Polar climate change and remote impacts

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APPLICATE.eu
Advanced prediction in
polar regions and beyond

HELMHOLTZ
RESEARCH FOR GRAND CHALLENGES

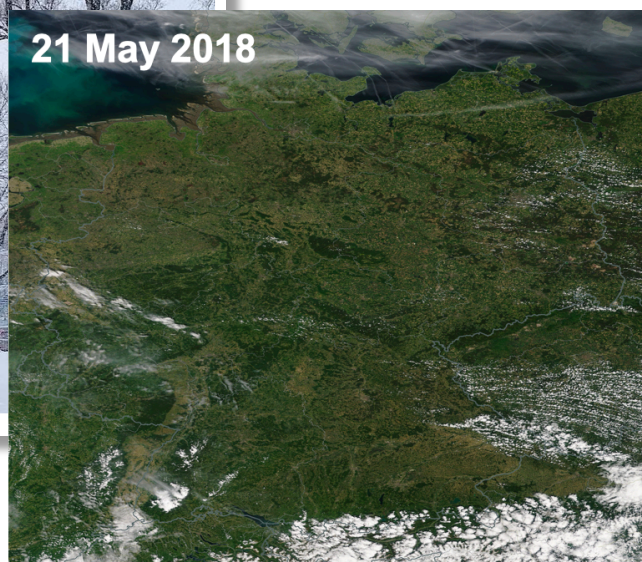# Arctic Amplification and midlatitude extremes

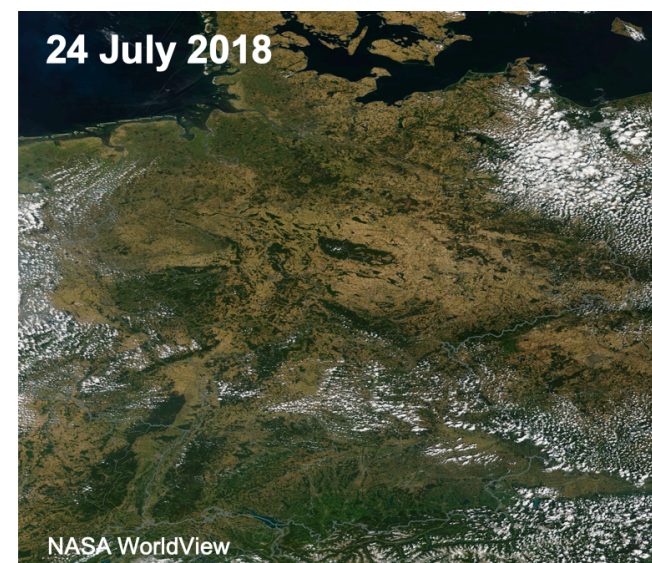## Cold snaps in winter

Weather, News

Meteorologists believe yesterday was Montreal's coldest snowstorm in nearly a century
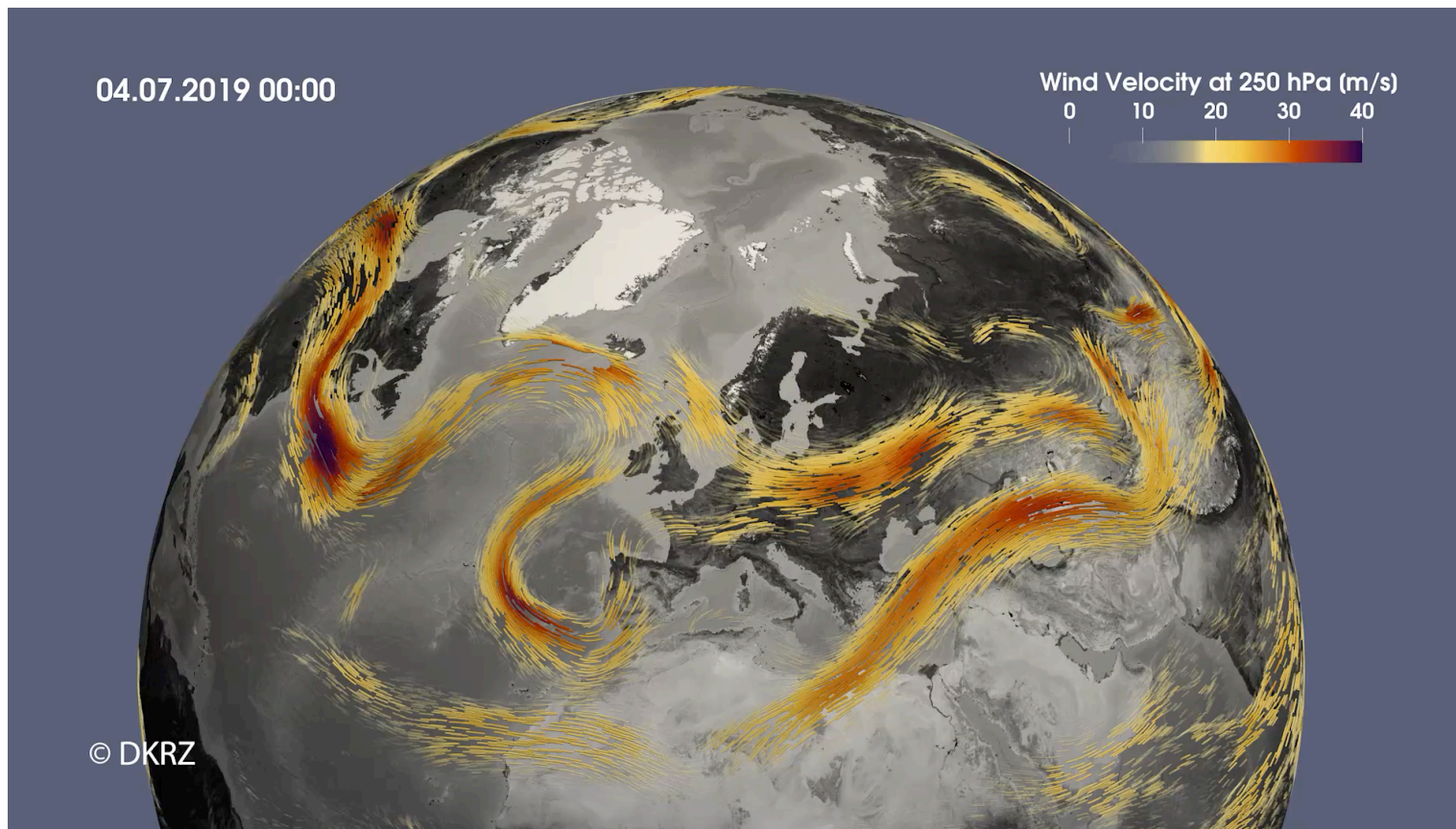
Tyler Jadah
Jan 21, 2019 6:54 am 🔥 139

Summetime heat waves

21 May 2018

24 July 2018

NASA WorldView

The jet stream Dynamical driver of midlatitude extremes

04.07.2019 00:00

Wind Velocity at 250 hPa (m/s)

0   10   20   30   40

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What IPCC has to say

"Changes in Arctic sea ice have the potential to influence mid-latitude weather" (*medium confidence*), but "there is *low confidence* in the detection of this influence for specific weather types."
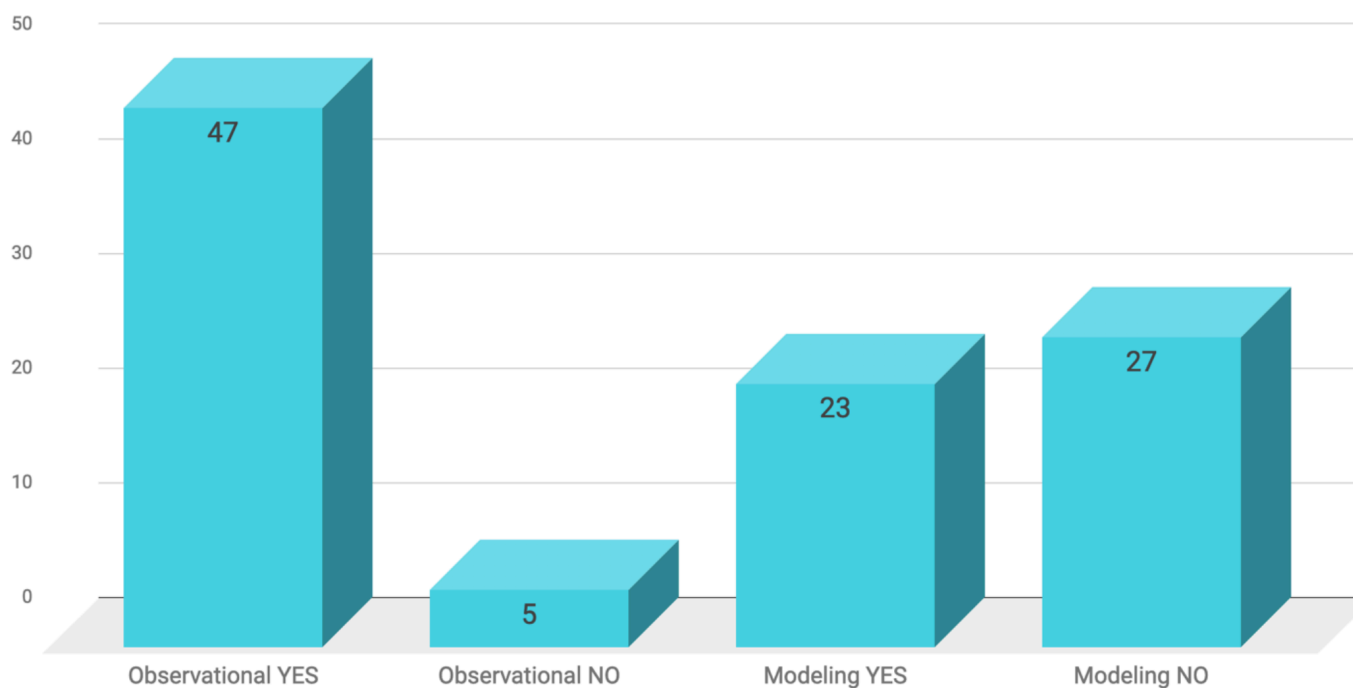
Summary for policy makers: IPPC Special Report on the Ocean and Cryosphere in a Changing Climate (2019)

Divergent consensuses?

Link between AA and severe winter weather?

Cohen et al., *Nature CC* (2020)

A coordinated approach CMIP6-PAMIP

| Article | Assets | Peer review | Metrics | Related articles |

Model experiment description paper

25 Mar 2019

The Polar Amplification Model Intercomparison Project (PAMIP) contribution to CMIP6: investigating the causes and consequences of polar amplification

Doug M. Smith[1], James A. Screen[2], Clara Deser[3], Judah Cohen[4], John C. Fyfe[5], Javier García-Serrano[6,7], Thomas Jung[8,9], Vladimir Kattsov[10], Daniela Matei[11], Rym Msadek[12], Yannick Peings[13], Michael Sigmond[5], Jinro Ukita[14], Jin-Ho Yoon[15], and Xiangdong Zhang[16]

[1]Met Office Hadley Centre, Exeter, UK
[2]College of Engineering, Mathematics and Physical Sciences, University of Exeter, Exeter, UK
[3]Climate and Global Dynamics, National Center for Atmospheric Research, Boulder, CO, USA
[4]Atmospheric and Environmental Research, Lexington, MA, USA
[5]Canadian Centre for Climate Modelling and Analysis, Environment and Climate Change Canada, Victoria, British Columbia, Canada
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[11]Max-Planck-Institut für Meteorologie, Hamburg, Germany
[12]CERFACS/CNRS, UMR 5318, Toulouse, France
[13]Department of Earth System Science, University of California Irvine, Irvine, CA, USA
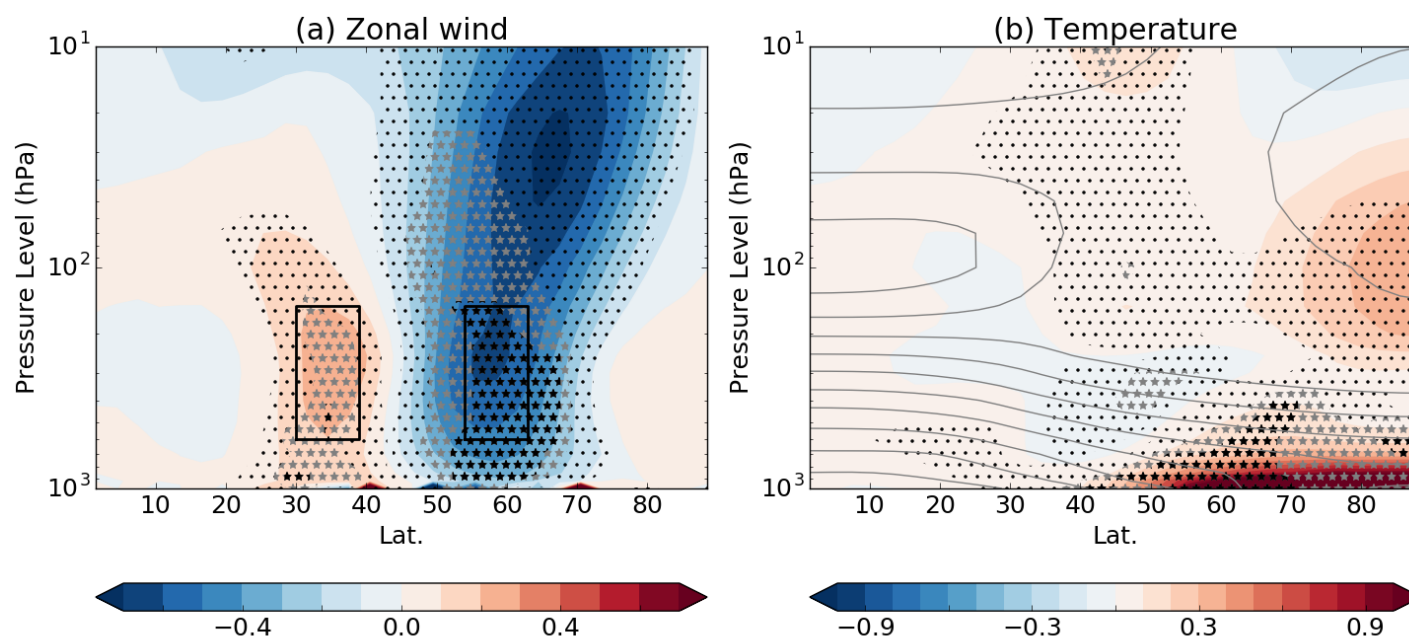[14]Institute of Science and Technology, Niigata University, Niigata, Japan
[15]Gwangju Institute of Science and Technology, School of Earth Sciences and Environmental Engineering, Gwangju, South Korea
[16]International Arctic Research Center, University of Alaska Fairbanks, Fairbanks, AK, USA

Response to future sea ice loss

(a) Zonal wind

(b) Temperature
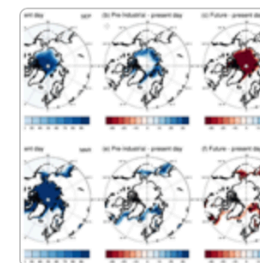
Rosie Eade and Doug Smith (MetOffice)

Multi-model response from 16 atmospheric models:

➜ Consistent thermodynamic response in the lower troposphere

➜ Equatorward shift of the tropospheric jet, but large model spread

➜ Some weakening of stratosphere winds, but less robust

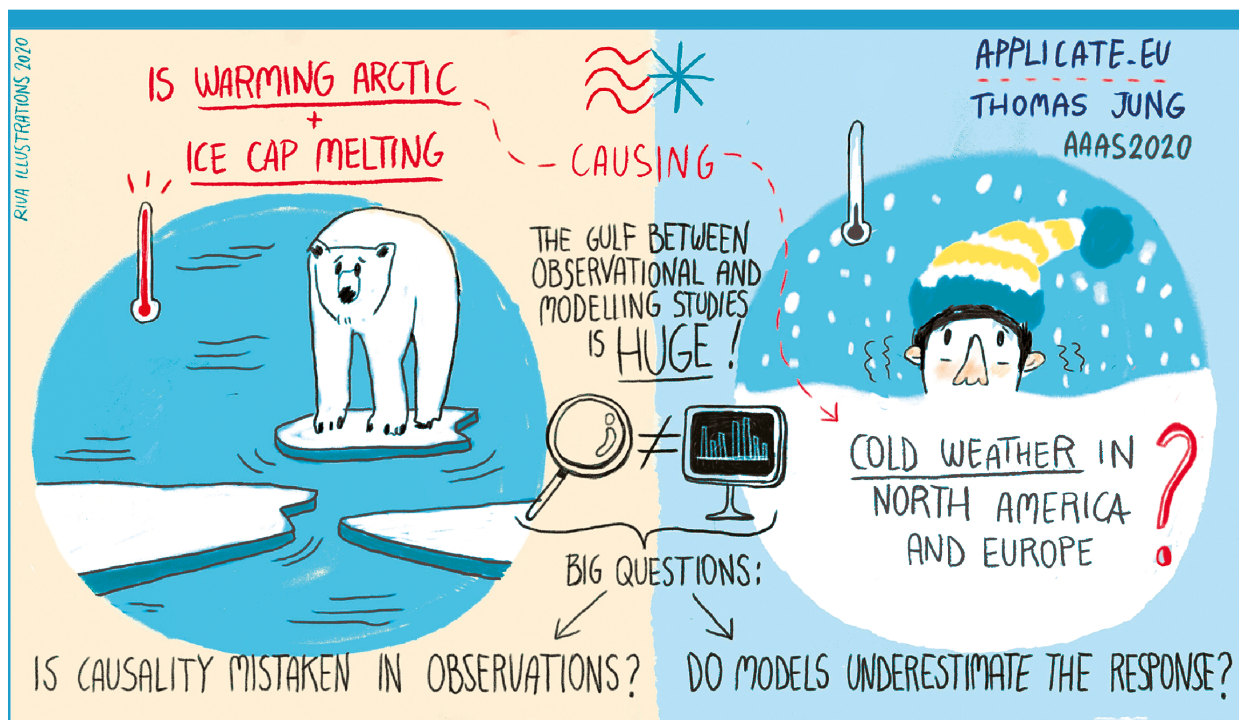# Response to future sea ice loss

→ Large model spread!

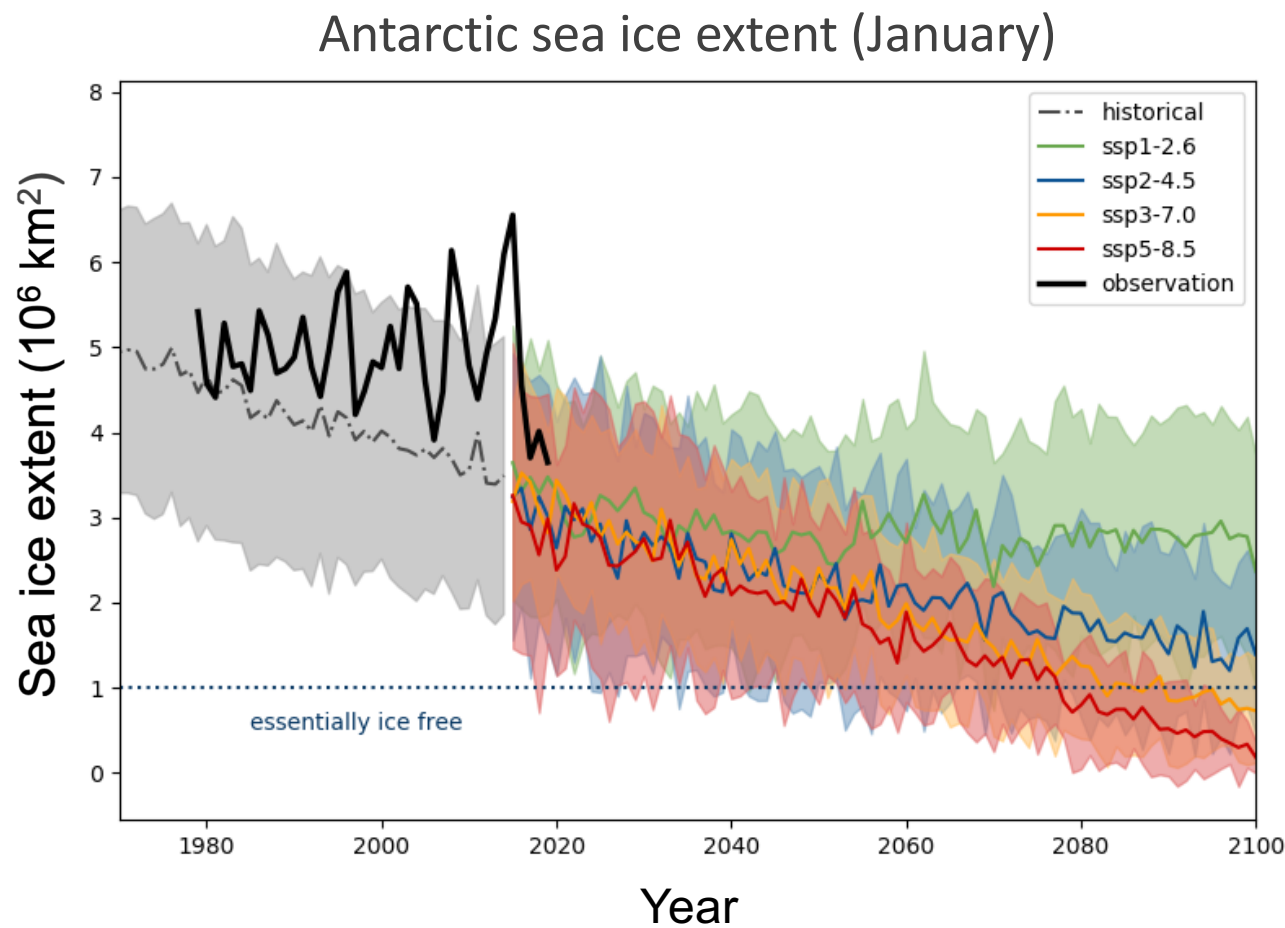Rosie Eade and Doug Smith (MetOffice)
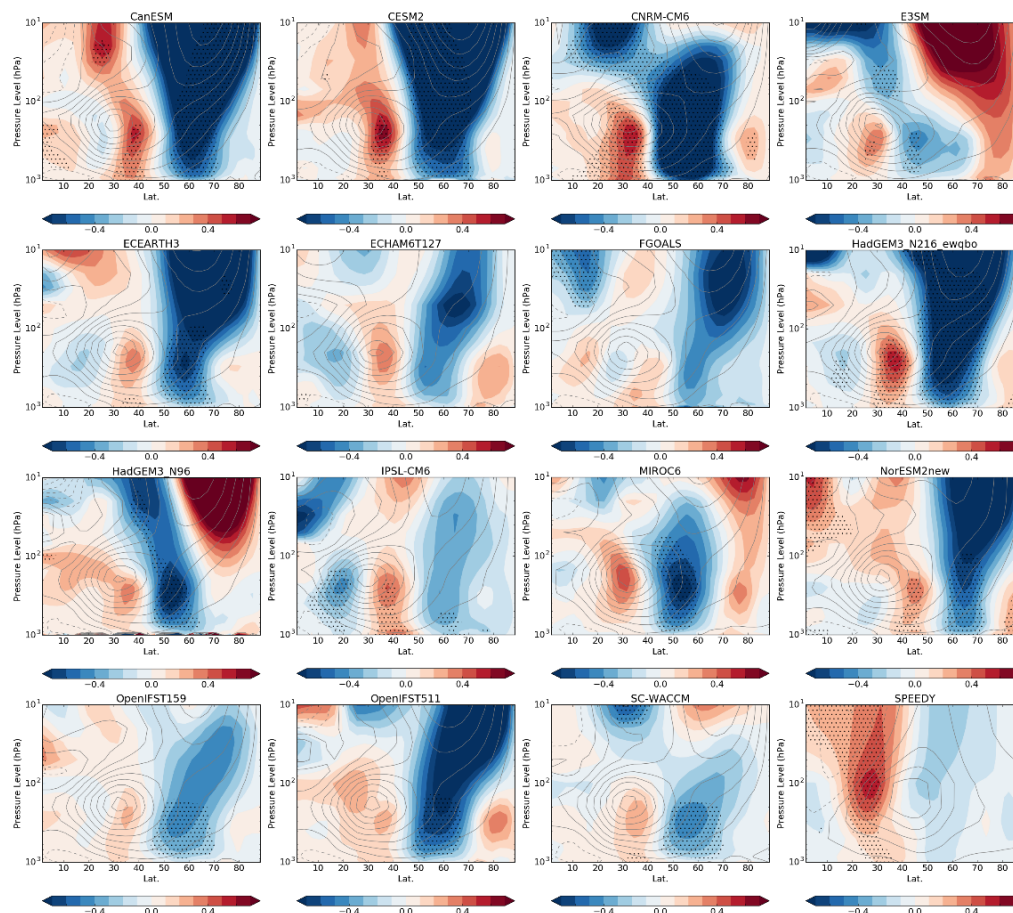
Warm Arctic – Cold continents?

→ Generate better understanding of the underlying processes

→ Carry out further analysis of PAMIP data

→ Develop PAMIP2 taking into account lessons learnt: Large ensembles, coupled models, high-resolution, …

→ Test our models for possible structural uncertainties

An example for structural uncertainties

Antarctic sea ice extent (January)

Directions in model development

→ Improved resolution (1km)

→ Incorporate key Earth system feedbacks

→ Confront model with observations

FESOM2 – The Finite-volumE Sea ice–Ocean Model – AWI
Visualization – DLR