APPLICATE

Advanced **P**rediction in **P**olar regions and beyond: Modelling, observing system design, and **LI**nkages associated with a **C**hanging Arctic Clim**ATE**

Start: 1 Nov 2016

End: 31 Oct 2020

Irina Sandu (ECMWF)

Thomas Jung (coordinator)
Alfred Wegener Institute (AWI), Germany

1st Annual Meeting:
15-17 Jan 18, Barcelona

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www.applicate.eu

16 partners from nine countries

APPLICATE
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Advanced prediction in Polar regions and beyond

ARCTIC PORTAL

VOEIKOV MAIN GEOPHYSICAL OBSERVATORY

INSTITUTE OF OCEANOLOGY OF RUSSIAN ACADEMY OF SCIENCES

Met Office

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uni Research

ECMWF

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Stockholm University

University of Reading

Norwegian Meteorological Institute

AWI

cnrs

UCL Université catholique de Louvain

CERFACS

METEO FRANCE

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

... and many collaborators!

Mission statement

APPLICATE
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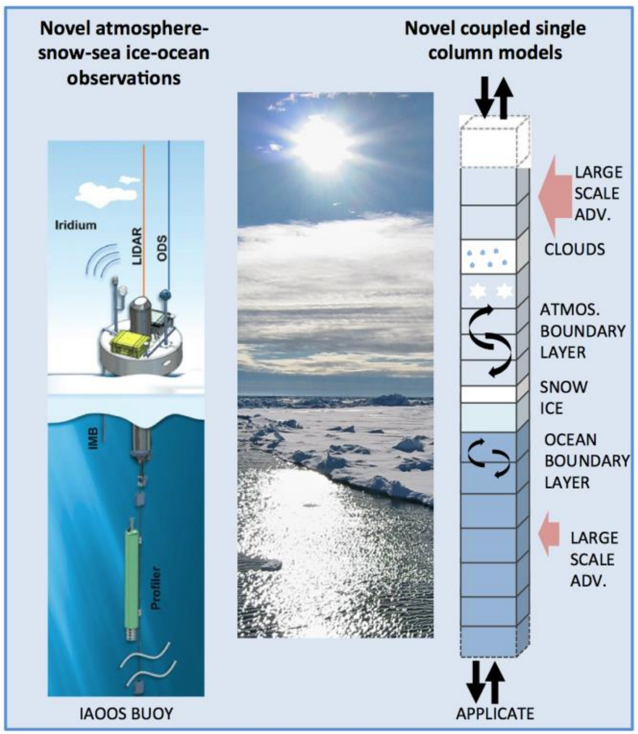
Advanced prediction in Polar regions and beyond

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.

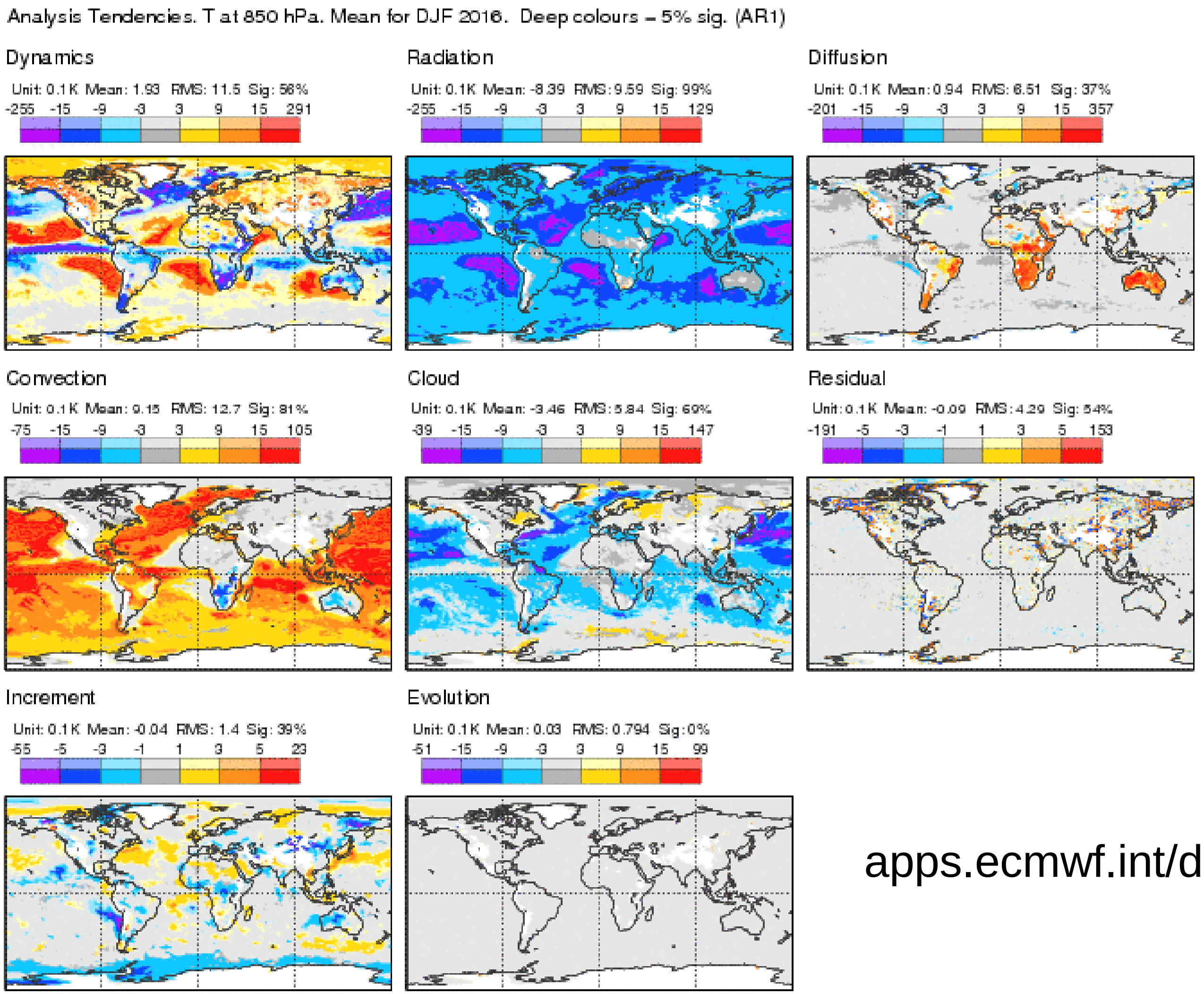
General approach

- Bringing together the NWP and climate communities
- Involving experts on the Arctic and midlatitudes
- Engaging operational centres for maximizing impact
- Effectively combining models and observations
- Exploiting existing international initiatives (e.g. WMO and US-CLIVAR WG)



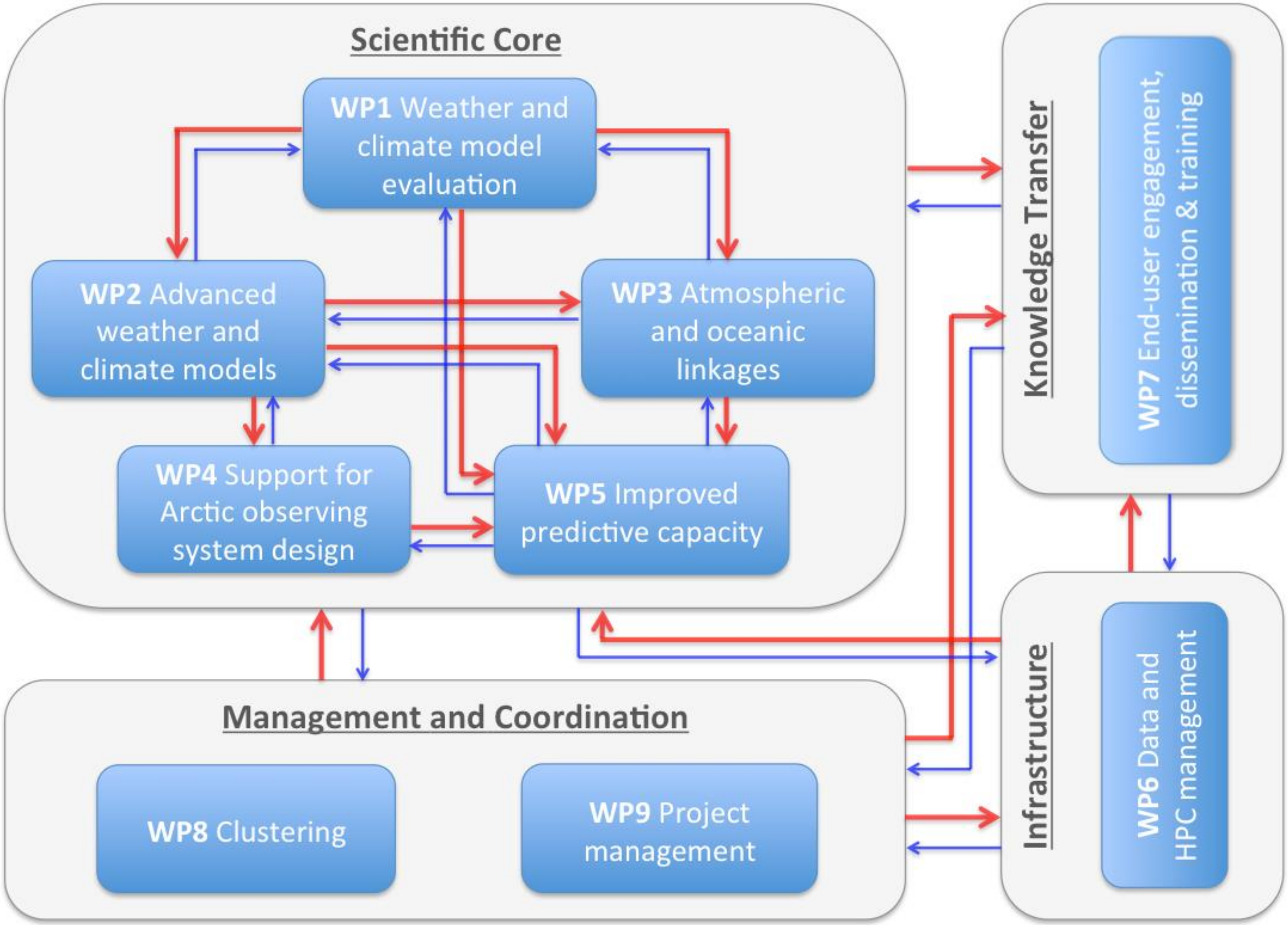
YOPP data set

ECMWF forecasts with additional output (tendencies) to help understanding model processes



apps.ecmwf.int/datasets/data/yopp

WP structure



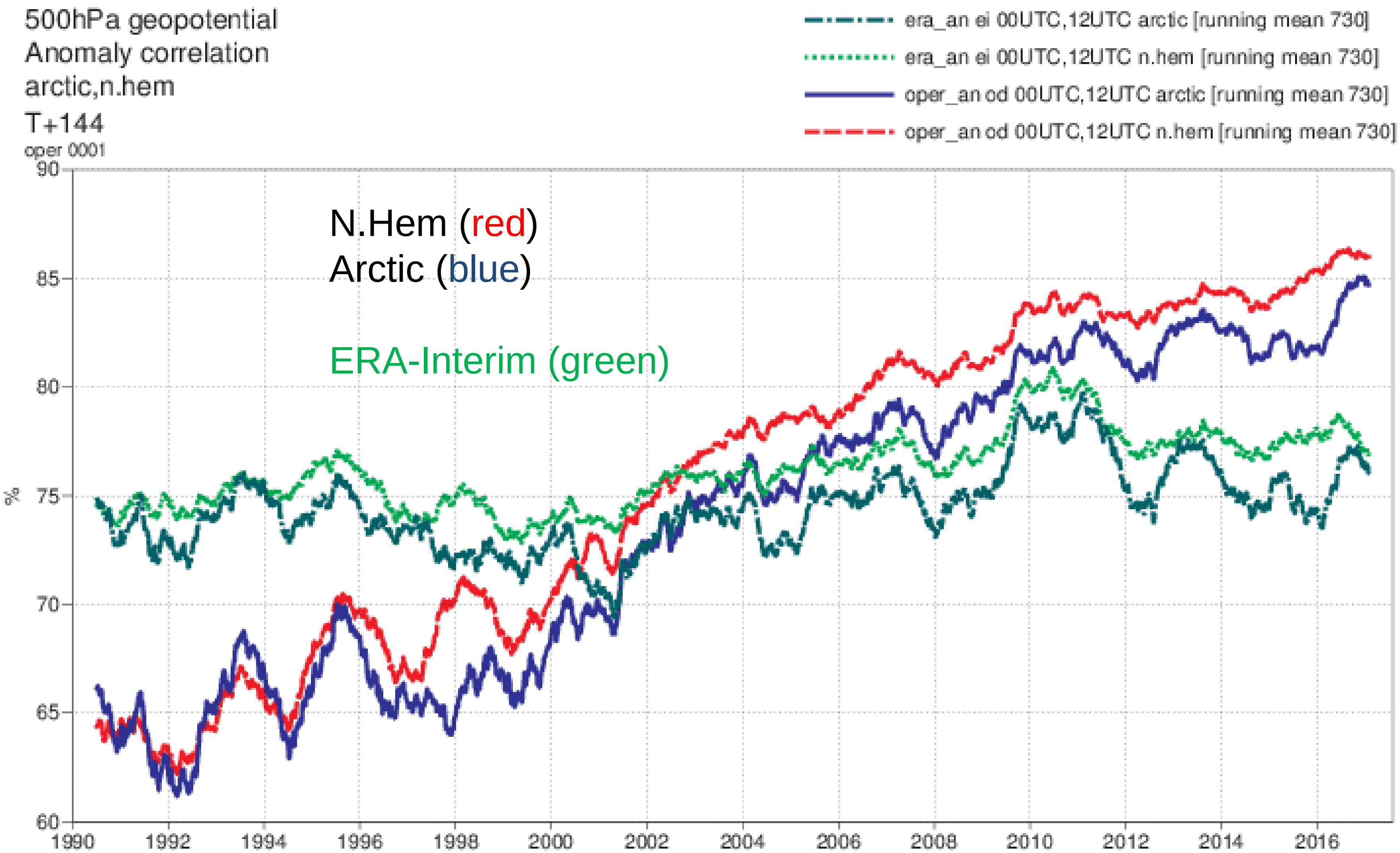
Some examples relevant to WGNE

Work done at ECMWF & University of Stockholm by:

Linus Magnusson, Peter Bauer, Cristina Lupu, Gianpaolo Balsamo
Gabriele Arduini,Thomas Haiden,Mark Rodwell, Mohamed Dahoui
Patrick Laloyaux, Kerstin Hartung, Gunilla Svensson

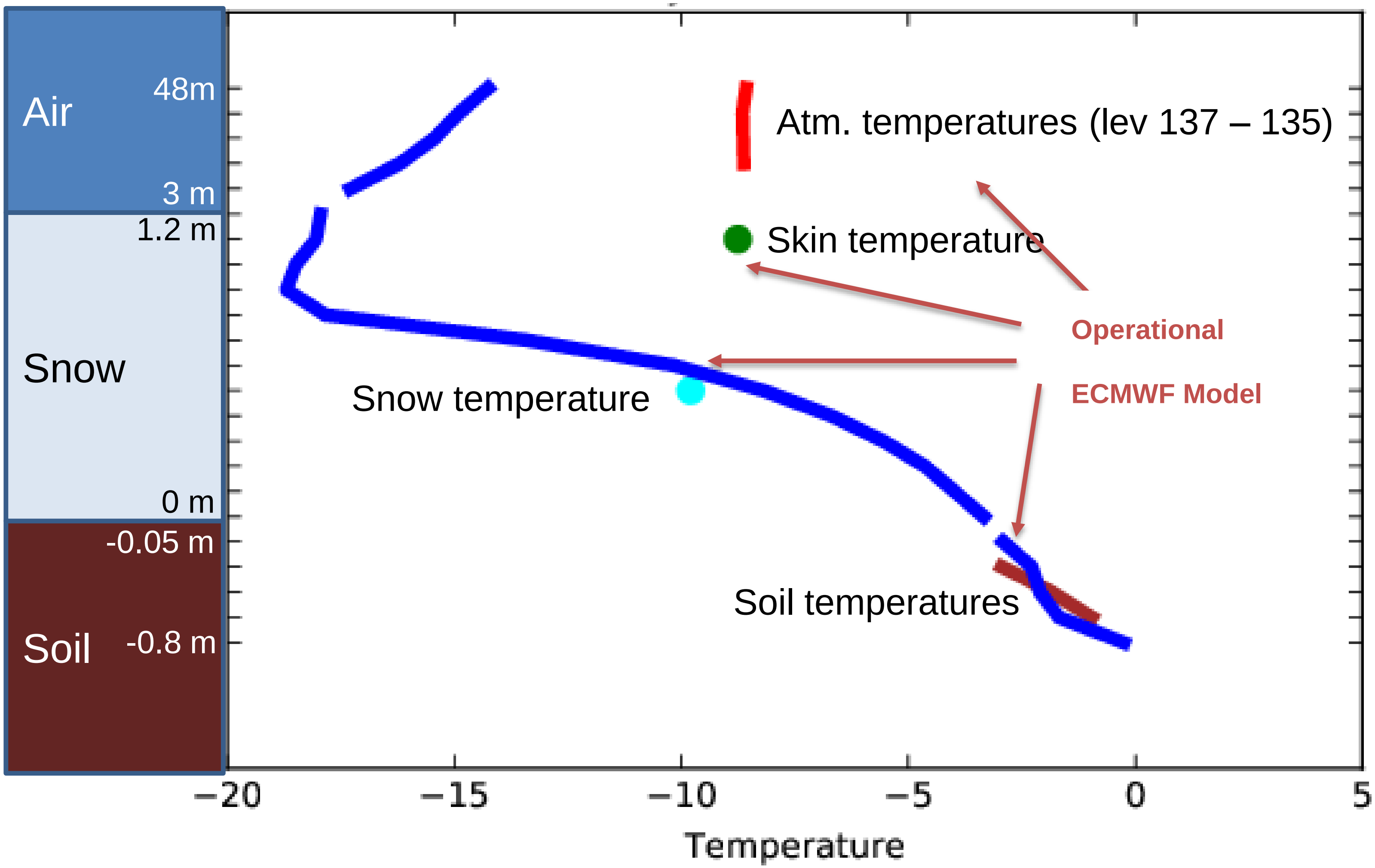
Other model developments focus on: snow, sea ice dynamics and thermodynamics and ocean processes that require high spatial resolution

Improvements 6-day ACC for Arctic and N.Hem



Using super-sites for understanding model processes

Mean temperature profile March 06z Sodankylä

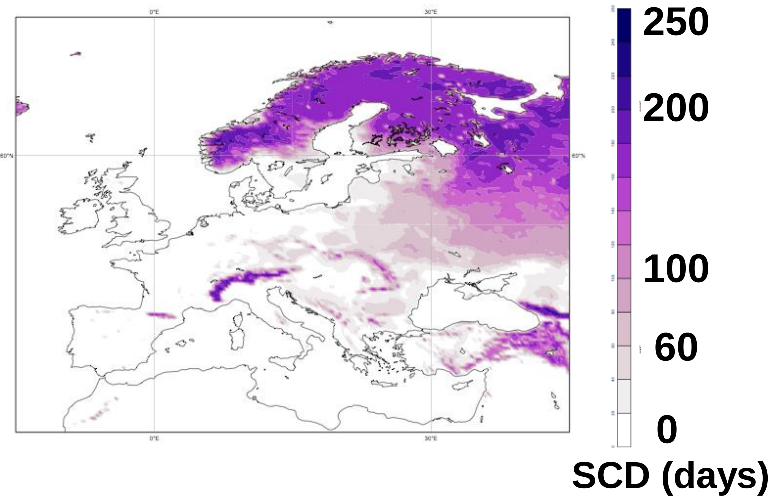


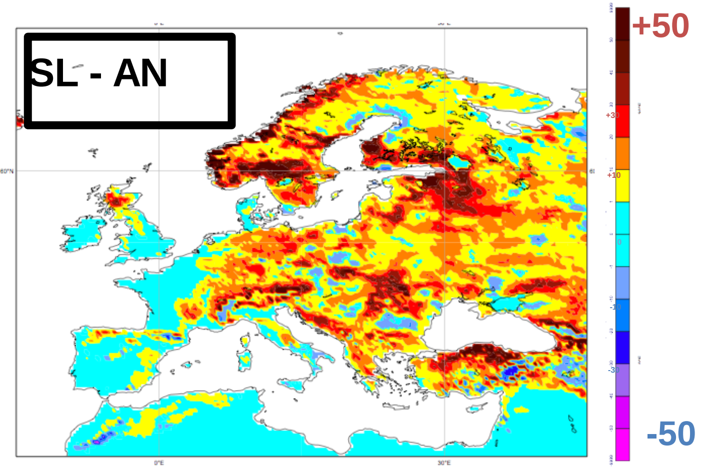
Thanks Linus Magnusson (ECMWF), and to the Finnish Meteorological Institute's Arctic Research Centre (FMI-ARC) for observations

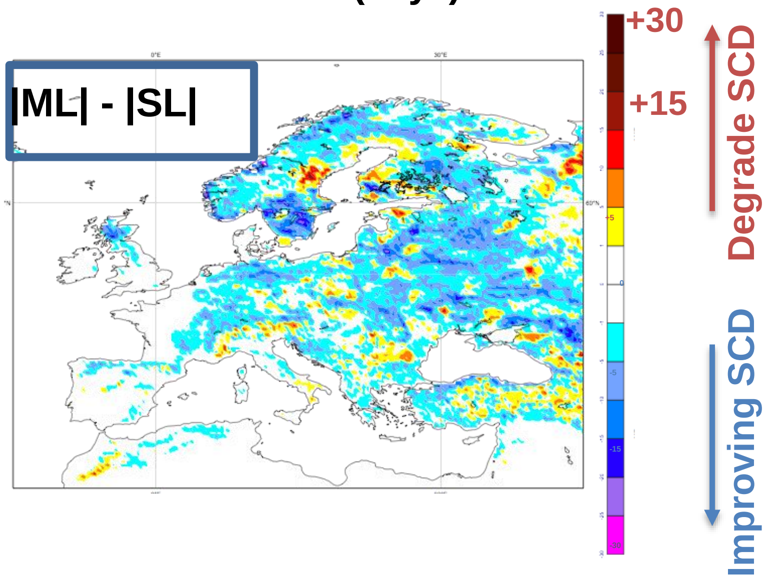
Snow cover duration (SCD) over Europe
Single layer versus multi-layer snow model

SCD = Number of days snow cover > 0.5; 201610 — 201704

Operational ECMWF analysis







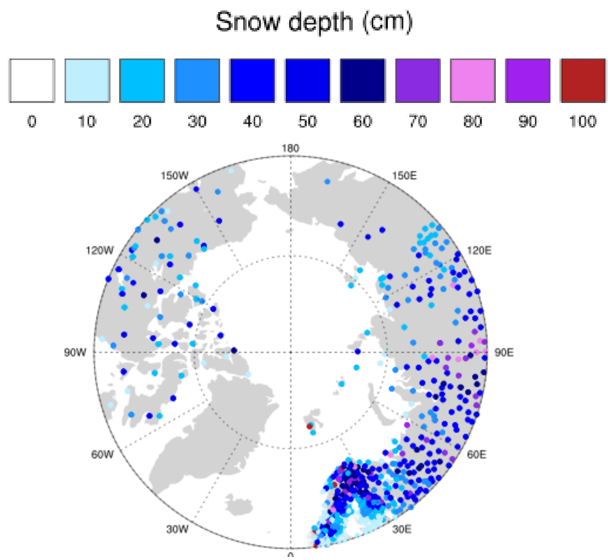
AN: Operational analysis

SL: Single-layer exp

ML: Multi-layer exp

Thanks Gabriele Arduini, ECMWF

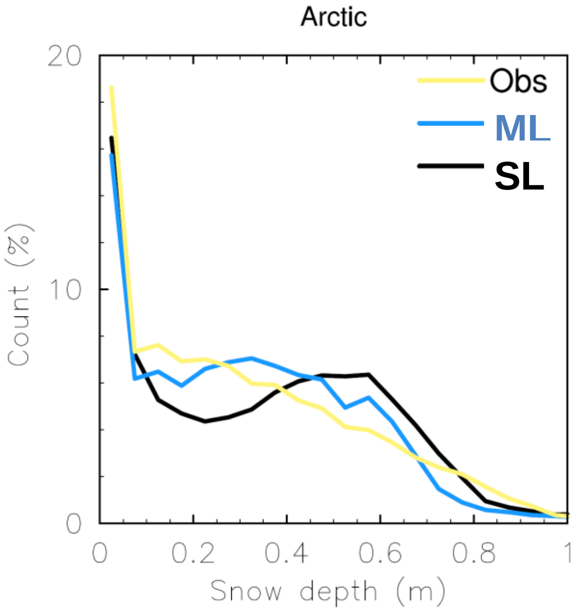
Snow depth (SD) evaluation with synop over Arctic



Snow depth synop observations

201612 — 201704

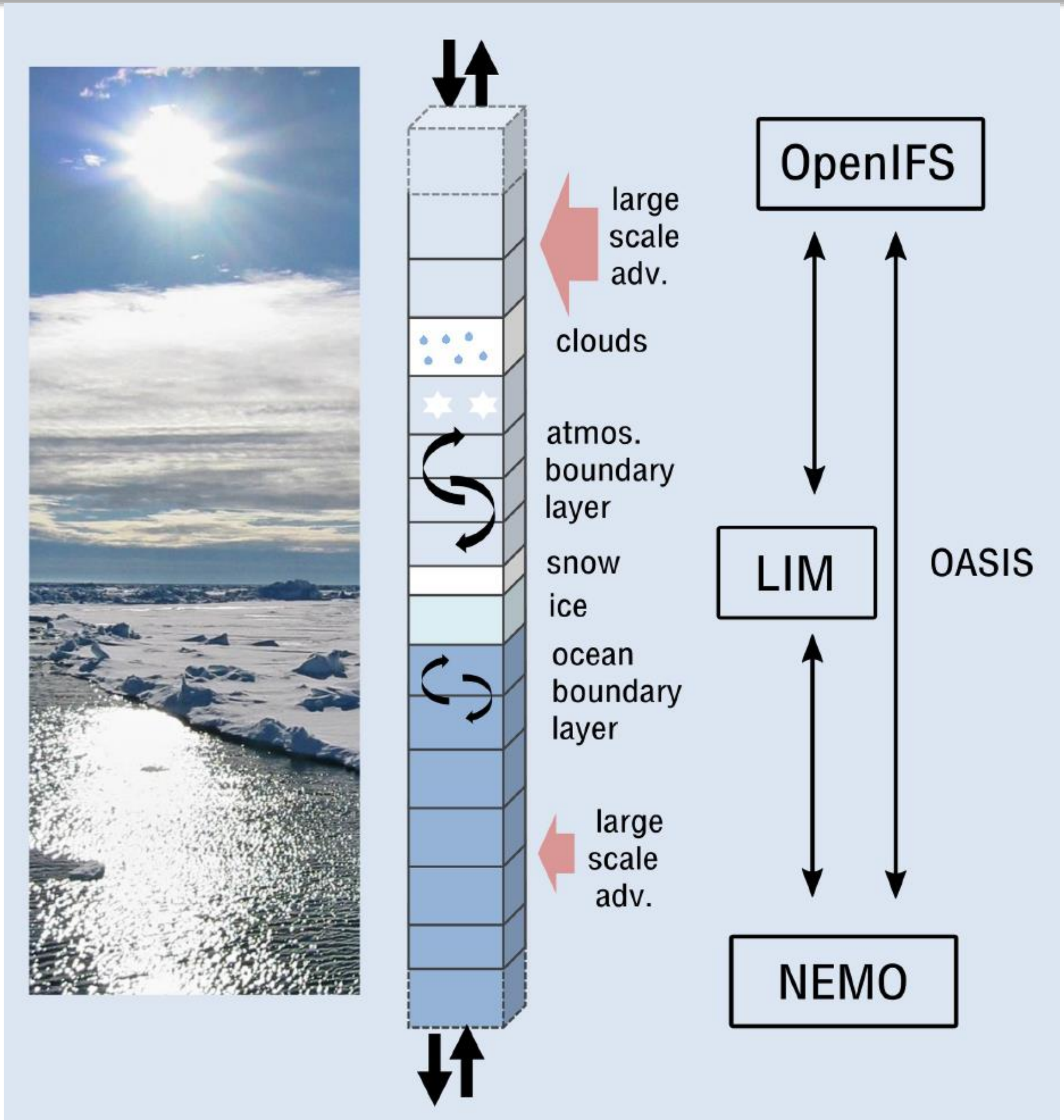
Snow depth (SD) histogram
for 201612 — 201704 for the Arctic



(cm)	SL	ML
MAE	15.2	13.6
RMSE	23.7	19.7

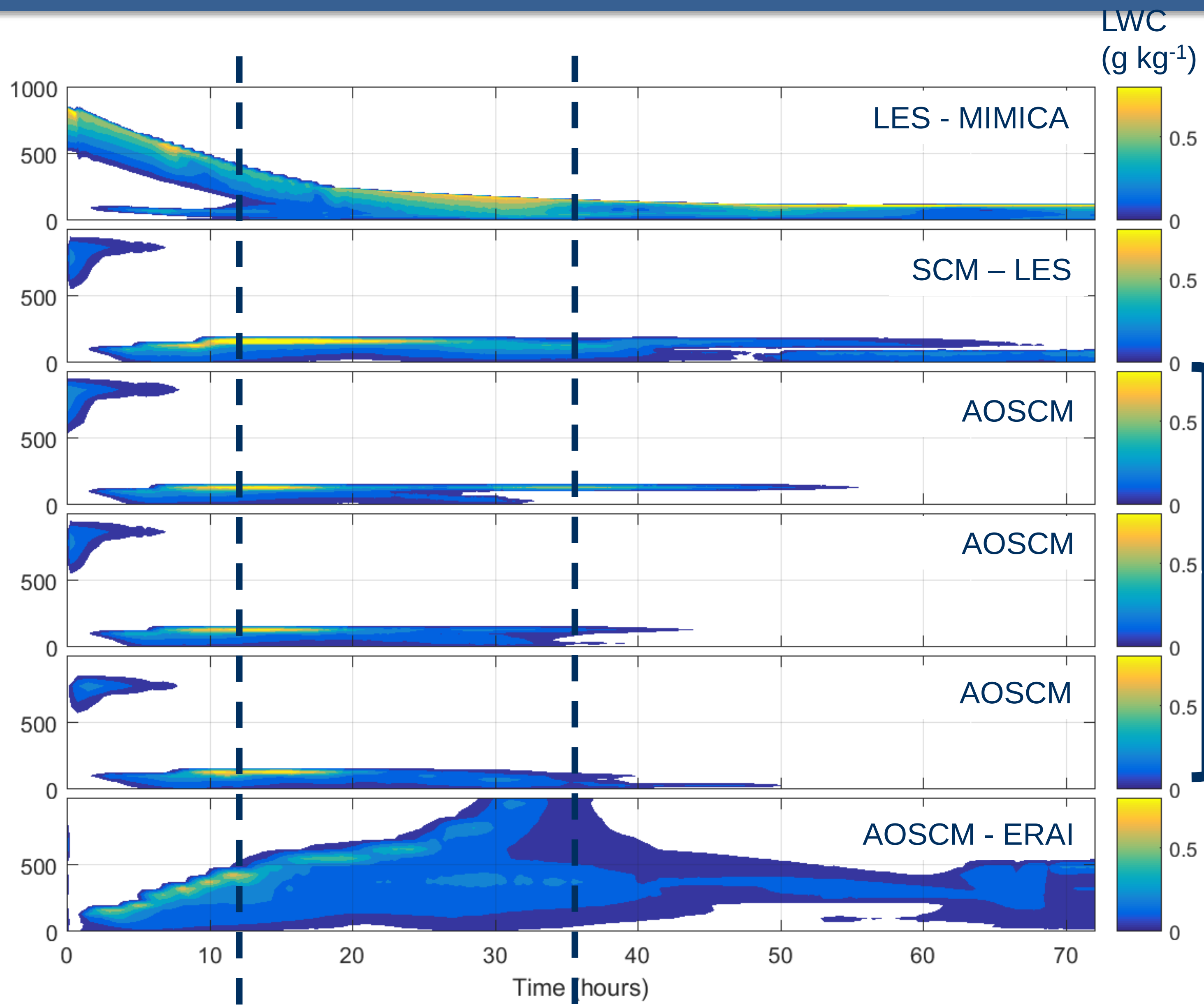
Thanks Gabriele Arduini, ECMWF

AOSCM – Atmosphere Ocean SCM



Thanks G. Svensson and K. Hartung, U. Stockholm

AOSCM - Simulation of ACSE case



LES case

SCM for LES case
Atmos. only

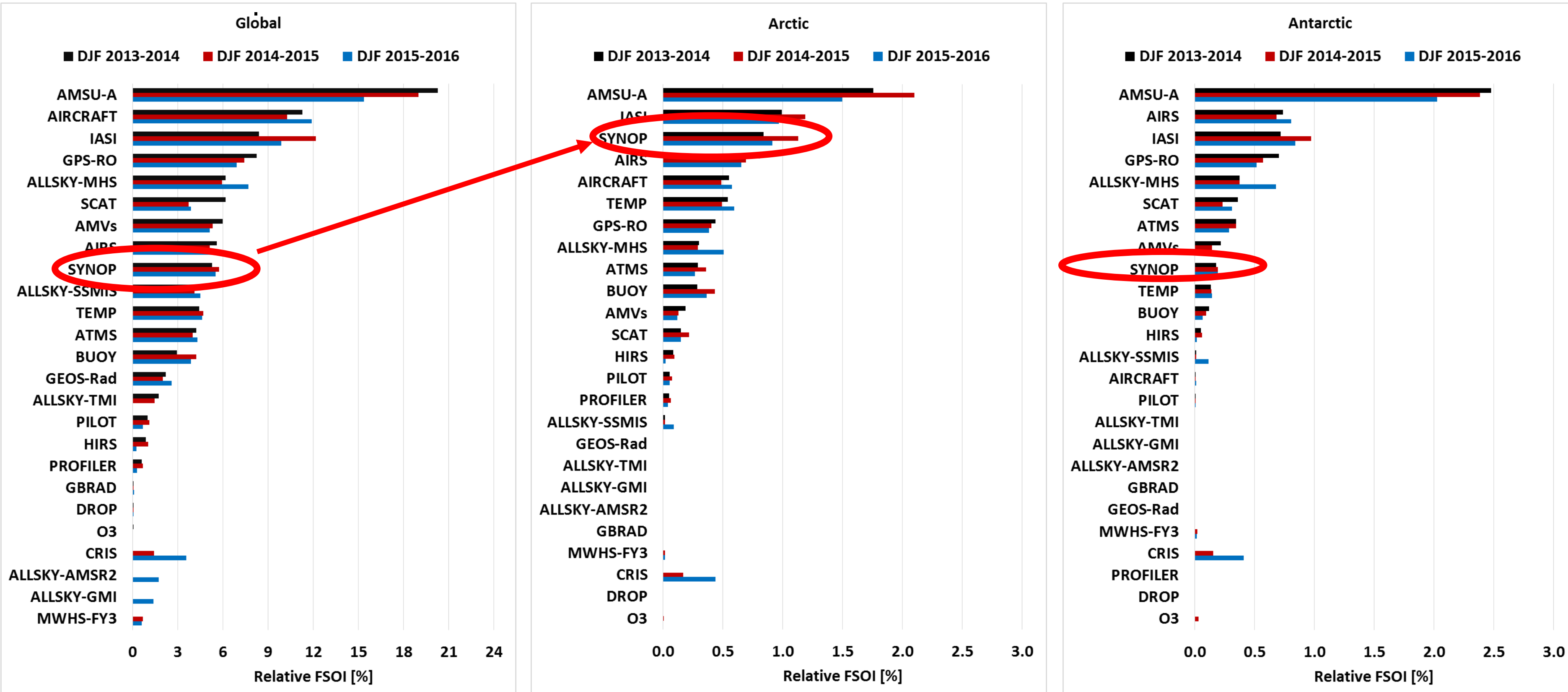
AOSCM for LES case
Sensitivity to time step and coupling frequency

ERA-Interim case

Thanks G. Svensson and K. Hartung, U. Stockholm

What observations contribute the most to the reduction in forecast error?

DJF period: *Forecast Sensitivity Observation Impact - FSOI , Cardinali 2009* (Statistics given as relative contribution to the global FSOI in %)



Thanks to Cristina Lupu, ECMWF

Summary

- APPLICATE - Advance predictive capacity in polar regions and beyond
  - Develop models with enhanced representation of Arctic processes
  - Contribute to developing the Arctic observing system
- Major contribution to YOPP (YOPP dataset)
- Super-sites needed to understand model processes
- Skill has improved with same pace over Arctic as N.Hem, still worse
- Importance of conventional observations