



Improved Predictions for the Arctic and Connections to the Midlatitudes

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with contributions from Erik Kolstad, Johanna Baehr, Jens Hesselbjerg Christensen, Steffen Olsen

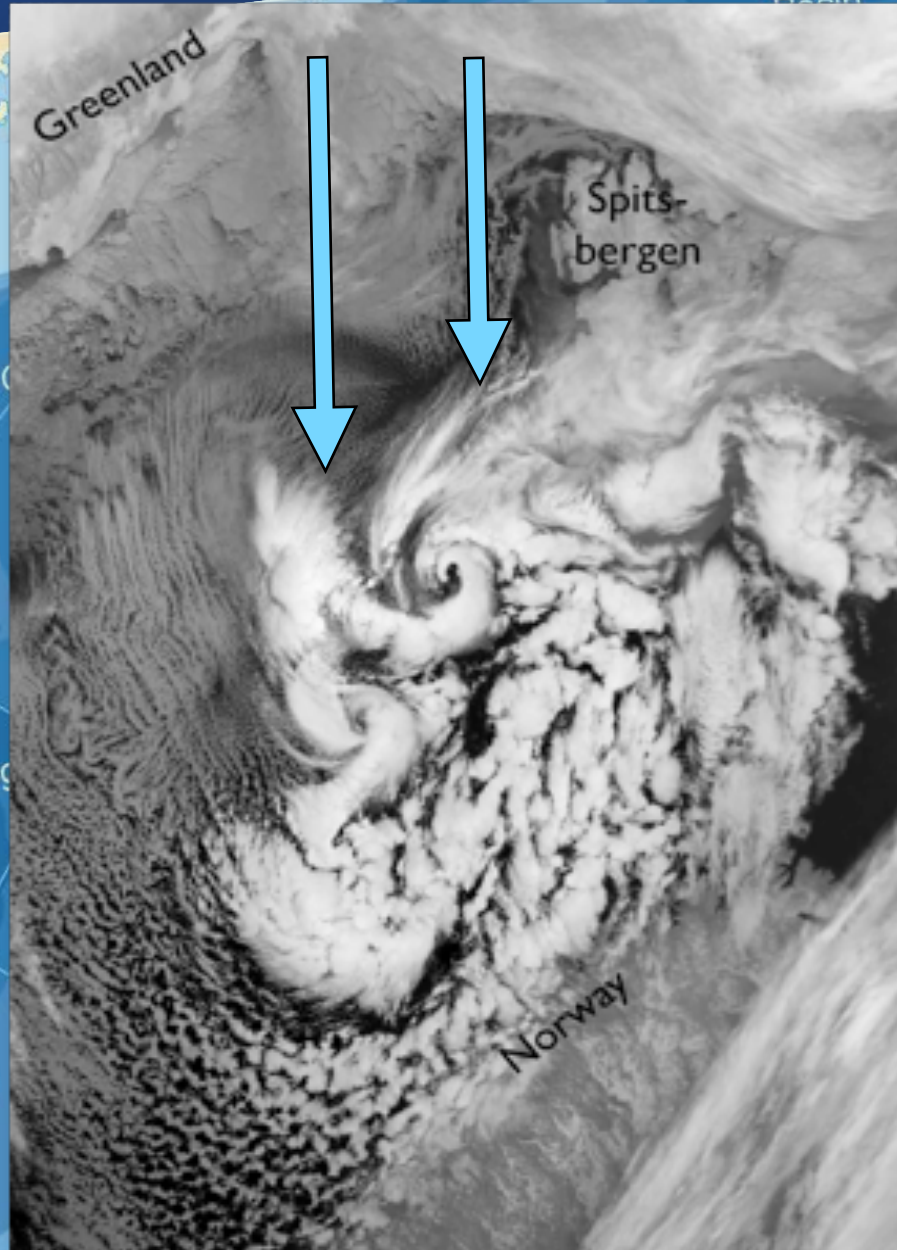


Many fishermen have set sail in clear weather after a storm has passed...

...only to be surprised by polar lows in the northerly flow.

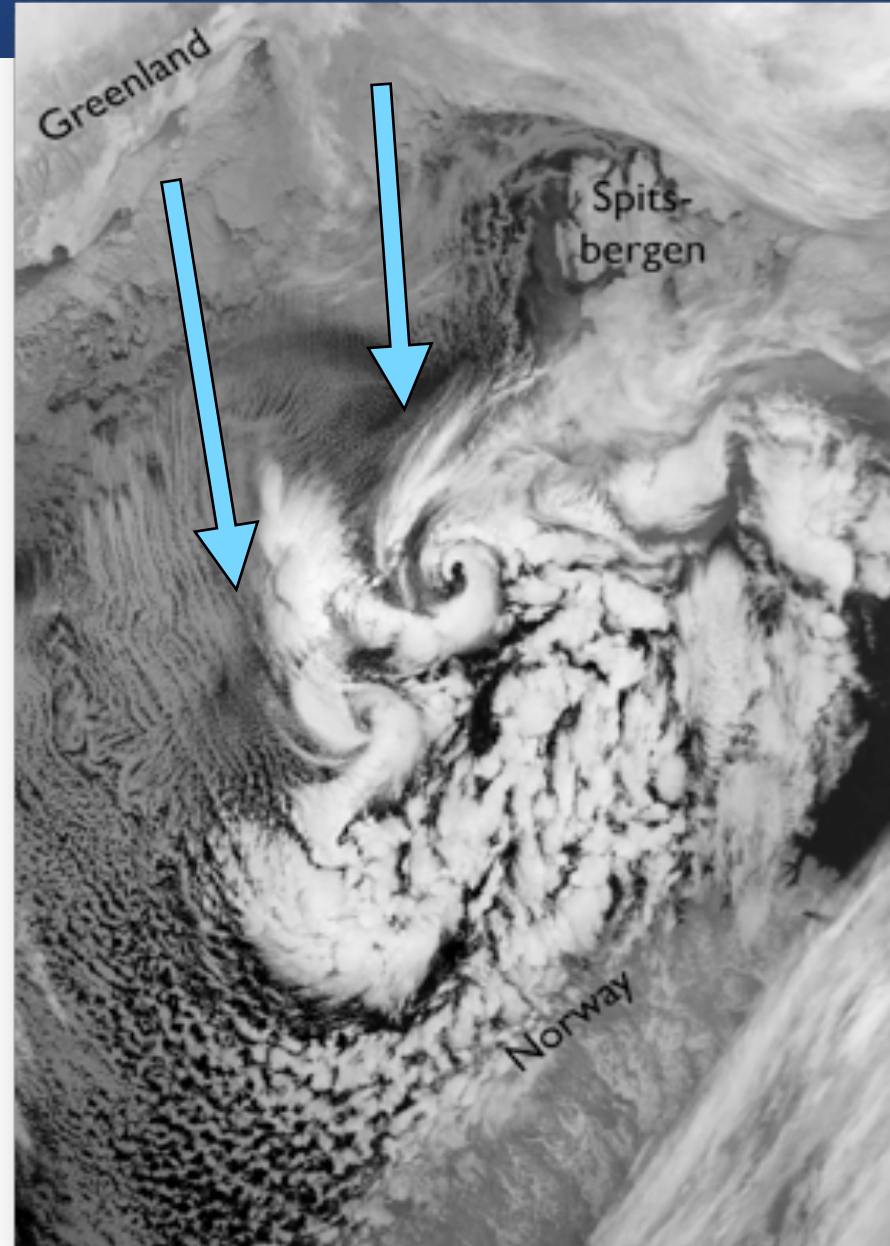






POLAR LOWS

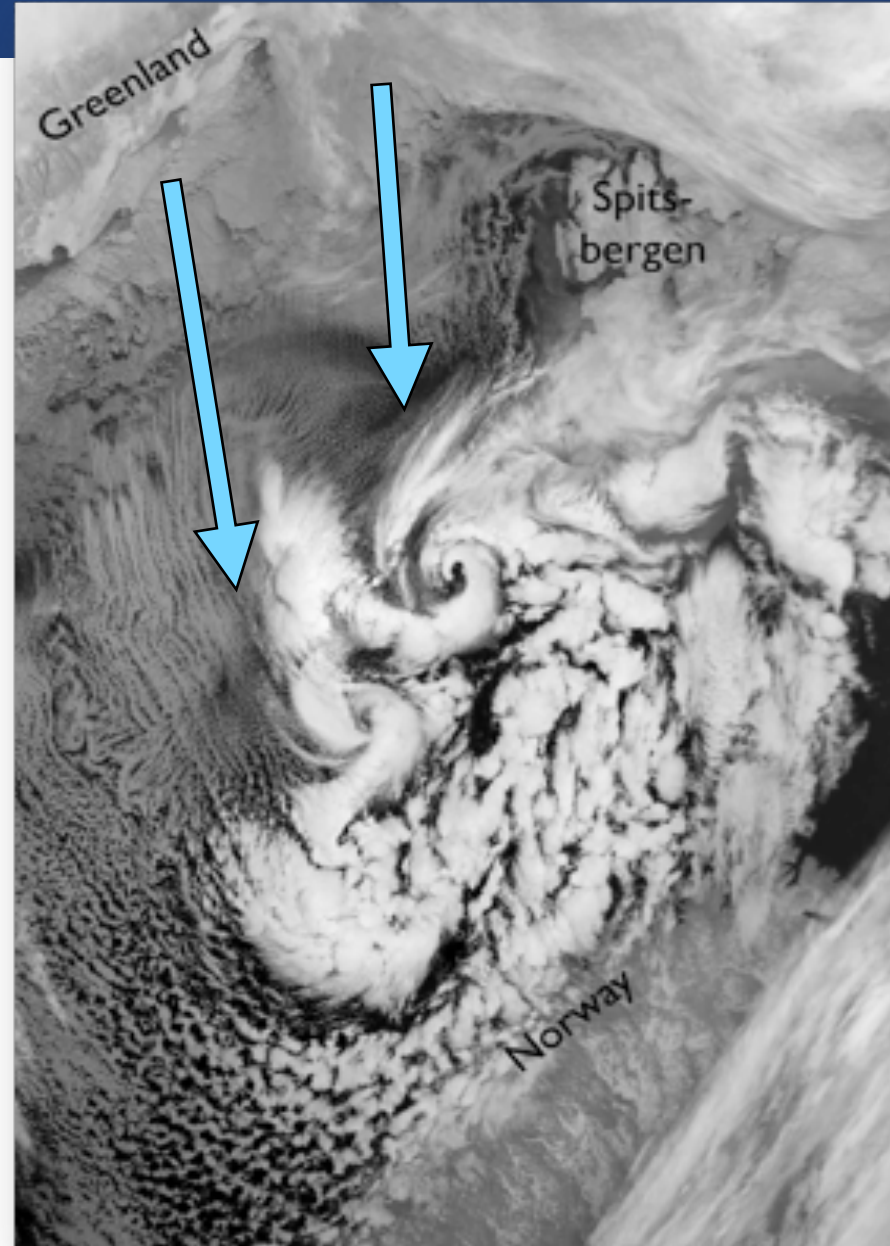
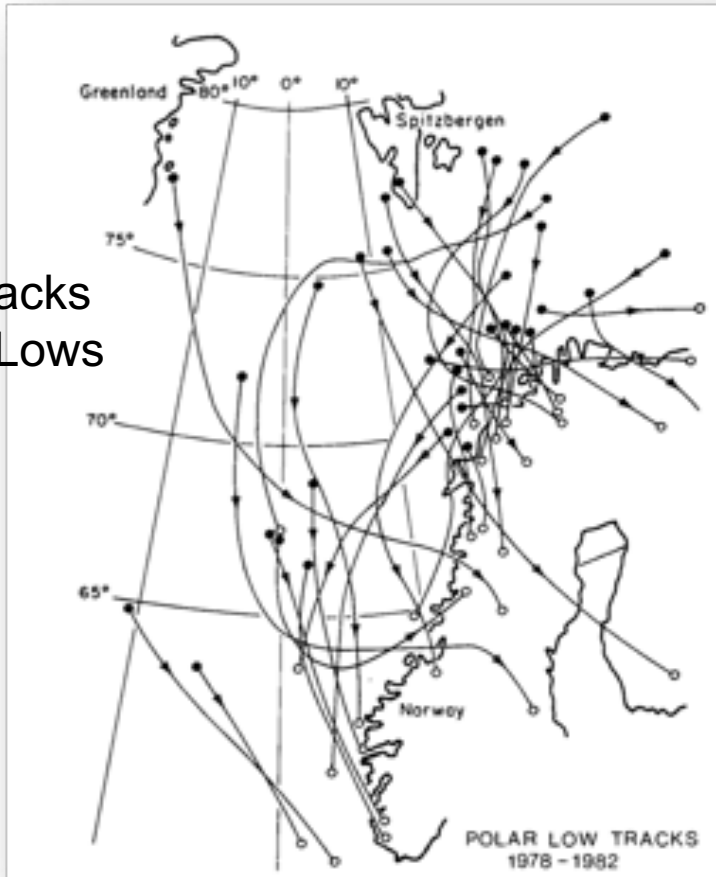
The main fuel for polar lows is the large vertical temperature difference between the ocean and the atmosphere



POLAR LOWS

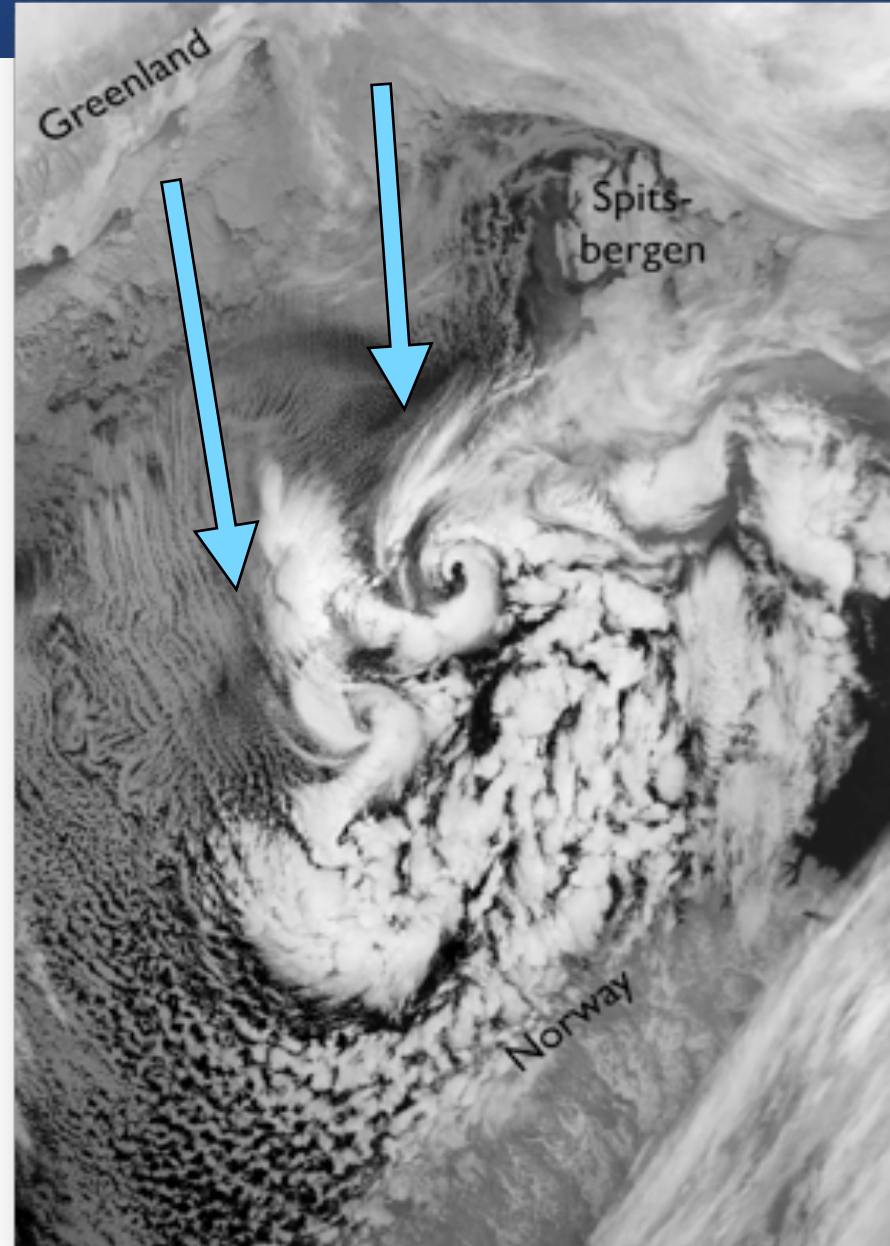
This phenomenon has been known for a long time

typical tracks of Polar Lows



WE CANNOT FORECAST INDIVIDUAL POLAR LOWS MORE THAN A COUPLE OF DAYS IN ADVANCE

But can we forecast the
environment in which they
form?



WHAT IS BLUE ACTION?

www.blue-action.eu

The Blue-Action project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727852.

BLUE ACTION: UNDERSTANDING THE IMPACT OF A CHANGING ARCTIC ON NORTHERN HEMISPHERE WEATHER AND CLIMATE



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.

BLUE ACTION: PROJECT SUMMARY

In response, Blue-Action aims to:

- improve our understanding of the impact of a changing Arctic on Northern Hemisphere weather and climate;
- improve the safety & wellbeing of people in the Arctic and across the Northern Hemisphere;
- reduce the risks associated with Arctic operations and resource exploitation; and,
- support evidence-based decision-making by policymakers worldwide.

BLUE ACTION: PROJECT SUMMARY



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.

BLUE ACTION: PROJECT SUMMARY

Blue-Action aims to work with:

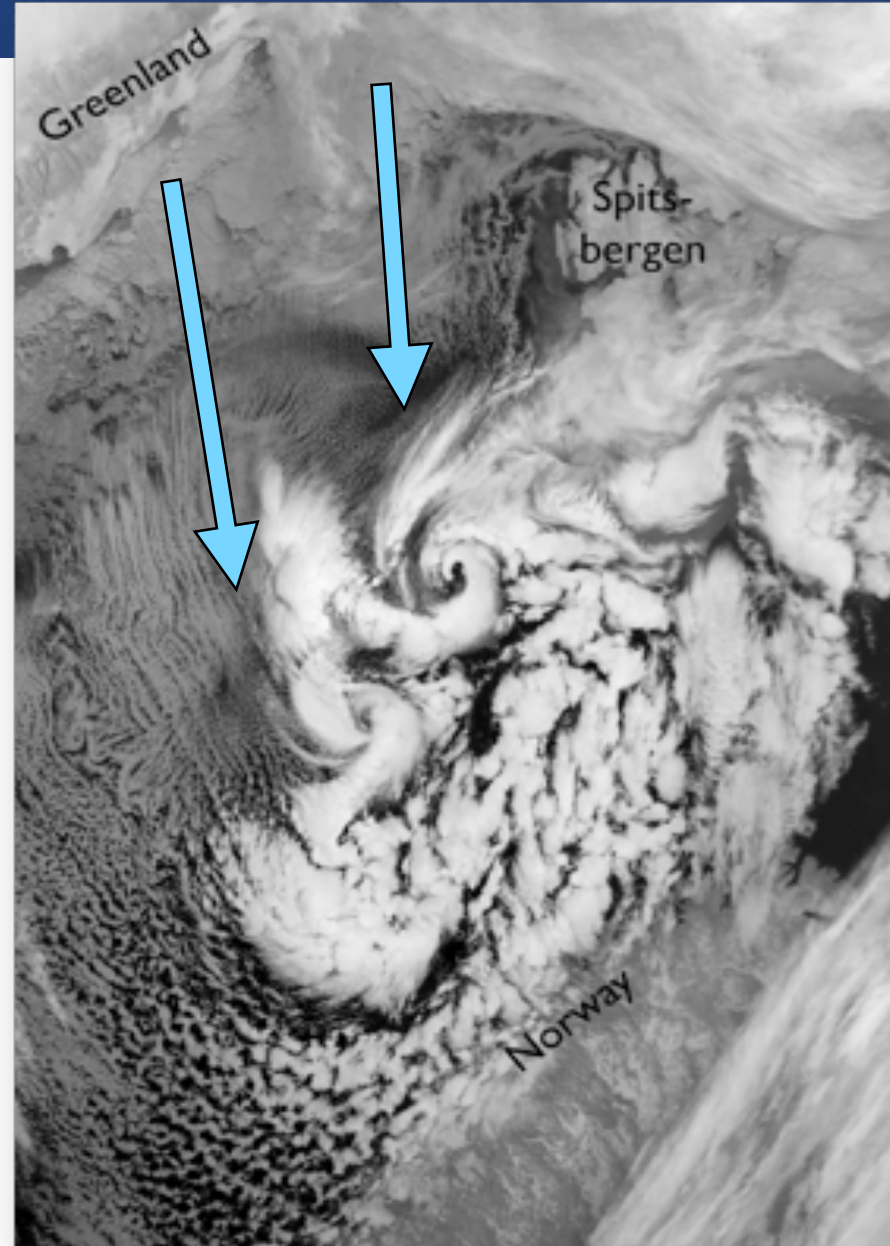
- **Researchers and projects** focussing on Arctic and northern hemisphere observational monitoring, climate modelling, forecasting, and climate services.
- **Governments and policymakers** in need of weather and climate information for evidence-based decision-making.
- **NGOs, public sector bodies, and community organisations** interested in extreme weather events, climate services, forecasting, and climate change.
- **Businesses or industries** who rely on seasonal to decadal climate predictions, risk estimates of extreme weather and climate events, or who would like to work with Blue-Action to co-develop climate services and tools.



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COLD AIR OUTBREAKS

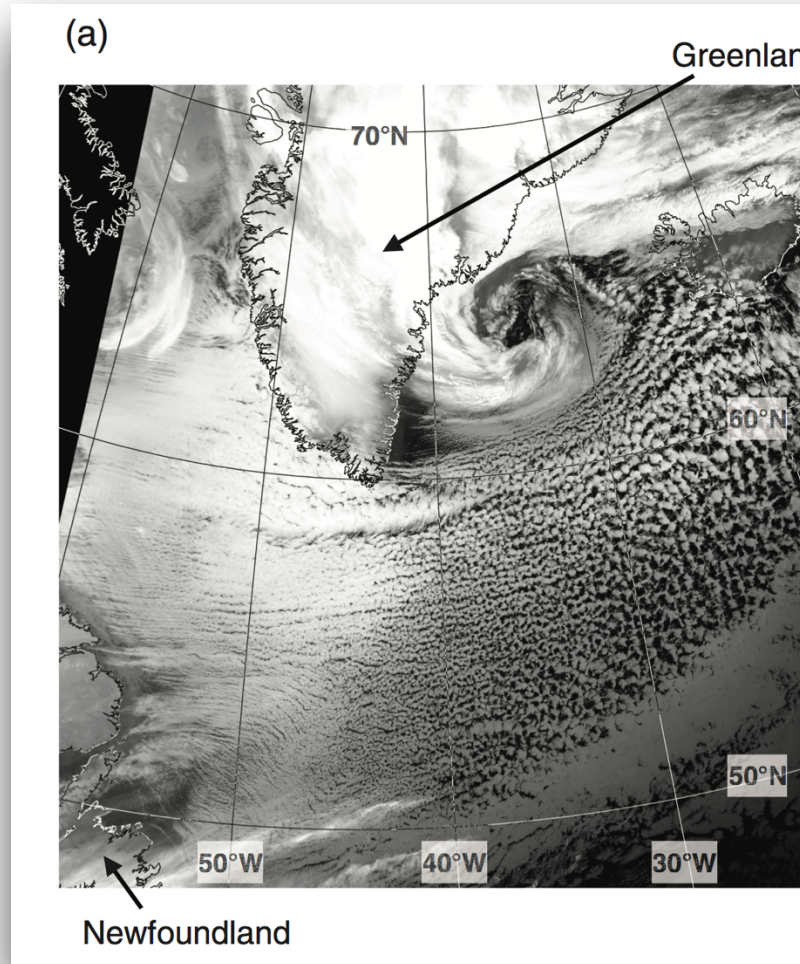


COLD AIR OUTBREAKS

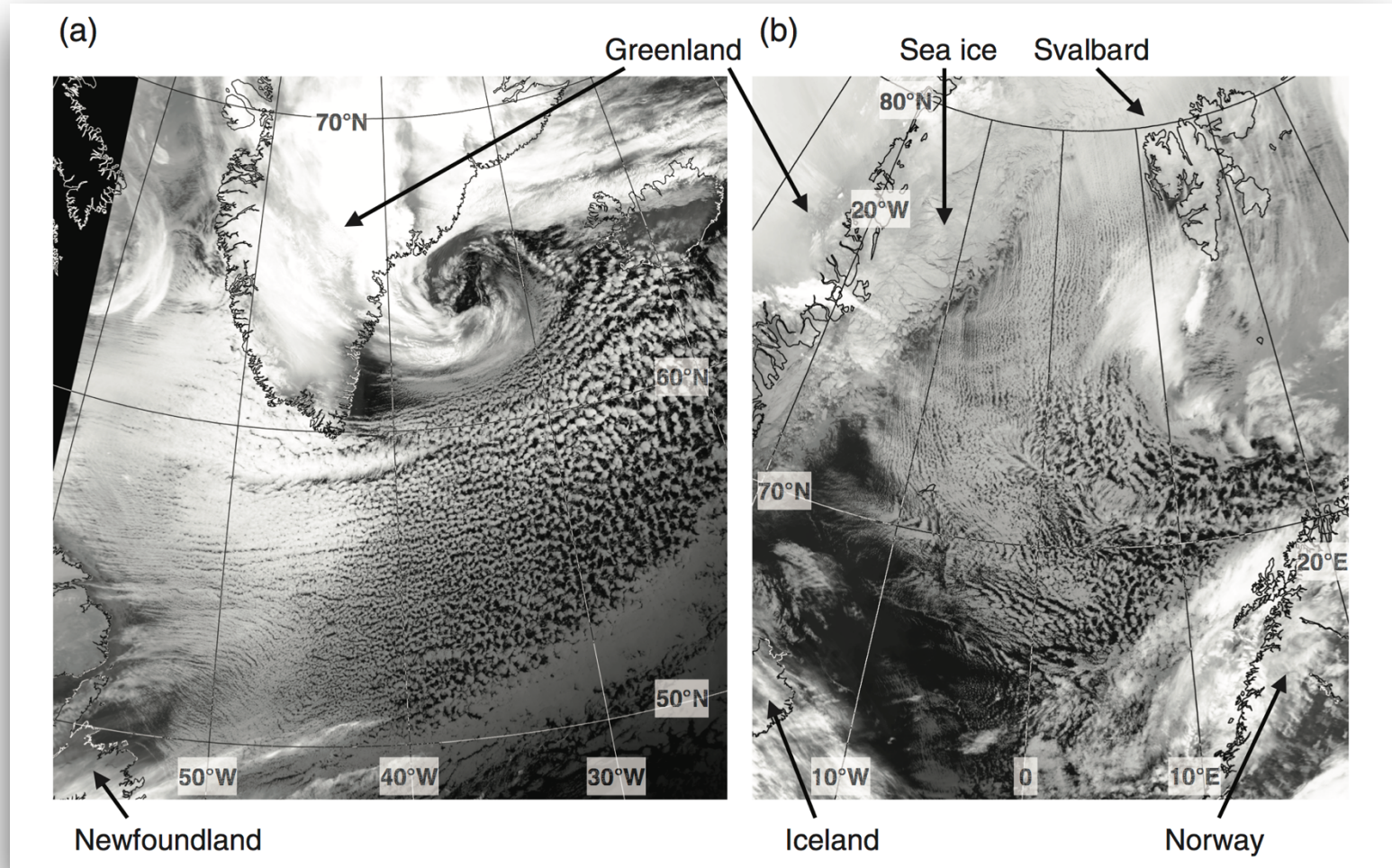
Wind speed over the ocean during cold air outbreaks is higher than in normal conditions.

This makes it worthwhile trying to forecast such outbreaks beyond the normal range of weather forecasts.

16 January 2005



25 January 2007



Kolstad, 2017

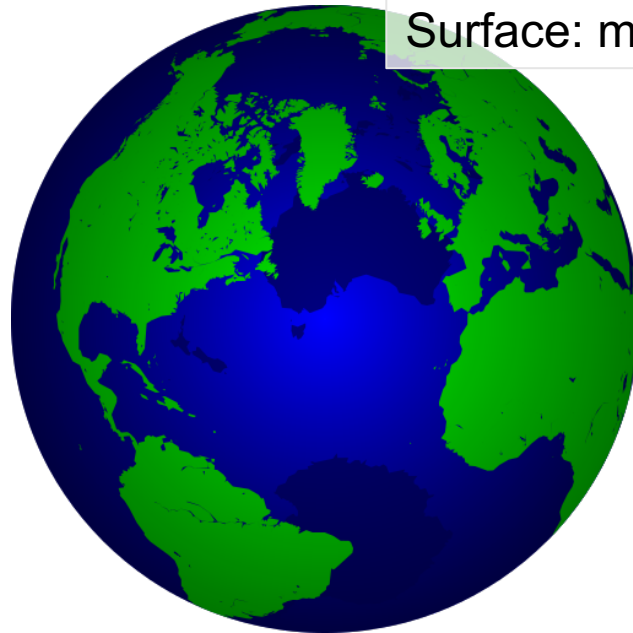
THE ROLE OF THE UPPER ATMOSPHERE FOR PREDICTION

Can prediction timescales for the Arctic be extended by better understanding the coupling with the upper atmosphere?

Upper atmosphere:
slow and persistent



Surface: more variable



CAN WE PREDICT THE SURFACE RESPONSE TO UPPER ATMOSPHERE EVENTS?

Average over 15 upper atmosphere extreme events

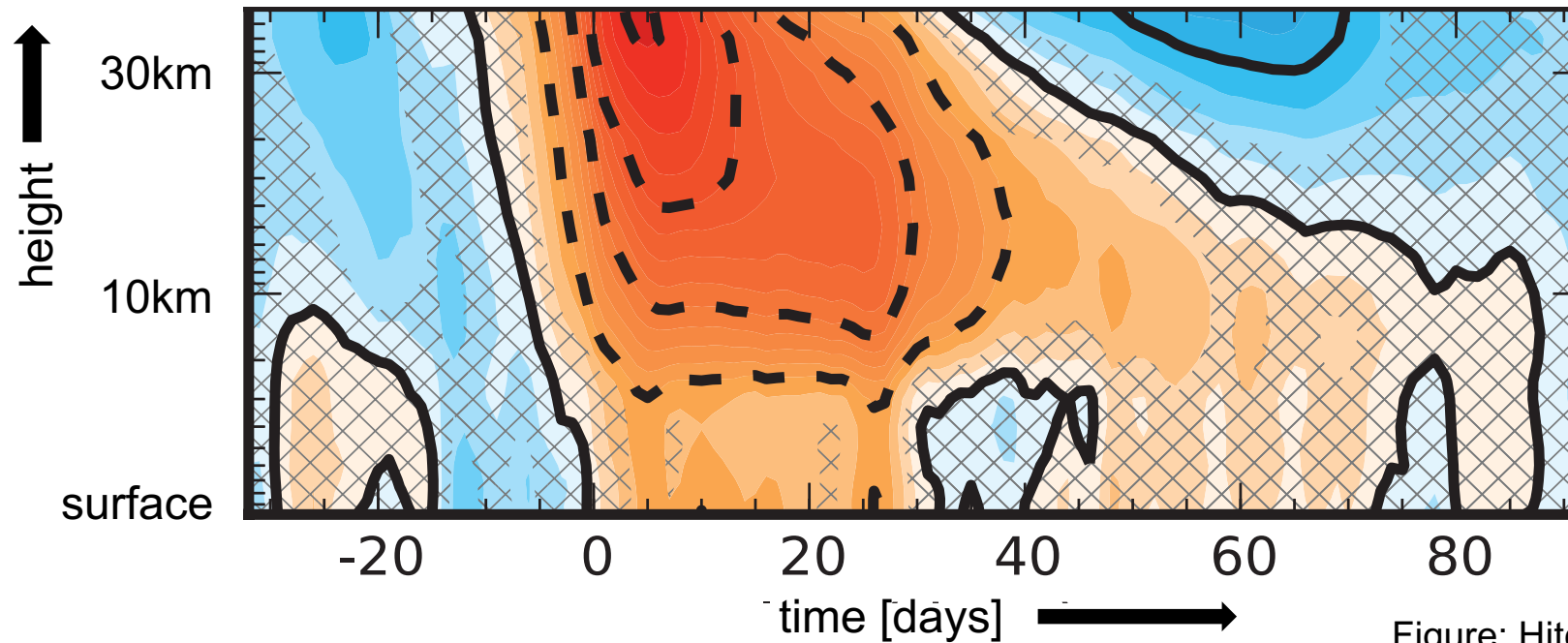
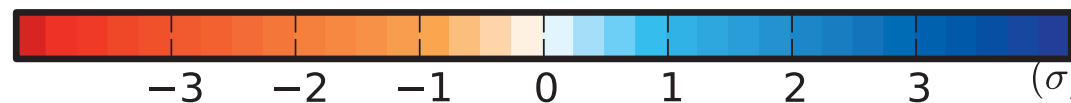


Figure: Hitchcock et al., 2013, J. Clim.



Northern Annular Mode Index
(reanalysis data)

IMPACT OF THE UPPER ATMOSPHERE ON COLD AIR OUTBREAKS

Example: large increases in the frequency of cold air outbreaks after upper atmosphere extreme events

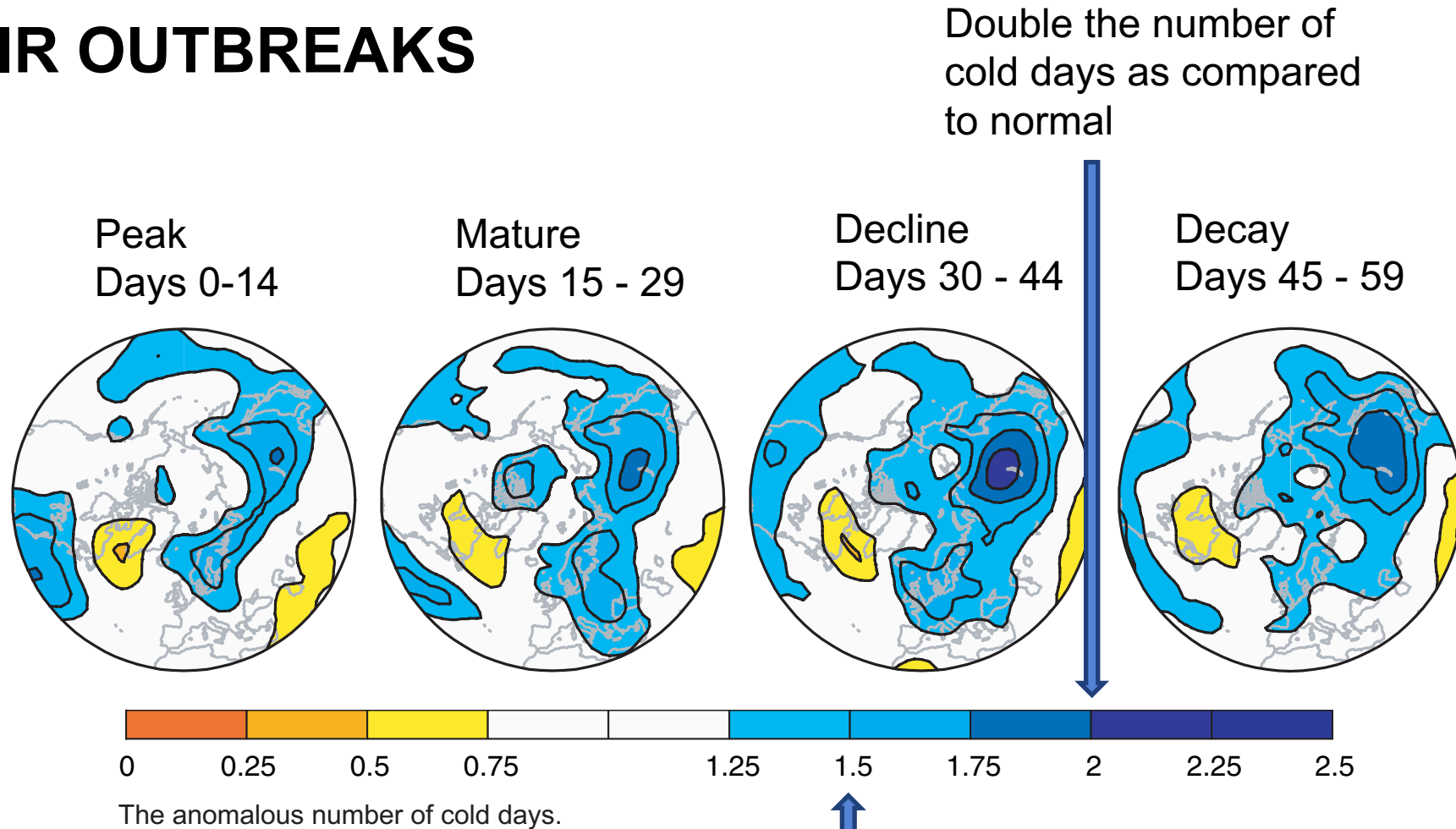
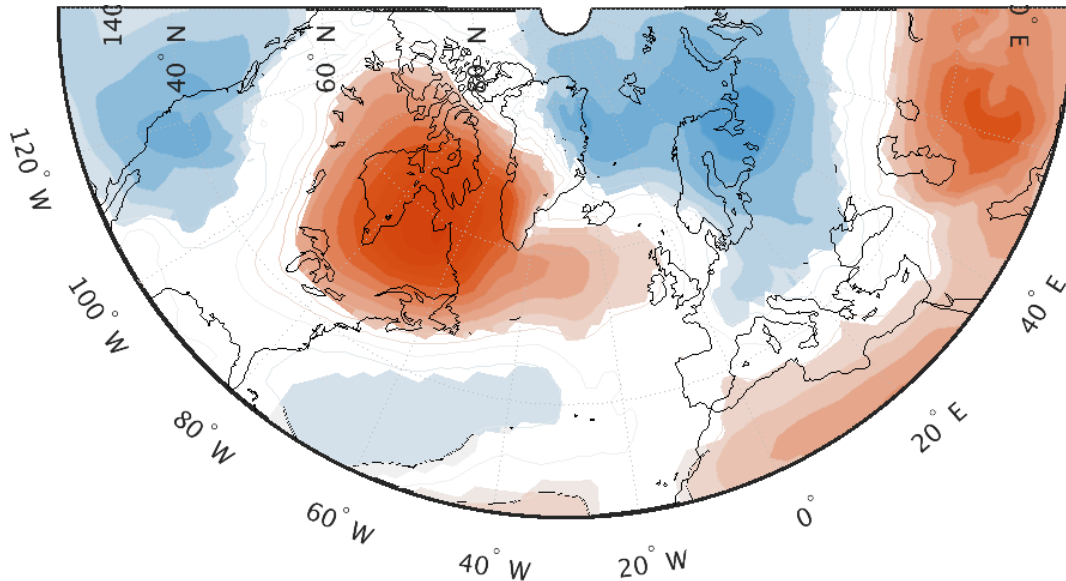


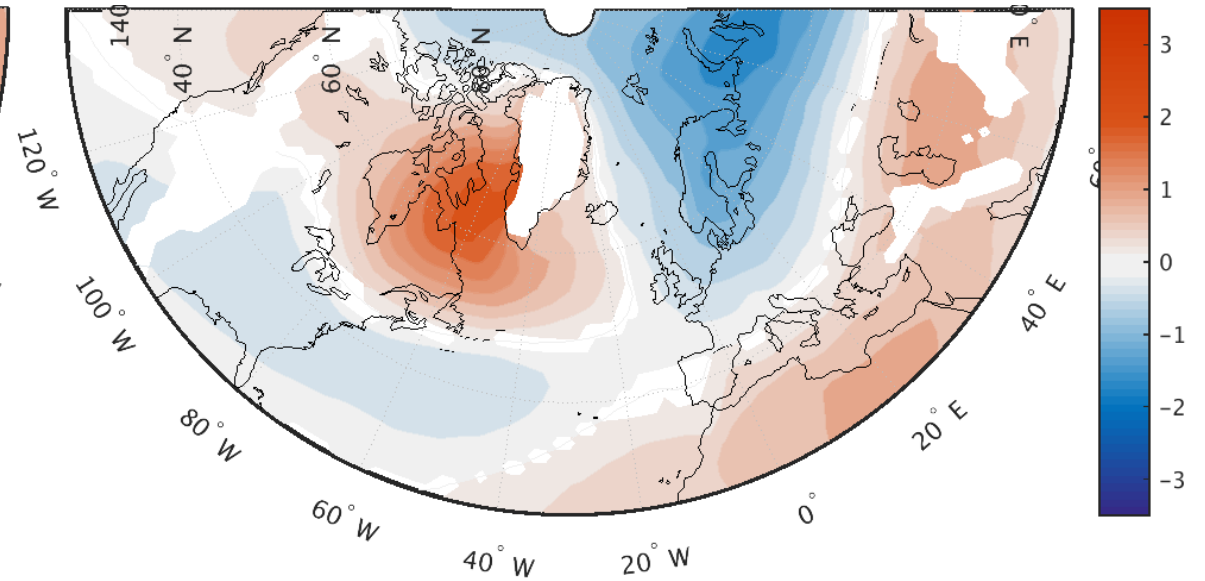
Figure: Kolstad et al., 2010

CAN WE PREDICT THE SURFACE RESPONSE TO UPPER ATMOSPHERE EVENTS?

Verification data (reanalysis)
(13 events)



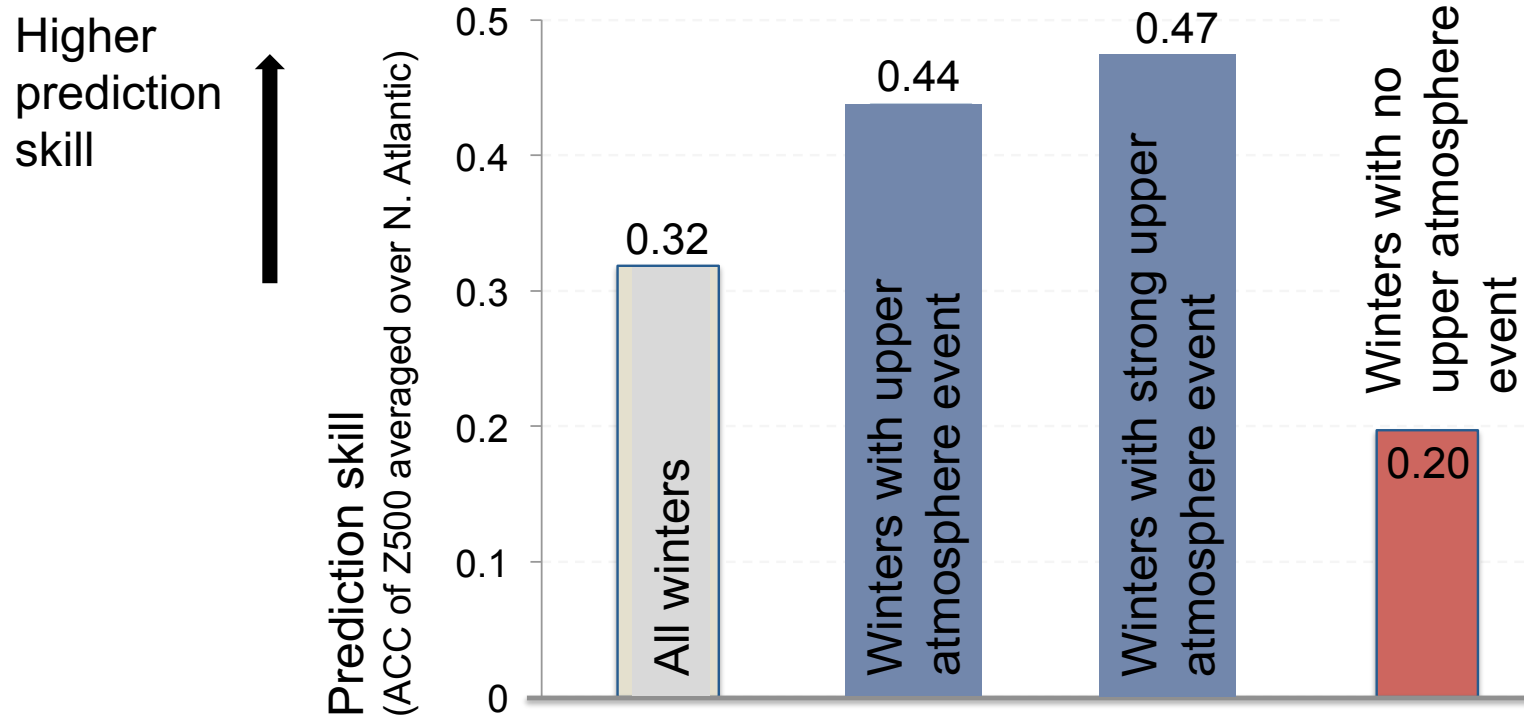
Forecast model prediction (MPI-ESM)
(403 events)



Temperature anomaly at 850hPa (1.5km height) for days 15 – 60 after an upper atmosphere event

Figures: Domeisen

PREDICTABILITY IS INCREASED OVER THE NORTH ATLANTIC FOR UPPER ATMOSPHERIC INFLUENCE



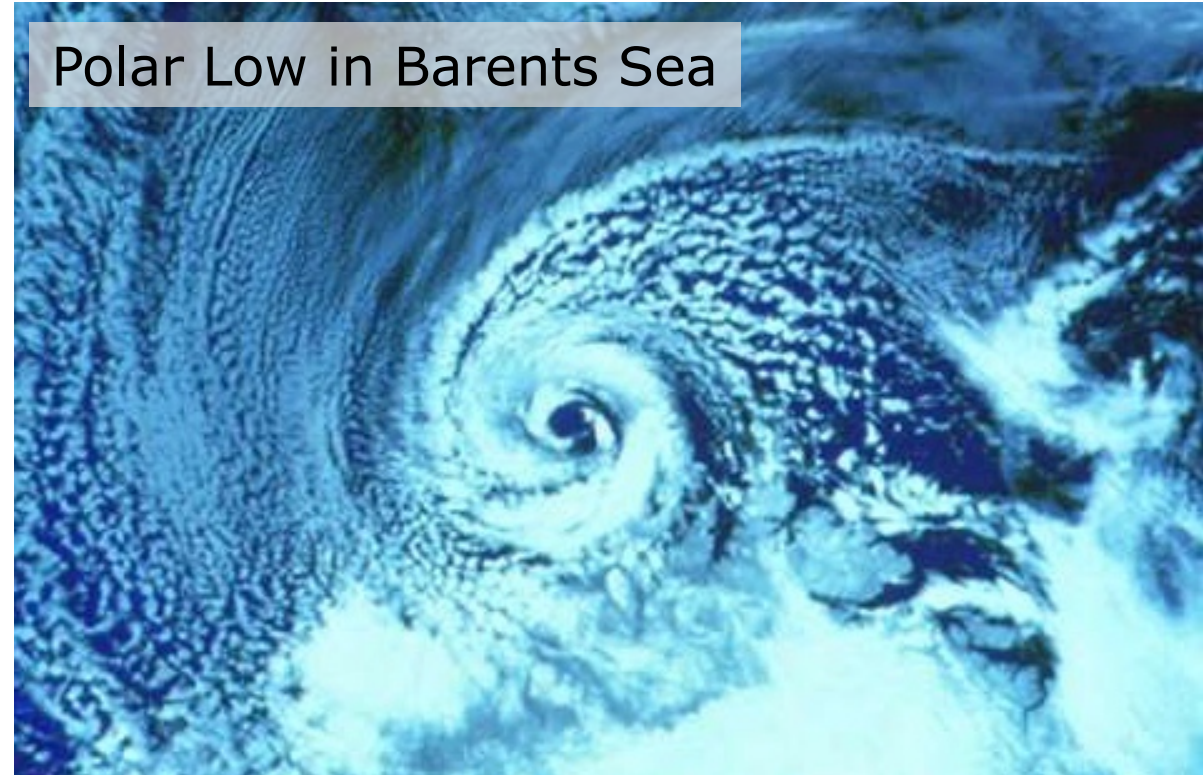
Figures: Domeisen

OUTLOOK: MAKING LONGTERM FORECASTS FOR THE ARCTIC

Goal: Test dynamical models to see if marine cold air outbreaks can be forecasted, and on which time scales (10–100 days).

Integrate these forecasts into a tool for risk management in the Arctic.

Polar Low in Barents Sea



SUMMARY

BLUE ACTION is an EU funded project dealing with the prediction of the Arctic environment and impacts on lower latitudes started in December 2016.

First results indicate that the upper atmosphere may be an important factor in adding predictability to the Arctic, in particular for cold air outbreaks, which are often associated with polar lows.



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