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ALFRED-WEGENER-INSTITUT  
HELMHOLTZ-ZENTRUM FÜR POLAR-  
UND MEERESFORSCHUNG

# APPLICATE

**A**dvanced **P**rediction in **P**olar regions and beyond:  
Modelling, observing system design, and **L**inkages  
associated with a **C**hanging **A**rctic clima**TE**

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# 16 partners from 9 countries



uniResearch



**Barcelona Supercomputing Center**  
Centro Nacional de Supercomputación

...and many international collaborators



# Budget and duration

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- Budget: € 8 Mio + separate Russian contribution
- 1<sup>st</sup> November 2016 to 31<sup>st</sup> October 2020 (4-years)

# Mission statement

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Develop enhanced predictive capacity for weather and climate in the Arctic and beyond, and determine the influence of Arctic climate change on Northern Hemisphere mid-latitudes, for the benefit of policy makers, businesses and society.

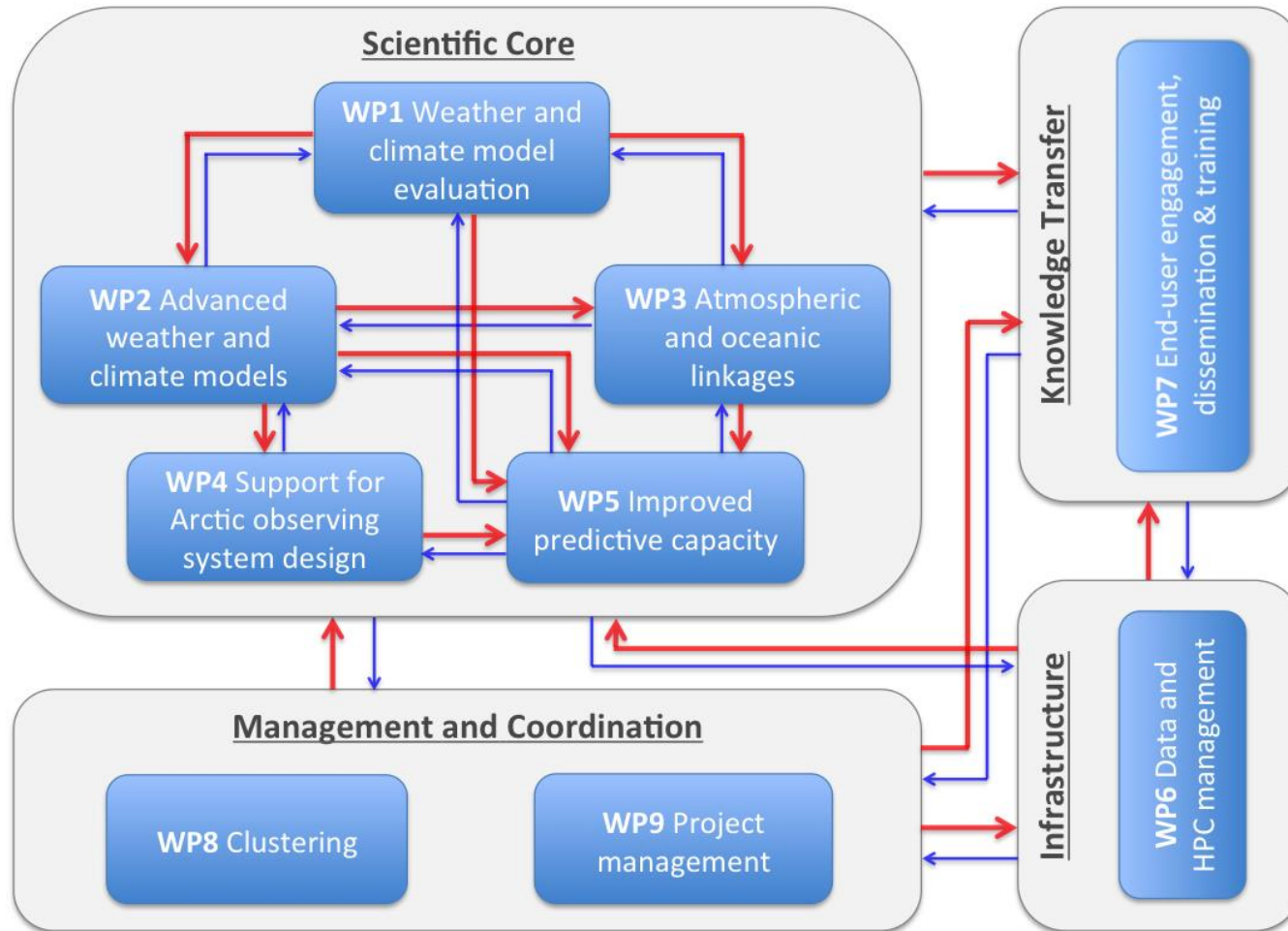
# Objectives

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- Observationally constrain models using advanced metrics and diagnostics
- Develop enhanced weather and climate models
- Determine the impact of Arctic climate change on midlatitudes through atmospheric and oceanic linkages
- Contribute to the design of the future Arctic observing system
- Enhance the capacity to predict Northern Hemisphere weather and climate
- Develop APPLICATE in coordination with external partners
- Transfer the knowledge generated through APPLICATE to stakeholders including training of early career scientists

# WP structure



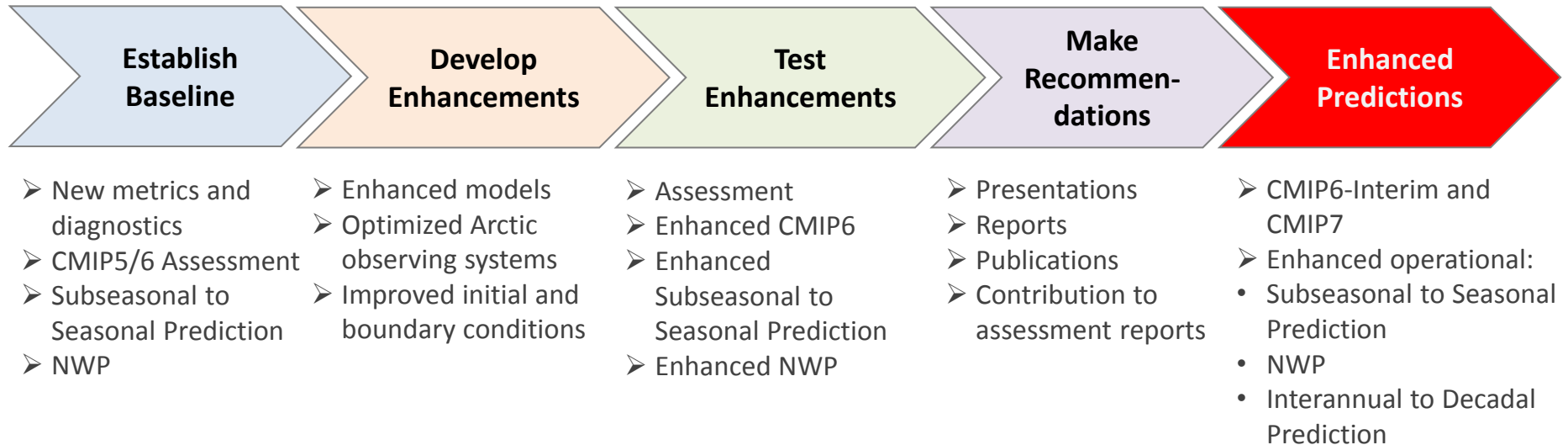
# General approach

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- Bring together the NWP and climate communities
- Involve experts on the Arctic and midlatitudes
- Engage operational centres for maximizing impact
- Effectively combine models and observations
- Exploit international cooperation (e.g. YOPP)

## APPLICATE's strategy for delivering enhanced predictions





## APPLICATE's strategy for enhancing our understanding of Arctic-midlatitude linkages

- Coordinated multi-model approach
- Employ coupled models
- Additional testing with atmosphere-only models
- Study linkages also from a short-term prediction perspective
- Repeat with enhanced models



# Participating models



## Climate models

Climate Models					
Model	AWI-CM	EC-Earth	CNRM-CM	NorESM	HadGEM
Partner	AWI	BSC, UCL, SU	CNRS-GAME, CERFACS	UiB, UR, Met.no	MO, UREAD
Atmosphere	ECHAM6 T127 L95	IFS T255/T511 L91	ARPEGE-Climat T127/T359 L91	CAM-OSLO 1°×1° L32 / L46	MetUM N216/N96 L85
Ocean	FESOM Unstruct. mesh 15-100 km L41 4.5-80 km L41	NEMO 1° , 0.25° L75	NEMO 1° , 0.25° L75	NorESM-O (extended MICOM) 1° , 0.25° L75	NEMO 1°×1° L75 0.25°×0.25° L75
Sea ice	FESIM	LIM3	GELATO	CICE	CICE
Surface	JSBACH	HTESSEL	SURFEX	SURFEX	JULES
CMIP6	Yes	Yes	Yes	Yes	Yes

+ Russian model

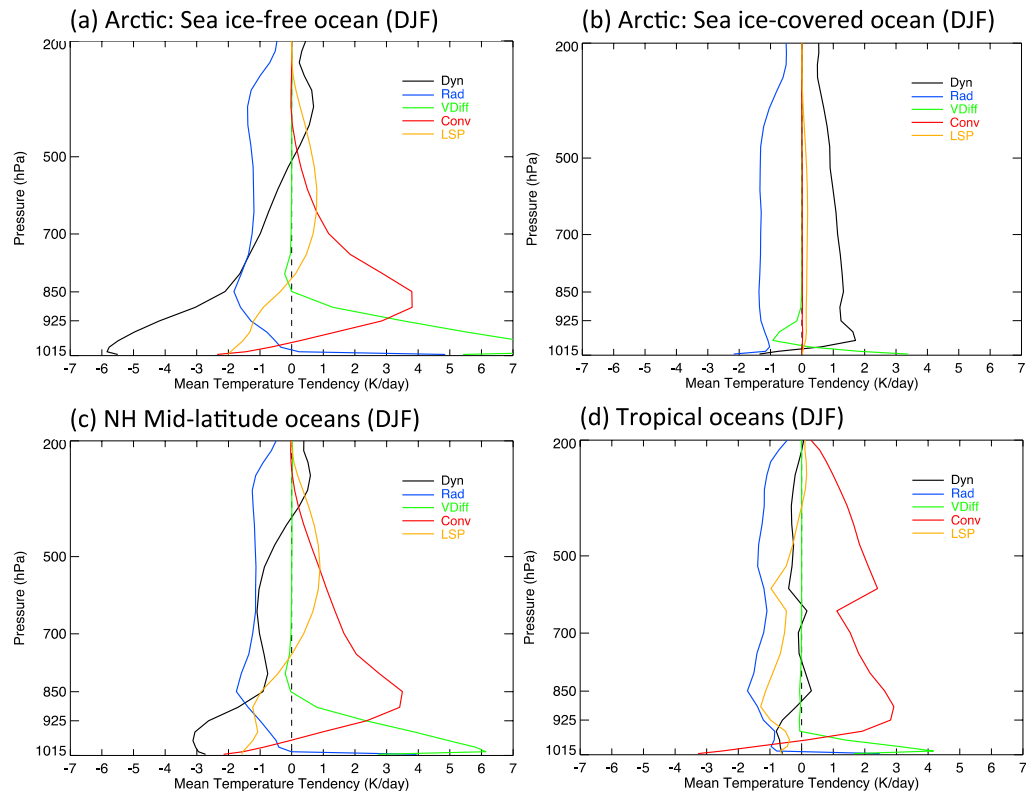
## S2S models

Subseasonal to Seasonal Prediction Systems				
Model	EC-Earth	CNRM-CM	IFS	HadGEM/GloSea
<b>Partner</b>	BSC, UCL, AWI	CNRS-GAME	ECMWF	MO, UREAD
<b>Atmosphere</b>	IFS T255/T511 L91	ARPEGE Climat T255/T359 L91	IFS T511-T319 L91	MetUM N216 L85
<b>Ocean</b>	NEMO 1°/0.25° L75	NEMO 1°/0.25°, L75	NEMO 1°, L75	NEMO 0.25°×0.25° L75
<b>Sea ice</b>	LIM3	GELATO	LIM2/3	CICE
<b>Land</b>	HTESSSEL	SURFEX	HTESSSEL	JULES
<b>Data assimilation</b>	Ensemble Kalman filter	Extended Kalman Filter SAM2	4D-Var	4D-Var, NEMOVAR 3D-Var FGAT

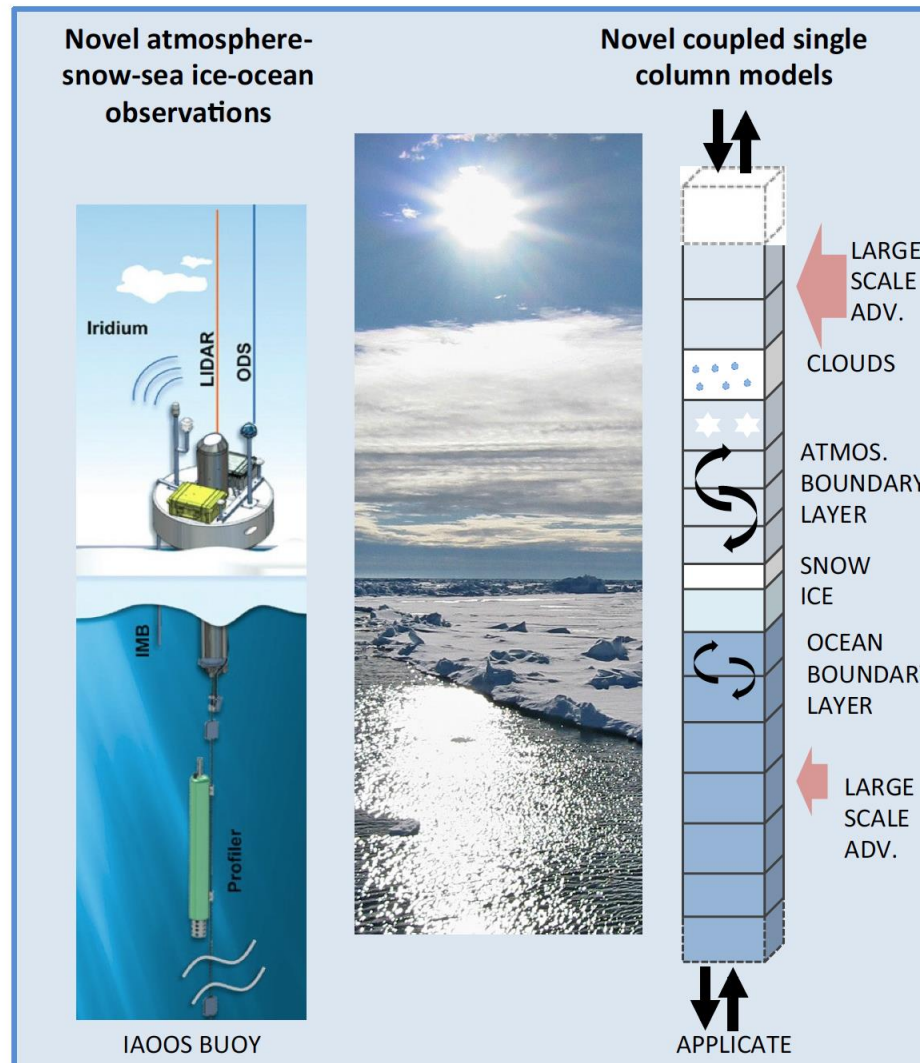
## NWP models

Numerical Weather Prediction Systems				
Model	ARPEGE	AROME	IFS	AROME-Arctic
Partner	CNRS-GAME	CNRS-GAME	ECMWF	Met.no
Atmosphere	ARPEGE T1198, stretched HR (7.5km on grid pole), L105	AROME 1.3km / 500m, 90 vertical levels	IFS T1279 L137	AROME 2.5 km L65
Ocean	N/A	N/A	N/A	N/A
Sea ice	GELATO	GELATO	N/A	SICE
Land	SURFEX	SURFEX	HTESSSEL	SURFEX
Data assimilation	4D-Var	dynamical adaptation	4D-Var	3D-Var

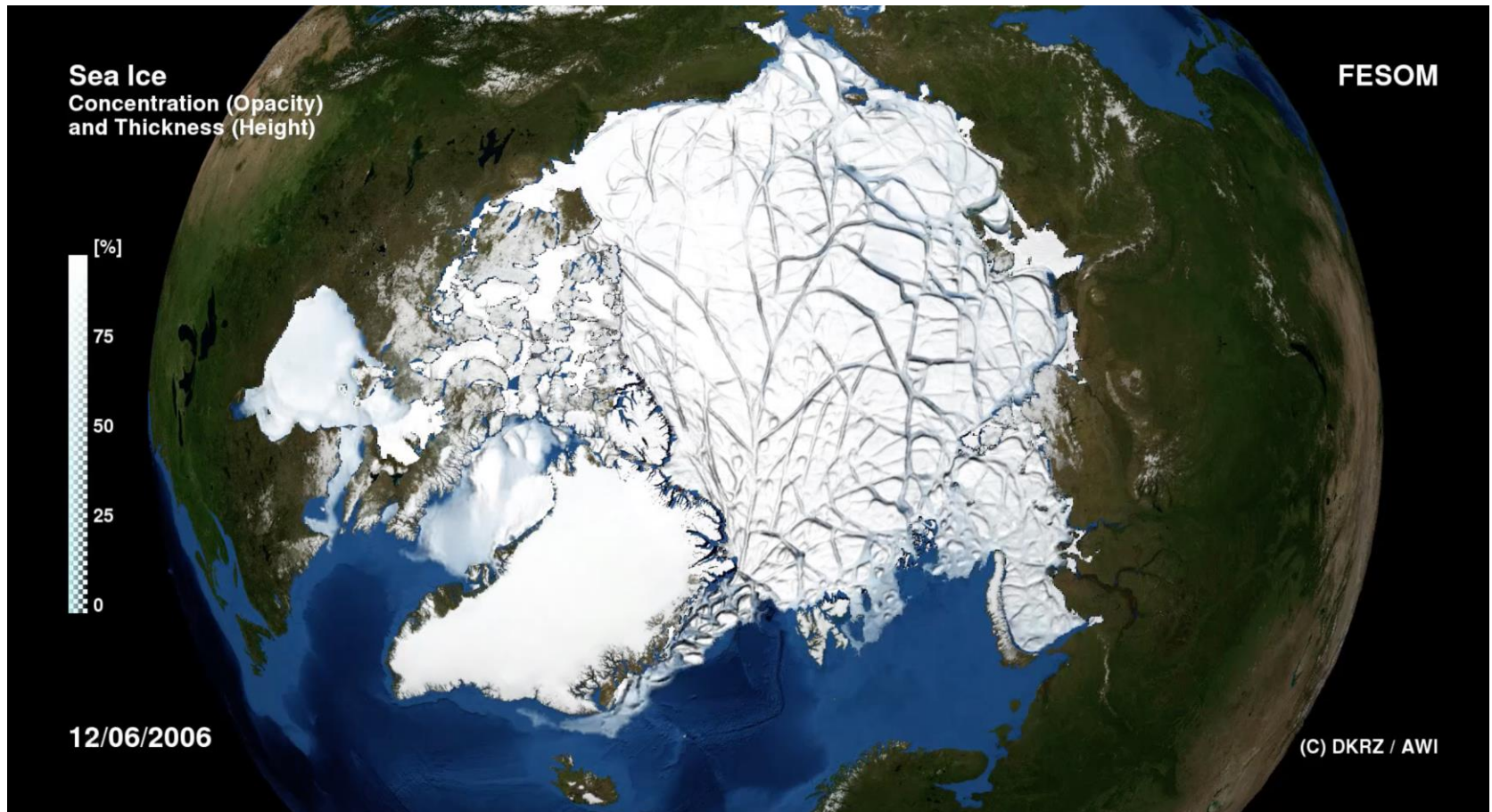
## YOPP high-resolution analyses, forecasts and physical processes database (“YOPP virtual field campaign“)



## Coupled Single Column Modelling

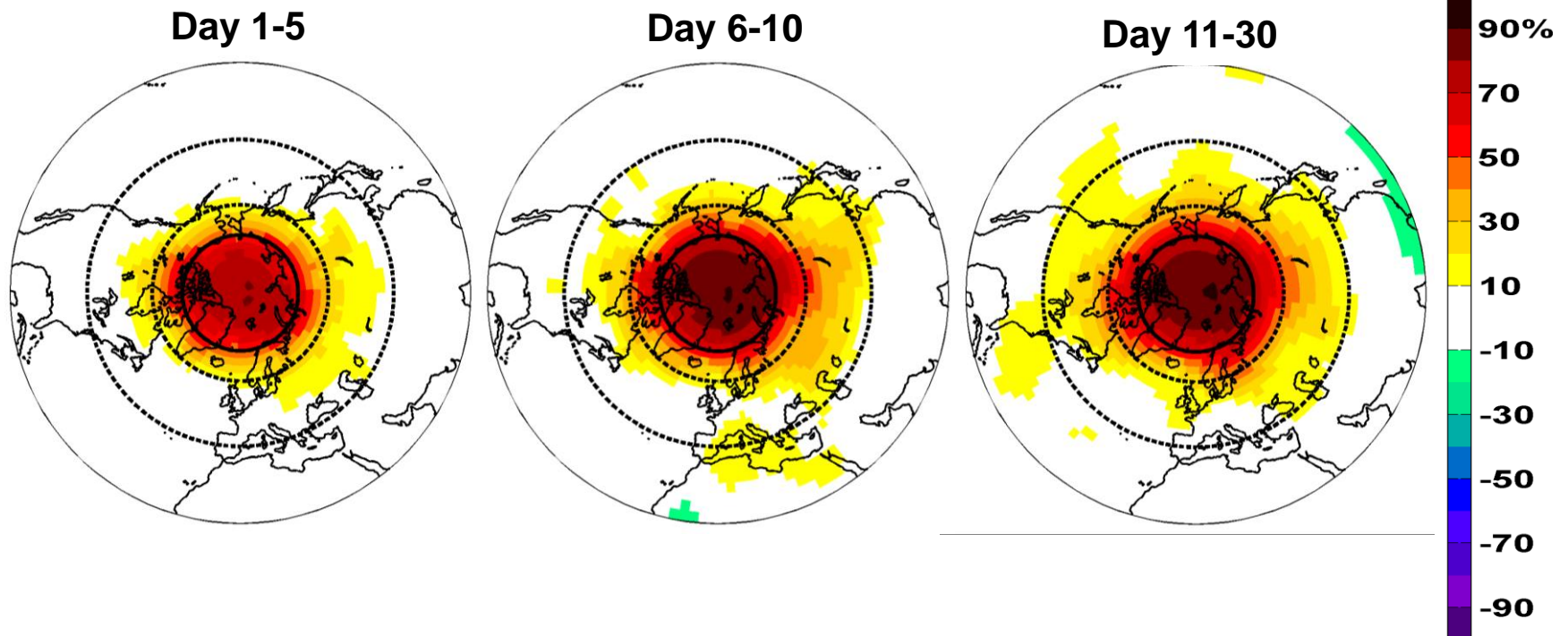


## High-resolution sea ice-ocean modelling



Wang et al. (2016), GRL

## Coordinated relaxation experiments with S2S systems

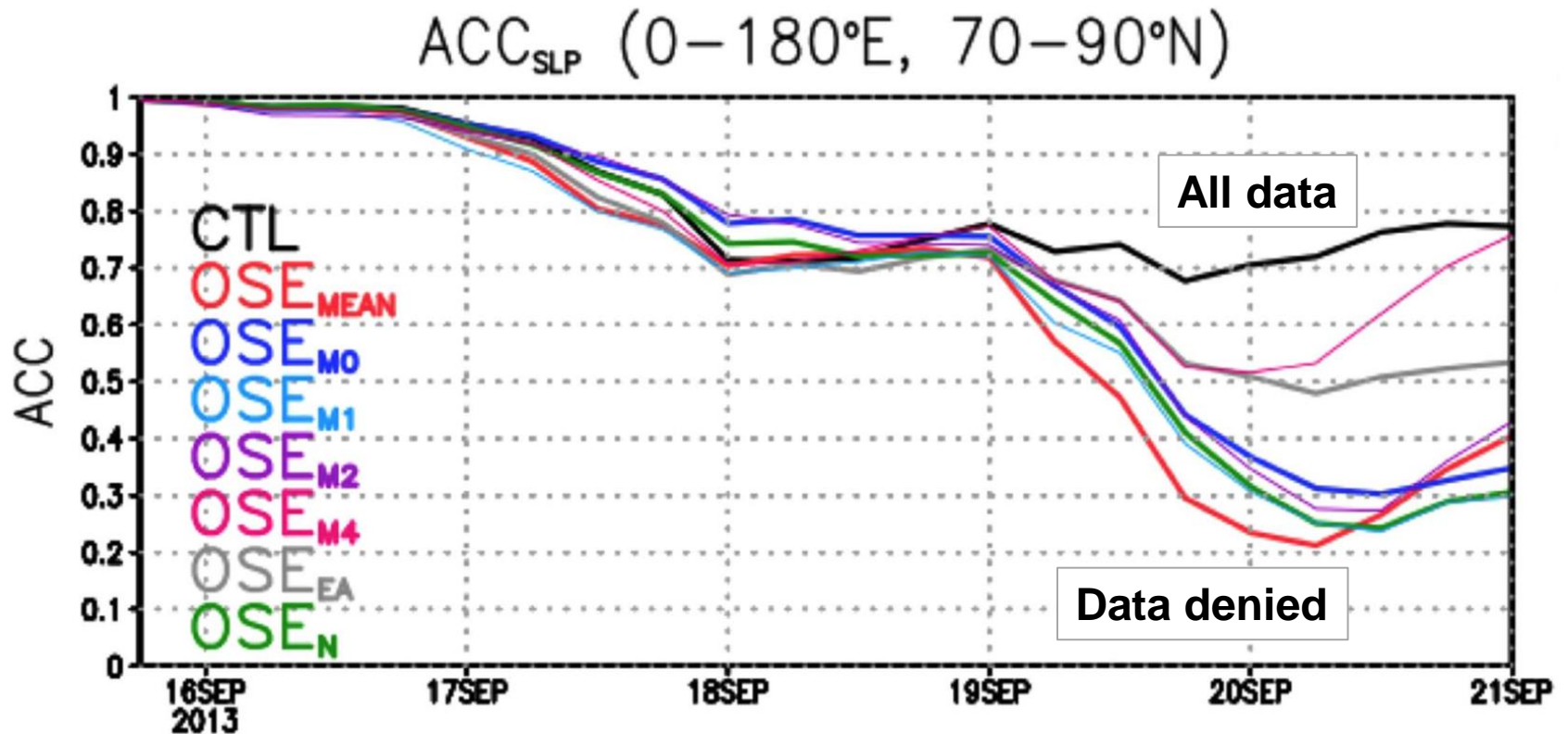


Jung et al. (2014), Geophys. Res. Lett.



# WP4—Selected activities

## Data denial experiments



Source: Jun Inoue

Focus on three key areas:

- User engagement
- Dissemination
- Training

Experienced partners taking the lead:

- Arctic Portal
- Barcelona Supercomputing Centre
- Association of Polar Early Career Scientists

# Summary—APPLICATE will...



- Advance predictive capacity in polar regions
- Develop models with enhanced representation of Arctic processes
- Contribute to developing the Arctic observing system (prediction & model development)
- Enhance our understanding of Arctic-midlatitude linkages (also from a prediction perspective)
- Bring different communities closer together
- Work with users and stakeholders
- Foster international collaboration
- Contribute significantly to YOPP

# User engagement

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- Work with a group of users and stakeholders
- Workshops, meetings at professional conferences and interviews
- Virtual consultations and surveys

- APPLICATE website
- Social media campaign
- Visual identity material
- Dissemination material
- Press releases
- Project reports
- Papers in the peer-reviewed literature