Source: Tagesanzeiger (CH), 29 Oct 2022

Expertenrat für Klimafragen

4. November 2023: Viele Sektoren verfehlen Vorgaben.

Zur Einhaltung der Klimaziele von Beschleunigung notwendig:

– Verkehr: x 14
– Industrie: x 10
– …

Das Ende zuerst

- Frage:

  Warum uns das Eis unter den Fingern zerrinnt?

- Antwort: unbegrenzter Klimawandel, weil …
  - Lobbygruppen der fossilen Industrie seit Jahrzehnten gegen wirksamen Klimaschutz agieren (merchants of doubt)
  - Politik profitiert (hat) und weiterhin populistisch agiert
  - Medien in der Aufklärung versagt haben
  - Wissenschaft zu zaghaft & redlich war
  - Gesellschaft über die Dramatik immer noch nicht im Bilde ist

Polar Research in the 21st Century

– new advances, remaining challenges –

It‘s cold.

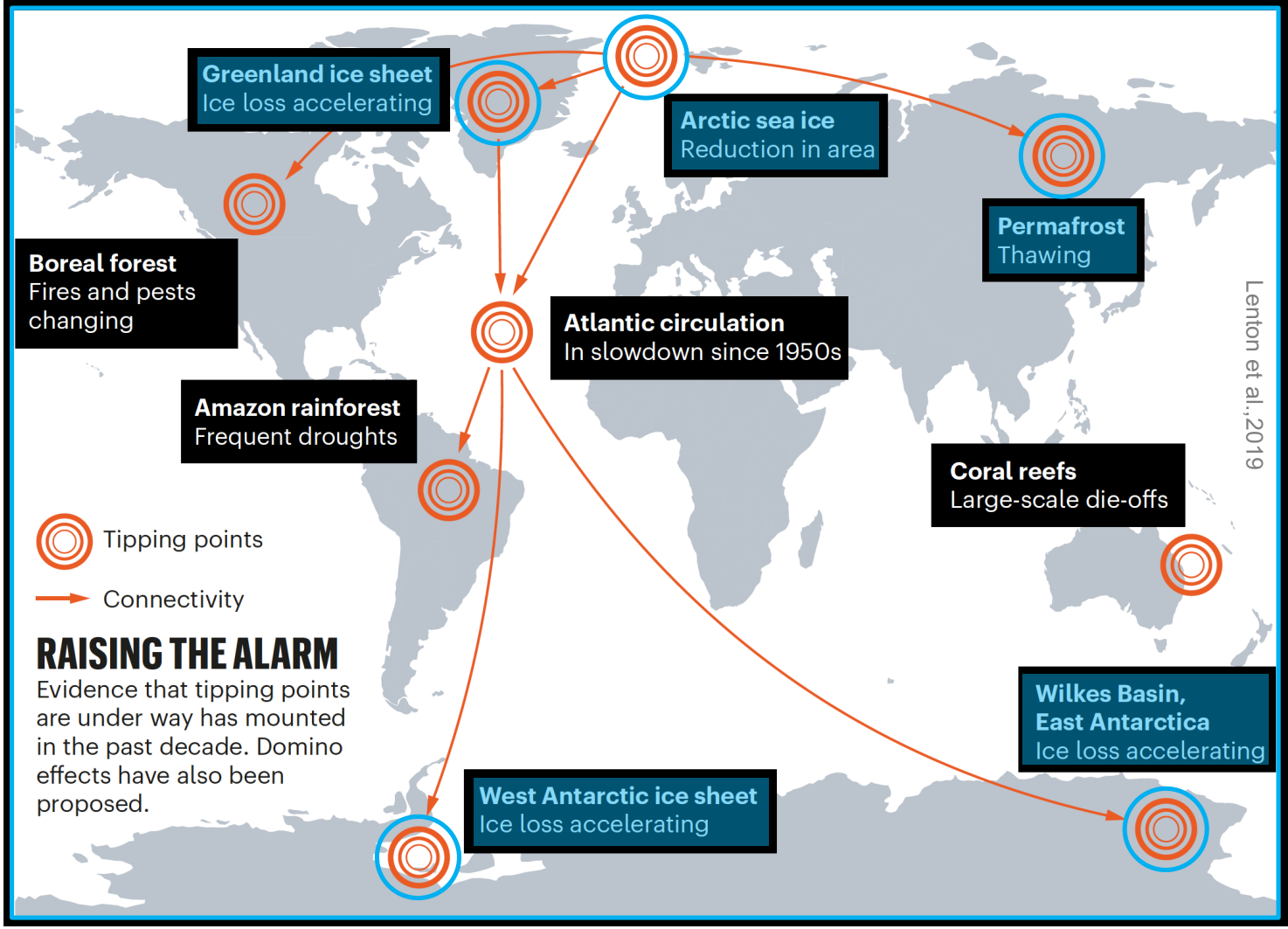
It‘s dark.

It‘s hostile.

It‘s far.

Why are we going there?

Why? Climate tipping points



How much is it to ensure the climate system?

risk = probability x damage

emergency = risk x urgency

$$= \text{risk} \times \frac{\text{reaction time}}{\text{intervention time}}$$

$$E = R \times U = p \times D \times \tau / T$$

If reaction time is longer than the intervention time left ($\tau / T > 1$),

we have lost control.

What means „losing control“?

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Und nun?

- Inventory – where do we stand?
- Prognoses
- Solutions

(I will not talk about fires, floods, heat waves, droughts, marine heat waves, coral bleaching, …)

MOSAiC

– the largest Arctic research expedition in history –

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Arctic change is dramatic

"What used to be skidoo or skiing trips are boat trips now"

March / April, Kongsfjord, Svalbard

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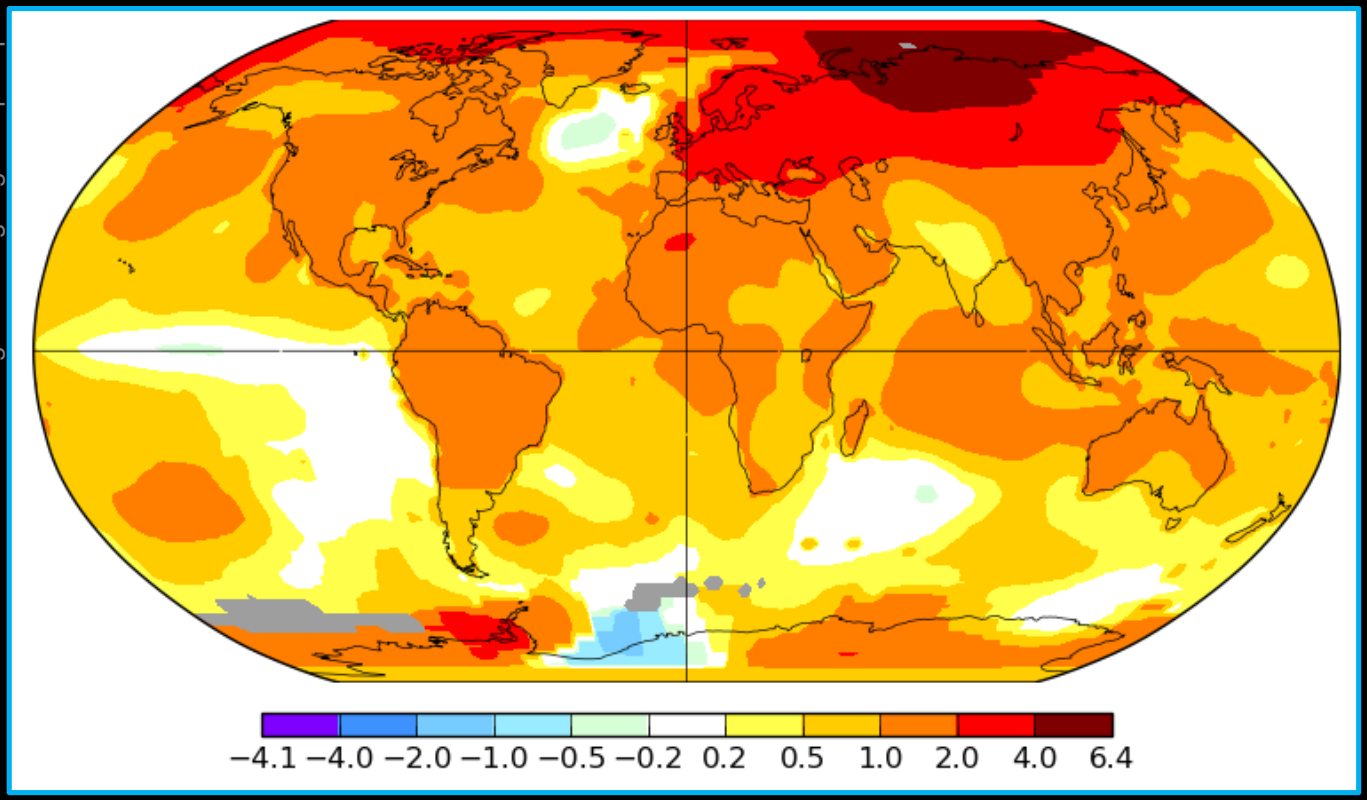
Arctic change in global context

IPCC/GIEC AR6 WGI, Valerie Masson-Delmotte et al., 2021

Source: data.giss.nasa.gov/gistemp/maps/



Observed temperature change in 2020 [ºC]
(compared to 1951-1980)

Surface air temperature in the Arctic has …

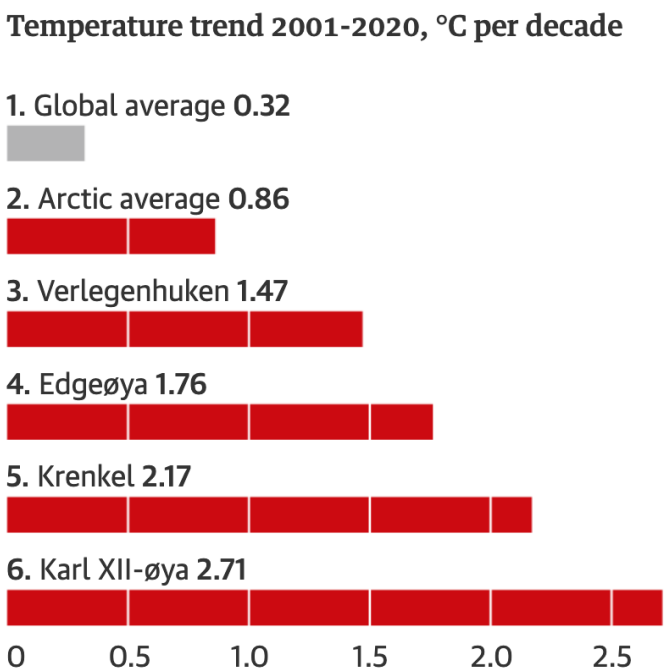
… increased by more than twice the global average,

… exceeded +2 ºC already now,

… led to more extremes.

Arctic change in global context

Weather stations reveal extraordinary heating

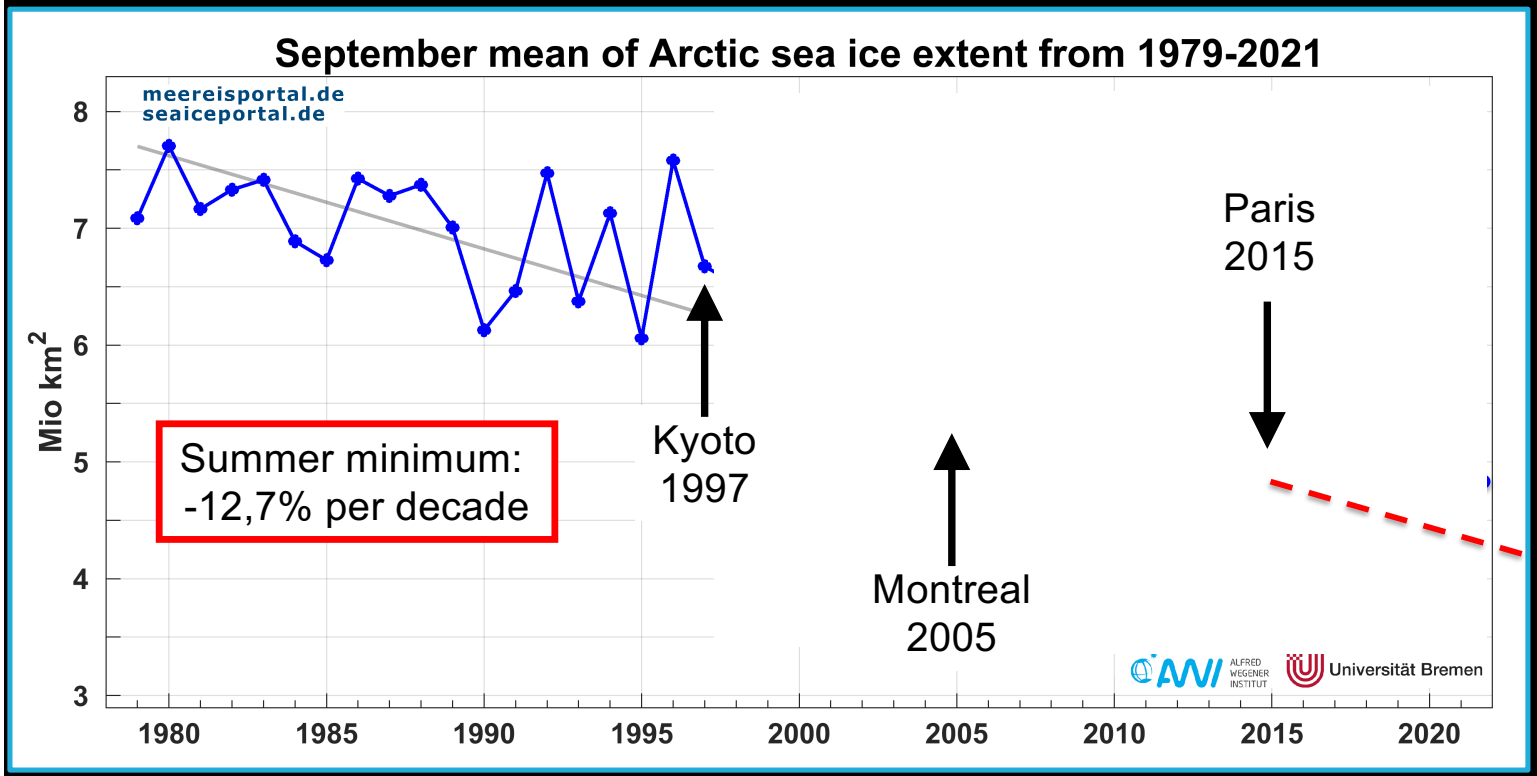


Guardian graphic. Source: Isaksen et al, Scientific Reports, 2022

Spitsbergen/Svalbard:

- more rain-on-snow
- more avalanches
- warmer winters
- longer summers
- more extremes

The future of Arctic sea ice



IPCC 2021: Arctic is likely to be practically sea ice free in September at least once before 2050 under all scenarios

Changes also in sea ice volume, timing and properties

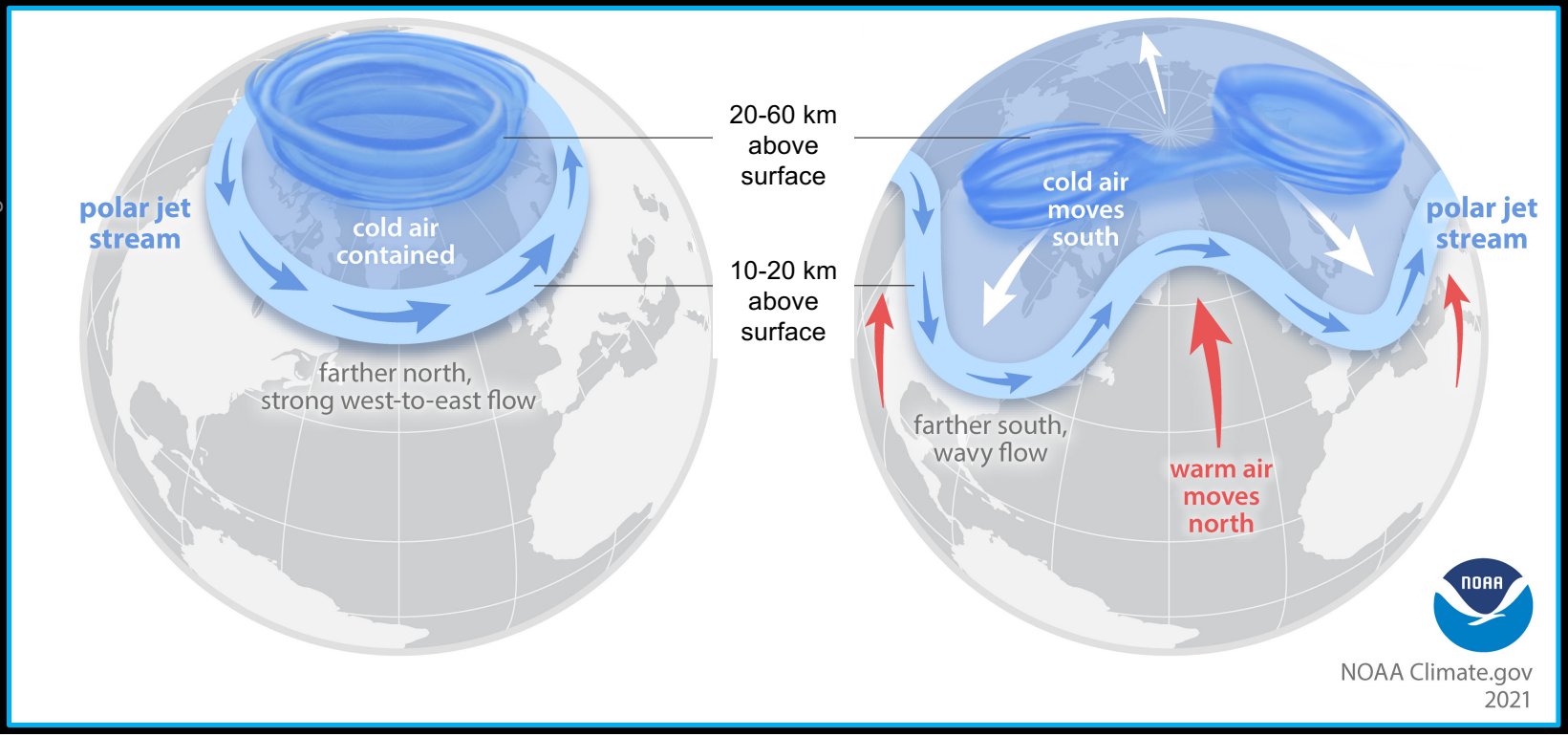
2050? 2070?

Source: www.meereisportal.de

Consequences for lower latitudes

Warming Arctic = more extremes

stable jet stream → meandering jet stream



Source: www.climate.gov/media/11999

Potential for cold air outbreaks => Cold spells in Europe and N. America

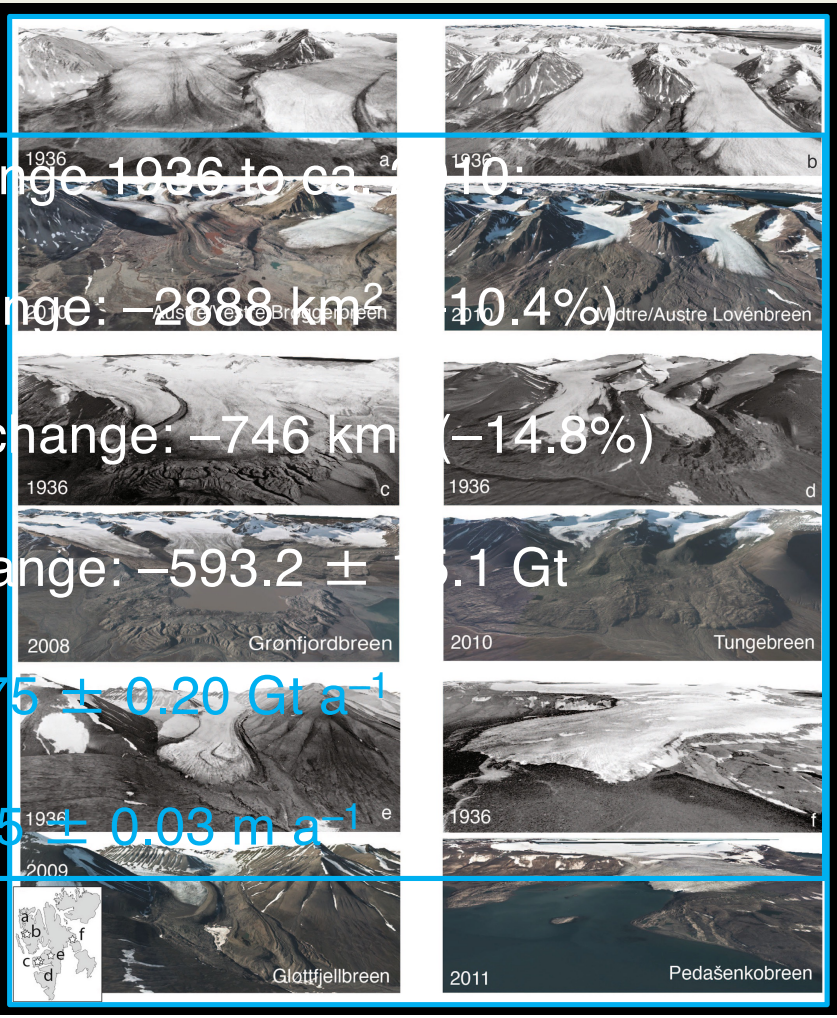
Warm and humid air advection into the Arctic

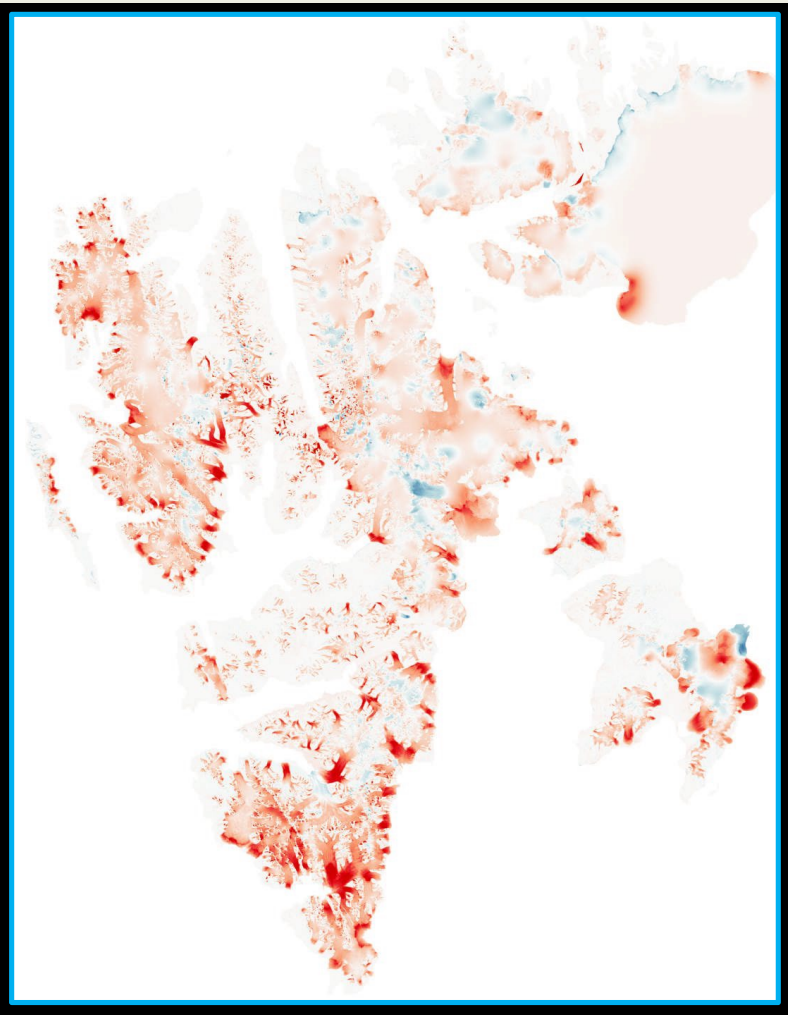
Svalbard Integrated Arctic Earth Observing System

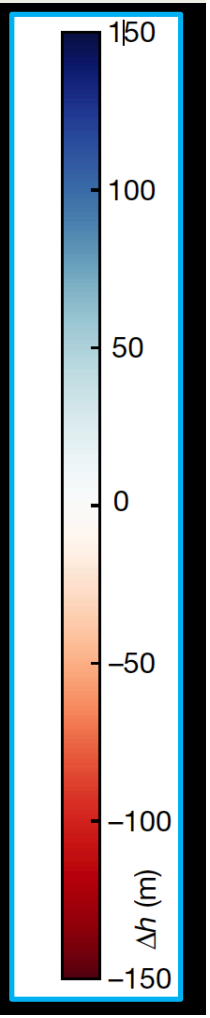
An international research infrastructure for Arctic Earth System Science

Glacier change 1936 to ca. 2010:

- Area change: –2888 km^2 (–10.4%)
- Volume change: –746 km^3 (–14.8%)
- Mass change: –593.2 ± 1.1 Gt
- M/t: –7.75 ± 0.20 Gt a^{-1}
- h/t: –0.35 ± 0.03 m a^{-1}



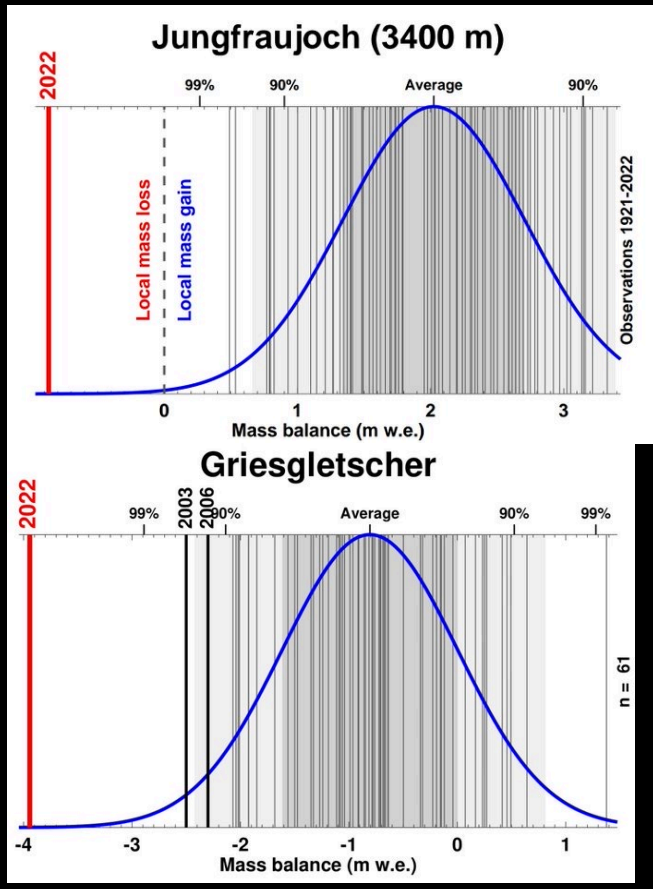




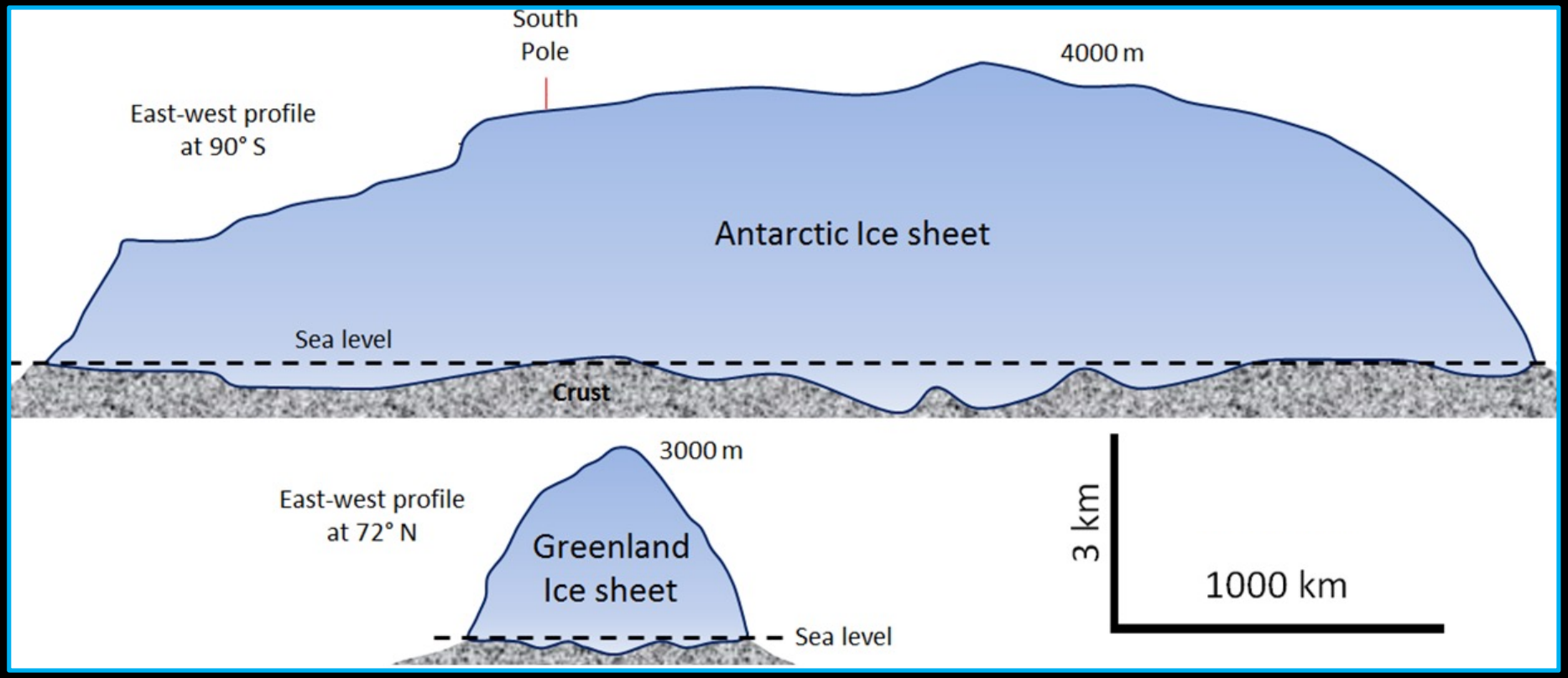
Geyman et al., 2022

Alps: mass balance year 2022

- ~4.5-Sigma event = at constant climate 1x in 15000 a
- Melt of this extent expected only in 10-20 years = reality overtakes prognoses
- Main cause: climate warming in Europe (ca. 2K above reference)
- Germany: 5 => 4 glaciers …



From sea ice and glaciers to ice sheets



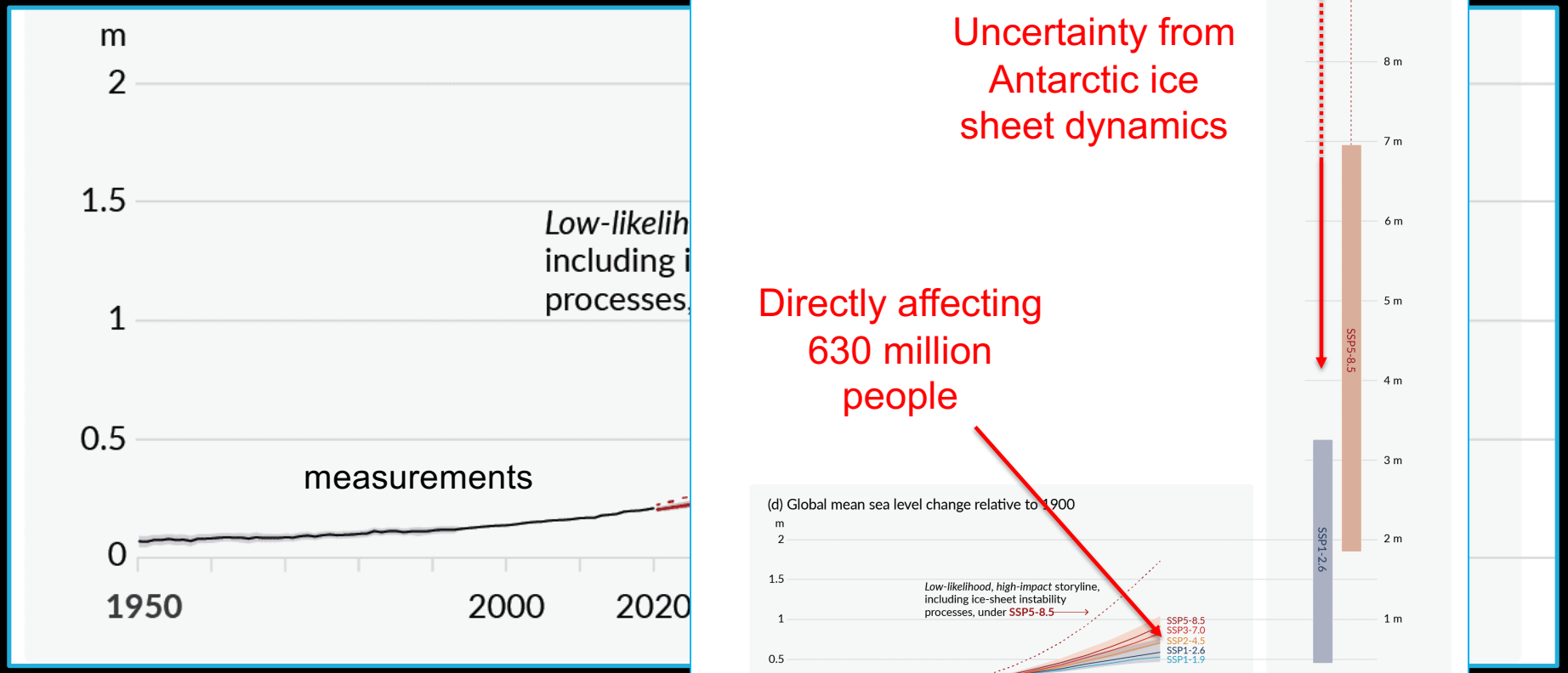
Antarctic sea ice:
3–18 million km² (summer–winter)

Arctic sea ice:
7–15 million km² (summer–winter)

Why are ice sheets important?

Sea level change

(relative to 1900)



Uncertainty from Antarctic ice sheet dynamics

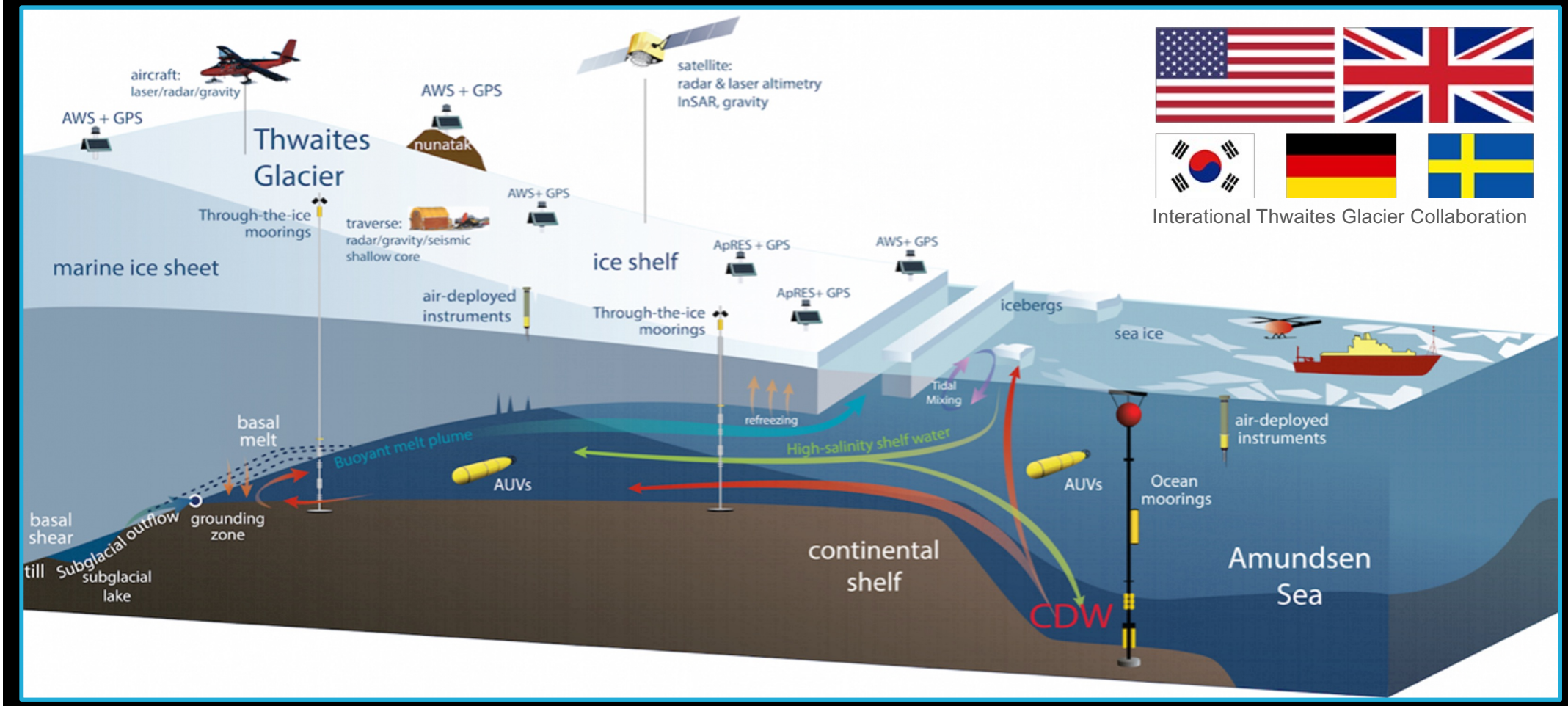
Directly affecting 630 million people

IPCC, AR6, 2021

Highest Risk: Thwaites Glacier

Highest Risk: Thwaites Glacier

Marine Ice Sheet Instability



Highest Risk: Thwaites Glacier

Marine Ice Sheet Instability

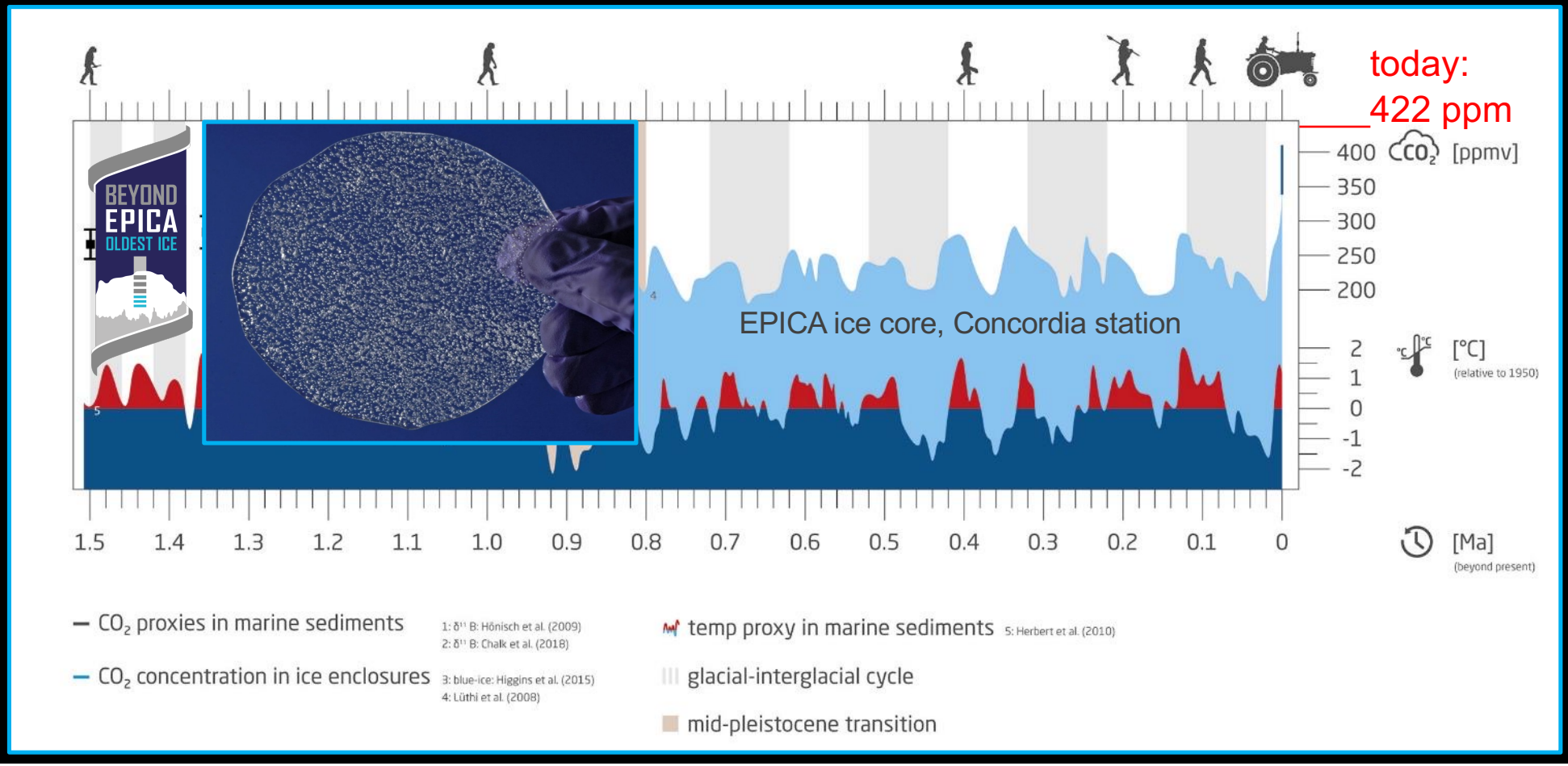
- Retreat in pre-observational period >5 times faster than observed

⇒ possibility for faster retreat not accounted for in models

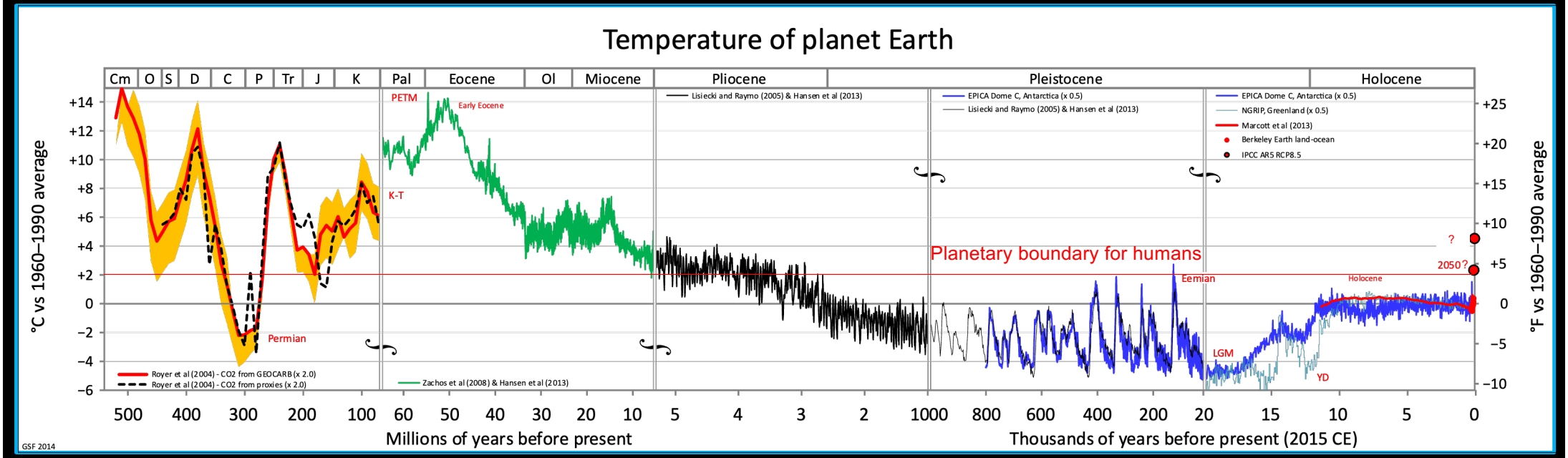
- 60 cm global mean sea level rise from Thwaites alone
- 3.5 m from West Antarctic ice sheet (Thwaites = door)
- Time scale of retreat after tipping point uncertain

Why are ice sheets important?

Unique paleo-climate archive

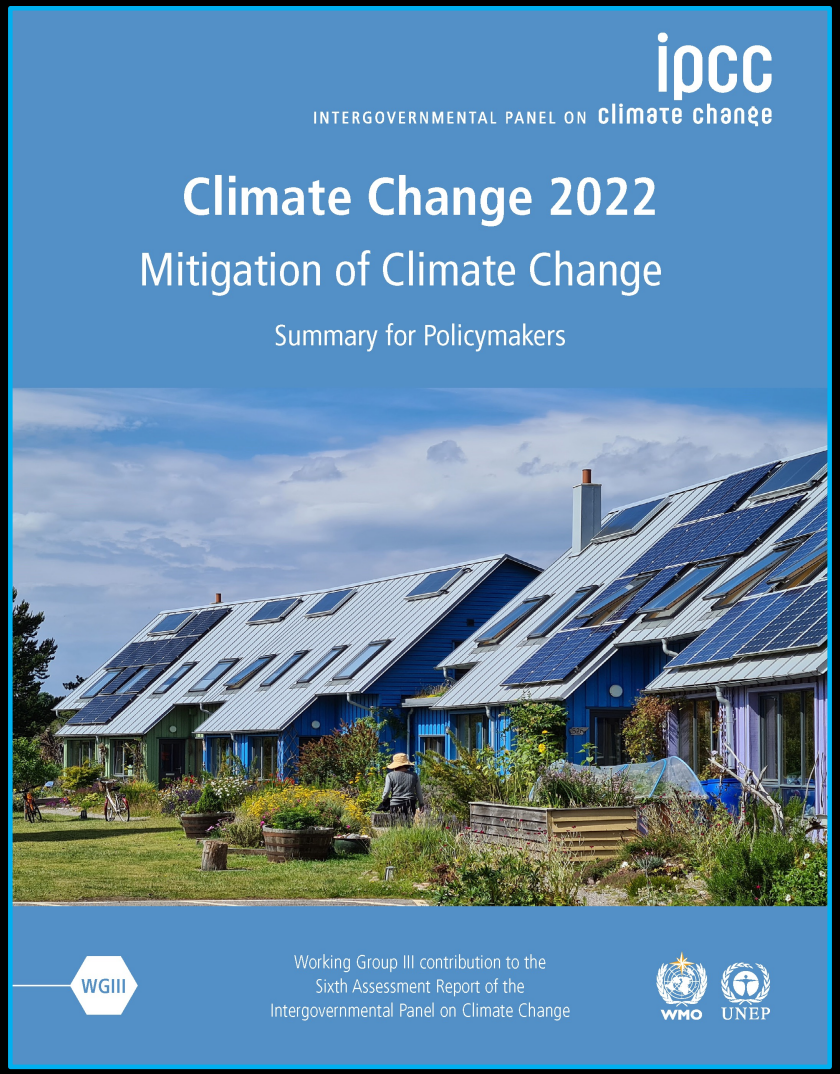


A brief history of Earth‘s climate



Fergus, 2021

Solutions


ipcc
INTERGOVERNMENTAL PANEL ON climate change
Climate Change 2022
Mitigation of Climate Change
Summary for Policymakers
WGIII
Working Group III contribution to the
Sixth Assessment Report of the
Intergovernmental Panel on Climate Change
WMO
UNEP

Climate Change = Climate Crisis

10 word-summary on recent knowledge

(Anthony Leiserowitz, Yale University, Co-Author IPCC/GIEC AR6 WGI)

It's real.

It's us.

Experts agree.

It's bad.

There's hope.

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In the future

Climate Change …

will determine *how* we will live

Biodiversity Loss …

if

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We have to bring the message across.

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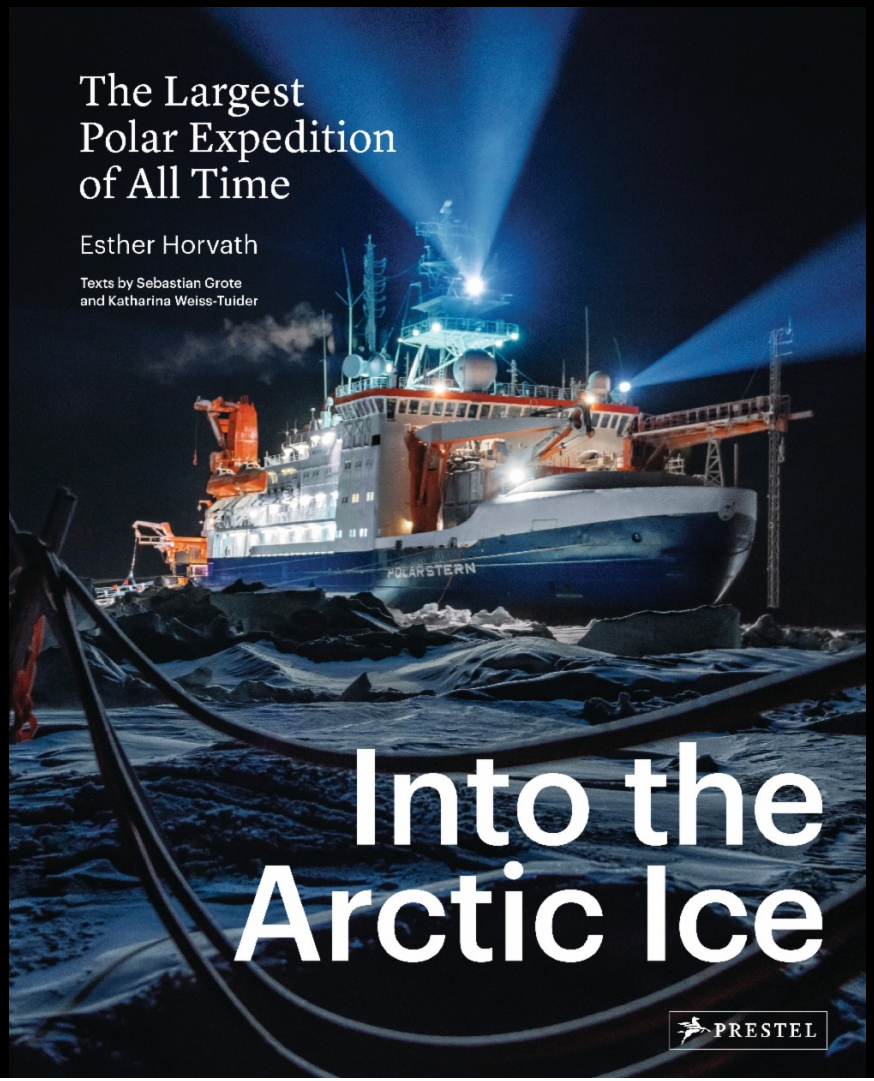
Polar Research in the 21st Century

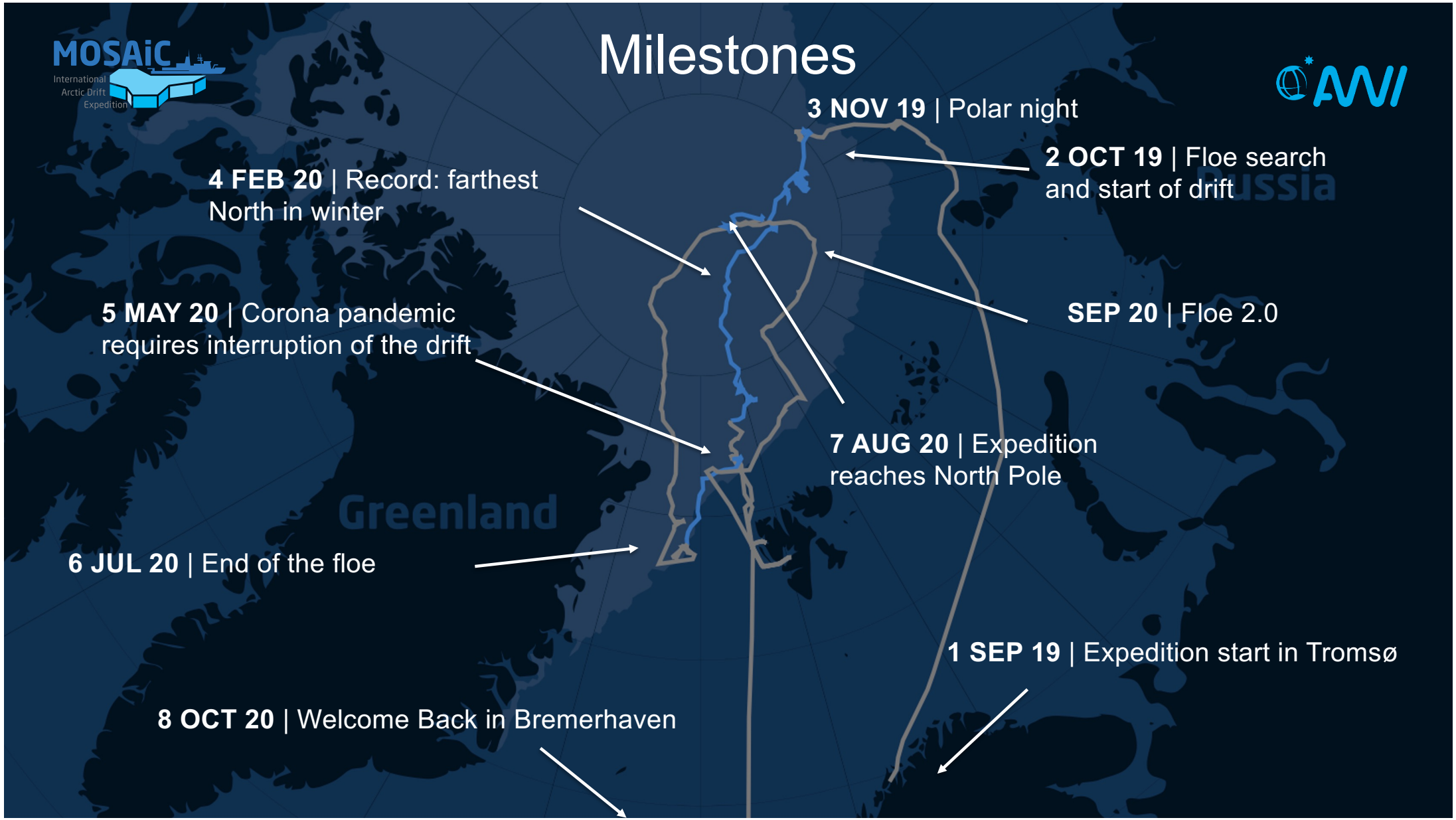
Remaining & New Challenges

It‘s cold.
It‘s dark.
It‘s hostile.
It‘s far.
It‘s urgent.
($r / T > 1$)

Available Solutions

Collaborate.
Multidisciplinarily.
Globally.
Act now!
To protect.




MOSAiC
International Arctic Drift Expedition
Milestones
AWI
3 NOV 19 | Polar night
2 OCT 19 | Floe search and start of drift
4 FEB 20 | Record: farthest North in winter
SEP 20 | Floe 2.0
5 MAY 20 | Corona pandemic requires interruption of the drift
7 AUG 20 | Expedition reaches North Pole
Greenland
6 JUL 20 | End of the floe
1 SEP 19 | Expedition start in Tromsø
8 OCT 20 | Welcome Back in Bremerhaven

MOSAiC International Arctic Drift Expedition

AWI

Thanks to all MOSAiC participants & crew members, topic leads and teams on land

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MOSAiC International Arctic Drift Expedition

AWI

10/2019	11/2019	12/2019	1/2020	2/2020	3/2020	4/2020	5/2020	6/2020	7/2020	8/2020	9/2020
Polar night: 6 October – 7 March					day/night	Polar day: 12 April – 12 September					
					Ice runway						
Phase 1 3 Months				Phase 2 2.5 Months		Phase 3 3 Months		Phase 4 2 Months		Phase 5 2.5 Months	

Ak. Fedorov

Cap. Dranitsyn

Cap. Dranitsyn
& Cap. Makarov

Maria S. Merian
& RV Sonne

Ak. Tryoshnikov

2x Twin Otter

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