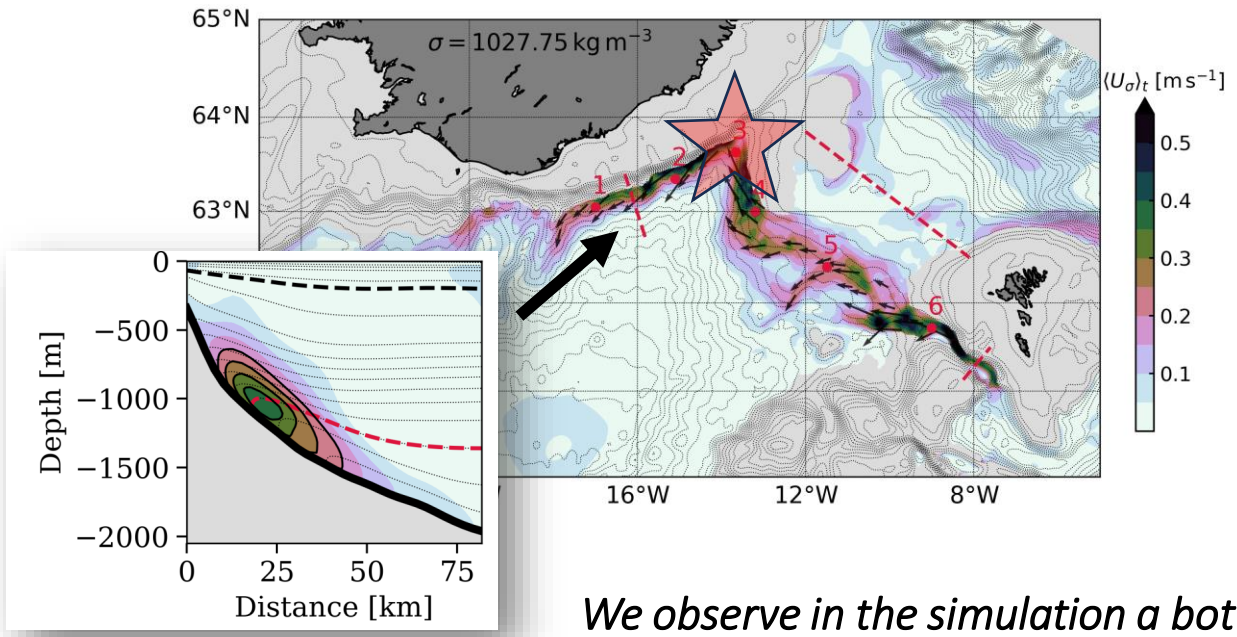


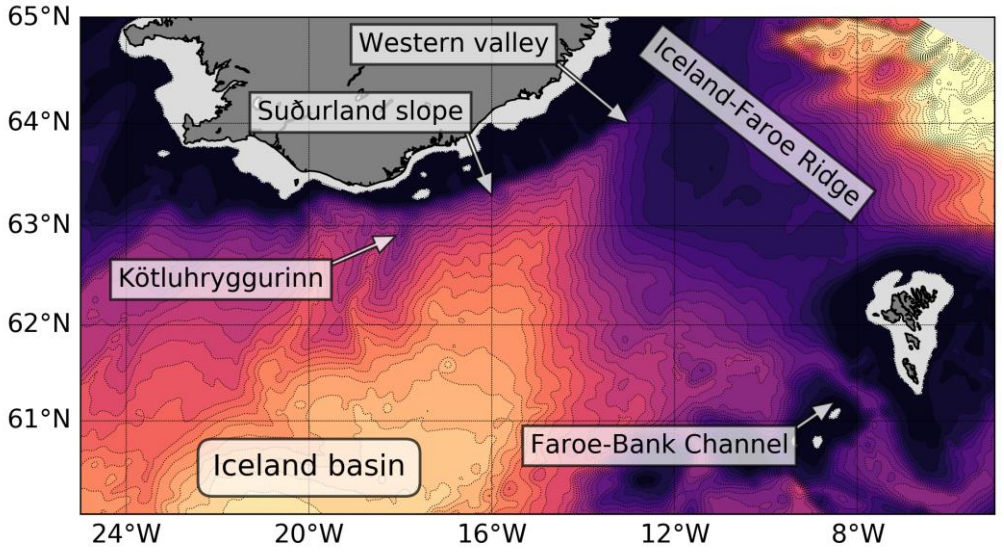
Use of a realistic simulation of the North Atlantic sub-polar gyre

CROCO (ex-ROMS) numerical model
Nesting approach (forcing at boundaries by NATL)
7-years long (after 2-years spin up)
2-km horizontal resolution
80 terrain-following vertical levels
Daily forcing
No tides

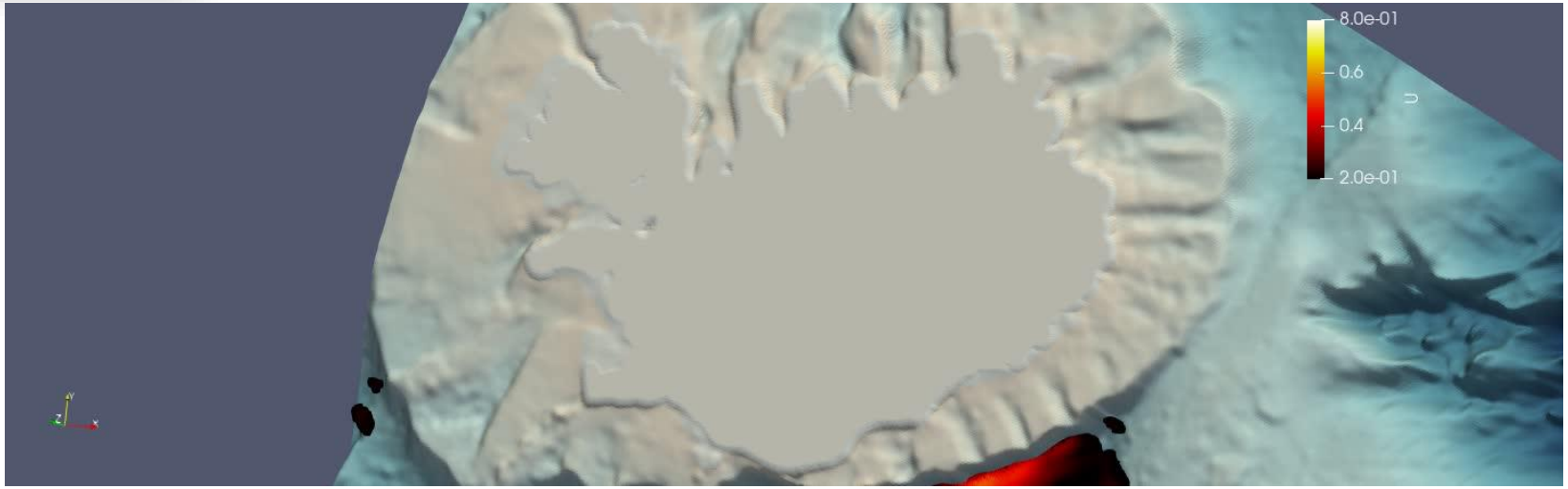
[1]Le Corre et al., 2020

Insights from the realistic simulation





We observe in the simulation a bottom current flowing south of Iceland at about 1000 m depth



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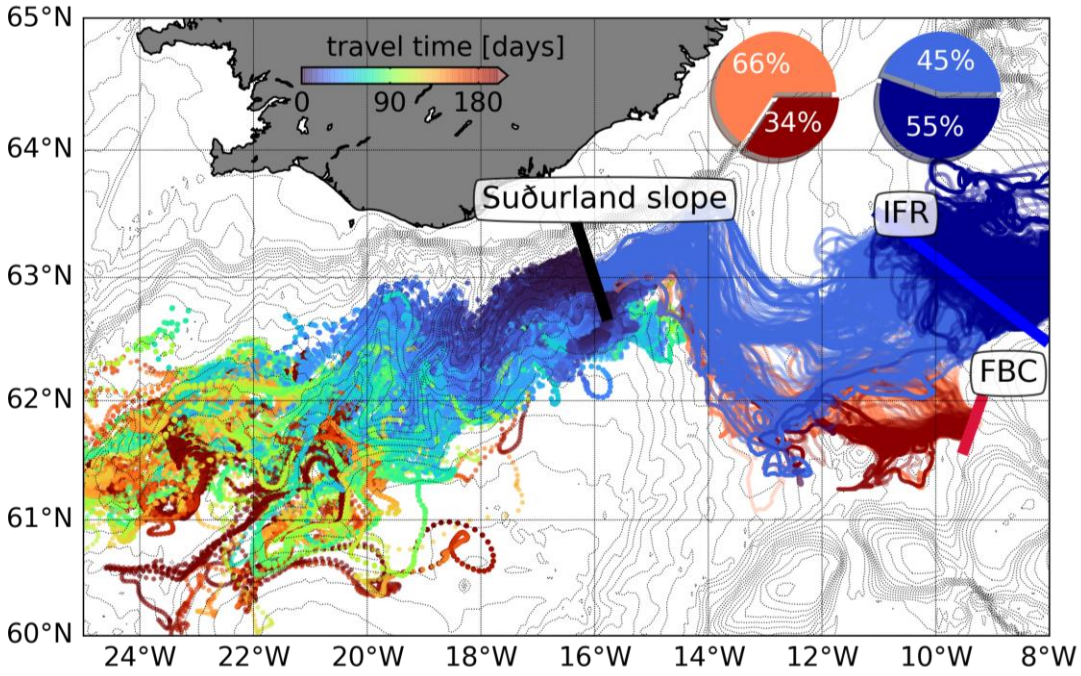
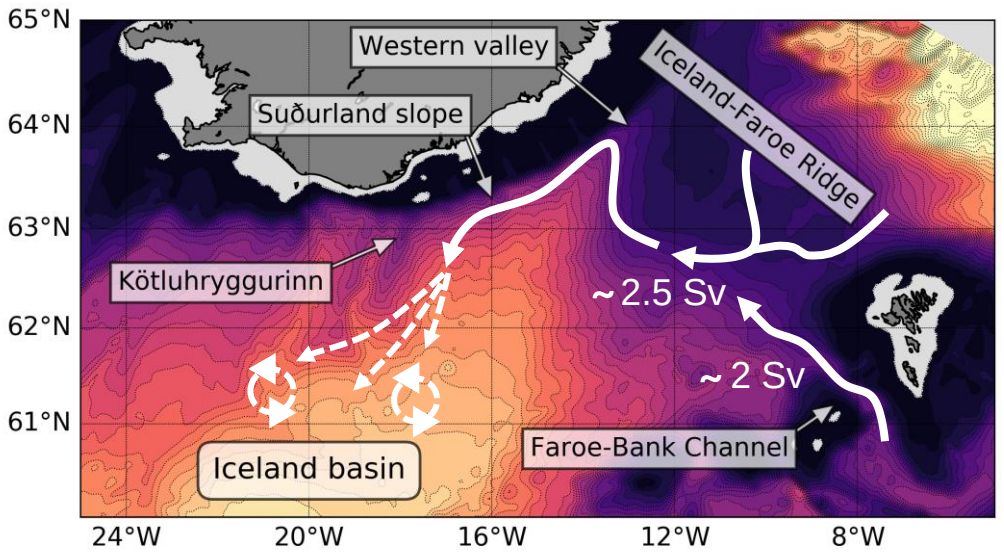
Spreading of the Bottom Boundary Current



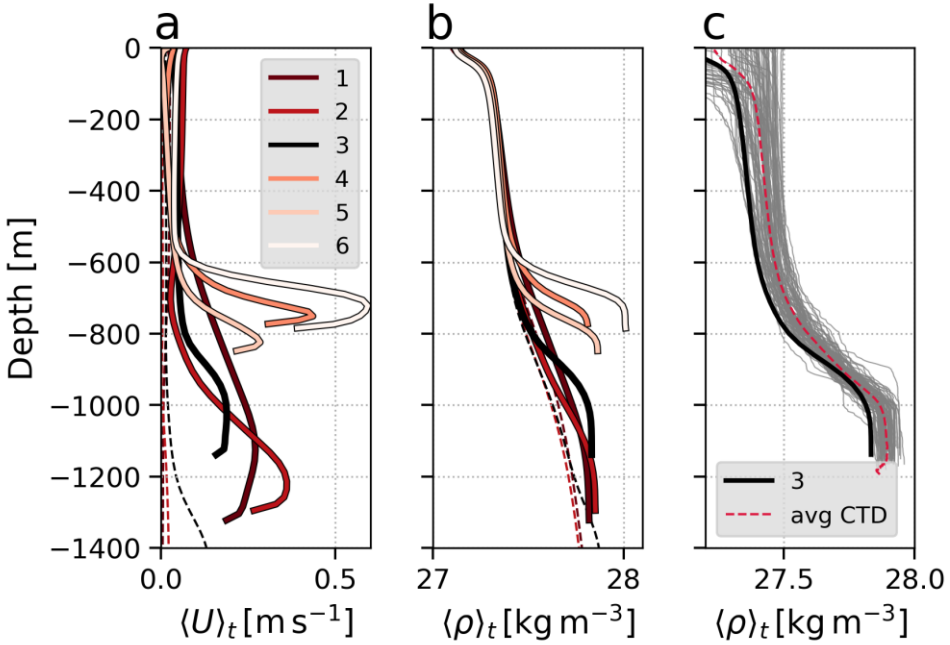


What we used so far:
In-situ data
High resolution numerical model
Tracers (particles)

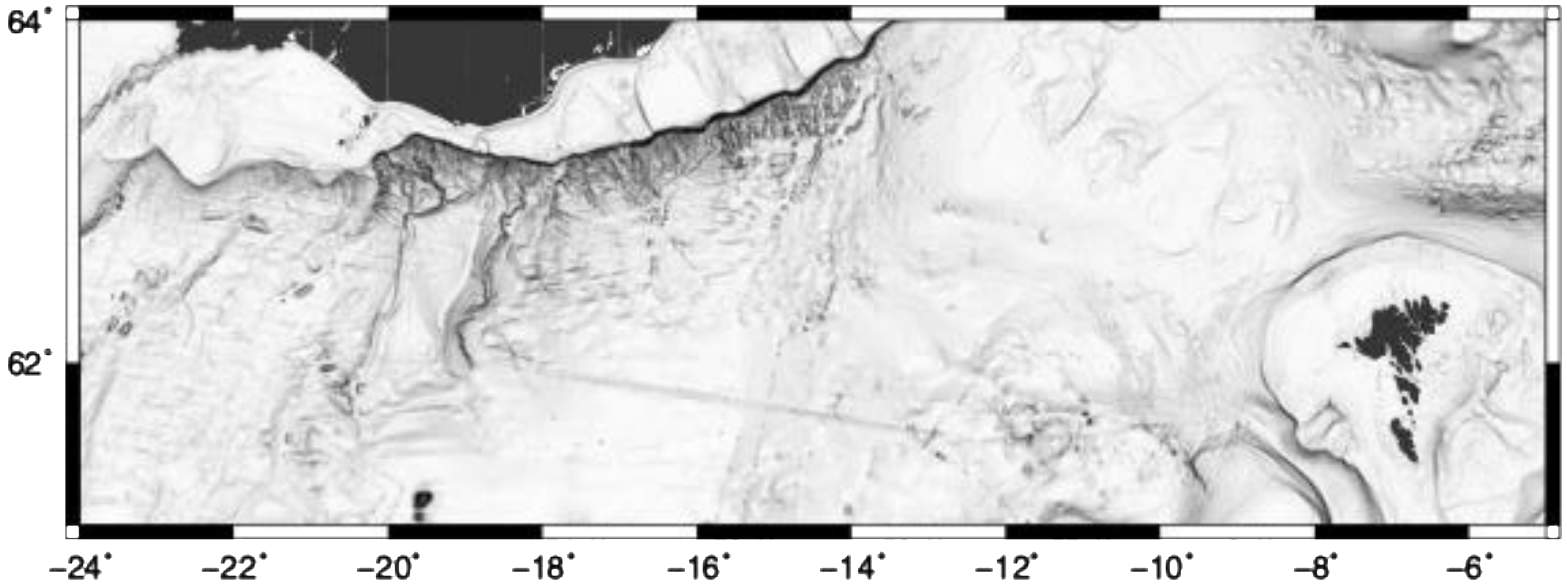
→ ***Origin:*** *Faroe Bank Channel and North of the Iceland Faroe Ridge.*
→ *Spreading of the water masses in the* ***Iceland basin***
→ *Particles have high values of vorticity suggesting a spreading by highly turbulent motions*

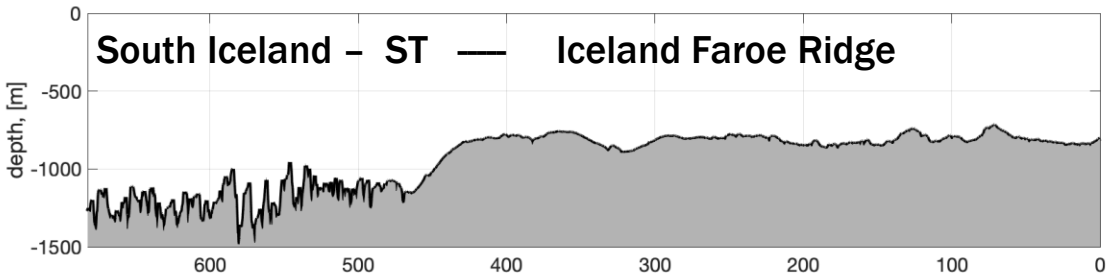
de Marez et al., 2024

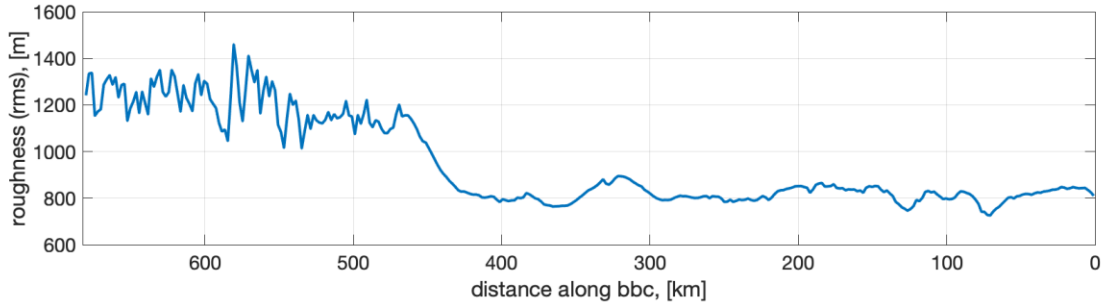
The bottom current south of Iceland (bathymetry controlled)



de Marez et al., 2024







$$h_{smooth} \sim 70[m]$$

$$h_{rough} \sim 300[m]$$

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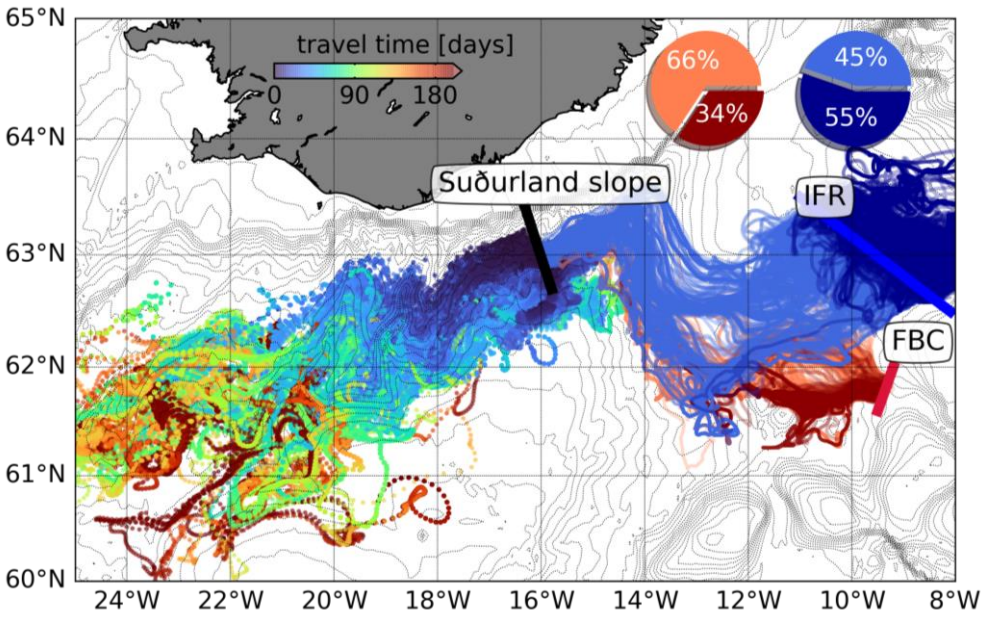
Is this current important for our fishing industry?

Langoustine fishing grounds

https://www.vsv.is/our-products/groundfish/cod/



SJÁVARÚTVEGS RÁÐSTEFNAN 2024

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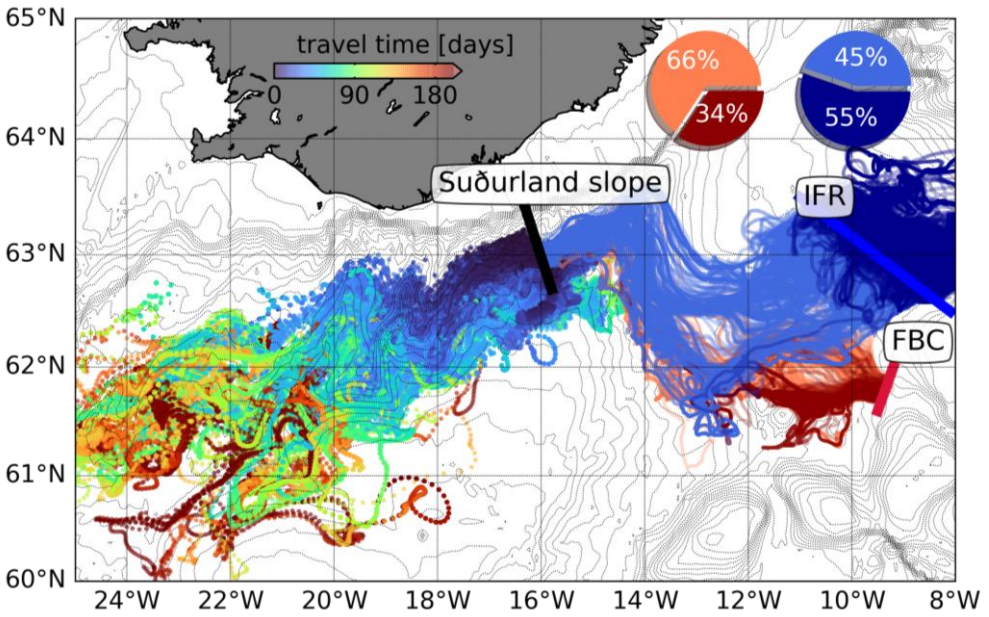

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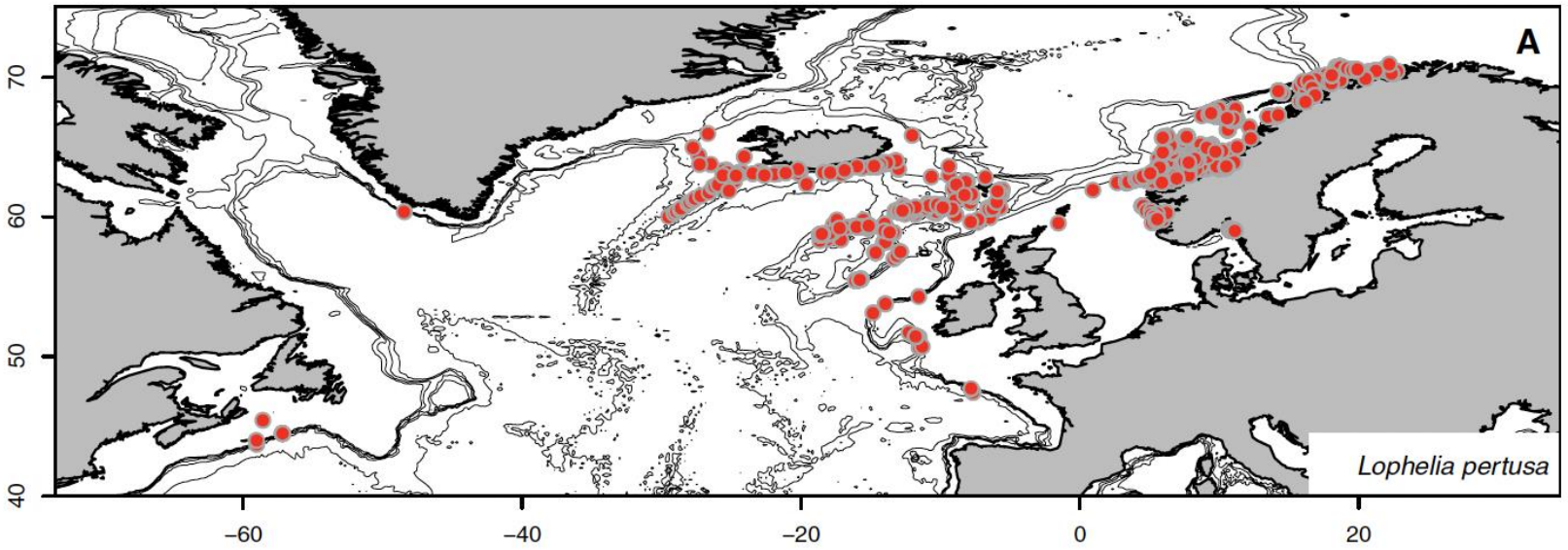
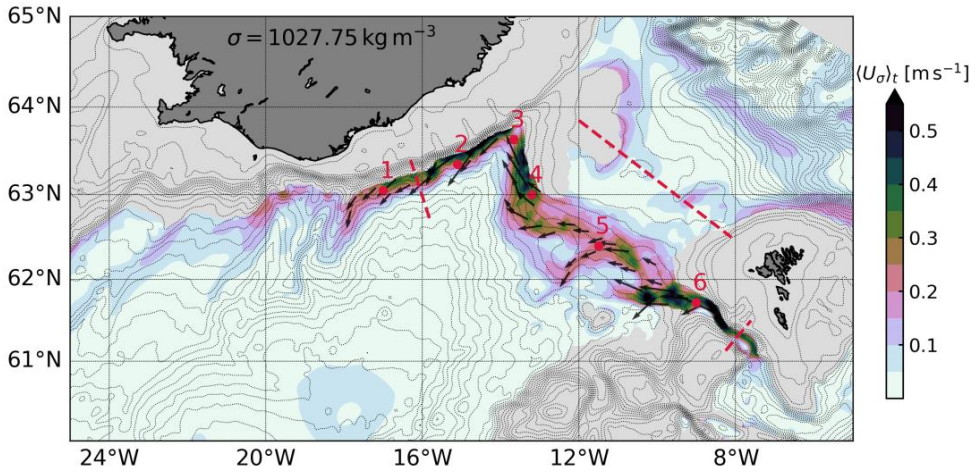
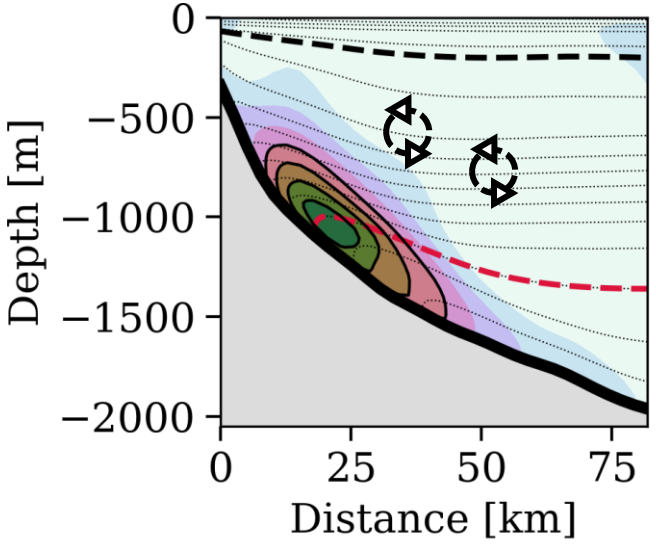
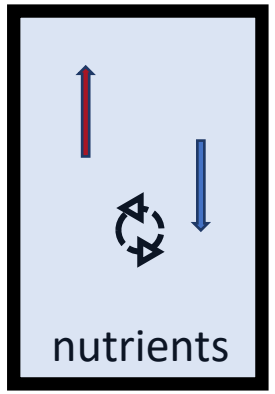
Is this current important for deep sea corals?



Hypothesis: This BBC has the capacity to bring deep rich in nutrients waters to the surface enhancing primary production!







[1]Buhl-Mortensen et al. 2015

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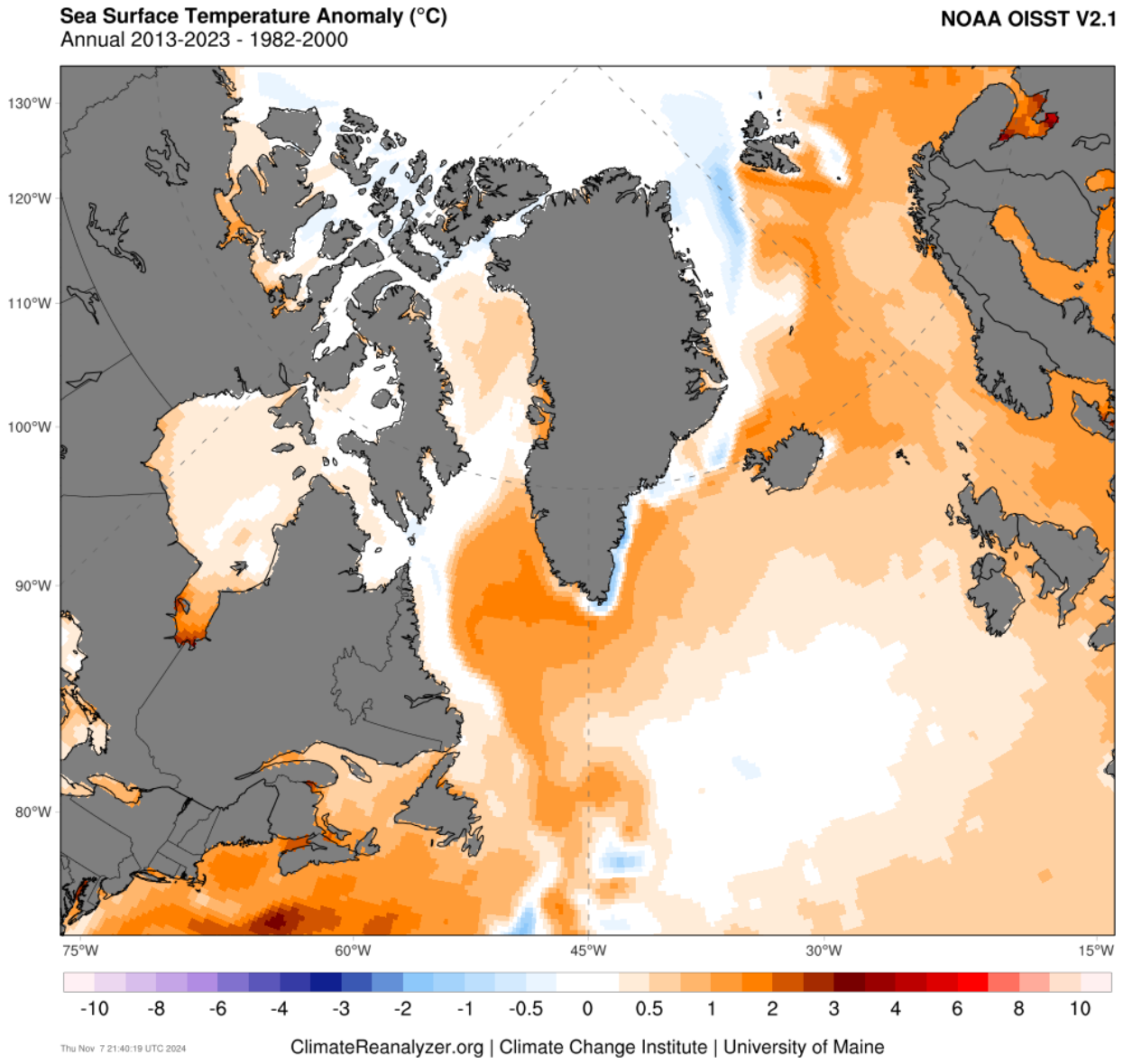
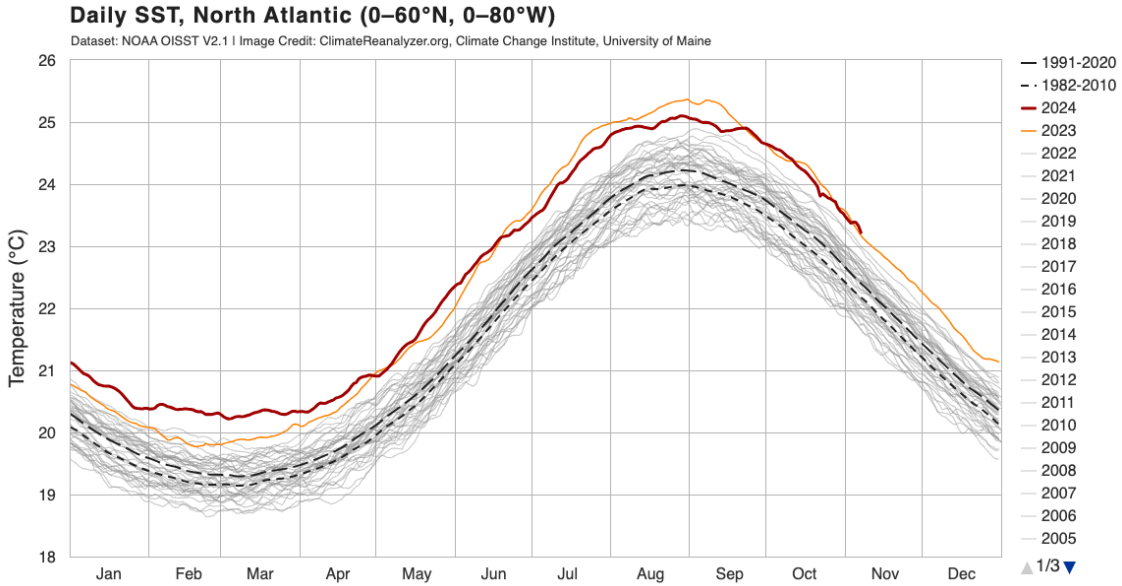
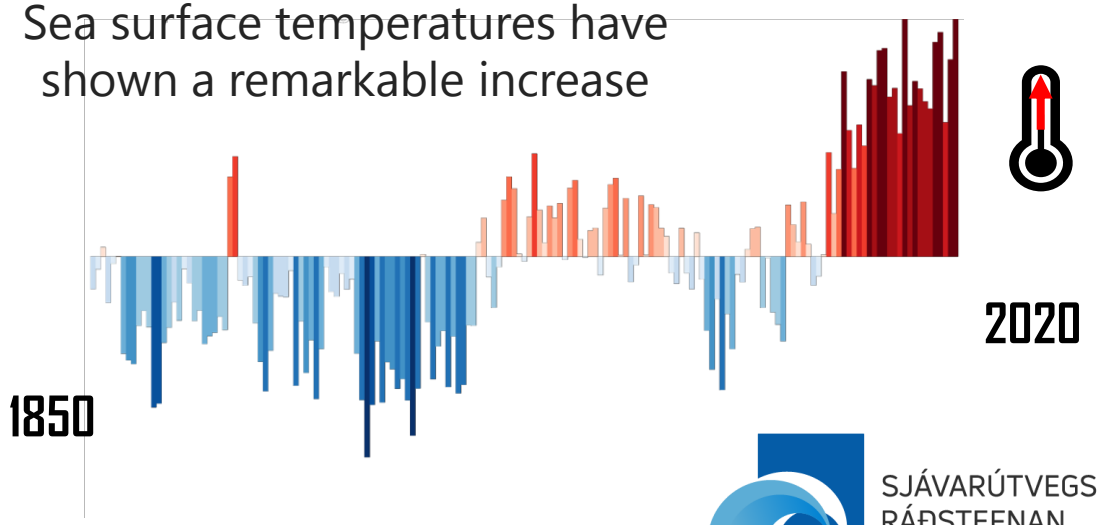
Changing climate in the Arctic and North Atlantic



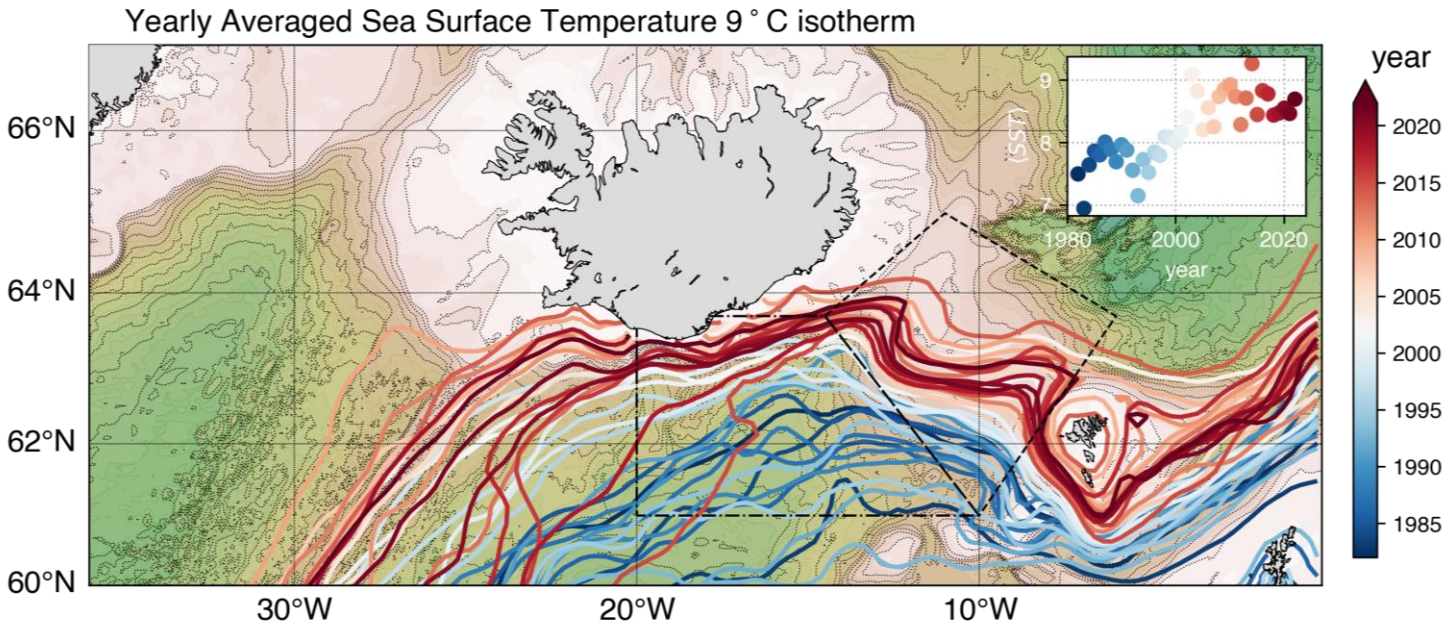


Sea surface temperatures have shown a remarkable increase



SJÁVARÚTVEGS RÁÐSTEFNAN 2024

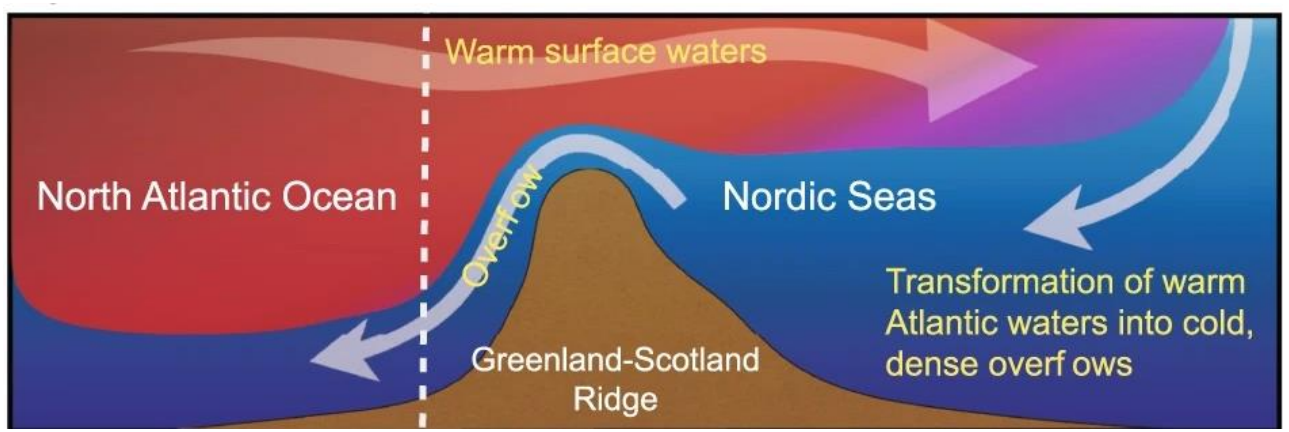
Changing climate and the BBC (scary movie)



*Evolution of the 9℃ isotherm in the past 40 years and increase of the average SST over the IFR. All quantities are year averages. (**de Marez et al., under-review**)*

Surface water warming

?

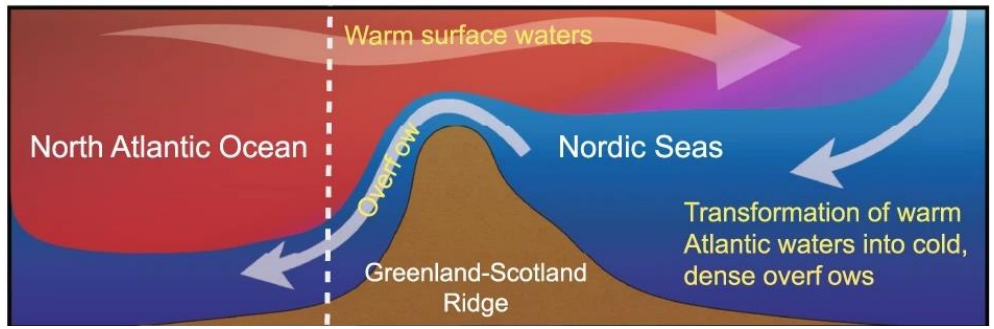


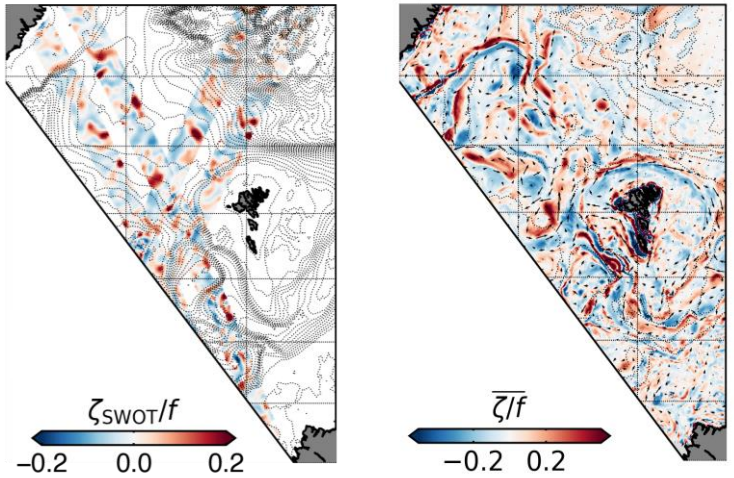
Årthun et al., 2023

Bottom water warming

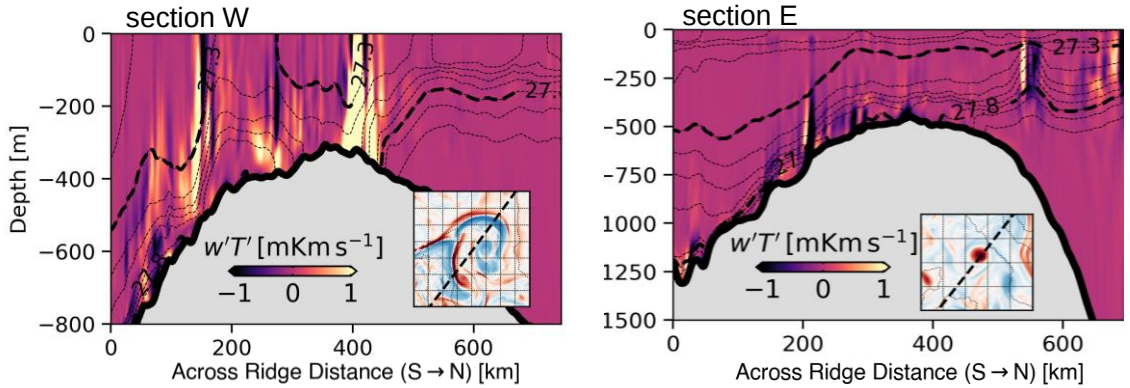
Changing climate and the BBC (scary movie)

Unfortunatelly ***YES****. we observe that the ongoing warming at the surface can reach the bottom.*
The hyperactive eddies over the IFR act as a pathway between the surface and the interior/bottom!

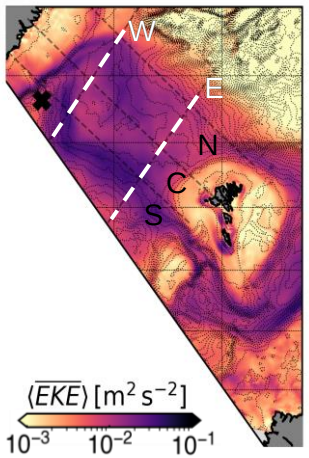




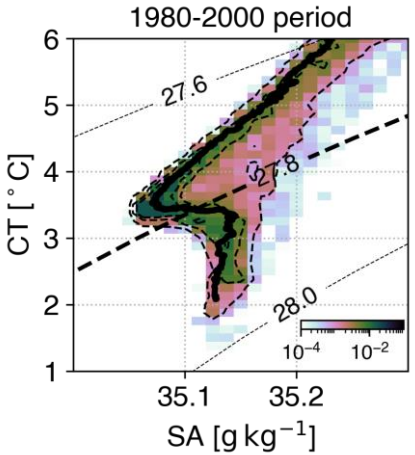
Mesoscale turbulence on top the IFR from SWOT data and GIGATL1



Sections of w'T' at two locations of the IFR, crossing mesoscale structures (inserts show relative vorticity at the surface)



The VHF reaches the the ISOW and those are bad news in the current changing climate…



de Marez et al., under-review

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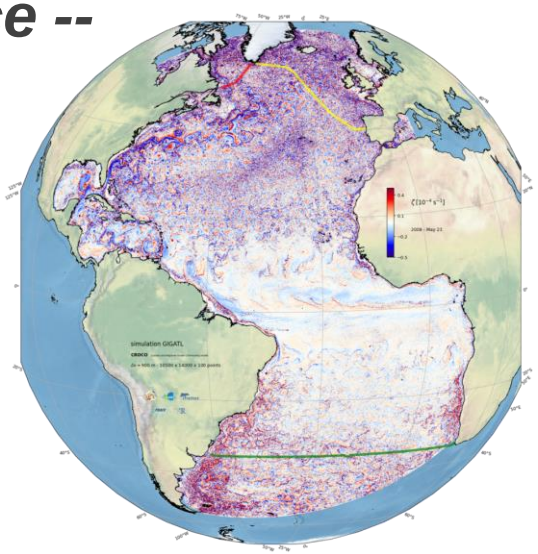
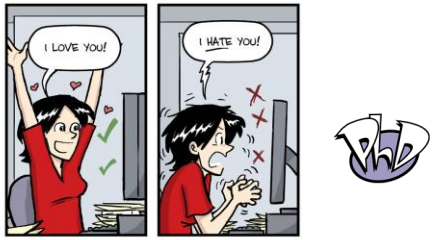
What was needed for this study?

Hafró *in-situ* data ($$$)

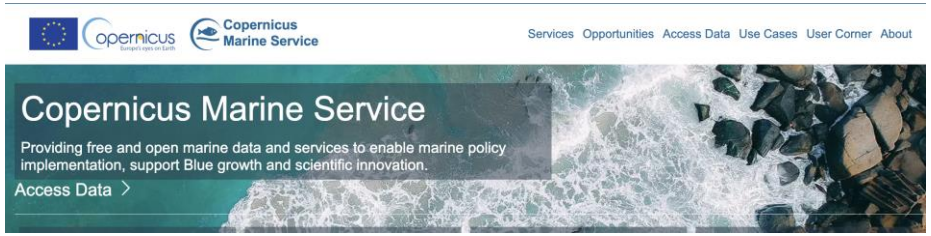
French super-high resolution numerical simulation *GIGATL1: 1km!!!* *-- open-source --*



Many hours of #NerdSpace



Copernicus data (open source) Low-resolution models and data



State of the art satellite data SWOT (2km)

University of Iceland HPC computer.

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What are the implications of our findings?

- **The Iceland-Faroe Ridge** is a **hotspot** and the primary region where surface warming can be effectively transported to bottom waters.
- It is very likely that this bottom warming have implications to the benthic ecosystems.
- **We need more data** and must continue monitoring the changes in temperature and salinity south of Iceland.
- To corroborate our proposed processes, ongoing monitoring is essential, and the current monitoring sections should be extended.
- While numerical Models valuable for explaining processes and identifying data gaps, whithout data for validation they are ineffective.
- We need to develop methods for explaining observed processes and effectively communicate our knowledge to stakeholders.