Forecasting sea surface temperatures for the Norwegian Sea some years ahead

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25 NOVEMBER 2015  helene.langehaug@nersc.no
Fish stocks respond to variations in ocean temperature

Atlantic Water temperature

Cod

Helland-Hansen and Nansen 1909
Outline

Part 1: Background
Ocean circulation and temperature of Atlantic Water in the Norwegian Sea

Part 2: Forecasting
Forecasting sea surface temperature in the Norwegian Sea
The origin of warm Atlantic Water; carried by the main currents northward

In this talk we will focus on Atlantic Water
A vertical section cutting through the Norwegian Sea

A layer of warm Atlantic Water

Continental slope
How can the temperature of Atlantic Water change?

Atmosphere cools the ocean surface

Cold water from the Arctic

Warm water from the Atlantic

Ocean
How can the temperature of Atlantic Water change?

- Explain 50% of the changes from year to year.
- Can have strong influence in combination with wind changes.
- Dominate changes on longer time-scales (10 years periods).
Ocean circulation influences the inflow of warm water into the Norwegian Sea

Source: NOC from Met Office OSTIA data
Why is it sometimes colder or warmer than normal in the Norwegian Sea?

Takes about 3-4 years for the change to be seen outside Svalbard.

Warmer than normal in early 60’s, 70’s, 90’s, and before/after 2000.
Outline

Part 1: Background
Ocean circulation and temperature of Atlantic Water in the Norwegian Sea

Part 2: Forecasting
Forecasting sea surface temperature in the Norwegian Sea
How often do we see large temperature changes in the Norwegian Sea?

Changes in the sea surface temperature the last ~60 years

Warmer than normal in early 60’s, 70’s, 90’s, and before/after 2000
(a change is seen every 10 years or so)

Hadley Centre data
What is needed to forecast changes in sea surface temperature?
Predicting sea surface temperatures in the northern Norwegian Sea

Model is corrected with ocean observations; model must start from a realistic climate – a warm or cold ocean
Can climate models predict changes in sea surface temperature?

~7 years after starting the prediction

This climate model suggests promising results for the Norwegian Sea.
However, there a large differences in skill from one model to another…

~8 years after starting the prediction

This climate model do not show promising results for the Norwegian Sea
When will we reach the goal of useful predictions for the Norwegian Sea?

We see promising results for the Norwegian Sea 😊

However, researchers are today working with the following challenges to reach the goal:

1. Large errors in the climate models
2. Limited amount of observations
3. Poor techniques to correct models with observations
4. Lack of understanding of important processes in the ocean
“For 100 år siden visste vi ikke at vi ville bli så avhengige av værvarselet som vi er i dag. Kanske det samme gjelder for havvarelsing – om 100 år så vet vi gjerne ikke hva vi skulle gjort uten havvareleset?”

Thank you!
In case someone is interested in further reading 😊

References

3. Website of the Institute of Marine Research (‘Havforskningsinstituttet’) and the Research Council of Norway