

Making advanced predictions in the Arctic and beyond: developments and results of the APPLICATE project

**Making advanced predictions in the Arctic and beyond:
Developments and results of the APPLICATE project**
The APPLICATE consortium
www.applycate.eu

What is APPLICATE?
APPLICATE will enhance the predictive capacity of weather and climate forecasts.

The APPLICATE app reach
Research on the edge
APPLICATE addresses pressing scientific questions of high societal relevance, by using and developing advanced modeling tools (coupled Earth System Models, high-resolution simulations, tailored weather and climate predictions).

Modeling & weather and climate prediction activities
Overarching goals:

- Advance understanding of predictability mechanisms by analyzing datasets for weather and climate prediction.
- Enhance Arctic weather and climate prediction in models by improving physics and feedback representations, and coupling methodologies.
- Develop and implement services to facilitate Arctic-specific model assessment.

Example

1000hPa, 500hPa, 200hPa
 [1000hPa ML] [500hPa 200hPa]
 [1000hPa ML] [500hPa 200hPa]

Understanding Arctic-midlatitude linkages in a warmer world
Overarching goals:

- Determine how changes in the Arctic impact mid-latitude weather events and extremes.
- Advance our understanding of remote and atmospheric linkages by coordinating multi-model experiments (Polar Application Model Intercomparison Project, PAMIP).

Example

What? Forecasted mean change in the annual mean wind speed in response to future Arctic sea ice loss during winter (DJF) for 15 different models from the APPLICATE partners and the wider international community involved in PAMIP. Units are m/s, and blue indicates areas strengthening westerly responses.

By what? Models participating in PAMIP show a robust weakening and equatorward shift of the winter surface westerly winds north to the

User engagement
APPLICATE actively promotes stakeholder engagement. Collaborating with participants from various stakeholder groups has been essential from the beginning of the project. APPLICATE has disseminated several case studies, e.g., an article related to Arctic climate change on fire in Alaska, or brochures in Swedish, on an energy production.

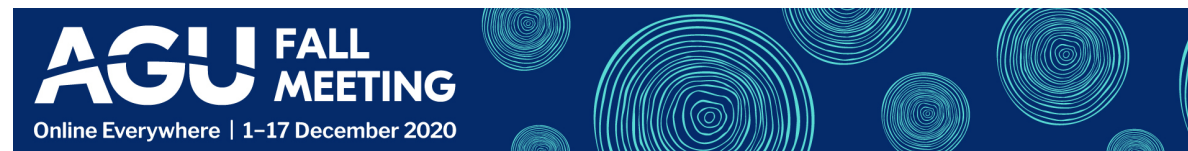
APPLICATE, it's also...
...a data repository featuring Time of Flight Prediction (TOF) datasets.

CHAT INFO ABSTRACT CONTACT AUTHOR PRINT GET POSTER

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PRESENTED AT:



WHAT IS APPLICATE?

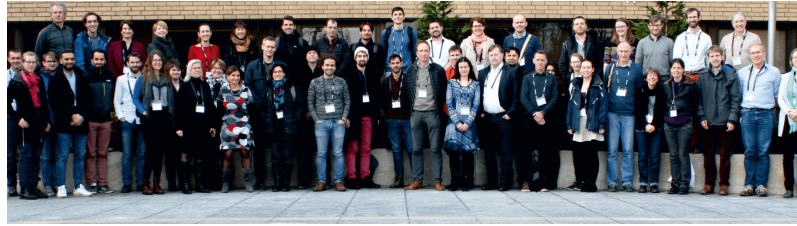
[VIDEO] https://www.youtube.com/embed/eSec_aUjkGg?rel=0&fs=1&modestbranding=1&rel=0&showinfo=0

APPLICATE (Advanced Prediction in Polar regions and beyond: modelling, observing system design and Linkages associated with a Changing Arctic climate), is an €8 million project financed by the EU **HORIZON 2020 Research and Innovation programme**. It involves 16 partners from nine countries (Belgium, France, Germany, Iceland, Norway, Russia, Spain, Sweden and the United Kingdom) is taking place over **November 2016-April 2021**.



The overarching goal of APPLICATE is to **develop enhanced predictive capacity** for weather and climate in the Arctic and beyond, and to determine the **influence of Arctic climate change on Northern Hemisphere** mid-latitudes, for the **benefit of policy makers, businesses and society** all alike.

THE APPLICATE APPROACH



Research on the edge

APPLICATE addresses pressing scientific questions of high societal relevance (<https://applicate.eu/about-the-project/key-questions#5-how-can-applicate-enhance-the-capacity-to-predict-northern-hemisphere-weather-and-climate>), by using and developing advanced modeling tools (coupled Earth System Models, high-resolution simulations, initialized weather and climate predictions).

International presence

APPLICATE members are frequently invited to international high-profile events (e.g., AAAS annual meeting, Arctic Frontiers) to share the most recent findings and experience on continuously evolving topics like Arctic-midlatitude linkages.

Open-access Policy

APPLICATE achieves gold standards for open science by making all its publications open-access, thereby adhering to European Union's recommendations (<https://ec.europa.eu/research/openscience/index.cfm?pg=openaccess>).

Open data sharing and access

APPLICATE's data strategy (<https://applicate.eu/data/data-strategy>) is aligned with European standards on free and open access to maximize the yield and re-use of data during and after the course of the project.

Education and training

APPLICATE organizes regular trainings, webinars, online courses, and summer schools (<https://applicate.eu/training/training-strategy>) to ensure knowledge flows and legacy for future generations of scientists and early-career scientists

Clustering

APPLICATE is part of the EU Polar Cluster (<https://www.polarcluster.eu/>) to foster exchanges, mutualize resources and align efforts with other existing forces.

Project structure, management, and governance

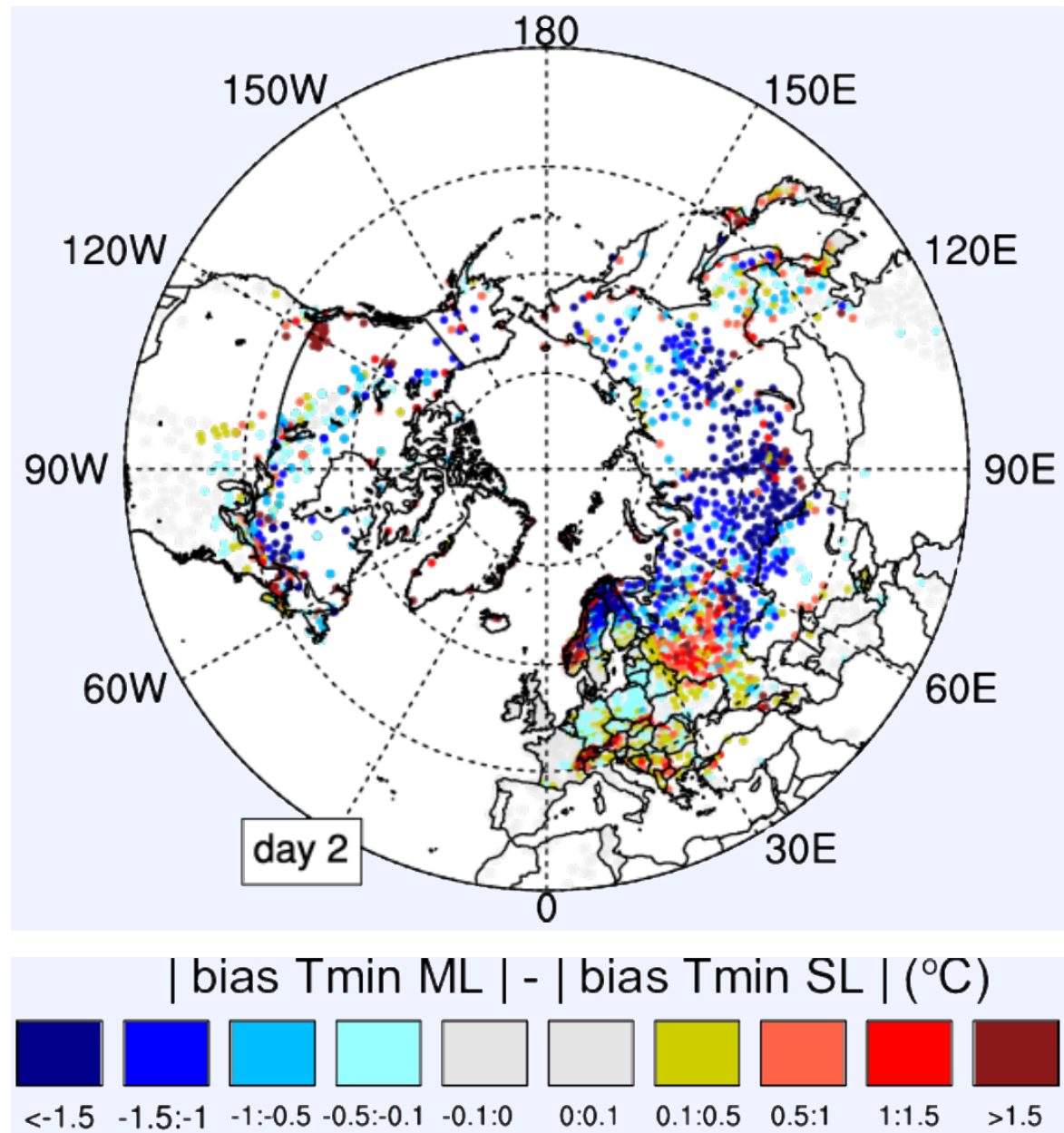
APPLICATE is organized in 9 topic-driven Work Packages (<https://applicate.eu/about-the-project/work-packages>) each managed by at least two people, ensuring gender and seniority balance as much as possible.

MODELLING & WEATHER AND CLIMATE PREDICTION ACTIVITIES

Overarching goals

- Advance understanding of predictability mechanisms by analyzing databases for weather and climate prediction
- Enhance Arctic weather and climate simulated in models by improving process and feedback representation, and coupling methodologies
- Develop and implement metrics to facilitate Arctic-specific model assessment

Example



What? Difference in near-surface air temperature **bias** between coupled re-forecasts **with and without the new multi-layer land snow scheme** of ECMWF IFS.

So What? The ECMWF IFS model **improves the representation of the snow processes** (melting, freezing and temperature change) and induces a **bias reduction for several near surface weather parameters** in coupled weather forecasts over snow covered regions, but also (not shown) an **improvement in the representation of the diurnal cycle of temperatures**

Want to know more?

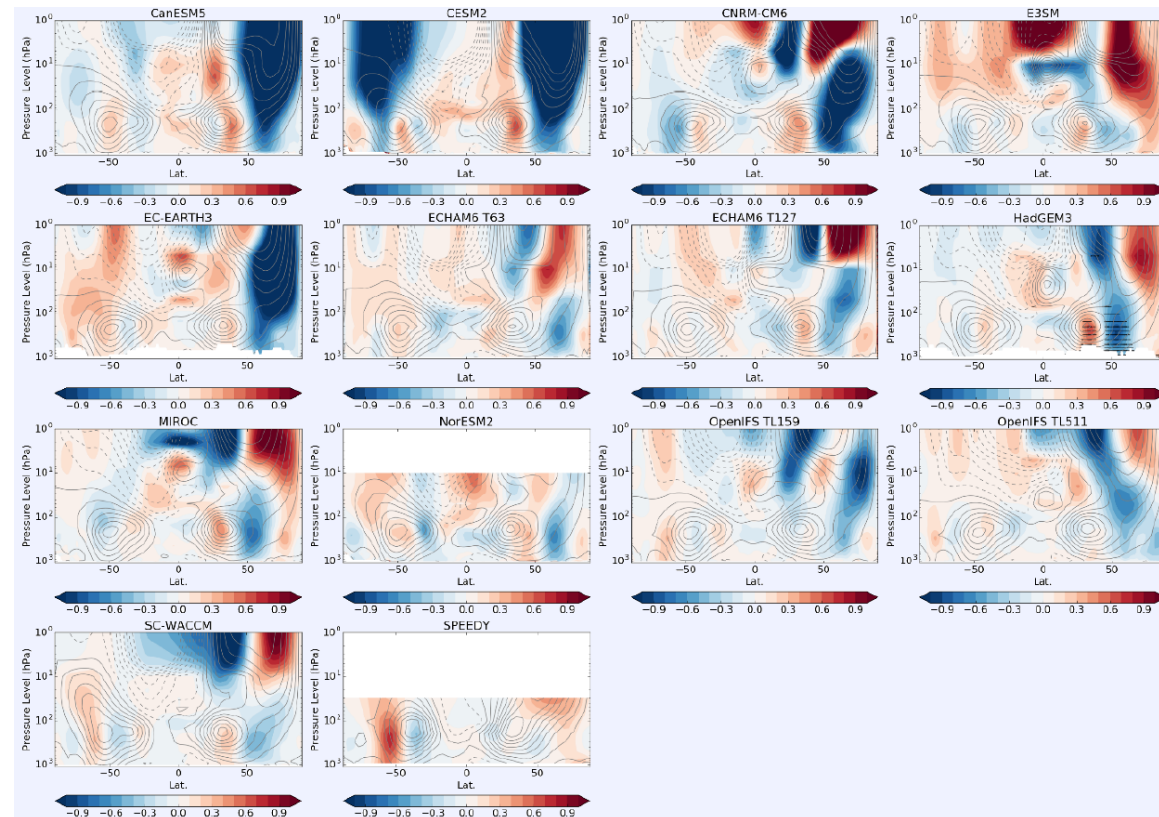
Arduini, G., Balsamo, G., Dutra, E., Day, J. J., Sandu, I., Boussetta, S., & Haiden, T. (2019). Impact of a Multi-Layer Snow Scheme on Near-Surface Weather Forecasts. *Journal of Advances in Modeling Earth Systems*, 11(12), 4687–4710.
<https://doi.org/10.1029/2019MS001725>

UNDERSTANDING ARCTIC-MIDLATITUDE LINKAGES IN A WARMER WORLD

Overarching goals

- Determine how changes in the Arctic system will impact weather events in mid-latitudes
- Advance our understanding of oceanic and atmospheric linkages by coordinating multi-model experiments (Polar Amplification Model Intercomparison Project, PAMIP)

Example



What? Ensemble-mean change in the zonal-mean zonal wind in response to future Arctic sea ice loss during winter (DJF) for 14 different models from the APPLICATE partners and the wider international community involved in PAMIP. Units are m/s; red and blue shades mean strengthening/weakening, respectively.

So what? Models participating in PAMIP show a **robust weakening and equatorward shift of the winter surface midlatitude westerly winds in response to reduced Arctic sea ice**, consistent with a negative North Atlantic Oscillation response.

USER ENGAGEMENT

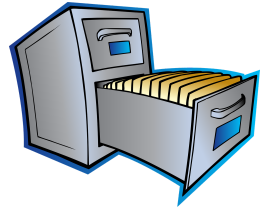
APPLICATE actively promotes stakeholder engagement. Collaboration with participants from various stakeholder groups has been maintained from the beginning of the project. APPLICATE has disseminated several **case studies**, e.g., on risks induced by Arctic climate change on **fires in Alaska**, on **infrastructure in Svalbard**, or on **energy production**.



(<https://applicat.eu/outreach/case-studies>)

APPLICATE, IT'S ALSO...

... a **data repository** featuring Year of Polar Prediction (YOPP) datasets...



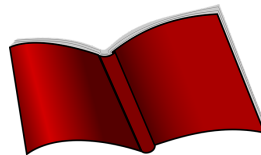
(<https://applycate.eu/data/data-portal>)

... a **blog** with frequent updates and outreach material...



(<https://blogs.helmholtz.de/polarpredictionmatters>)

... **49 publications** (as of 20 Nov 2020) from the peer-reviewed literature...



(<https://applycate.eu/publications>)

... active presence on **social media** ...



(http://twitter.com/applycate_eu)

(<http://facebook.com/ApplycateEU/>)



... a project funded by the EU Horizon 2020 programme.



(<https://ec.europa.eu/programmes/horizon2020/en>)

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ABSTRACT

The Arctic region is undergoing dramatic changes in its environment and climate, and these changes have the potential to influence and transform the weather and climate in lower latitudes. It is important to find out the breadth of these transformations, and to do so it is fundamental to research these processes and work on enhancing weather and climate predictions.

A European consortium of scientists has undertaken this mission and initiated the EU-funded H2020 project APPLICATE. The project started in 2016 with a budget of 8M€ with the objective of improving the representation of key processes in coupled atmosphere-sea ice-ocean models, delivering enhanced numerical weather forecasts, seasonal to interannual climate predictions and centennial climate projections. The project's focus concerns the linkages between the Arctic and mid-latitudes, which are explored through a coordinated multi-model approach using coupled atmosphere-ocean models. APPLICATE is contributing to the design of the future Arctic observing system to improve the capacity to reanalyse the climate system and enhance models' predicting skills, establishing collaborations with other programs (e.g., with projects within the EU-funded Polar Cluster). The project has also a strong user engagement component, which sees the dissemination of the scientific results as a priority and seeks to provide policy-makers and other stakeholders with the necessary knowledge and useful tools to make decisions regarding weather and climate strategies. APPLICATE is also invested in training and education endeavours that aim to widen and strengthen the community working on weather and climate research in the polar regions.

In this presentation, we will give an overview of APPLICATE activities and as part of our effort to understand changes in the Arctic and their far-reaching impacts for both environment and communities. It will be the occasion to look back at the past four years of work and research and summarize the achievements, success stories and impact the project, as well as the community behind it, accomplished.