H2020 Blue-Action:
Arctic Impact on Weather and Climate

Who are we?

- We bring together experts from 40 organizations in 17 countries on three continents
- We work directly with local communities, businesses operating in the Arctic and industrial organizations, local authorities and maritime industries.
- Blue-Action is coordinated by *Steffen M. Olsen* (DMI) and *Daniela Matei* (MPI).

When?

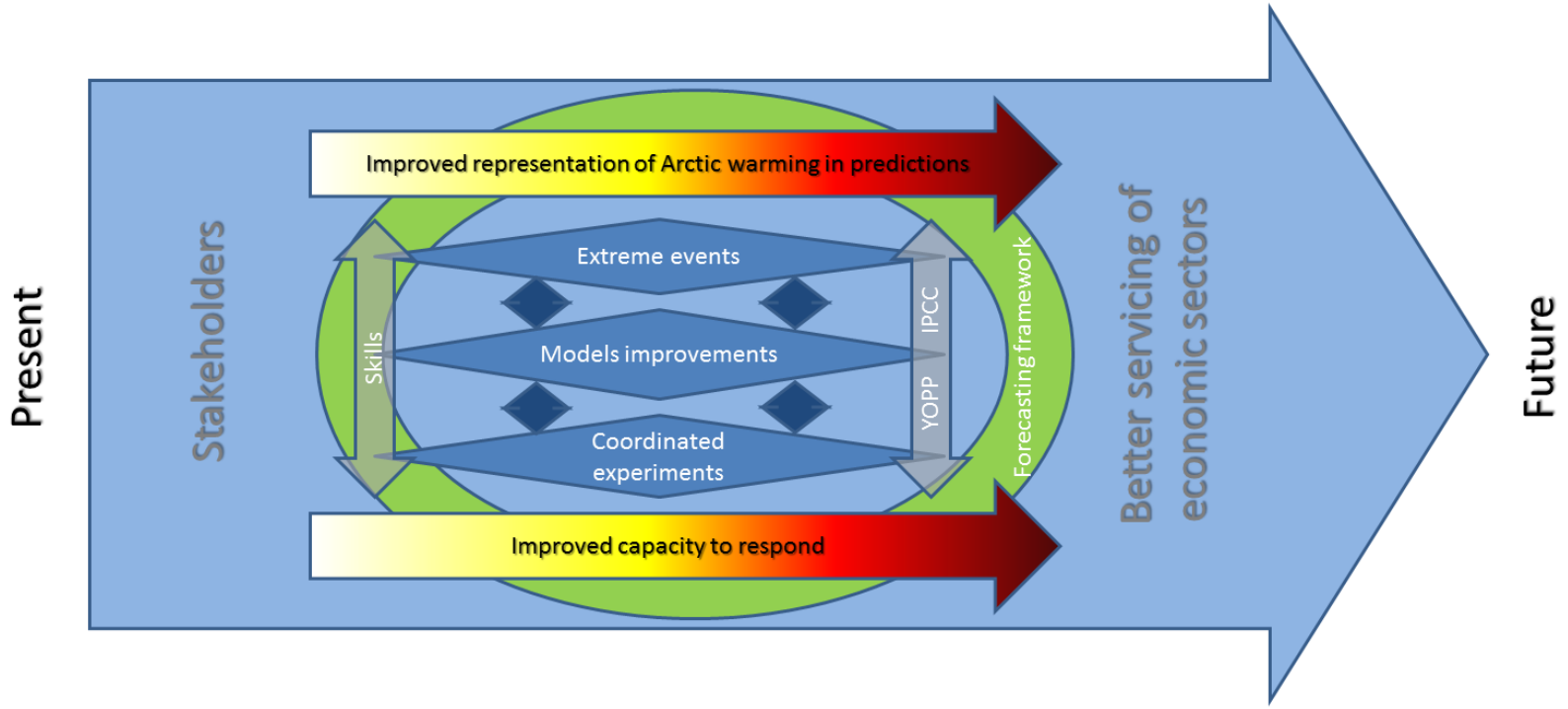
- Blue-Action started 1 December 2016 and will run till Feb. 2021.
- The Kick-off event took place in the Harnack-Haus, Berlin 18-20 January 2017

The Danish Meteorological Institute

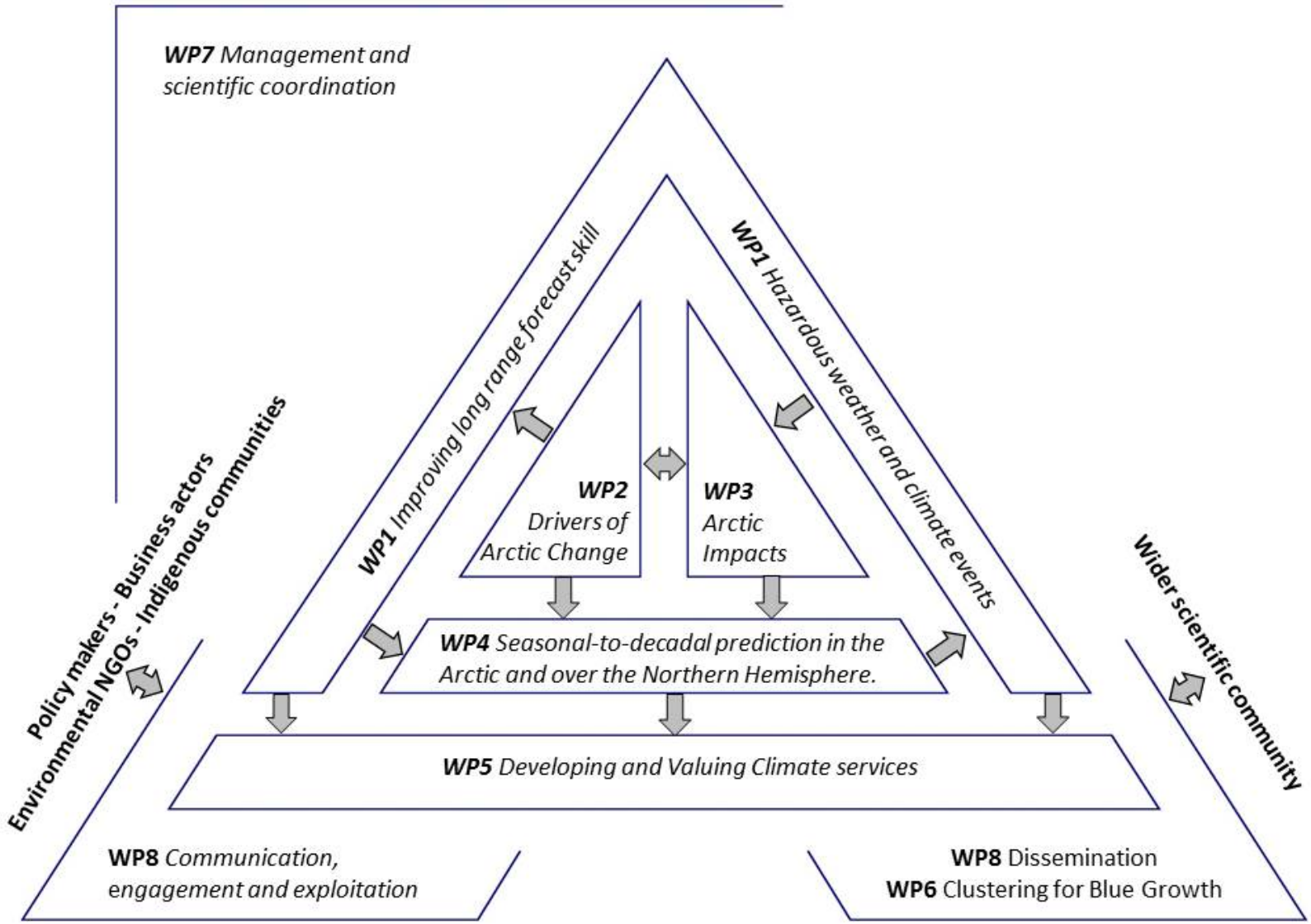
Max-Planck-Institut für Meteorologie

Overarching Objective
- The concept

To actively improve our ability to describe, model, and predict Arctic climate change and its impact on Northern Hemisphere climate, weather and their extremes, and to deliver valuated climate services of societal benefit.



Project Structure



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WP1: Improving seasonal long range forecast skill of risks for hazardous weather and climate events

Johanna Baehr (UHAM), Jens Hesselbjerg Christensen (DMI)

Objective: To develop and apply novel statistical and dynamical approaches to quantify predictability of weather and climate extremes

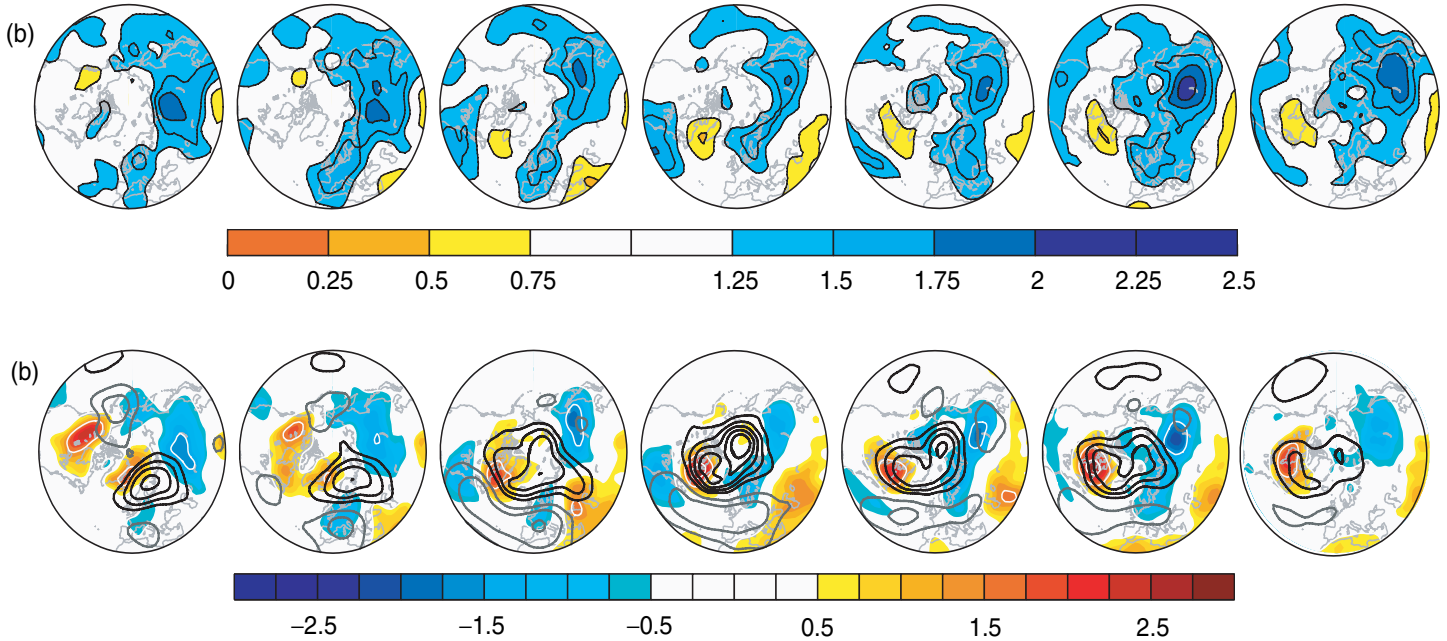
Working Plan and tasks:

- use a process-oriented diagnostic analysis of weather systems
- focus will be on the conditions associated with hazardous weather events under present and future climate conditions (including large scale modes of variability and teleconnections)
- characterize extremes at different spatial and temporal scales by using a rigorous mathematical framework (extreme value theory)
- conduct a process-oriented diagnosis of weather systems associated with the occurrence of weather extremes
- detection and attribution of weather systems and extremes
- analyze weather systems and extremes in seasonal prediction systems

transfer the results to operational use, including stakeholder contacts

We cannot forecast polar lows on the S2S time scale, but perhaps the environment in which they form: cold air outbreaks

Example: large increases in the frequency of cold air outbreaks (top) coincide geographically with the regions of mean temperature change (bottom).



Top: The composite number of cold days divided by the date-wise climatological mean number of cold days for each grid point relative to weak vortex days during the specified time intervals.
Bottom: Composites of 850 hPa geopotential height anomalies (in m with solid contours, positive in black, negative in grey, contour interval 10 m, zero contour omitted) and 850 hPa temperature anomalies (in K with filled contours, with white contours along the values specified on the colour bar) relative to weak vortex days, averaged over the specified time intervals.

Kolstad et al., 2010

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WP2: Lower latitude drivers of Arctic changes

Karin Margretha H. Larsen (FAMRI)
Gerard McCarthy (NERC)

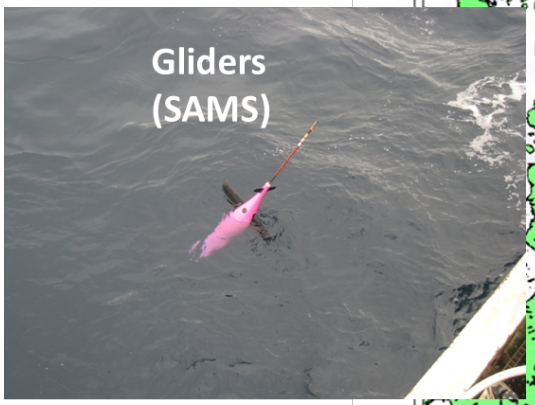
Objectives

- Enhancing the predictive capacity beyond seasons through assessment of **oceanic anomalies** of predictive potential
- Reanalysis to serve as input to WP4 (Enhancing the capacity of s2d prediction)
- Optimizing observational systems
  - Near real time data access from TMAs (NACLIM, AtlantOS, NERC)
  - Integrate New Earth Observation into TMA estimates.

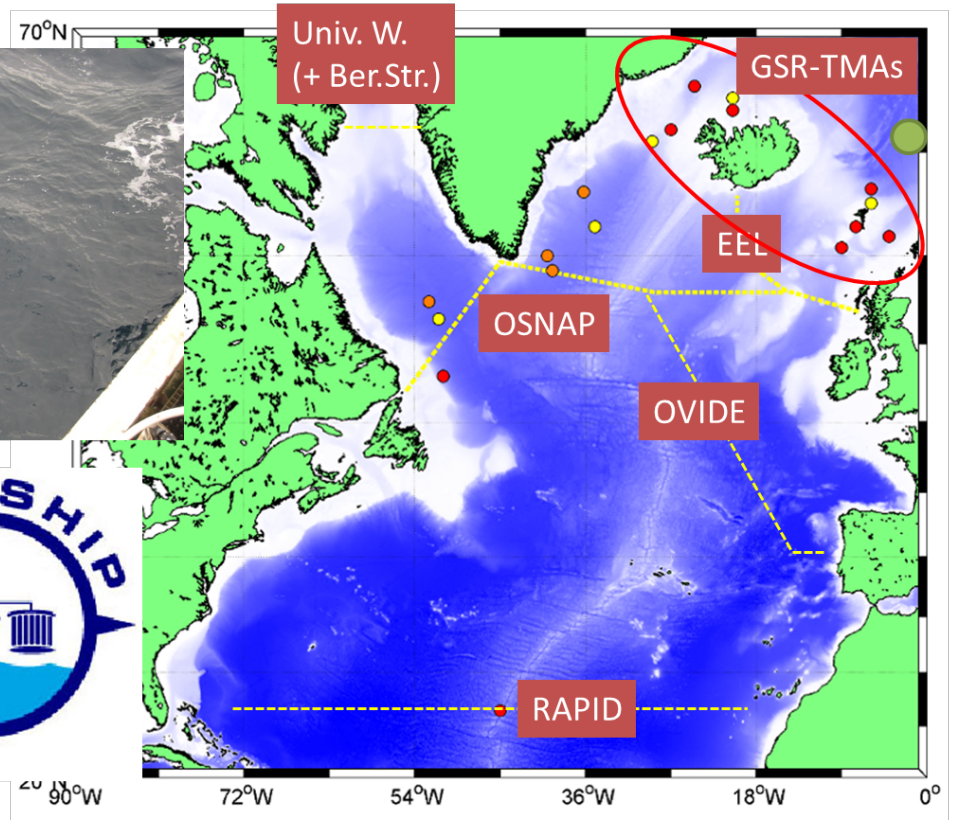
- Reducing and evaluating the uncertainty in prediction systems
  - Improve simulations of poleward flow (model development)
  - Observations and newest reanalyses products to be compared with climate models

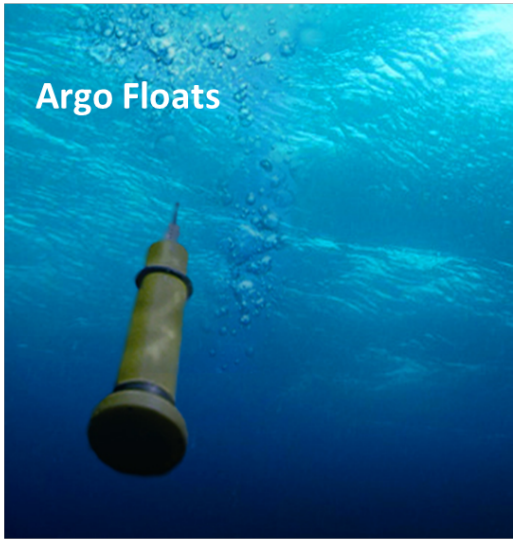
WP2 Observations/Data

WP2 Observations/Data



New Earth Obs.





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WP3: Linkages of Arctic climate changes to lower latitudes

Yongqi Gao (NERSC) and Guillaume Gastineau (CNRS)

Objective:

To investigate the Arctic warming impacts and its modulation by the Atlantic Multi-decadal Oscillation (AMO) and Inter-decadal Pacific Oscillation (IPO) using specifically-designed **coordinated multi-model experiments.**

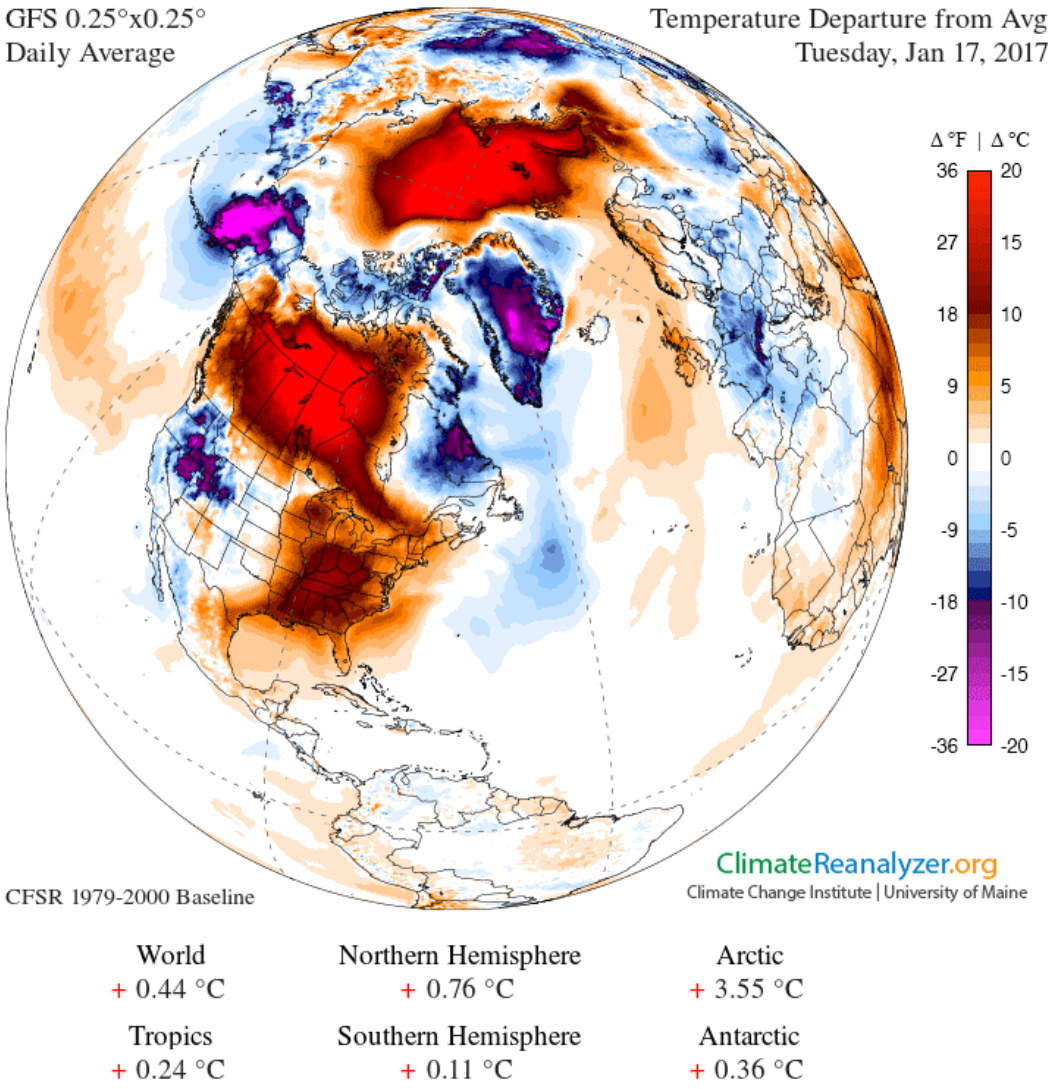
Approach:

Coordinated experiments seeking to disentangle:

- Arctic warming by atmospheric pathways (AGCM's)
- Oceanic influence on Arctic warming (Coupled Climate Models)

Experimental modelling and developments

- Improve representation of surface heat flux in Arctic (AGCM's)
  - Representing the effect of leads (sea-ice)
  - PBL depth, especially in shallow PBLs



Daily SAT Anomalies (Jan.17th,2017)

http://climatereanalyzer.org/

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WP4: Enhancing the capacity of seasonal-to-decadal predictions in the Arctic and over the Northern Hemisphere

Daniela Matei (MPI) and Noel Keenlyside (UiB)

Goals

- To identify the current limitations in predicting Arctic climate (and its link to NH climate) and
- to develop improved models and methodologies to enhance the skill of initialized climate predictions in the Arctic and over the NH.

An updated forecast ensemble will be performed with the improved systems and delivered to selected impact case studies.

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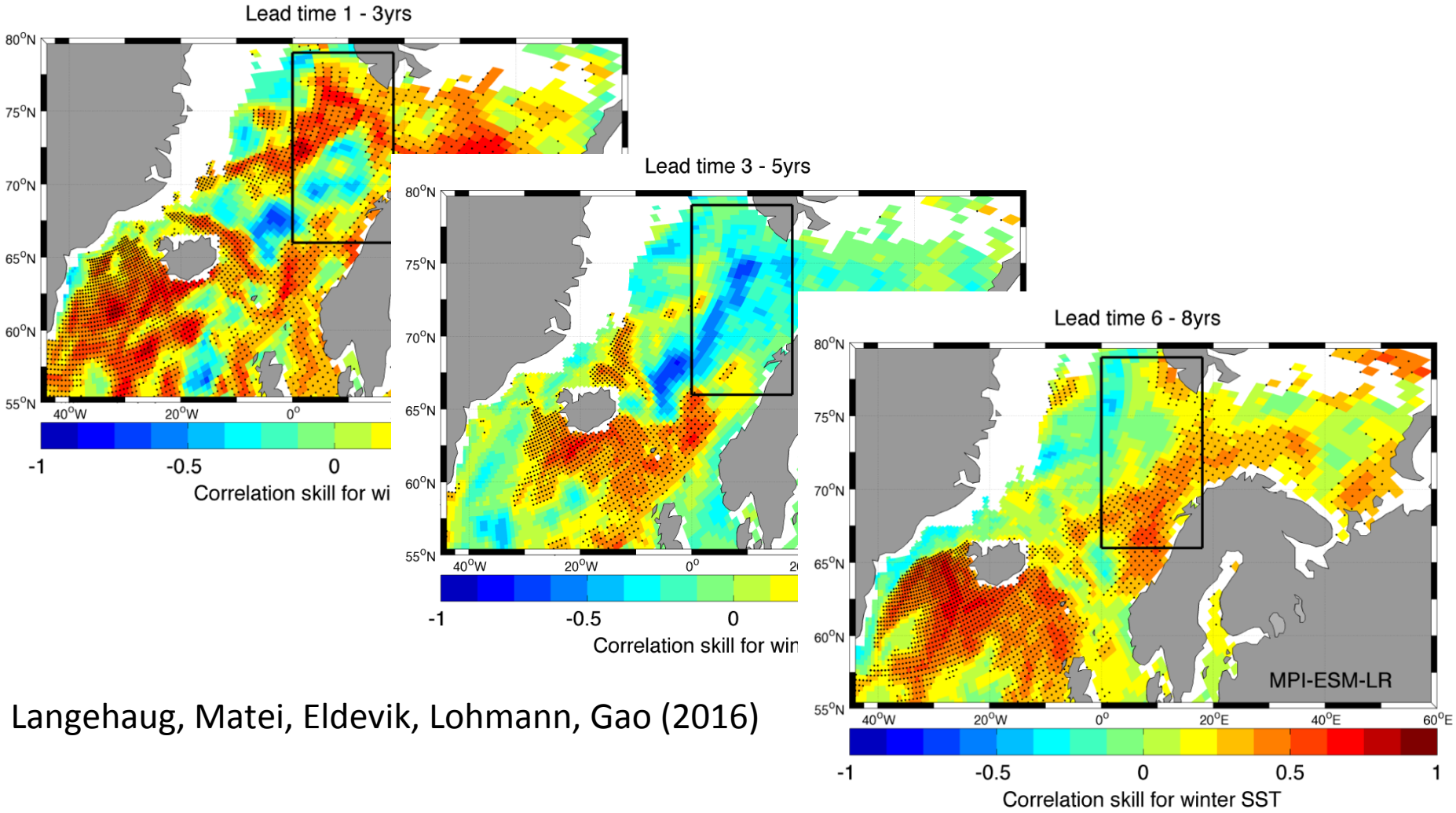
Tasks:

- **Mechanistic and statistical skill assessment of baseline subseasonal-to-decadal multi-model predictions**
  - A seamless approach in checking whether the identified Arctic-lower latitudes linkages are found in initialised predictions (focus on extremes)
- **Coordinated experiments to quantify the contribution of the Artic and high latitude North Atlantic in predictability of Northern Hemisphere extreme weather and climate**
  - Retrospective seasonal-to-multiyear hindcasts for selected case studies (pacemaker or data with-holding predictions)
- **Explore alternative ways of enhancing predictive skill through improved model configurations and innovative initialization techniques**

WP4: Any predictive skill for of winter SST in the Nordic Seas and Barents Sea?



Langehaug, Matei, Eldevik, Lohmann, Gao (2016)

Yes! – but the predictive skill and representation of mechanisms differ widely among models!

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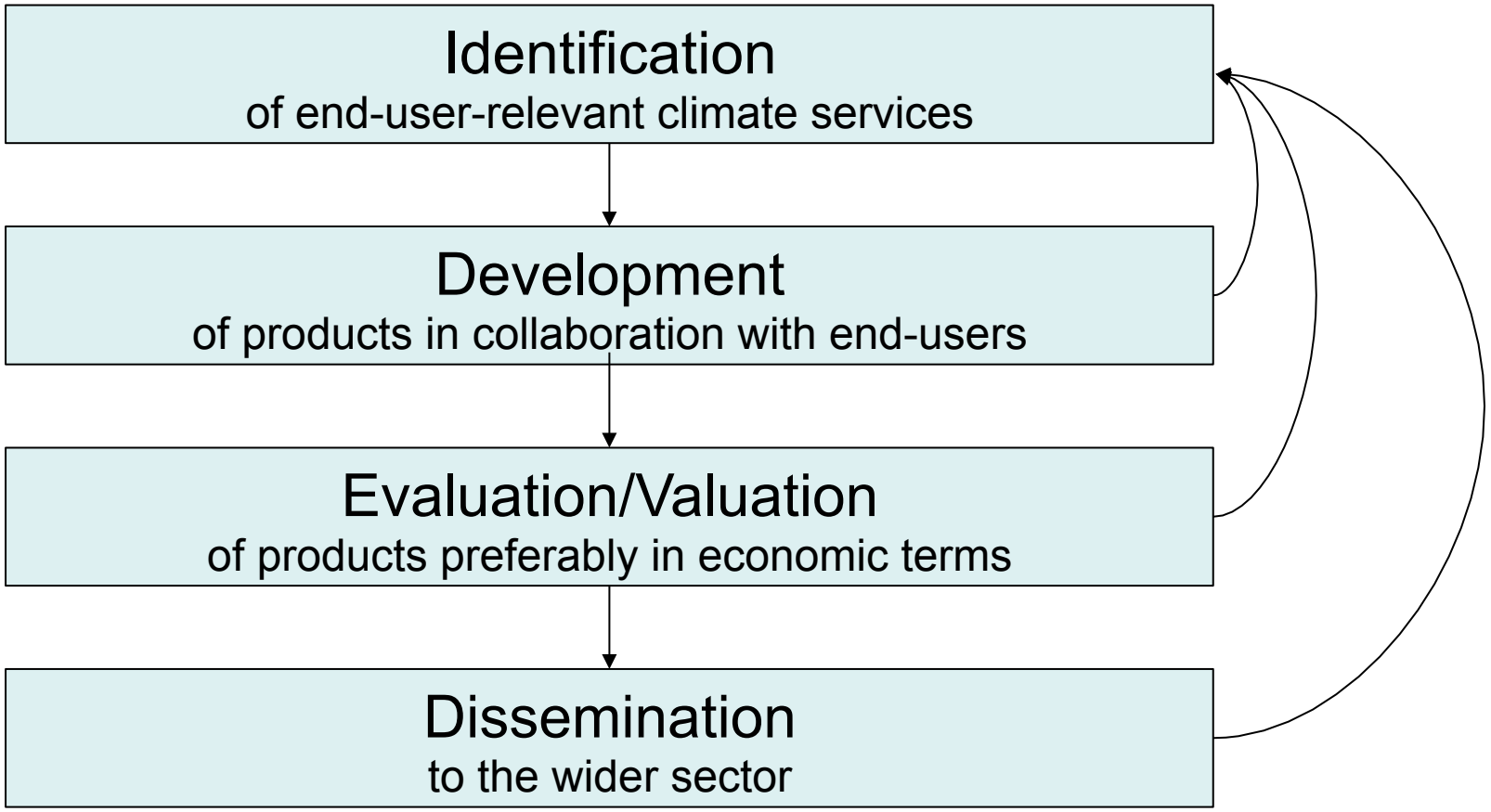
WP5: Developing and Valuing Climate Services

Mark R. Payne (DTU-Aqua) and Kathrin Kell (IASS)

Translate the skill of forecast models into products that are relevant to stakeholders

Demonstrate the value of these products to stakeholders and estimate their economic value

Five Case Studies Applying a Common(ish) Approach



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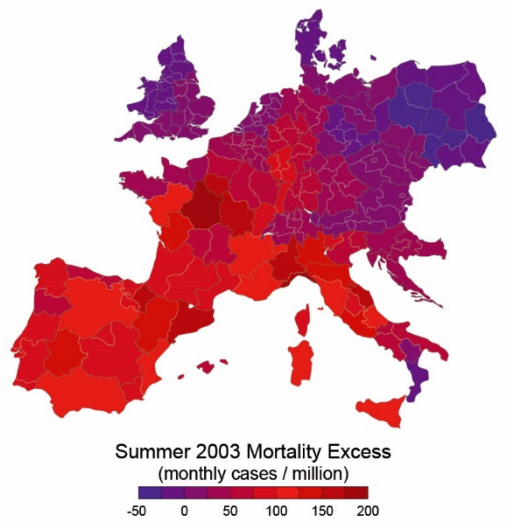
WP5: Temperature Related Mortality (TRM)

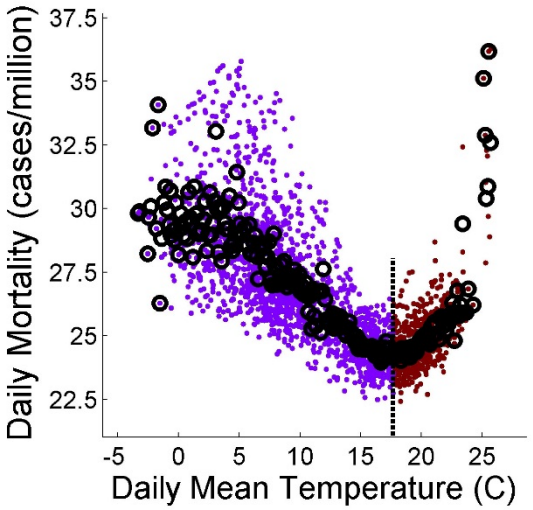
IC3R

ALMADA
CÂMARA MUNICIPAL

Develop forecast scheme for thermal stress and TRM for 160 administrative units across Europe



e.g. Excess Mortality due to 2003 Summer Heatwave



Both summer and winter temperatures are important

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WP5: Winter Tourism Industry in Lapland

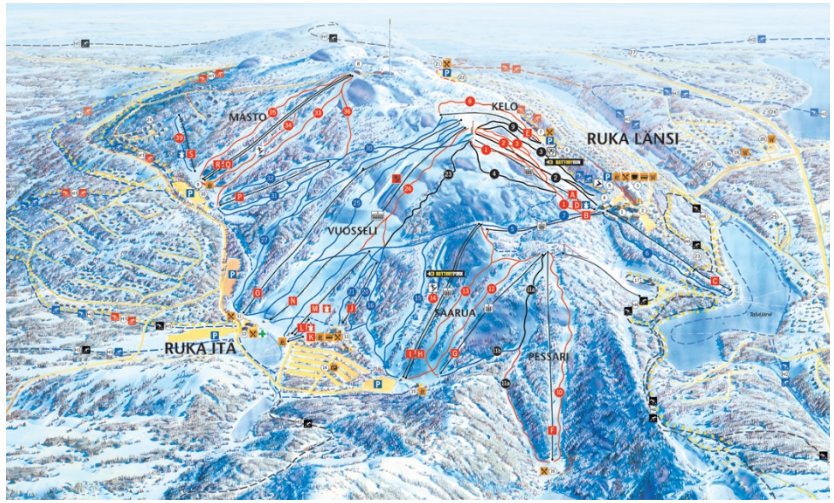
ARCTIC CENTRE
University of Lapland

SRSL

RUKA!
SKI.RUKA.FI

Seasonal forecasts of winter conditions to (i) allow for planning of activities and (ii) compare with Alps to establish competitiveness of Lapland

Planning of snow-making and storage requirements



Planning of alternative activities

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Potential areas of collaboration between BLUE-ACTION and APPLICATE

- Improving climate modelling and prediction in high-latitudes, and implications for Europe (or lower latitudes) (WP1, WP2, WP5)
- Coordinating the climate (and maybe predictions) experiments (WP3)
- Sharing experience regarding the interaction with end users (WP7)
- Knowledge transfer: training activities for students/early career scientists (WP7)

Thank you!

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www.Blue-Action.eu

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