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Arctic Impact on Weather and Climate

UNDERSTANDING THE IMPACT OF A CHANGING ARCTIC ON NORTHERN HEMISPHERE WEATHER AND CLIMATE.

Steffen M. Olsen

Arctic Workshop of the Transatlantic Ocean Research Alliance
Brussels on 29 and 30 March 2017

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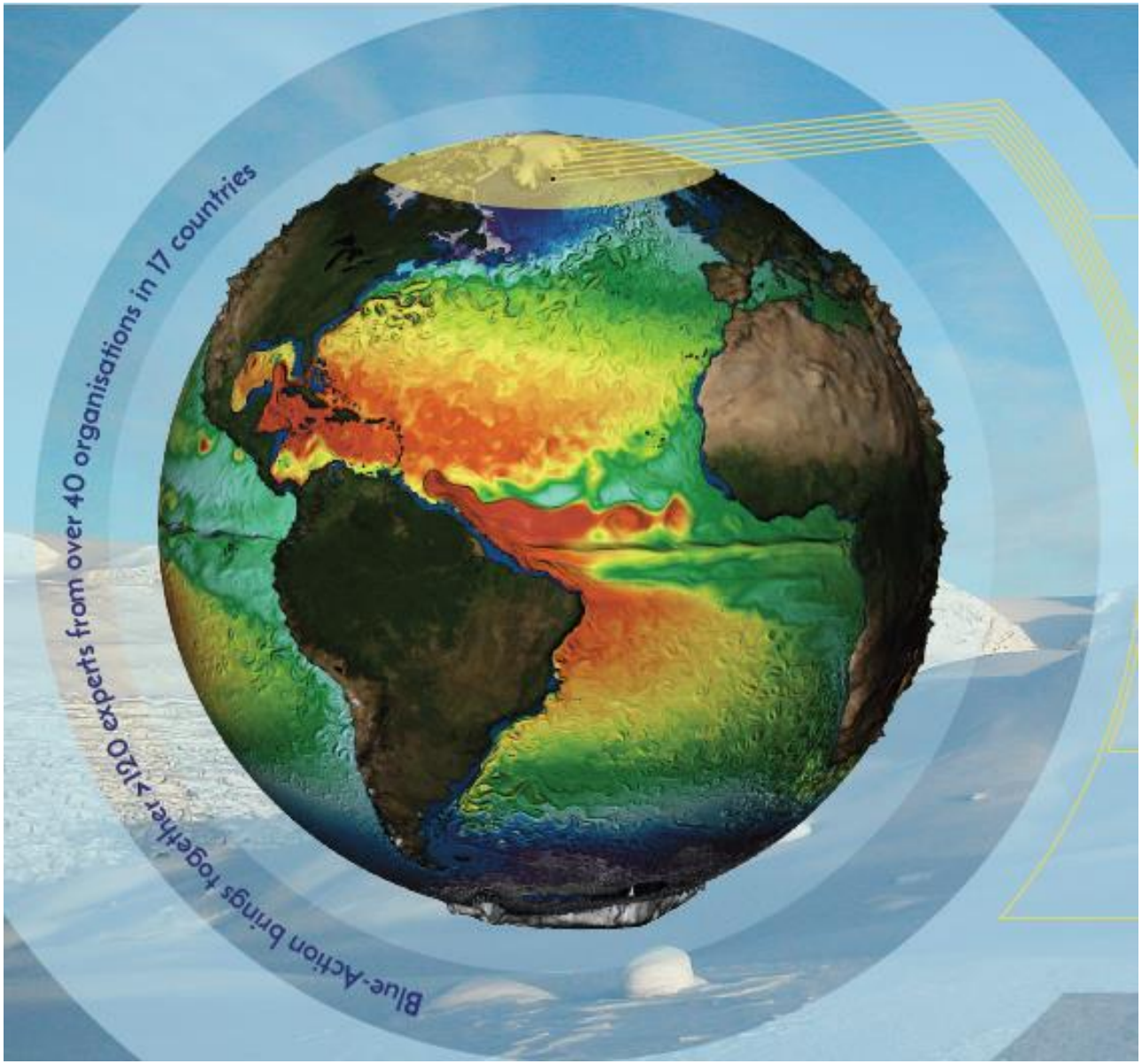

Coordination

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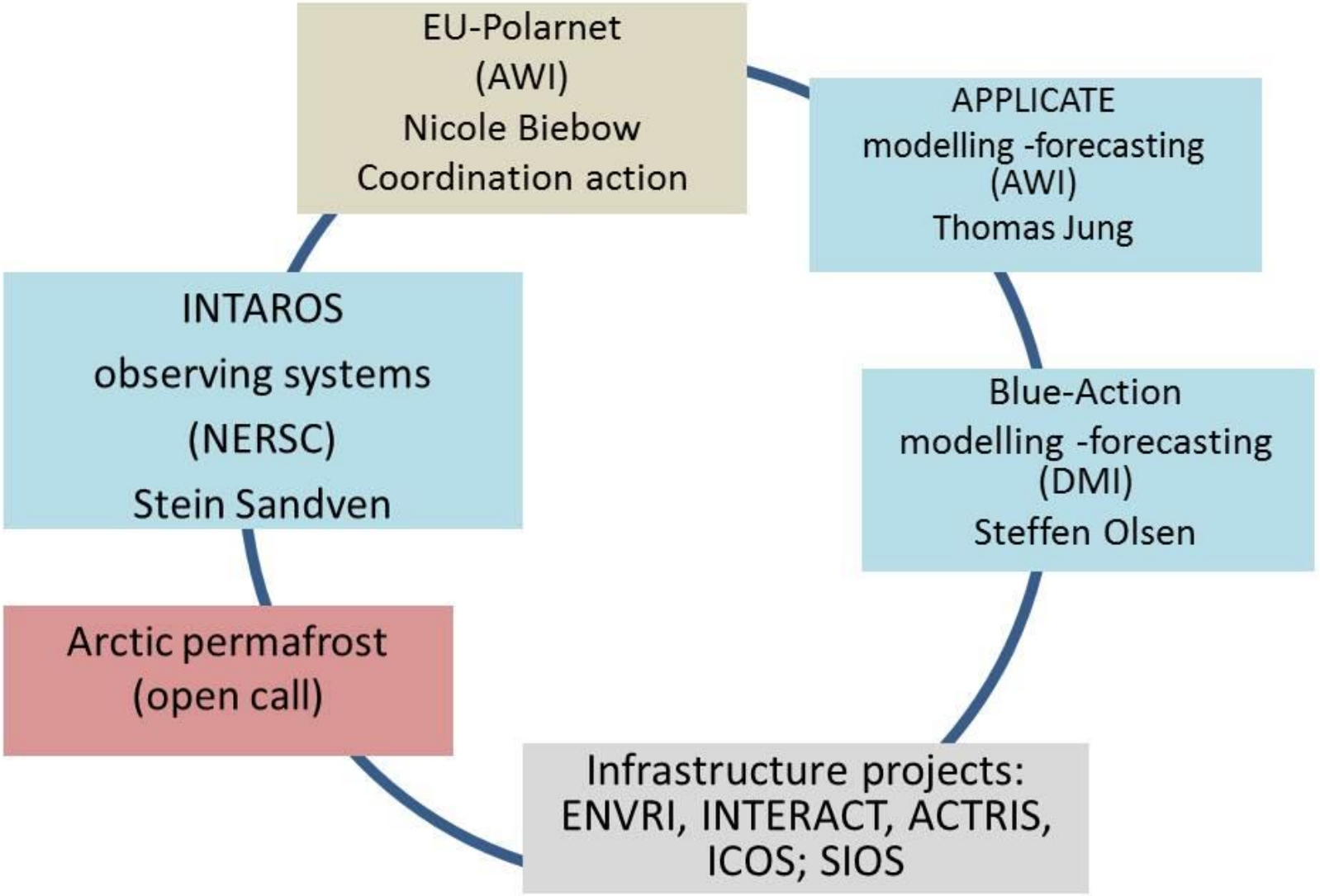
Non-EU Partners

- USA
- Canada
- Russia
- China
- Korea

The Danish Meteorological Institute

Max-Planck-Institut für Meteorologie

The 'Arctic Cluster'



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Why?

- To actively improve our ability to describe, model, and predict Arctic climate change and its impact on Northern Hemisphere climate.

- 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.

- To enable robust and reliable forecasting and deliver better predictions at sub-seasonal to decadal scales.

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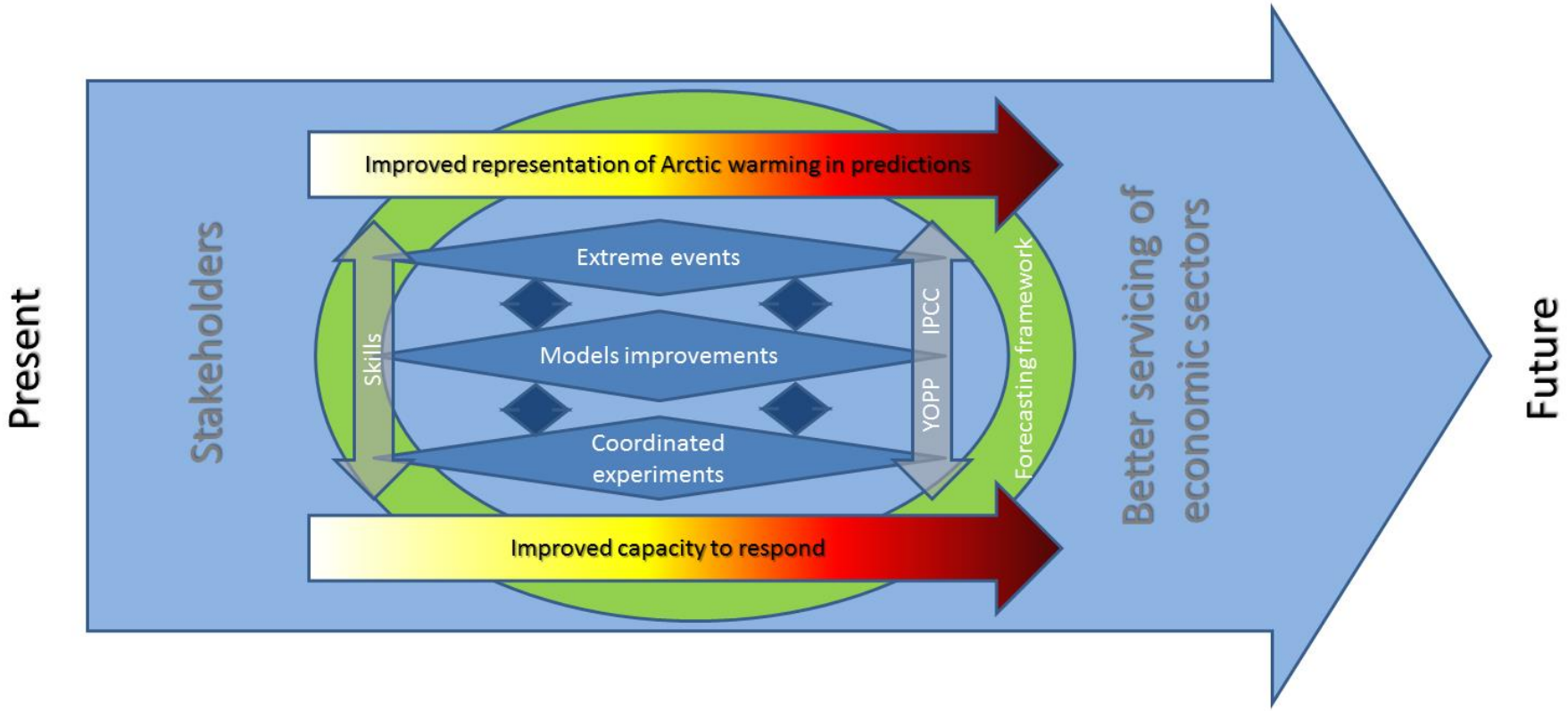
How?

- Through synthesising observations, assessing model performance, designing and performing coordinated multi-model sensitivity experiments, developing innovative bias reduction and initialization strategies.



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Specific Outputs and Outcomes

- Co-design a series of case studies with organisations and industries that rely on accurate weather and climate forecasting
- To apply new modelling techniques to cutting-edge climate services
- Embed scientific developments and improved model capacity within international programmes including Copernicus C3S, IPCC AR6 and PPP-YOPP

WCRP World Climate Research Programme

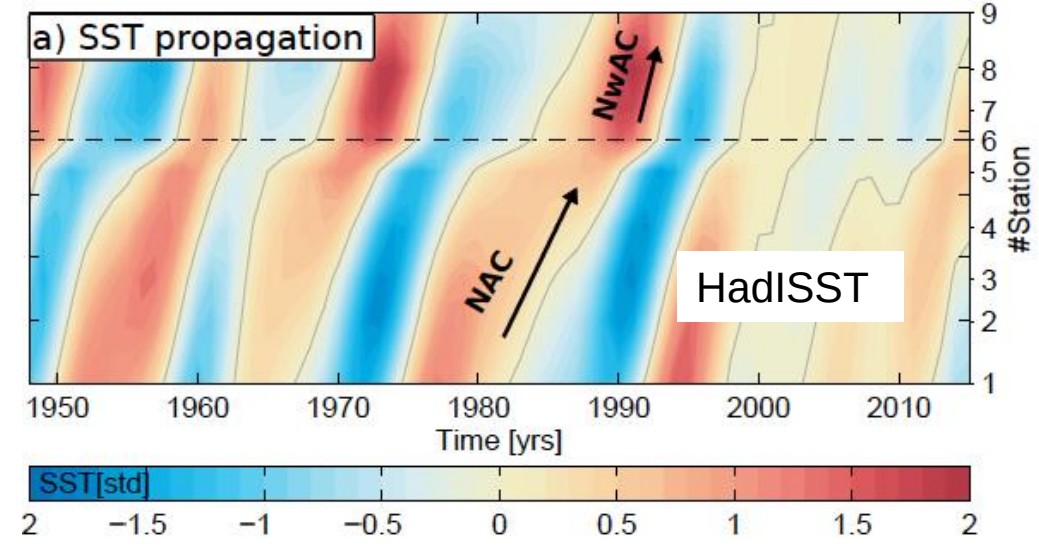
Climate Change Service

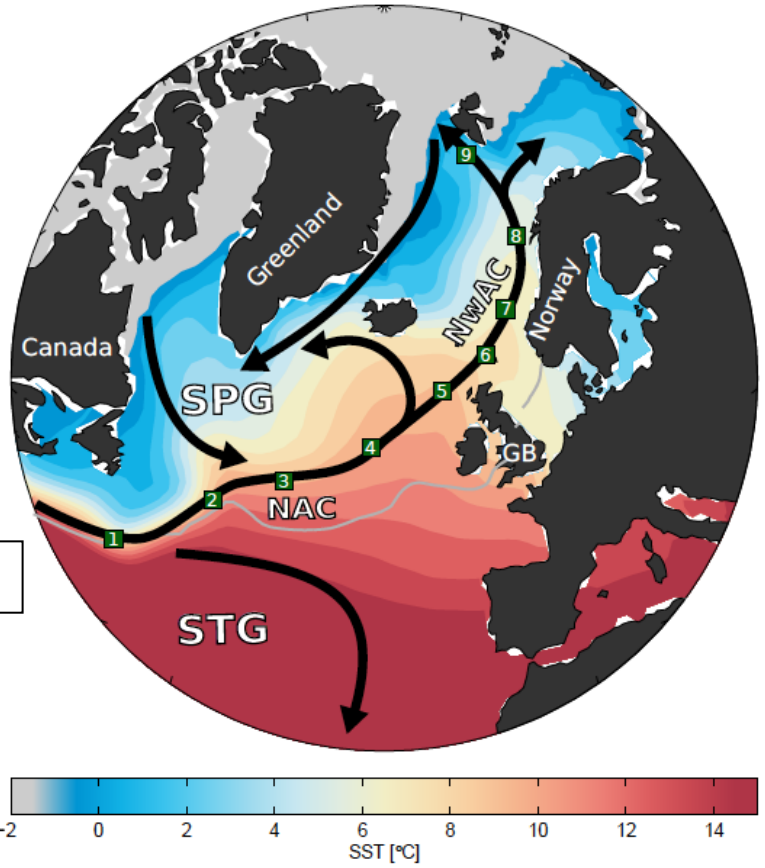
YOPP YEAR OF POLAR PREDICTION

Oceanic anomalies of predictive potential

- 55% of variance explained
- Propagation speed: 3 cm/s
- Period: 14 years
- Similar propagation characteristics for salinity and tracers imply ocean circulation

Complex EOF on 5-year low-pass filtered data





Onarheim et al., Skillful prediction of Barents Sea ice cover. *GRL*, 2015

Arthun and Eldevik, On Anomalous Ocean Heat Transport toward the Arctic and Associated Climate Predictability. *J. Clim.*, 2016

Connected Ocean Observatories

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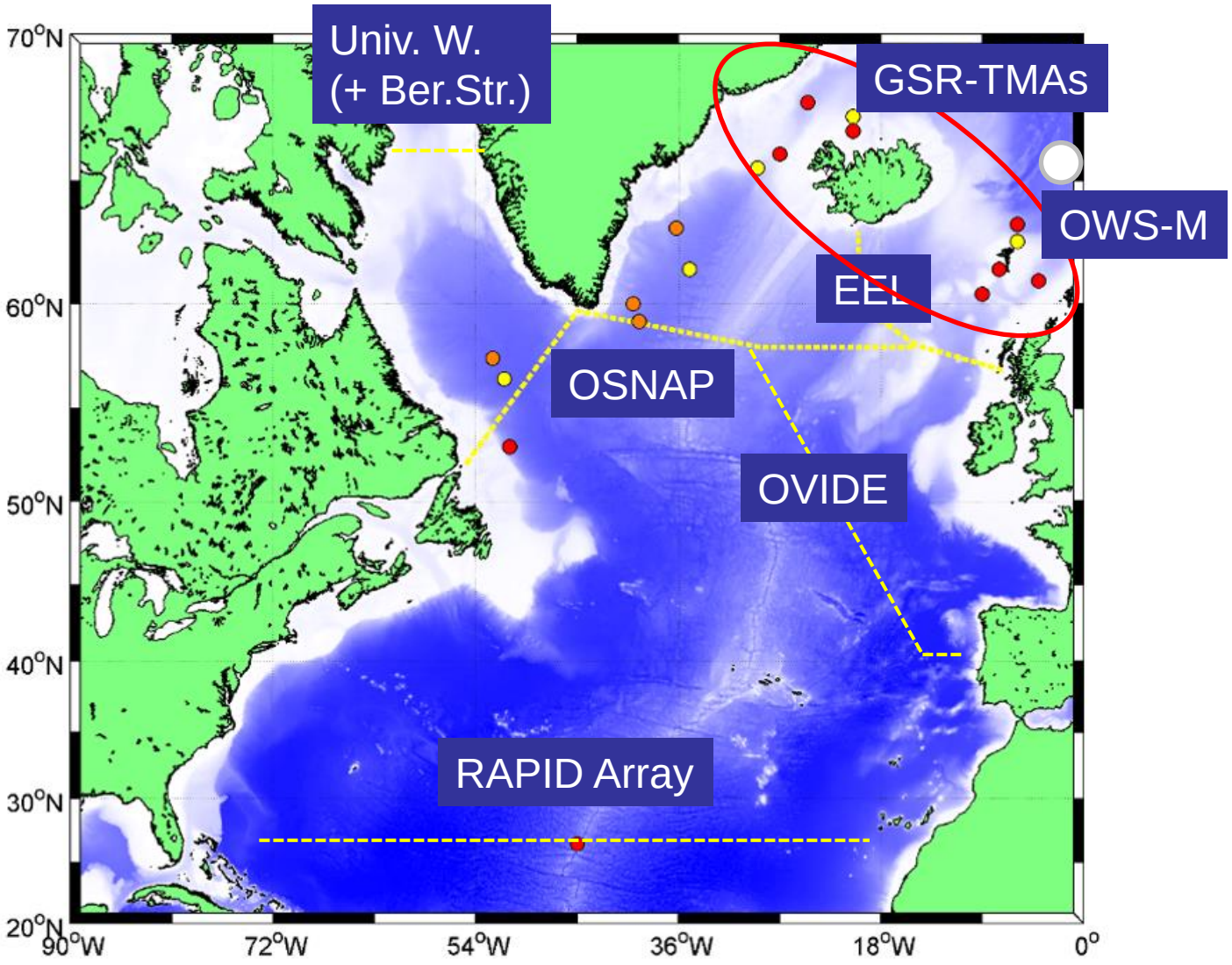
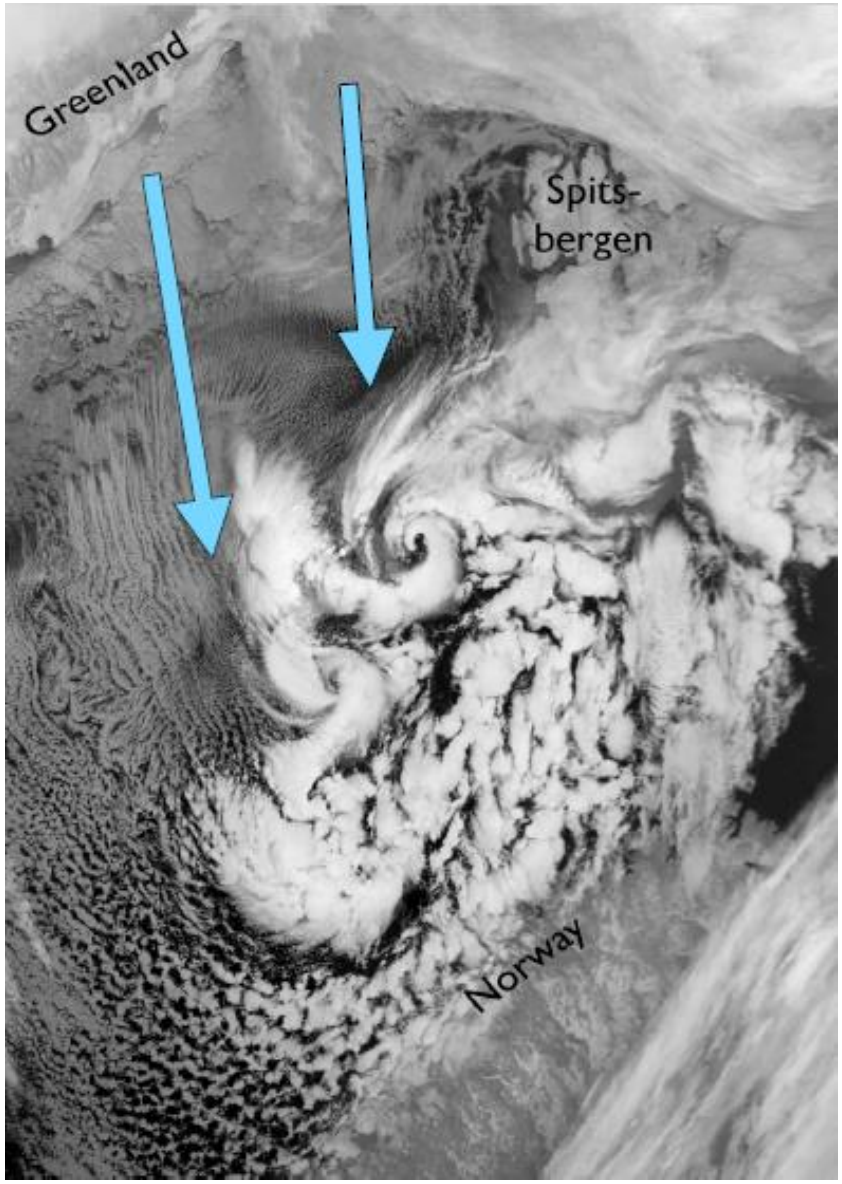


Extreme Arctic Marine Weather

We cannot forecast individual polar lows more than a couple of days in advance.

But maybe we can forecast the environment in which they form?



Warm Ocean – Cold Air

Extreme Arctic Marine Weather

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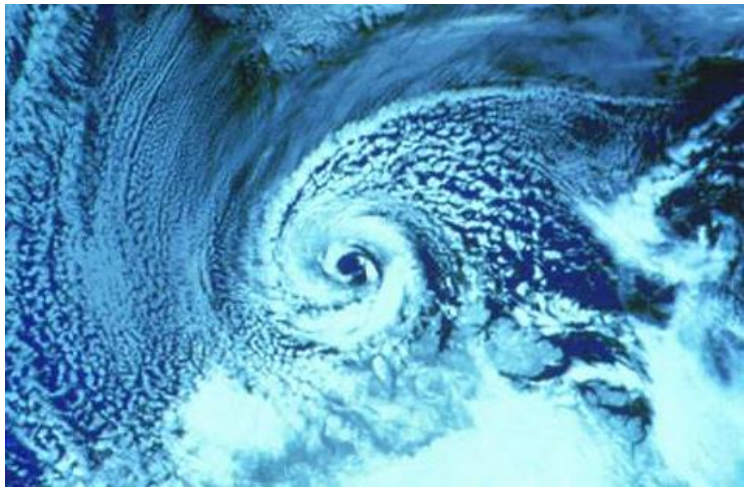
Test dynamical models to see if marine cold air outbreaks can be forecast, and on what time scales (10–100 days)

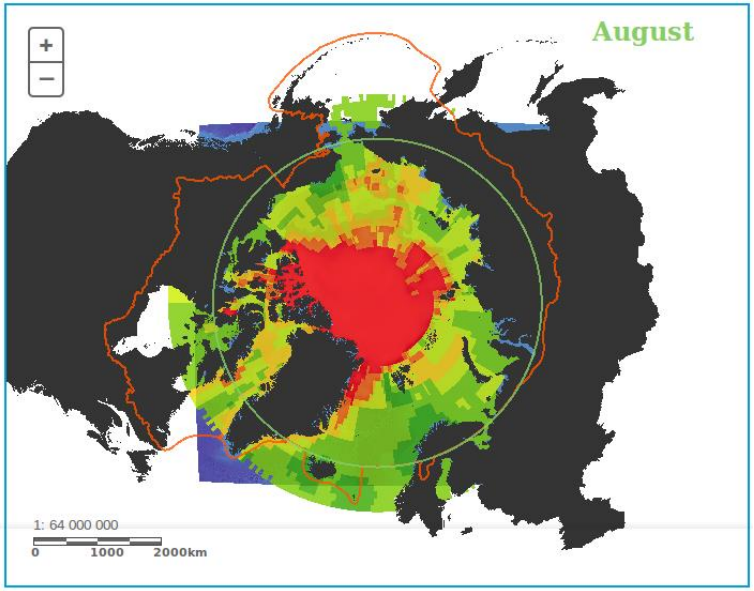
Combine dynamical forecasts with empirical forecasts of northward-propagating SST anomalies and sea ice extent

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

Polar Low in Barents Sea



Safety Risk Map



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