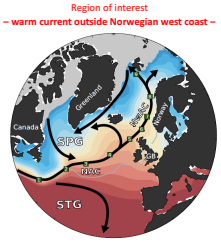
Predictive skill along the extension of the North Atlantic Current in the Norwegian Climate Prediction Model

H. R. Langehaug*, *F. Counillon, N. Keenlyside*

*helene.langehaug@nersc.no

Motivation

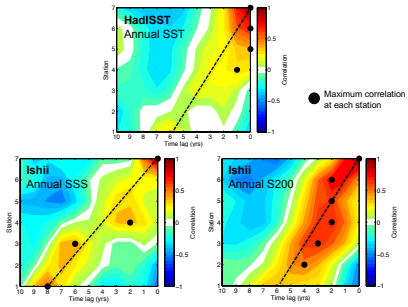
- ❑ Observational data show northward propagation of thermohaline anomalies in the ocean – a mechanism is identified
- ❑ Climate models have predictive skill in the Subpolar North Atlantic up to a decade ahead, but less skill in the Nordic Seas
- ❑ Why poor skill in the Nordic Seas for forecast times above 1-2 years?
- ❑ We hypothesize that the poor skill in the Nordic Seas is related to a misrepresentation of the propagation mechanism



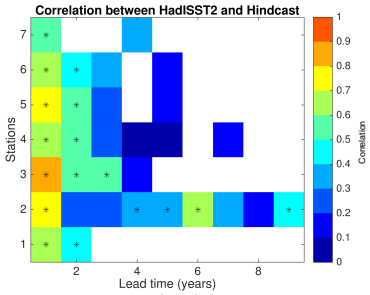
Århun et al. 2017

The mechanism

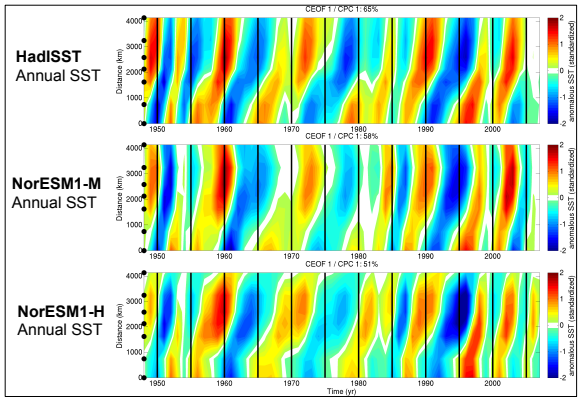
- The propagation of thermohaline anomalies takes about 10 years (St1 to St9) and repeats every 10-15 years
- There is a positive correlation between the thermohaline variability at the station in the Fram Strait and all other stations, but with a time lag.



Norwegian Climate Prediction Model (NorCPM)



Predictive skill for SST at stations



Langehaug et al., in review, Climate Dynamics

Forced NorESM

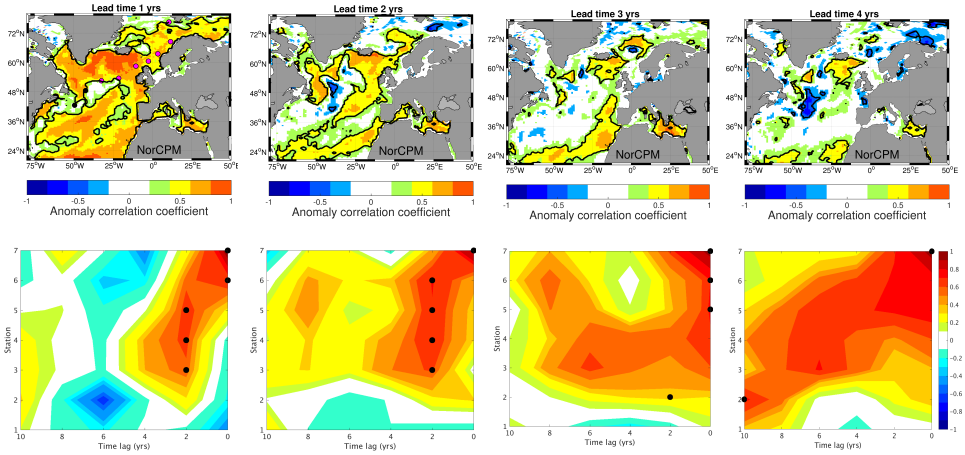
- A climate model forced with realistic atmospheric forcing manages to reproduce the propagation and timing of the **SST anomalies**
- But not the timing of the sub-surface salinity anomalies is reproduced

Norwegian Earth System Model (NorESM)

Prediction system (NorCPM)

- Assess hindcasts/retrospective predictions for years 1960-2011
- Only initialized by SST
- Hindcasts starts every second year and run for 10 yrs
- Each hindcasts consist of 20 members
- Here we use the ensemble mean and compare with HadISST2 data

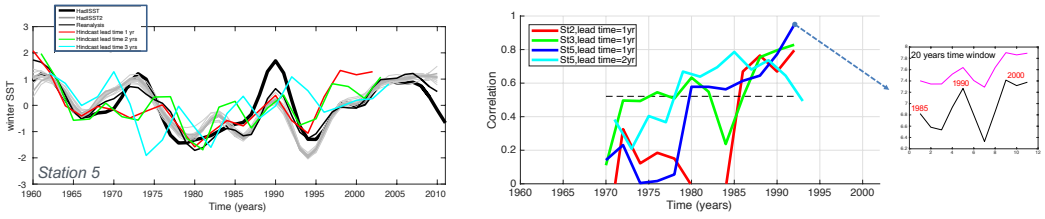
What is the relation between predictive skill and representation of mechanism?



Main conclusions

- We confront NorCPM with a mechanism identified from observations – an oceanic teleconnection from low to high latitudes.
- NorCPM represents this mechanism on short forecast times (up to 2 years ahead), but at longer forecast times it fails to reproduce the mechanism.
- This could be one reason for the poor skill in the Nordic Seas at longer forecast times than 2 years.
- NorCPM shows that predictive skill varies in time; low skill in ~1960-1980 and higher skill in ~1980-2000.

Predictive skill varies with time



About lead time: NorCPM hindcasts starting in 1960 is initialized in November 1959, and is run for 10 yrs from January 1960. In this work we use winter SST (Jan-Apr). Thus, the hindcasts at lead time 1 yr are an average of months 2-5 after initialization. Likewise, hindcasts at lead time 2 yrs are an average of months 14-17 after initialization.