

Blue Action: Quantify the role of a changing Arctic in predictive capability of weather and climate of the Northern Hemisphere

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Photo credit: Kathryn Hansen /NASA



WHY BLUE-ACTION?

Faced with a changing climate, businesses, policymakers, and local communities need to access reliable weather and climate information to safeguard human health, wellbeing, economic growth, and environmental sustainability.



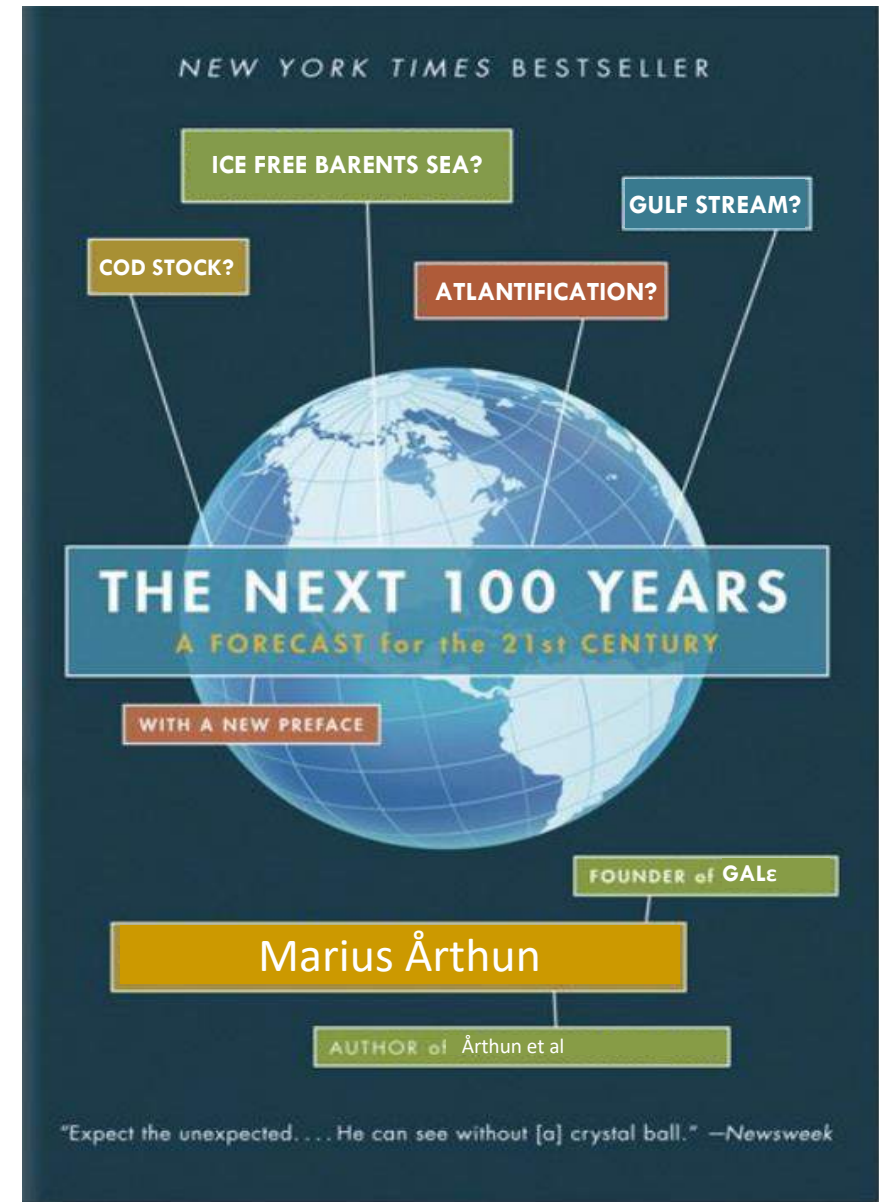
NASA/Kathryn Hansen

Blue-Action brings together experts from over 40 organisations in 17 countries across 3 continents to:

- Develop new methods to characterise climate conditions where hazardous weather system forms across the Northern Hemisphere and establish their link to Arctic climate change.
- Deliver an improved representation of Arctic warming and its impact on atmosphere and ocean circulation.
- Enable robust and reliable forecasting to deliver better predictions at sub-seasonal to decadal scales.

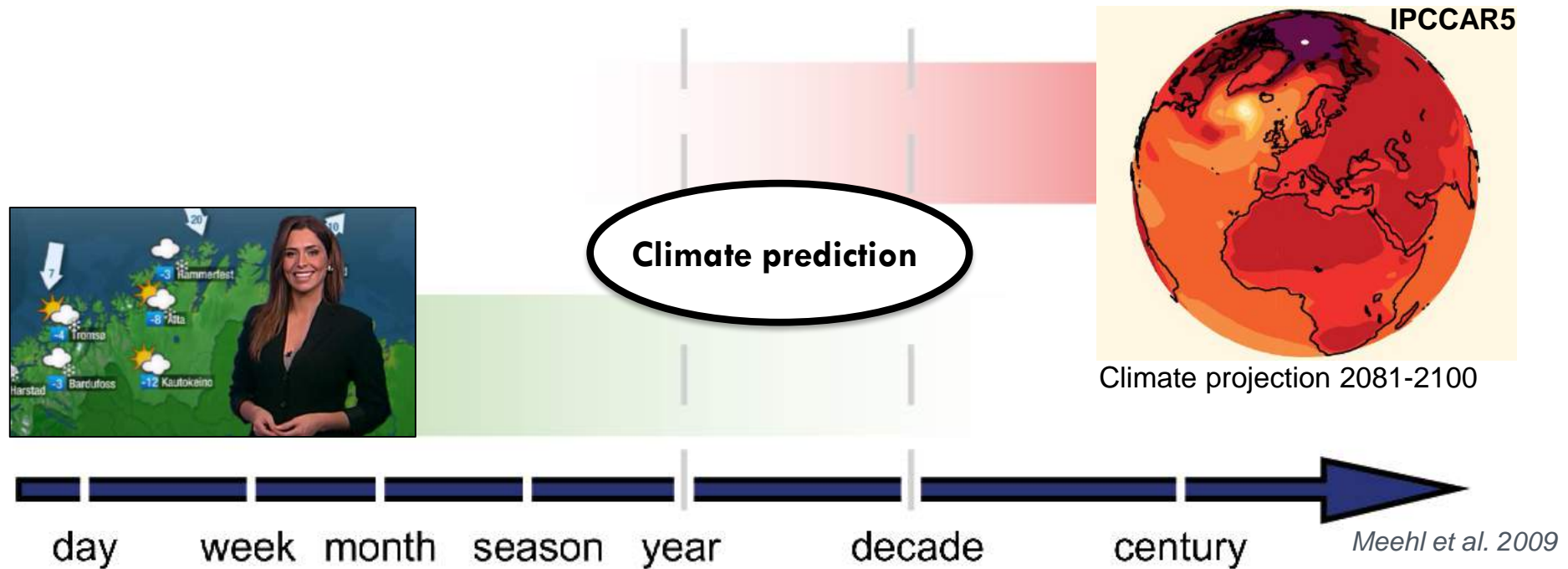
WP2: Lower latitude drivers of Arctic changes

- How can we predict Arctic-Atlantic climate?
- Can we predict Arctic fish stock changes?



*adapted from George Friedman (2009)

What is climate prediction?



Multi-year predictions fill the gap between short-term predictions and century-scale climate change projections → could enable strategic planning on longer time scales than today.

What is climate prediction?



Will there be more cod in the Barents Sea in 2025?

Climate prediction

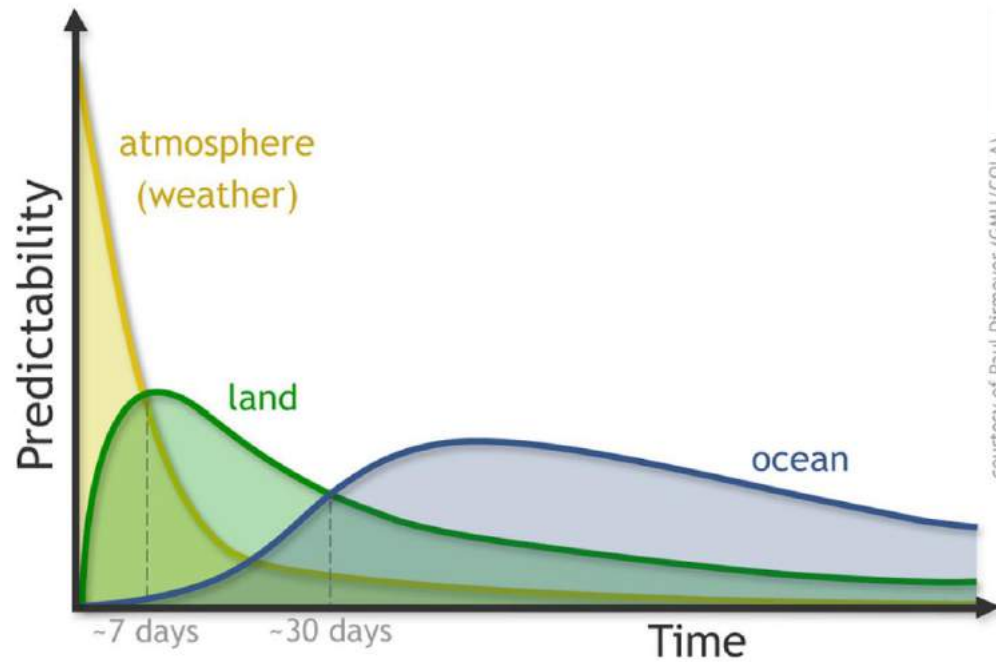


How will the snow conditions be next year?



Will summers in Norway become wetter the next few years?

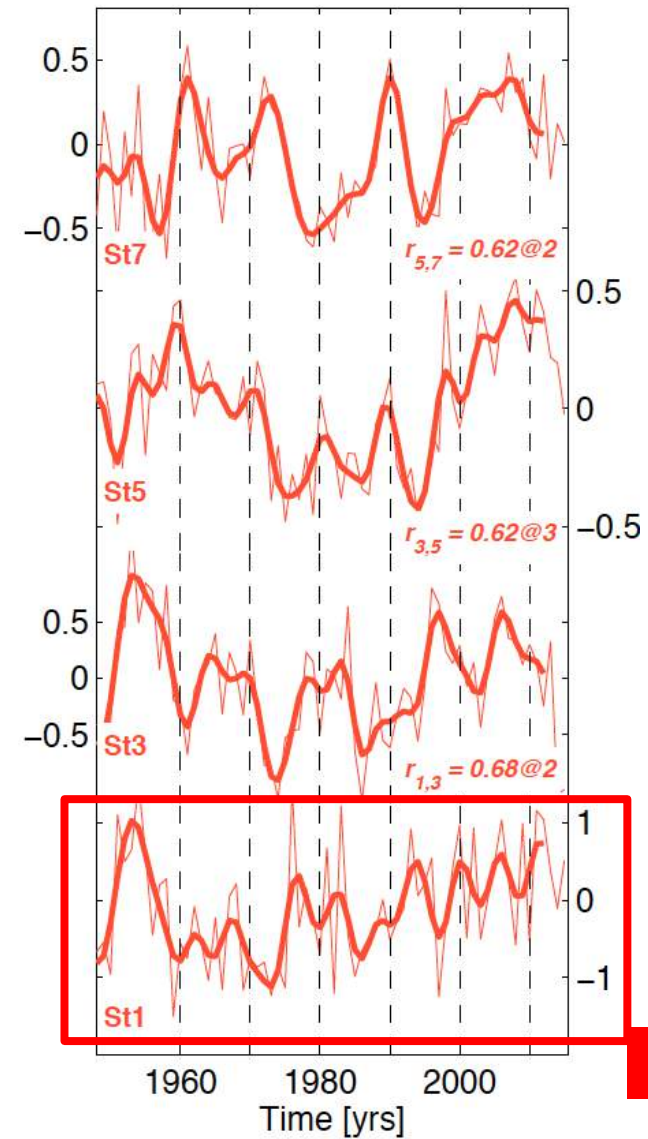
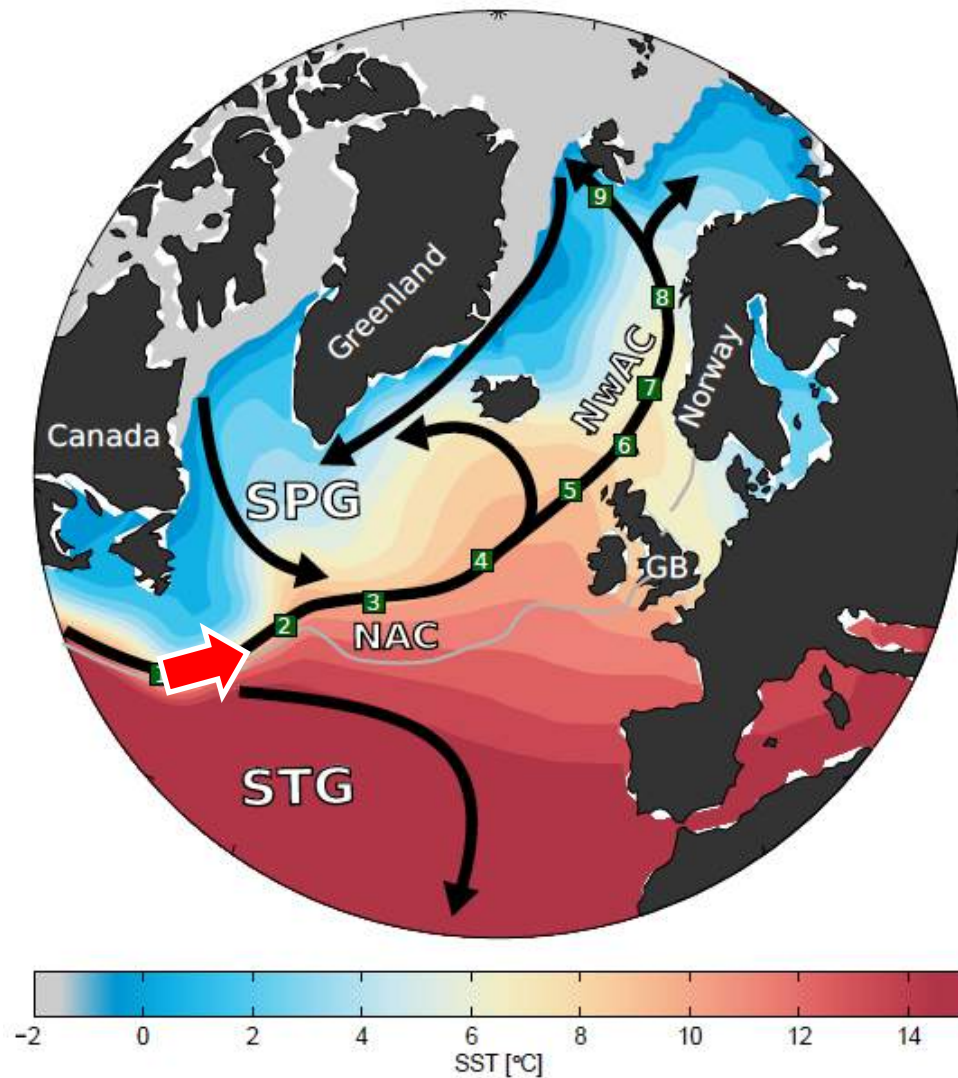
Climate predictability provided by the ocean



Mariotti et al. 2018



Circulation of ocean temperature anomalies

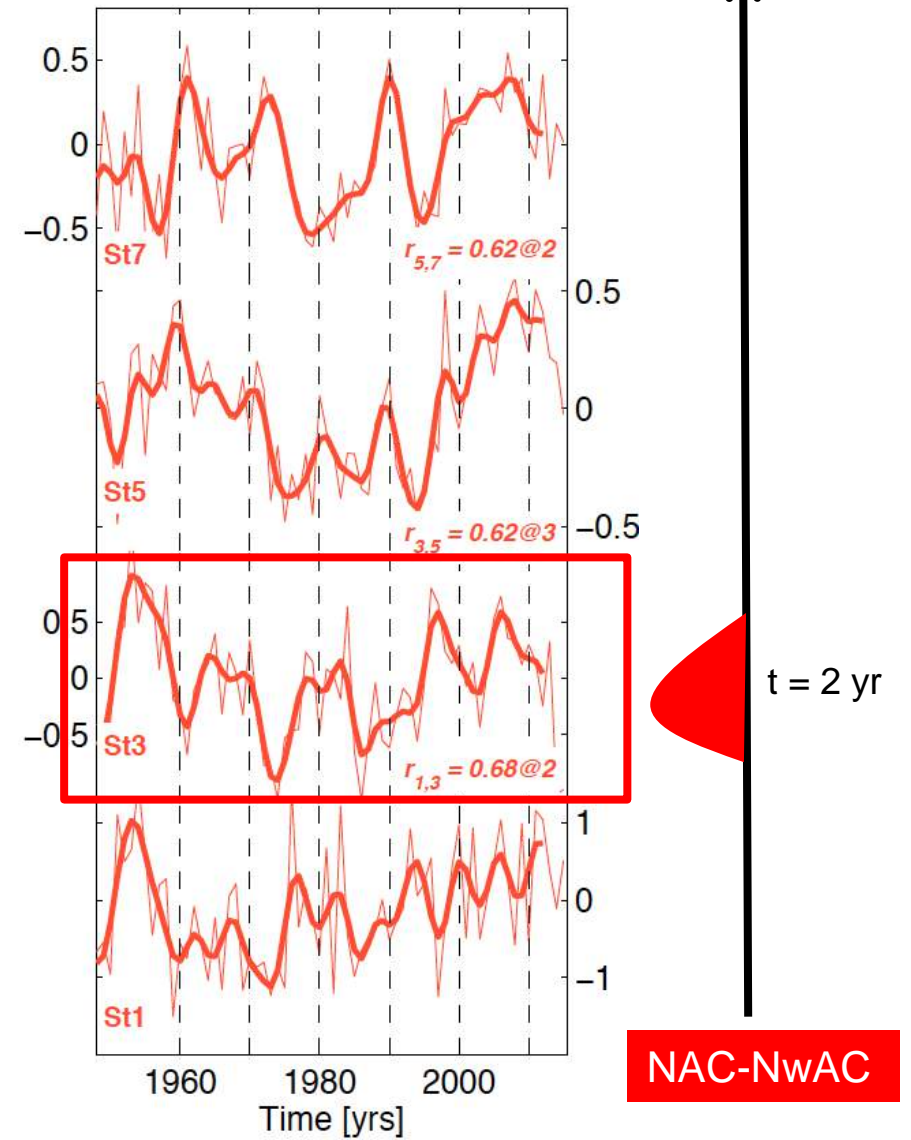
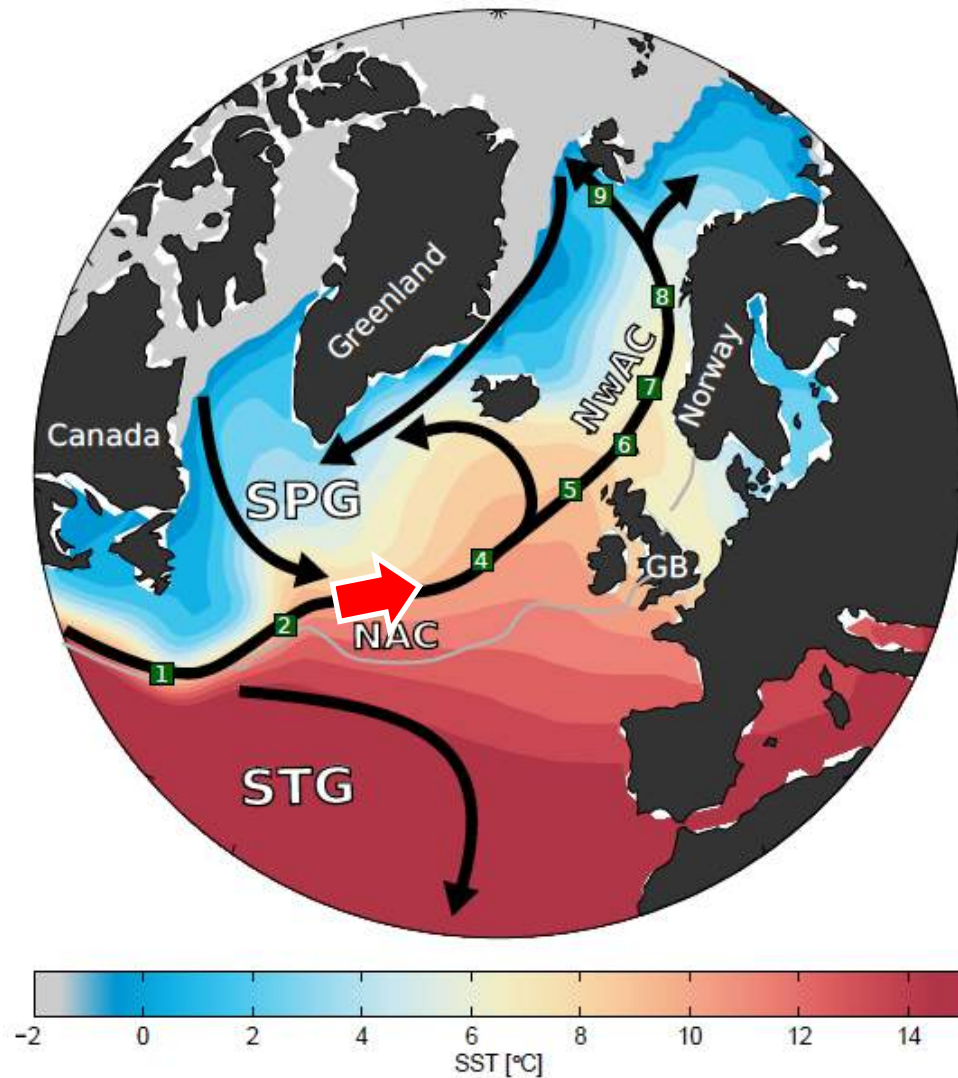


ARCTIC

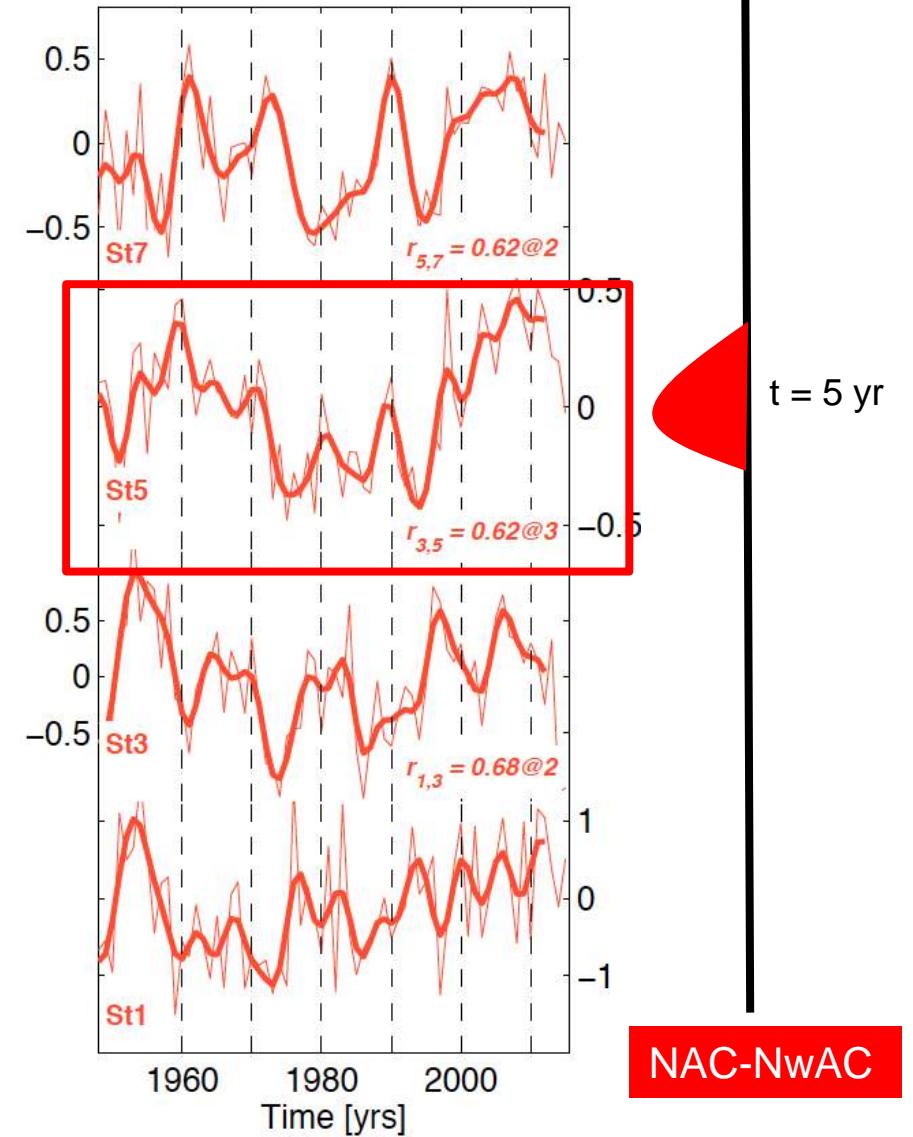
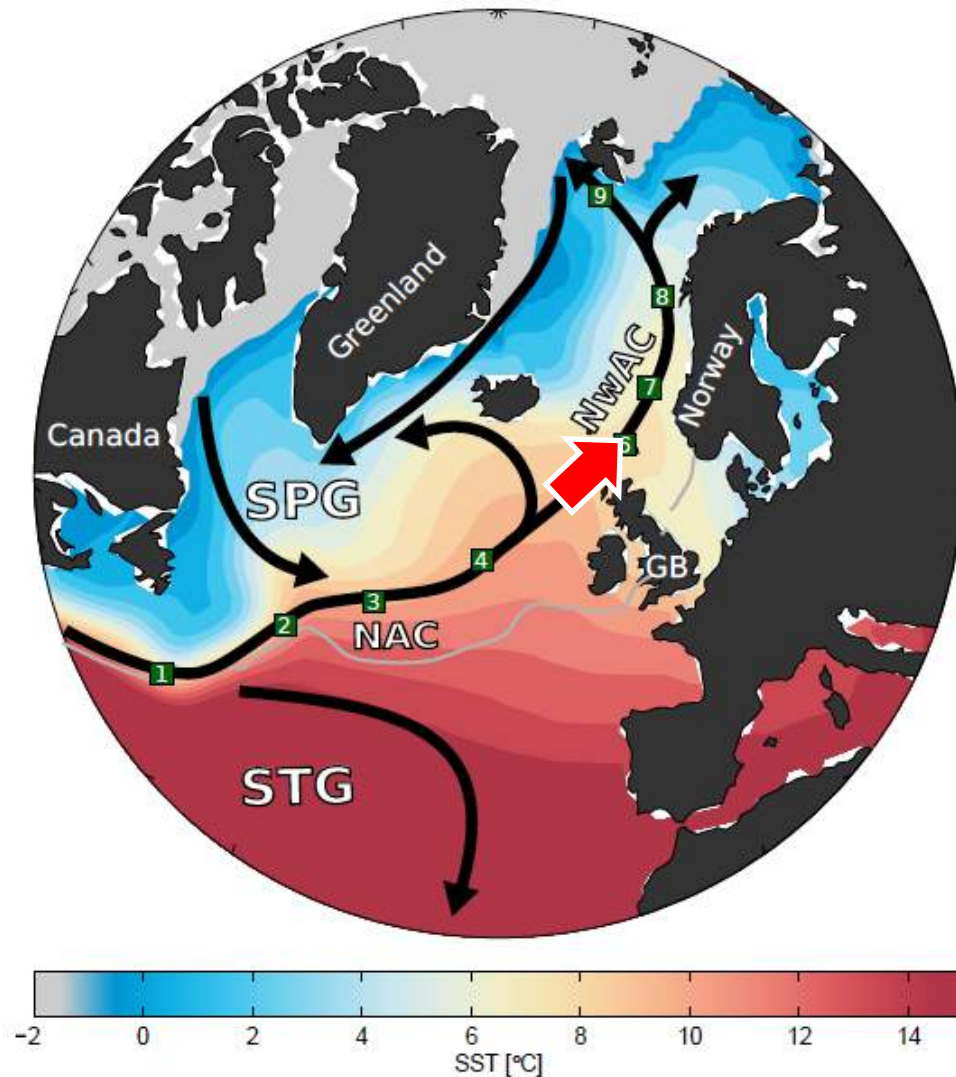
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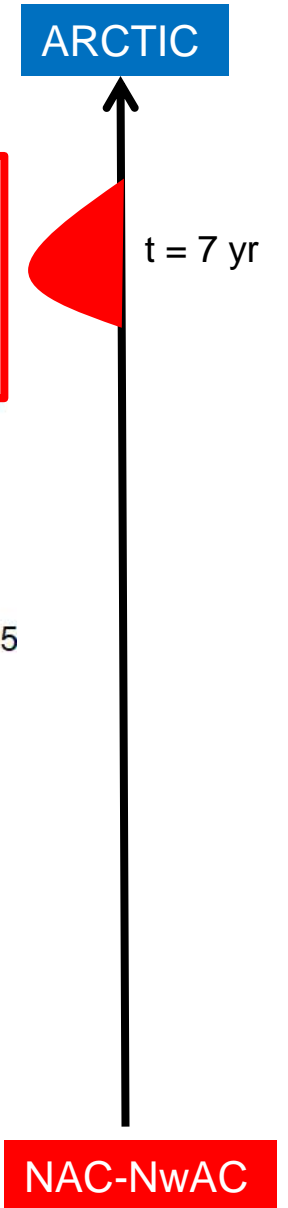
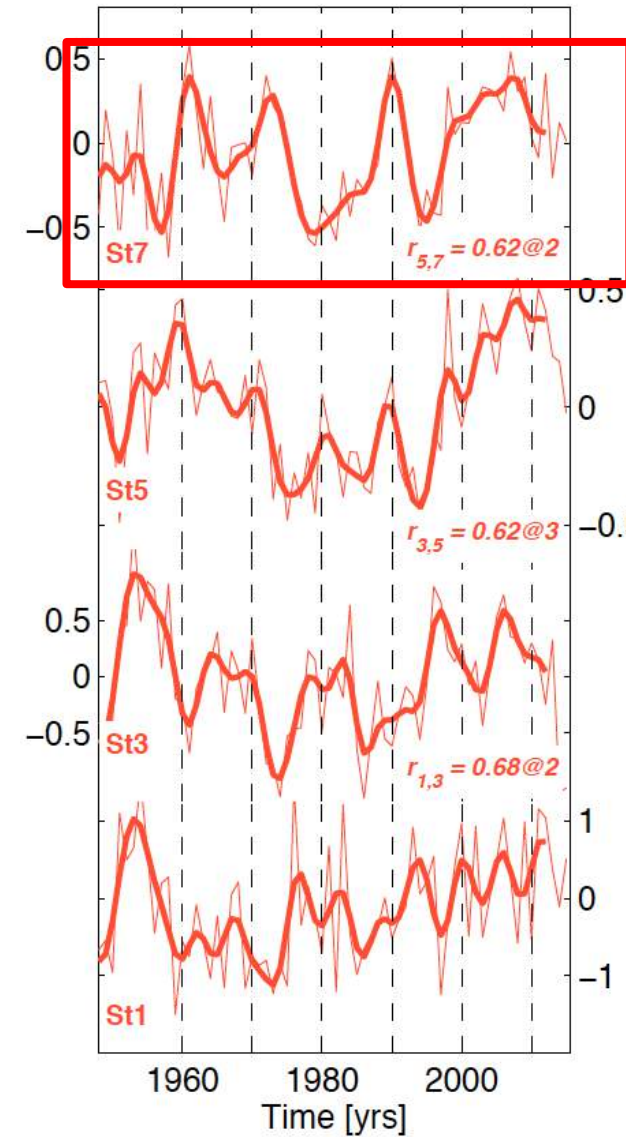
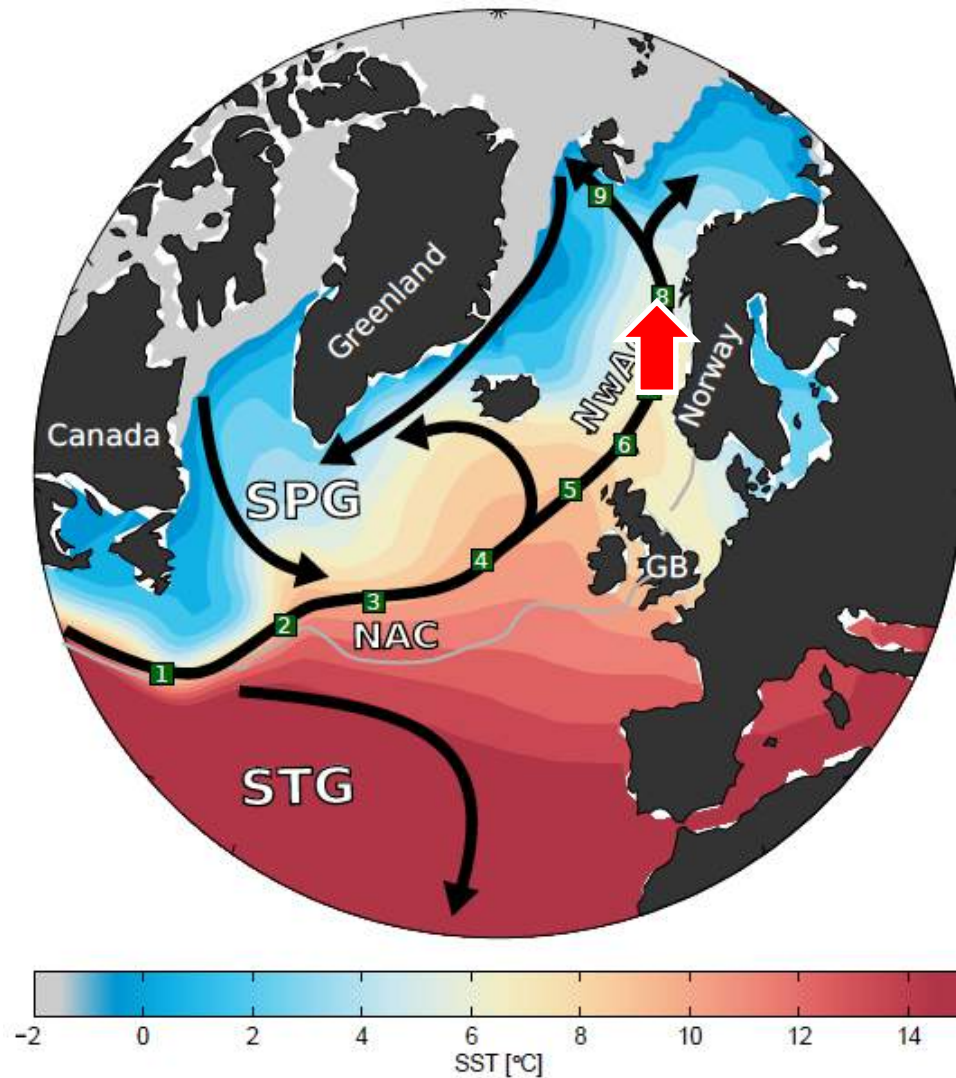
Circulation of ocean temperature anomalies



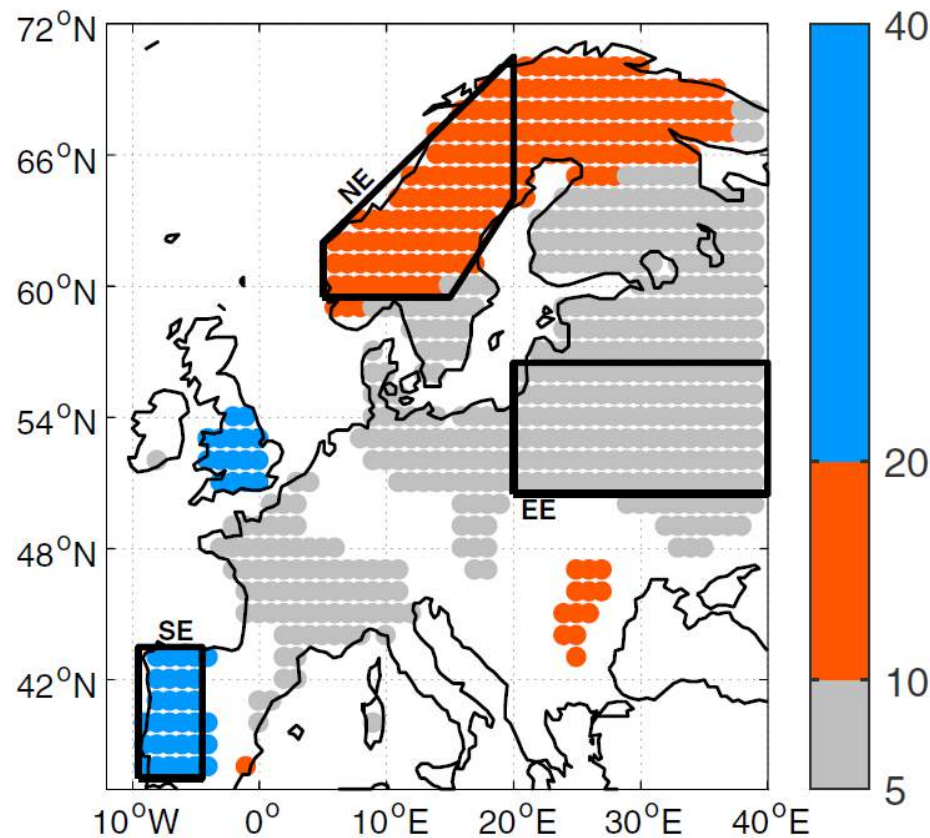
Circulation of ocean temperature anomalies



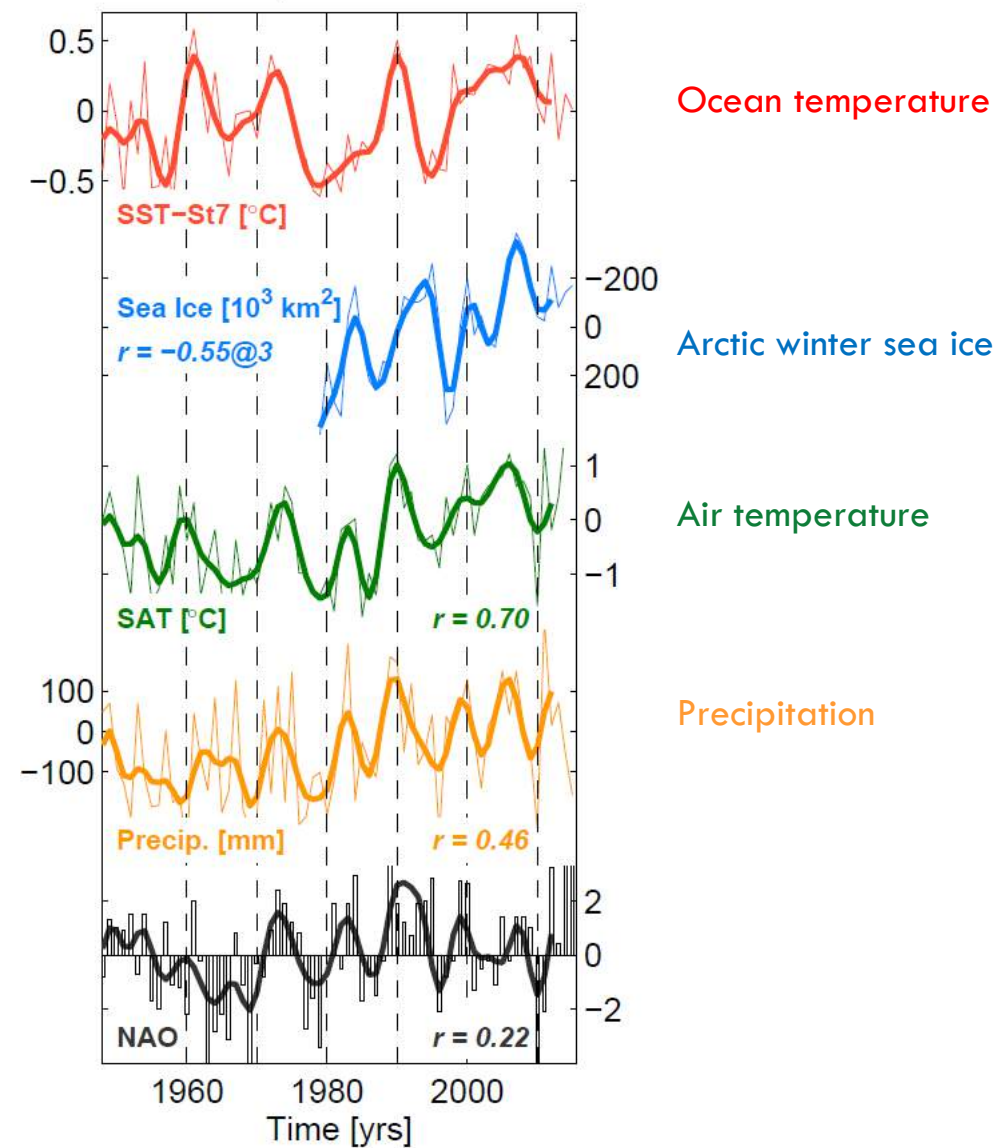
Circulation of ocean temperature anomalies



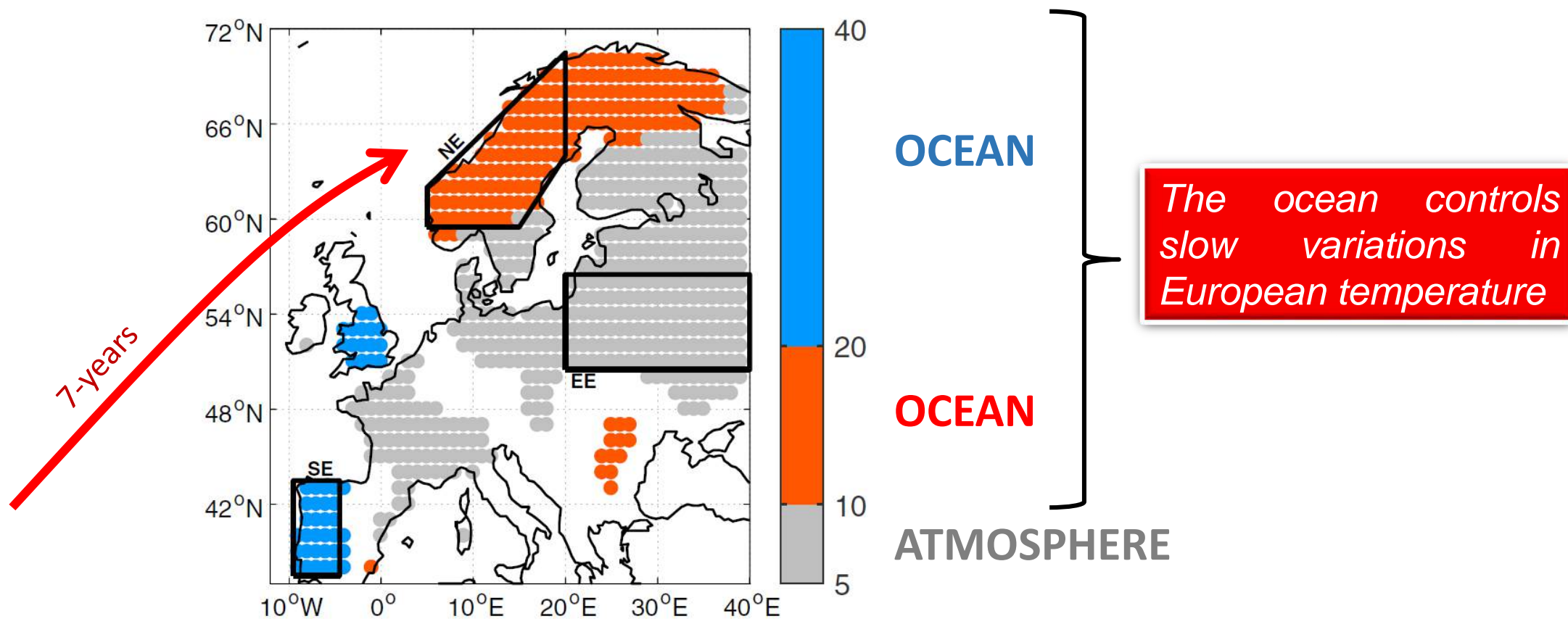
Oceanic influence on Arctic-Atlantic climate



Colours: The leading time scale (in years) of air temperature variability in winter



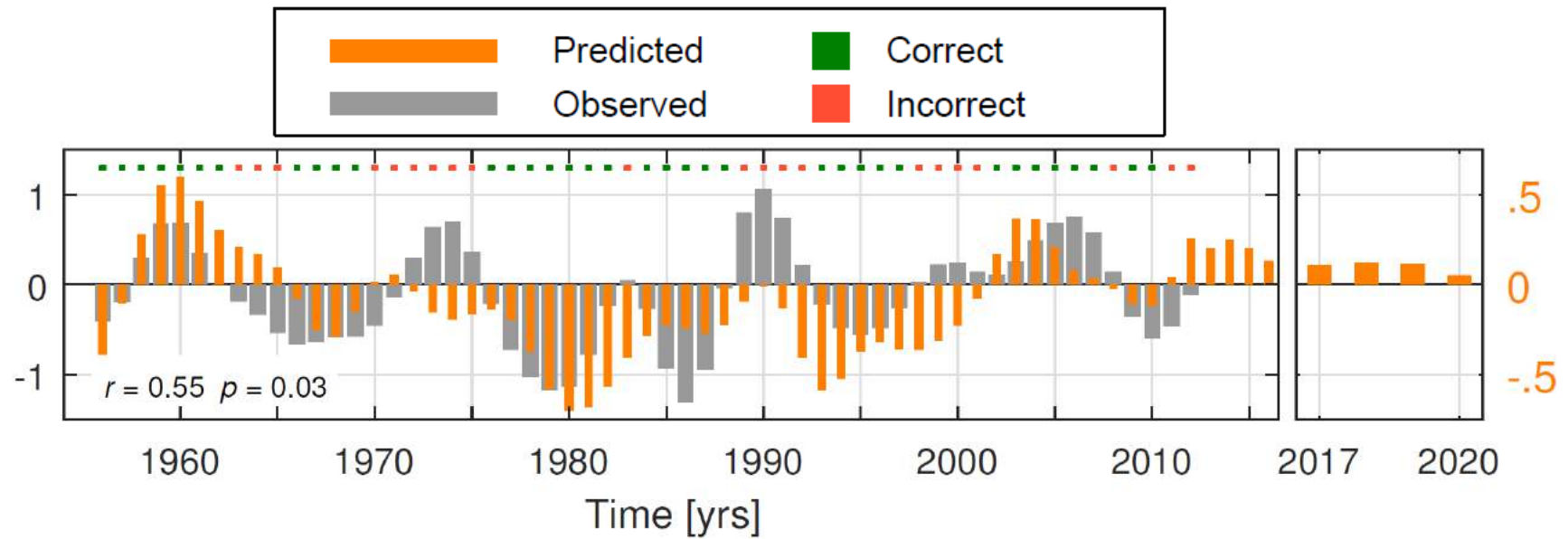
Oceanic influence on Arctic-Atlantic climate



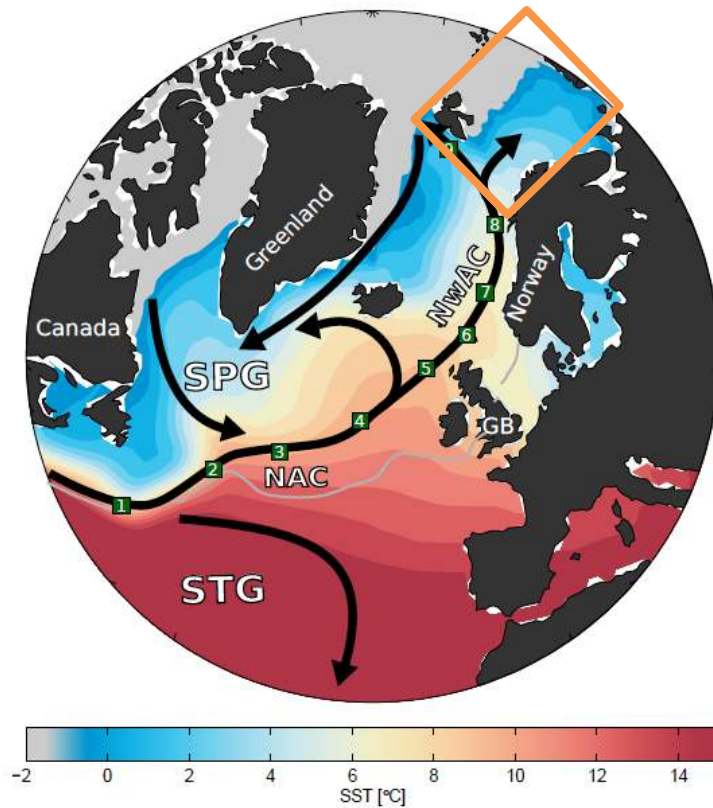
Colours: The leading time scale (in years) of air temperature variability in winter

Oceanic influence on Arctic-Atlantic climate

7-year prediction of air temperature in Norway



Can Barents Sea cod stock changes be predicted?



The Barents Sea is an economically important fisheries area

Major commercial species: Barents Sea cod (*Gadus morhua*)



“..exploiting this predictive skill [of the ocean] to aid in resource management is emerging as one of the new challenges in marine science..”

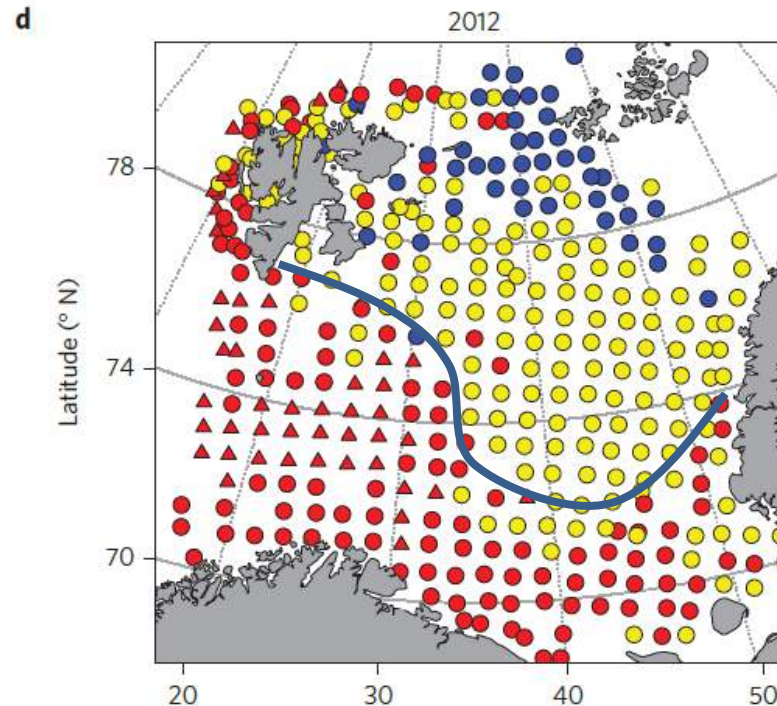
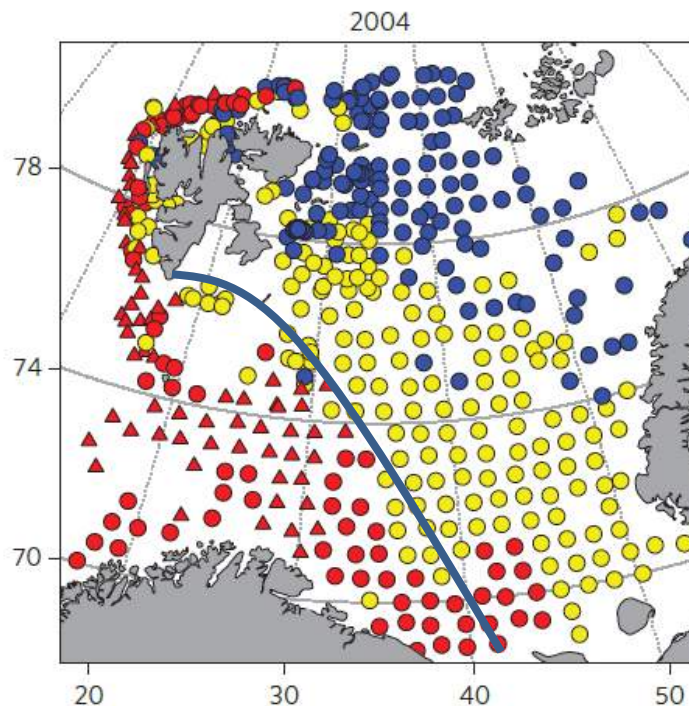
ICES

Can Barents Sea cod stock changes be predicted?

Cold ocean
More sea ice
Less cod

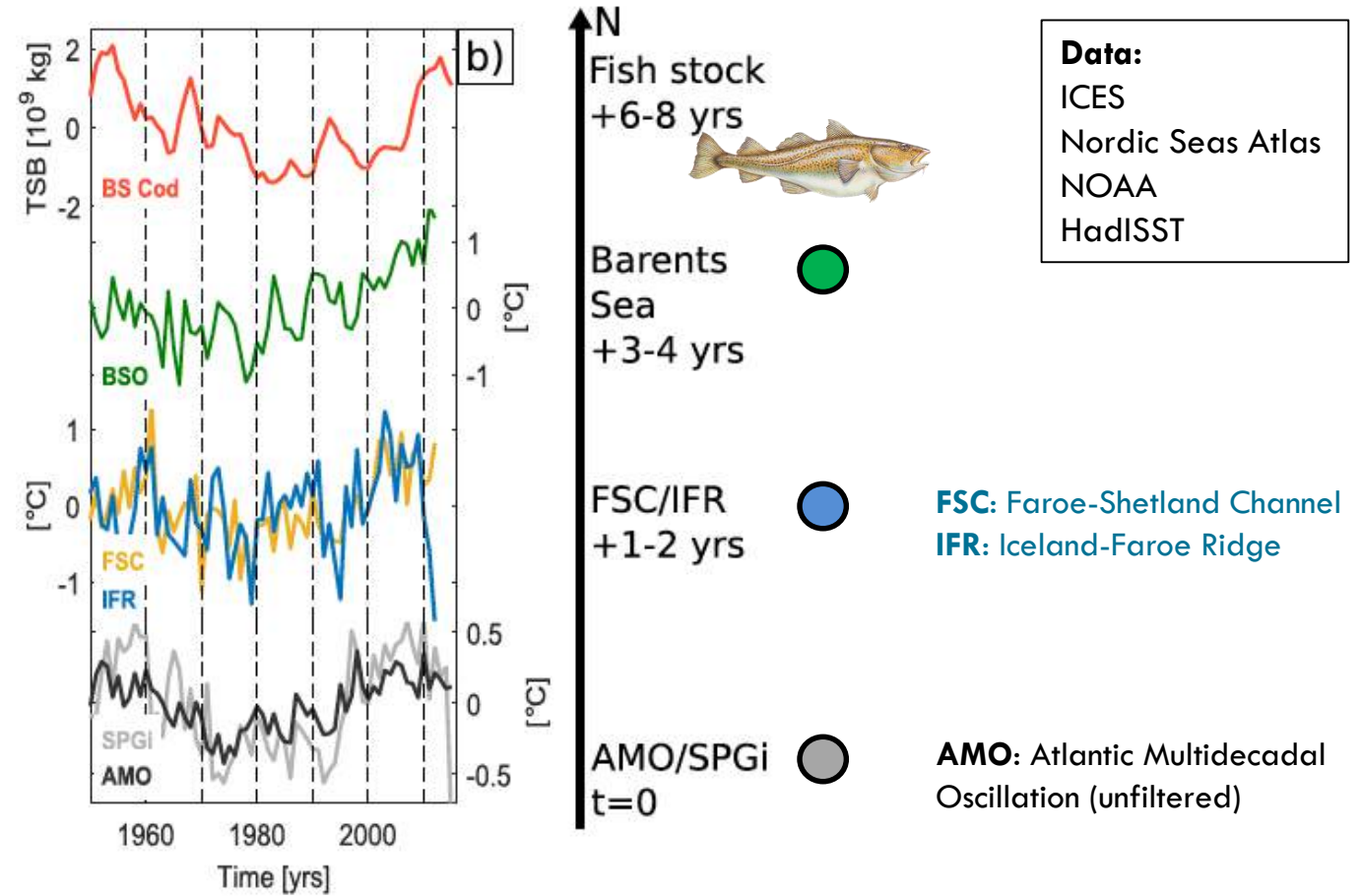
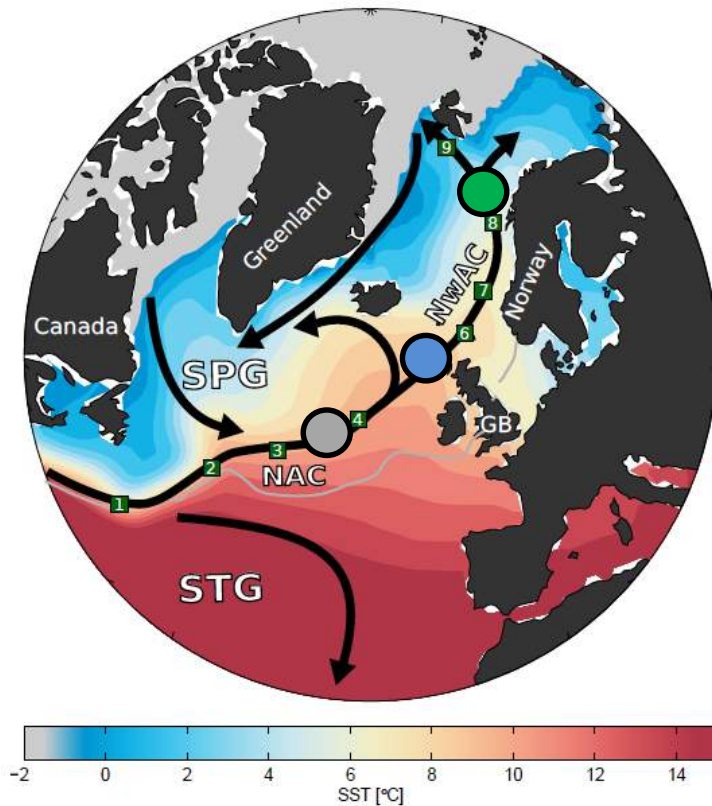
Warm ocean
Less sea ice
More cod

- Atlantic (cod)
- Central
- Arctic

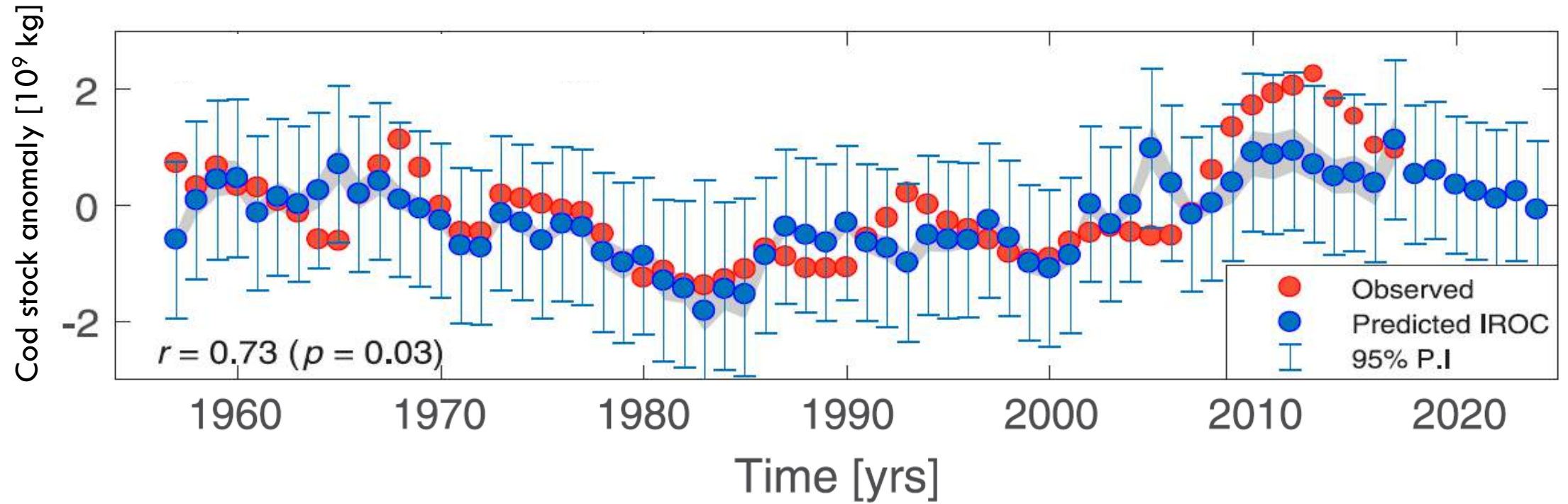


**Fish stocks respond to variations in ocean temperature.
Ocean temperature in the Barents Sea is predictable from upstream conditions.**

Can Barents Sea cod stock changes be predicted?



Climate based multi-year predictions of the Barents Sea cod stock



CONCLUSIONS

- Ocean temperature in the North Atlantic provides predictability of northern European SAT and commercially valuable fish stocks.
- Multi-year predictions fill the gap between short-term predictions and century-scale climate change projections → could enable strategic planning on longer time scales than today.
- Major challenges remain: The mechanisms underlying prediction are incompletely understood and poorly represented in models.



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