Draft Agenda (time in CET)

14:30 – 14:35 **Welcome remarks**
Steffen M. Olsen (DMI, DK)

14:35 – 14:45 Richard Davy (NERSC, NO), *Arctic Warming and its Impacts: Uncertainties, Implications and Prospects*

14:45 – 14:55 JB Sallée (LOCEAN, FR), *Amplification in the Antarctic: Current Knowledge and Future Directions*

14:55 – 15:05 Lily Hahn (University of Washington, USA) *Polar Amplification: Processes and Asymmetries*

15:05 – 15:15 Doug Smith, (MET Office, UK) *Polar Amplification Model Intercomparison Project (PAMIP)*

15:15 – 15:55 **Discussion (hosted by Renuka Badhe, European Polar Board)**

- Where are the opportunities to work across disciplines in the future?
- What are the observational requirements to improve our understanding of PA, and how do we best meet them?
- What the barriers in model development, and how do we overcome them?
- What are the stakeholder needs for the research and how can we meet them?
- How can we prioritise research and funding requirements?
- What are the policy implications?

15:55 – 16:00 **Summary**
Steffen M. Olsen

The Blue-Action project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 727852. SO-CHIC is funded by the same programme by grant agreement no. 821001.

POLAR AMPLIFICATION DISCUSSION SESSION

Surface albedo feedback is believed to be the principle contributor to polar amplified warming **- but there is much more to it.**

Impacts are global, but people living in the Arctic are in the frontline

POLAR AMPLIFICATION DISCUSSION SESSION

Welcome remarks – by *Steffen M. Olsen* (DMI, DK)

Arctic Warming and its Impacts: Uncertainties, Implications and Prospects
- *Richard Davy* (NERSC, NO)

Amplification in the Antarctic: Current Knowledge and Future Directions
- *JB Sallée* (LOCEAN, FR)

Polar Amplification: Processes and Asymmetries
- *Lily Hahn* (University of Washington, USA)

Polar Amplification Model Intercomparison Project (PAMIP)
- *Doug Smith* (MET Office, UK)

Discussion and summary - hosted by Renuka Badhe (European Polar Board)

Richard Davy
NERSC (NO)

JB Sallée
LOCEAN (FR)

Lily Hahn
University of Washington (USA)

Doug Smith
MET Office (UK)

Richard Davy
NERSC (NO)

JB Sallée
LOCEAN (FR)

Lily Hahn
University of Washington (USA)

Doug Smith
MET Office (UK)

- Uncertainties persists and need to be reduced in order to understand the local impacts of Arctic Warming
- Speeding up model development is essential - make use of novel tuning procedures.

Richard Davy
NERSC (NO)

JB Sallée
LOCEAN (FR)

Lily Hahn
University of Washington (USA)

Doug Smith
MET Office (UK)

- Emphasized the role of the Southern Ocean in PA and gave new directions for improved understanding of the Antarctic response

Richard Davy
NERSC (NO)

JB Sallée
LOCEAN (FR)

Lily Hahn
University of Washington (USA)

Doug Smith
MET Office (UK)

- In addition to Southern Ocean heat uptake, a weak Antarctic lapse rate feedback contributes to weaker warming in the Antarctic than the Arctic
- Antarctic elevation causes asymmetry in climatological inversions affecting lapse rate feedbacks and warming differently between the poles

Richard Davy
NERSC (NO)

JB Sallée
LOCEAN (FR)

Lily Hahn
University of Washington (USA)

Doug Smith
MET Office (UK)

- PAMIP shows us how imperfect models can still help us to come closer to an understanding of drivers, sensitivities and global impacts of Polar Amplification.
- Understanding the feedbacks with mid-latitude weather is key to improved projections.

SO-CHIC
Southern Ocean Carbon and Heat Impact on Climate

BLUE ACTION

EUROPEAN POLAR BOARD
1995 - 2020

POLAR AMPLIFICATION DISCUSSION SESSION

BJERKNES CENTRE for Climate Research

Arctic warming and its impacts: *Uncertainties, Implications and Prospects*

Richard Davy

Nansen Center, Bergen, Norway

UNIVERSITY OF BERGEN NORCE NERSC Nansen Center, Bergen HAVFORSKNINGSINSTITUTTET INSTITUTE OF MARINE RESEARCH

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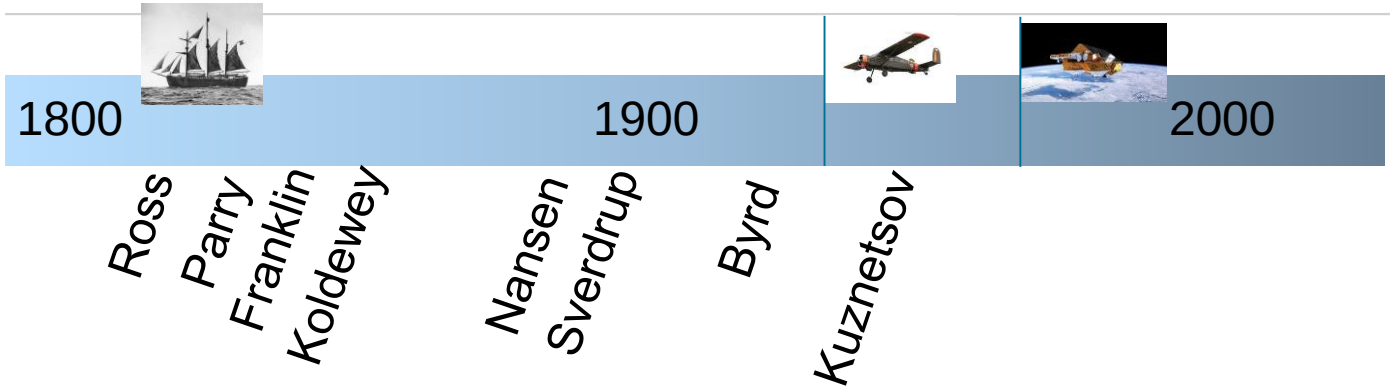
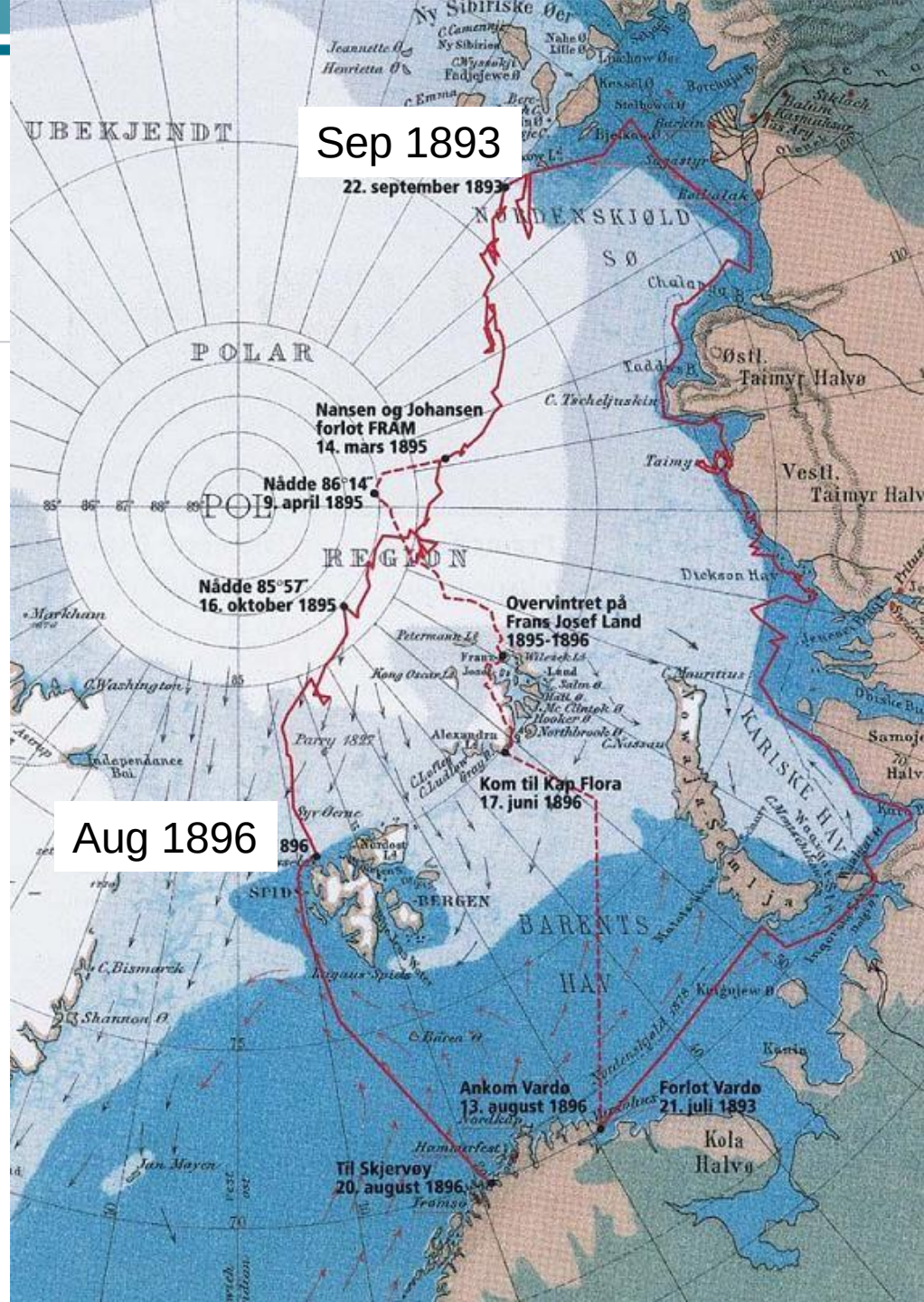
Sparsity of early observations

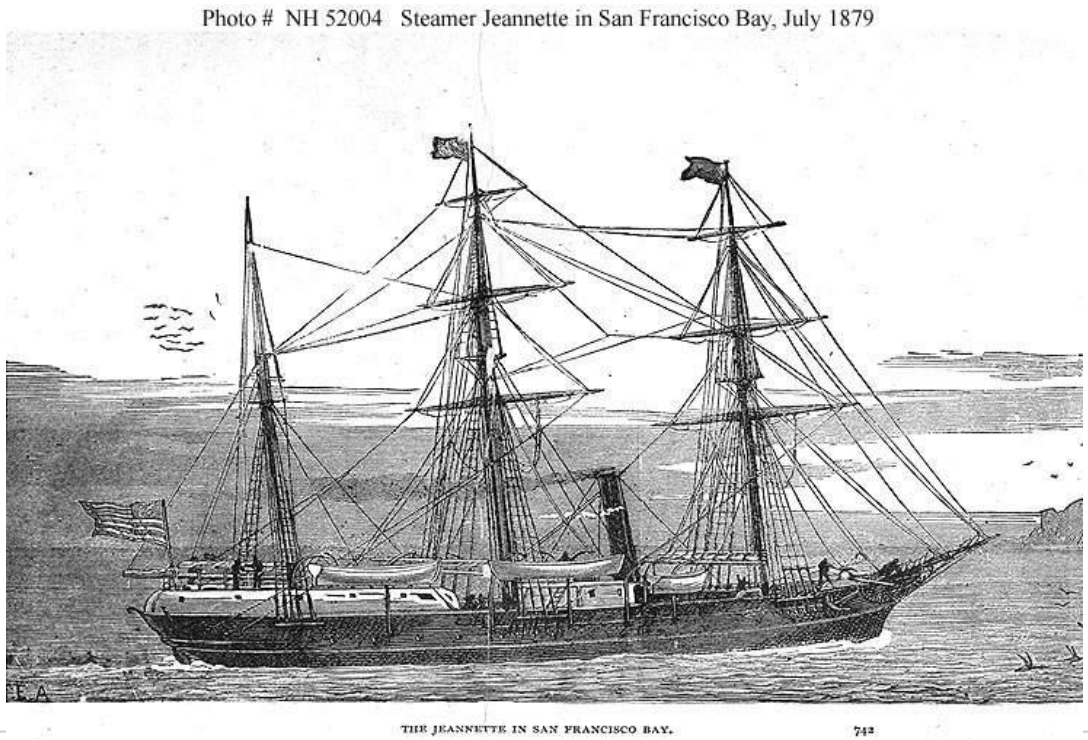


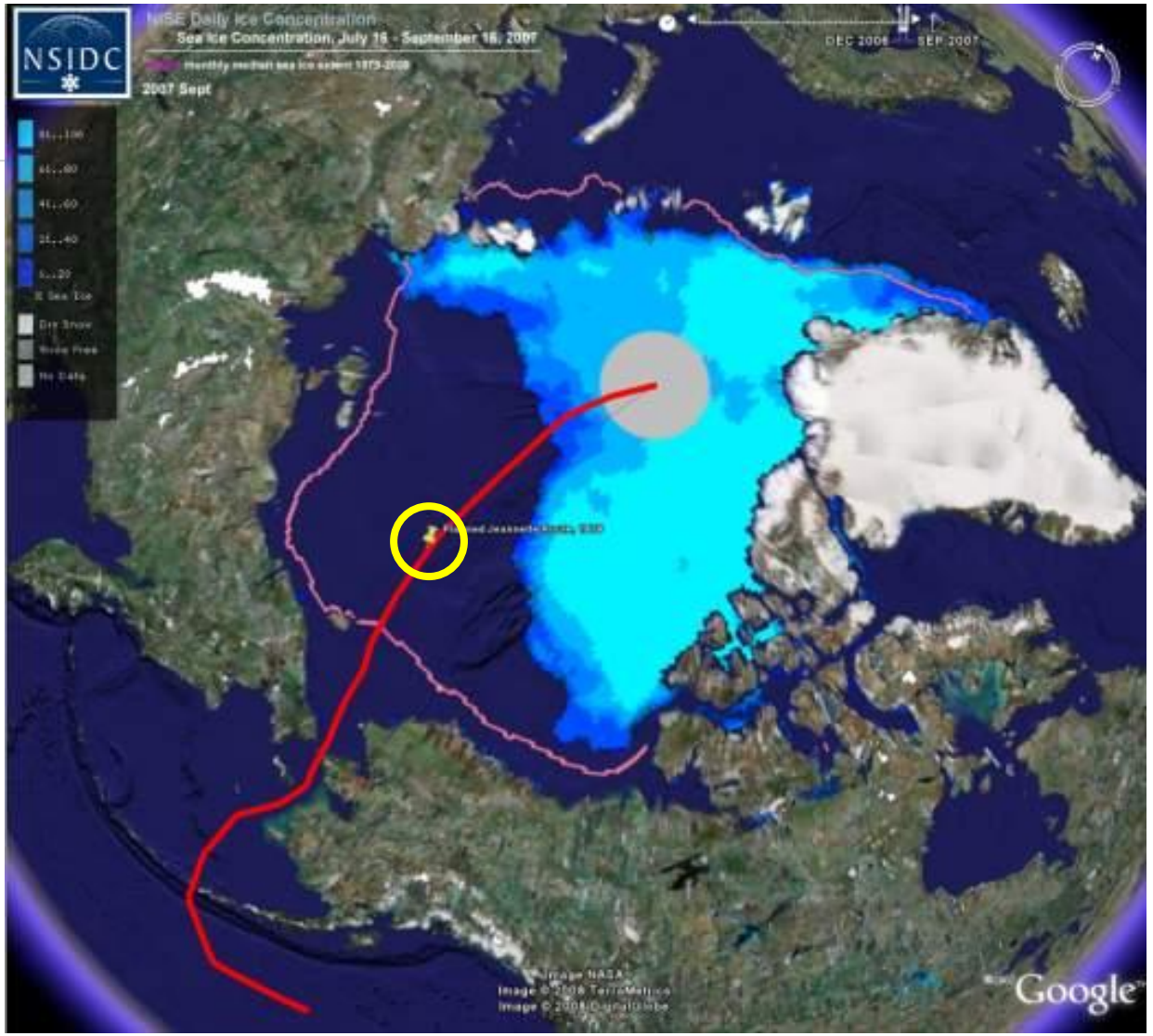
Fridtjof Nansen makes observations of water temperature, **12 July 1894.**



USS Jeanette (1879-1881)

Today they could have got within 500km of the pole without seeing ice





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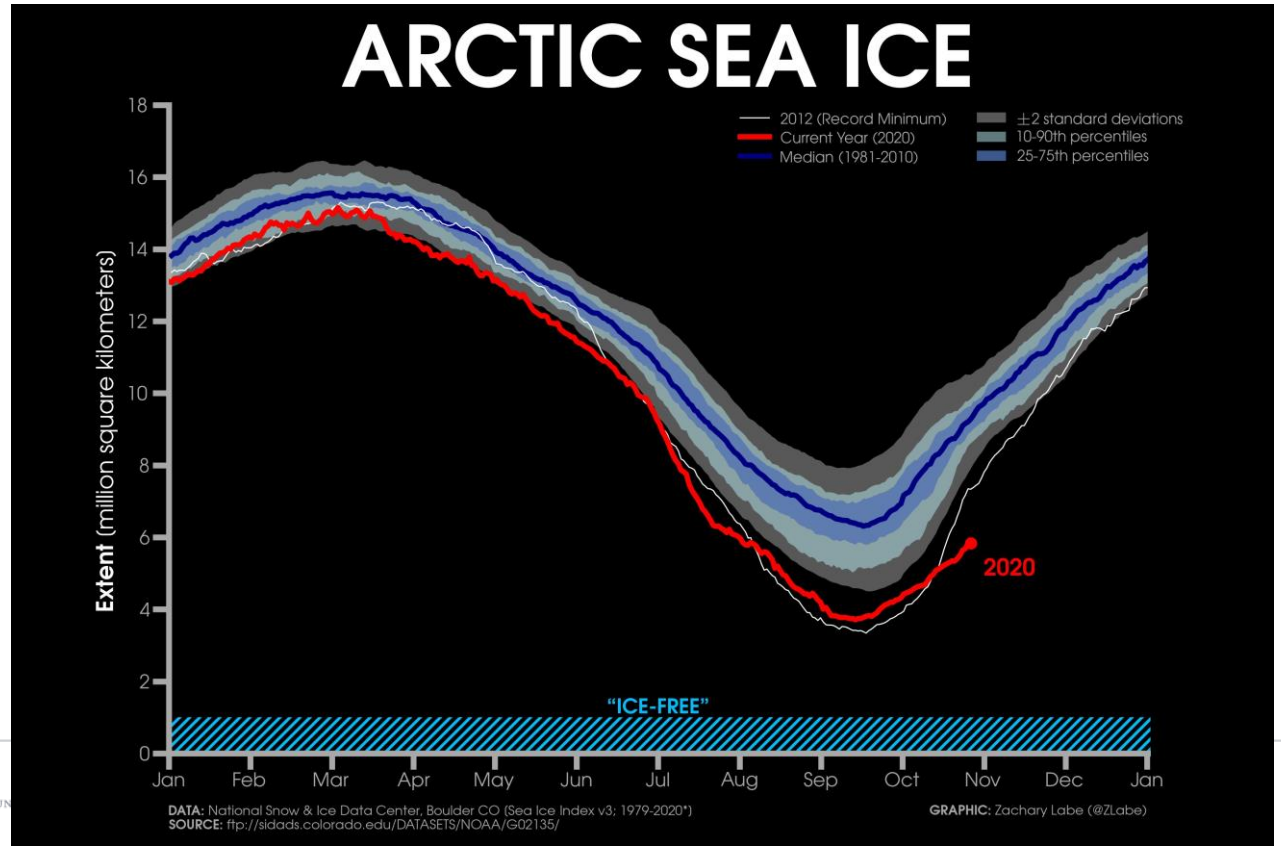
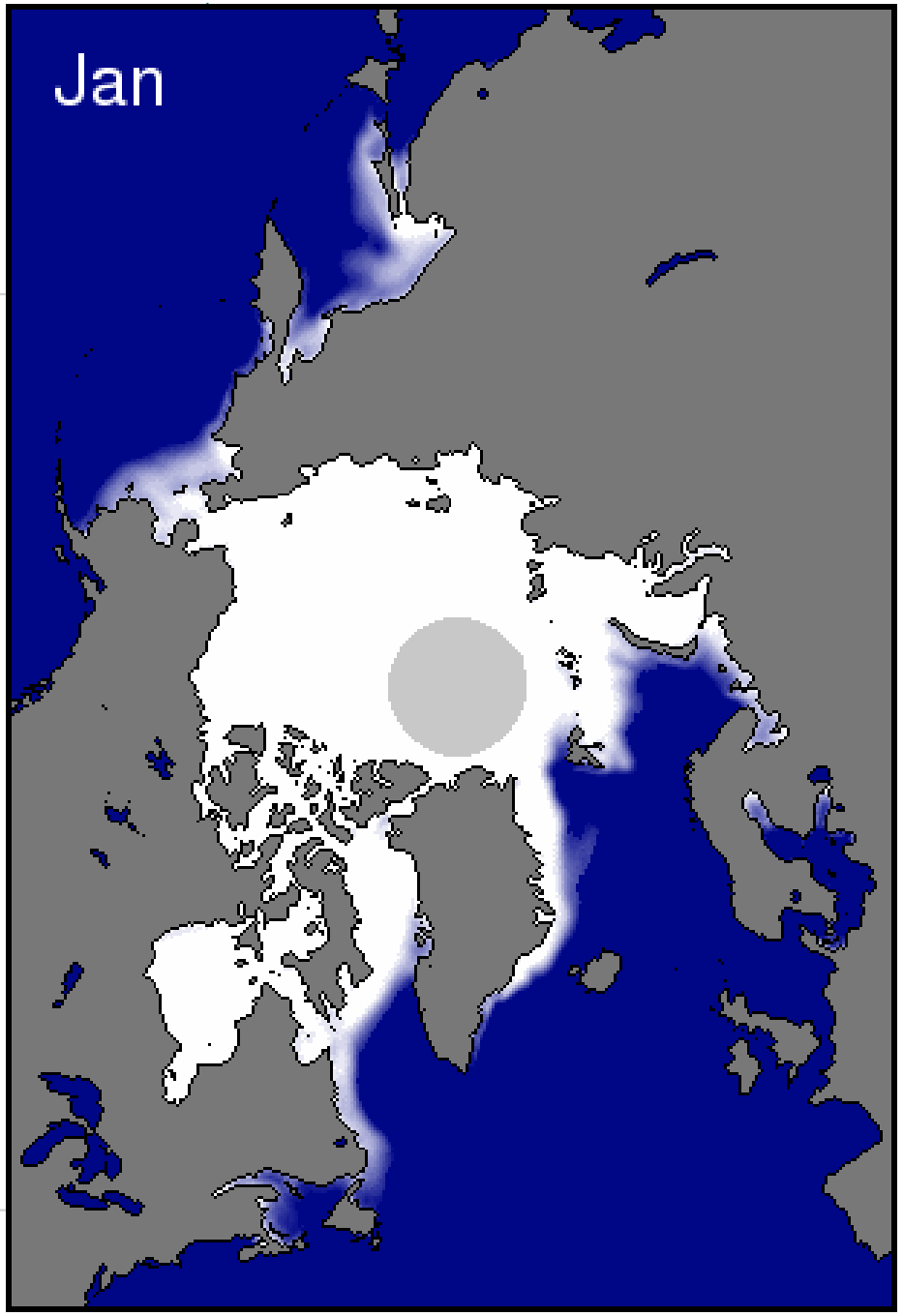
Satellites enabled monitoring of Arctic *sea ice extent*

- Rapid reduction in sea ice extent since 1979
- Uncertainties up to 1 million km^2





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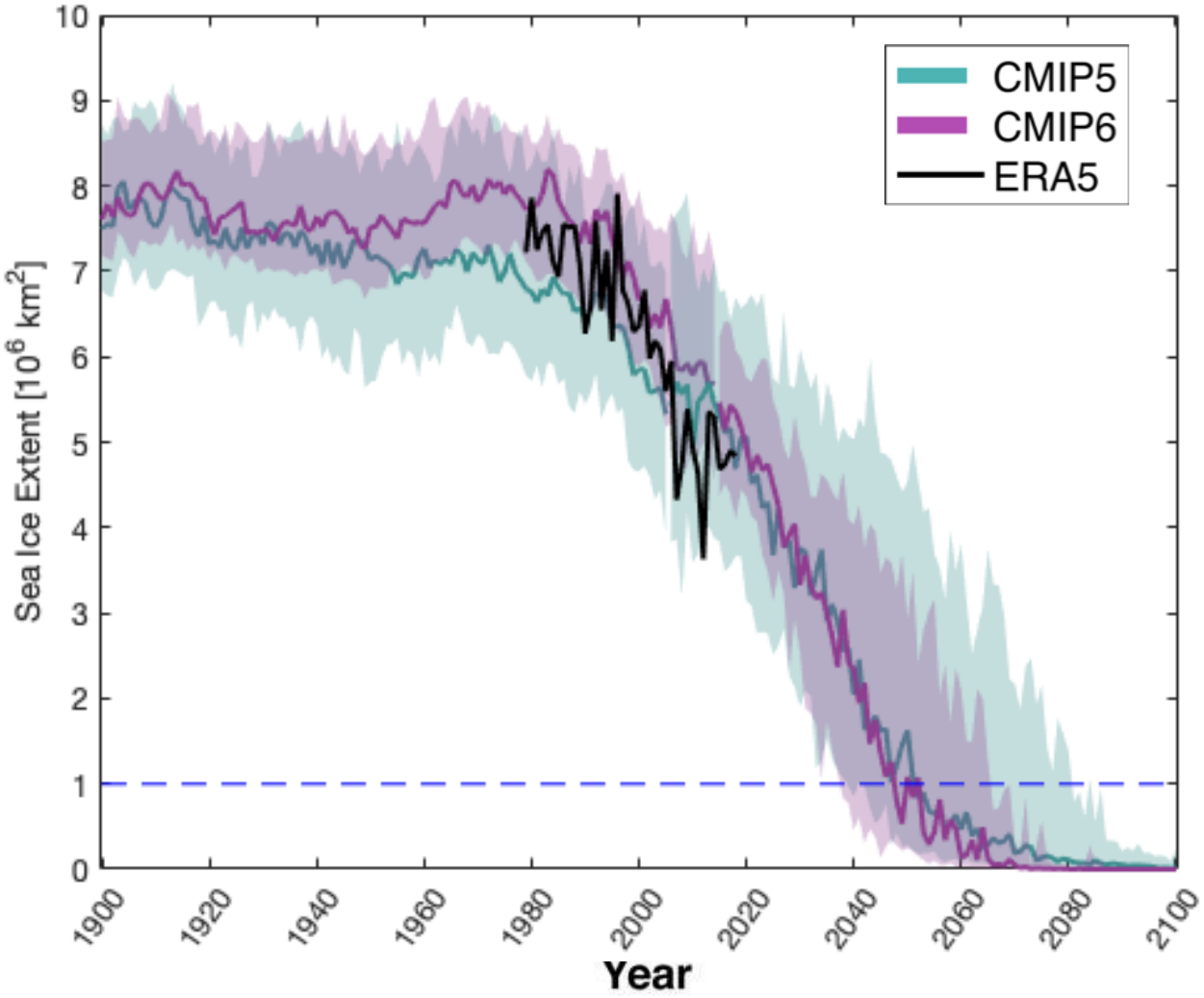
Sea ice extent used for **model evaluation**

- Arctic amplification seen in the first climate models (Manabe and Wetherald, 1975)
- Models changed to match observed extent
  - Model tuning
  - Better physics
- CMIP5, CMIP6 models better capture sea ice extent



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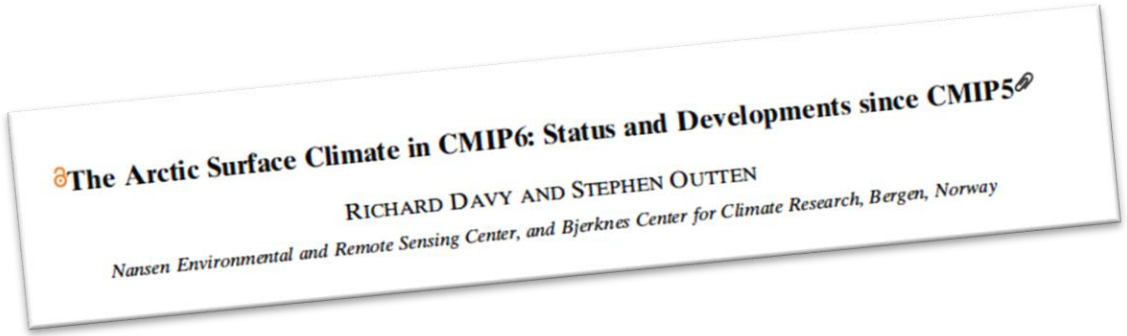
Amplified Arctic warming throughout 21st century

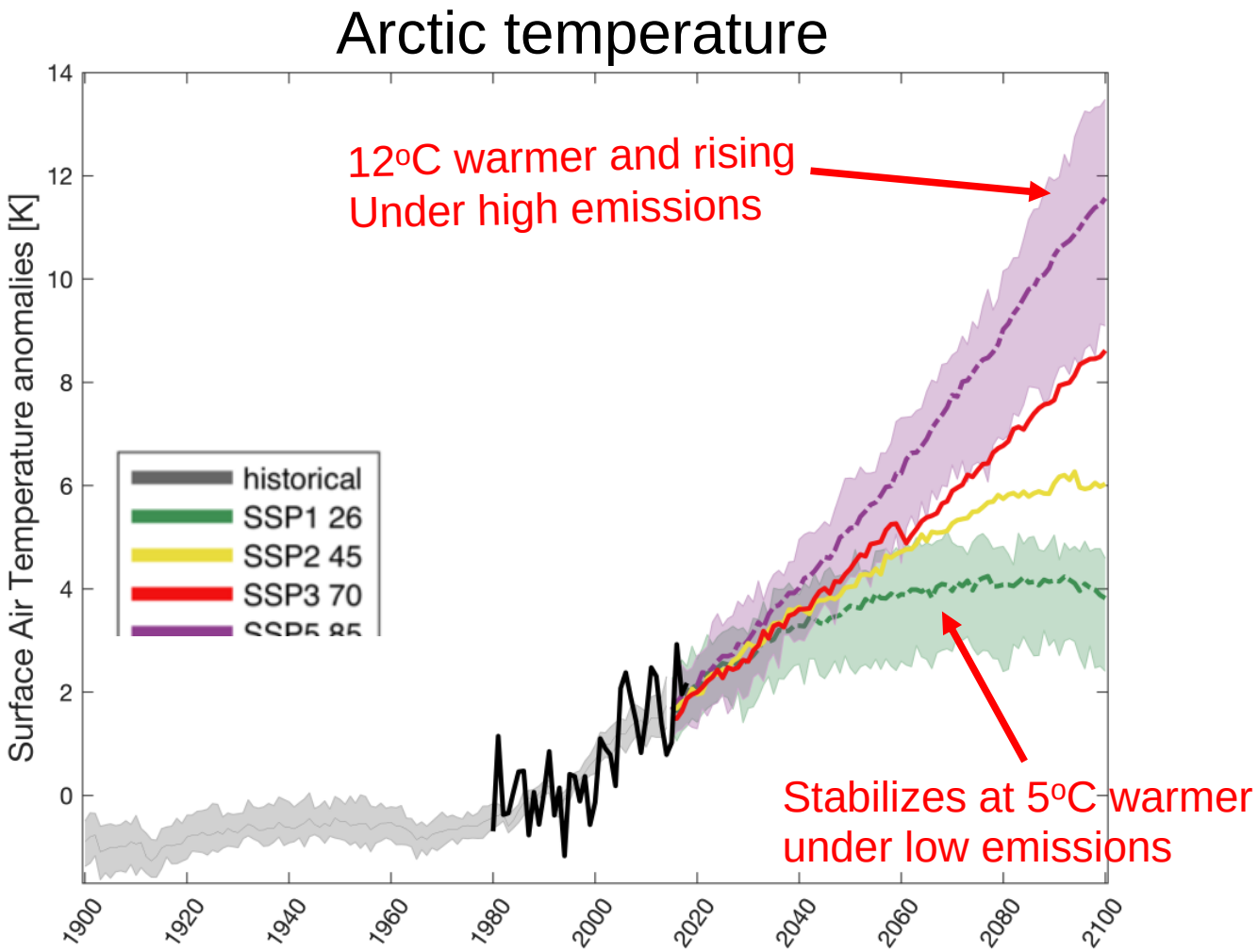
High confidence in sea ice extent gives confidence in other variables.

*Arctic warming **3x** global warming in all scenarios*


The Arctic Surface Climate in CMIP6: Status and Developments since CMIP5

RICHARD DAVY AND STEPHEN OUTTEN

Nansen Environmental and Remote Sensing Center, and Bjerknes Center for Climate Research, Bergen, Norway



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ipcc INTERGOVERNMENTAL PANEL ON climate change

The Ocean and Cryosphere in a Changing Climate

Consequences of Arctic warming

Local impacts

- retreating, thinning sea ice
- glacier mass loss
- permafrost thaw
- sea level rise
- more marine heatwaves

Remote impacts

- regional climate change (e.g. inter-seasonal feedbacks)
- mid-latitude weather (*PAMIP*)

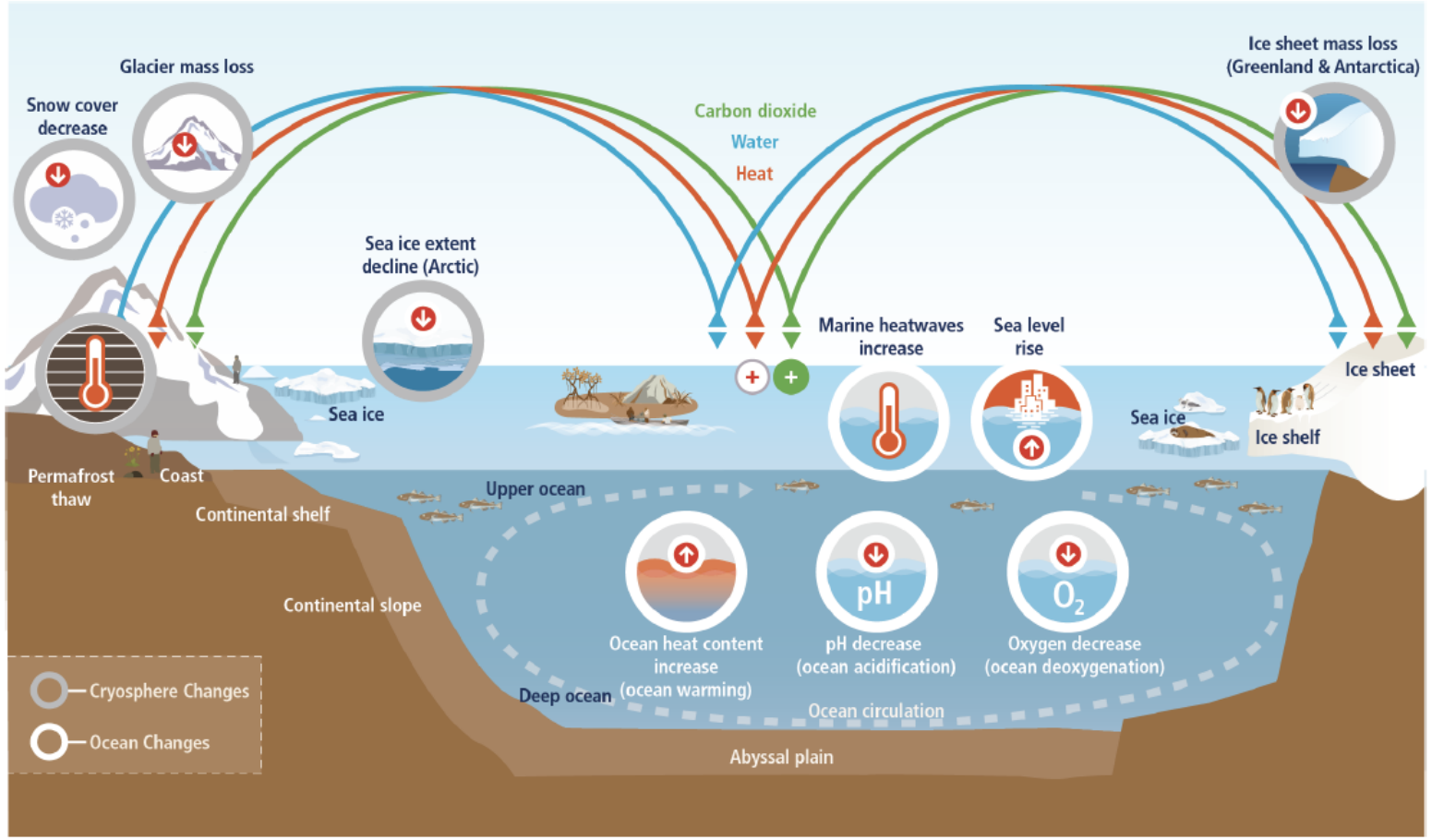

Figure 1 from IPCC Special report on Ocean and cryosphere in a changing climate

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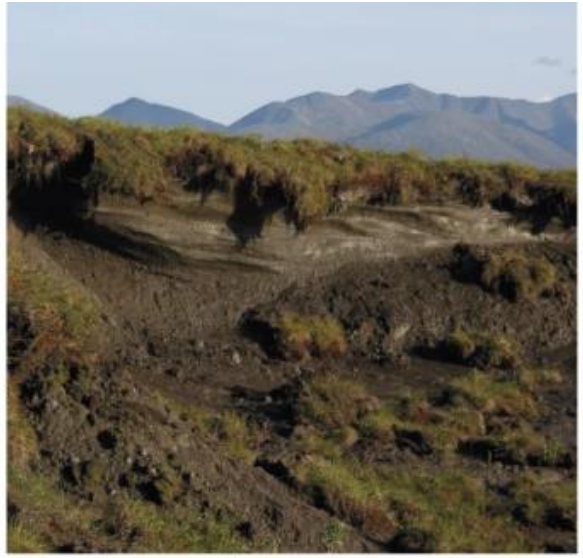
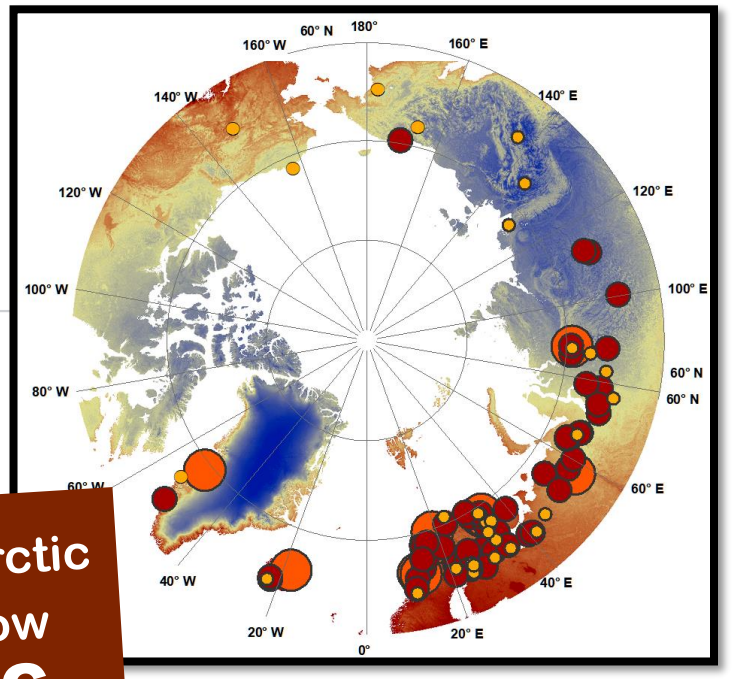
Local impacts are hard to reach: *Permafrost, urban Arctic*

- Permafrost change driven by small-scale feedbacks.
- Urban heat islands further amplify warming

Thermokast lake expansion



Ground collapse, erosion



55% of Arctic people are now living in **+3°C** or warmer world!

Thawing permafrost threatens buildings

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Making better use of observations

- *Observations-as-reference* evaluation cycle helped drive model improvement
- Model bias is largest issue for improving projections / predictions, delivering climate services
- Better use of observations through data assimilation
  - Supermodels assimilating observations to remove bias
- Speeding up model development
  - Semi-automatic model tuning to overcome *'development trough'*