



university of
 groningen

faculty of arts

Noodkreet vanaf Spitsbergen

We moeten aan de bak voor minder klimaatverandering



Maarten J.J.E. Loonen

24 mei 2024

10^{de} NIBI conferentie

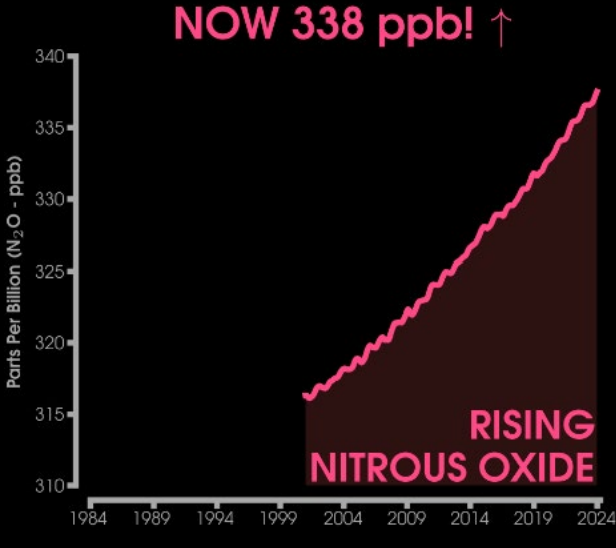
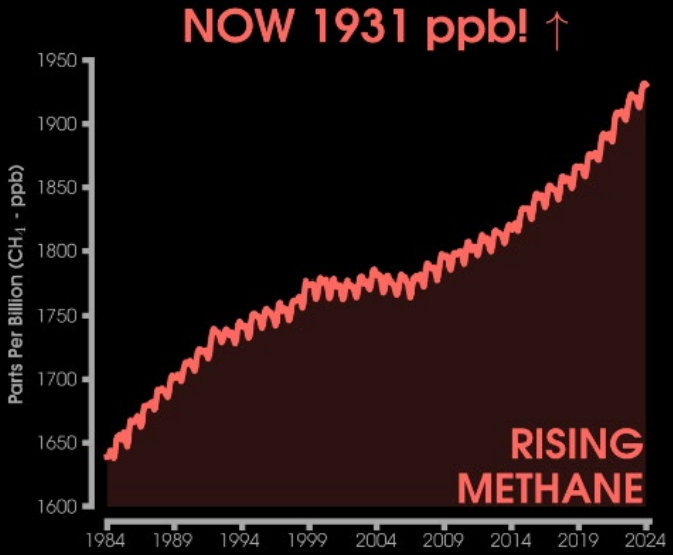
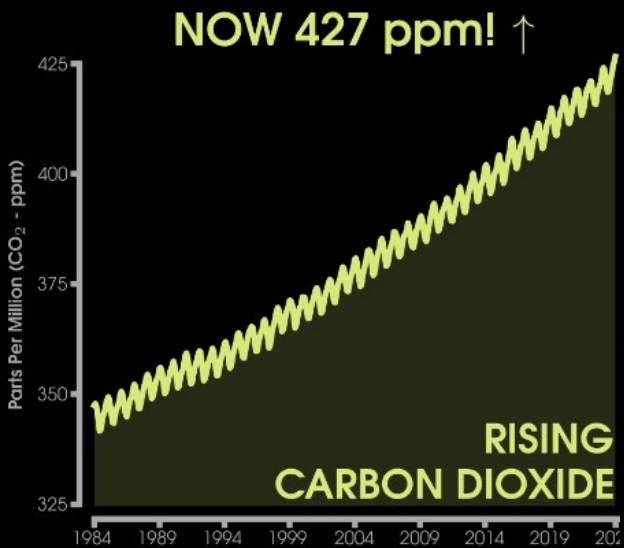
Egmond aan Zee

ARCTIC



CENTRE

University of Groningen The Netherlands



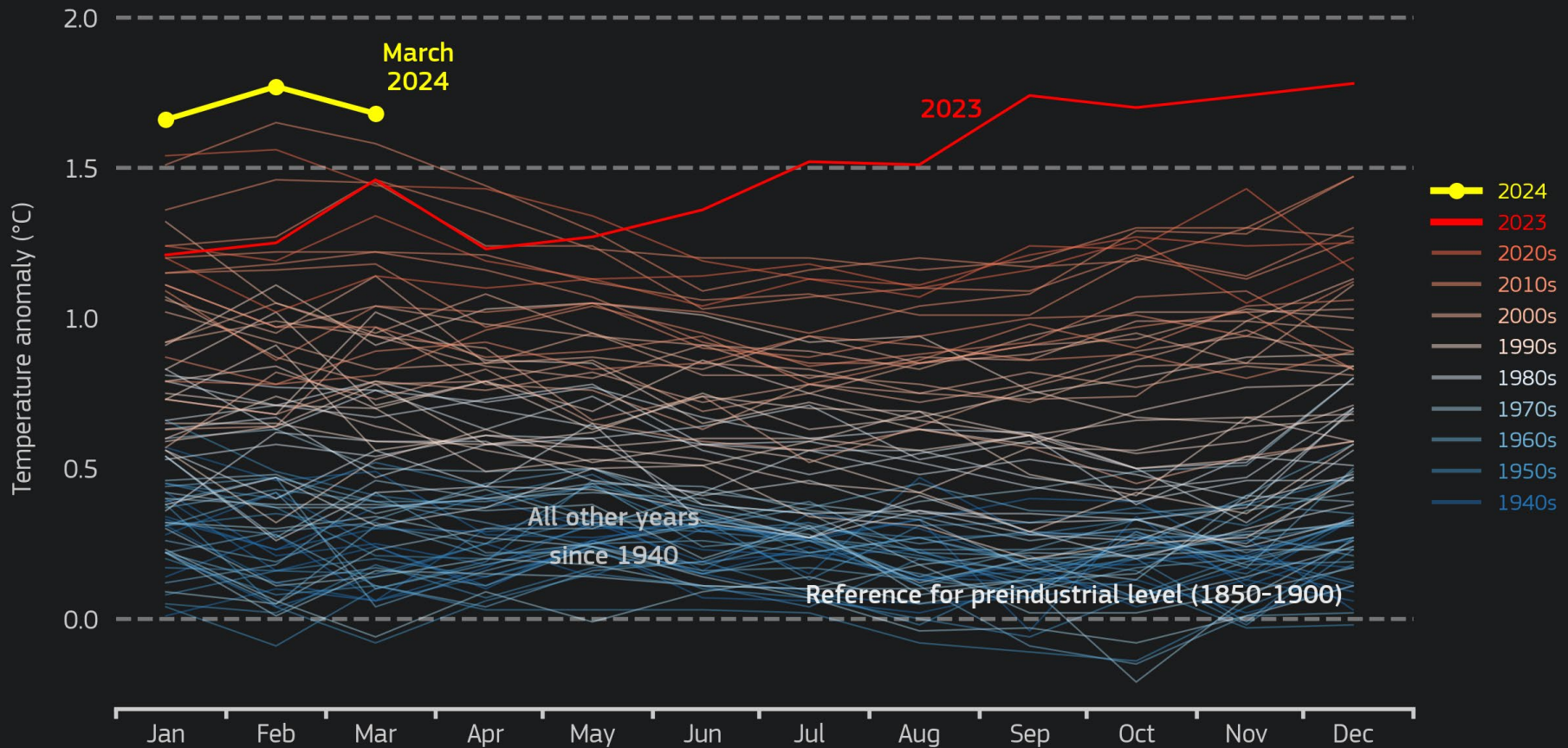
zacklabe.com
[Twitter@ZLabe](https://twitter.com/ZLabe)

Globale trend van de meest belangrijke klimaat-opwarmende gassen in de atmosfeer.

Gegevens van 1984 tot en met april 2024.

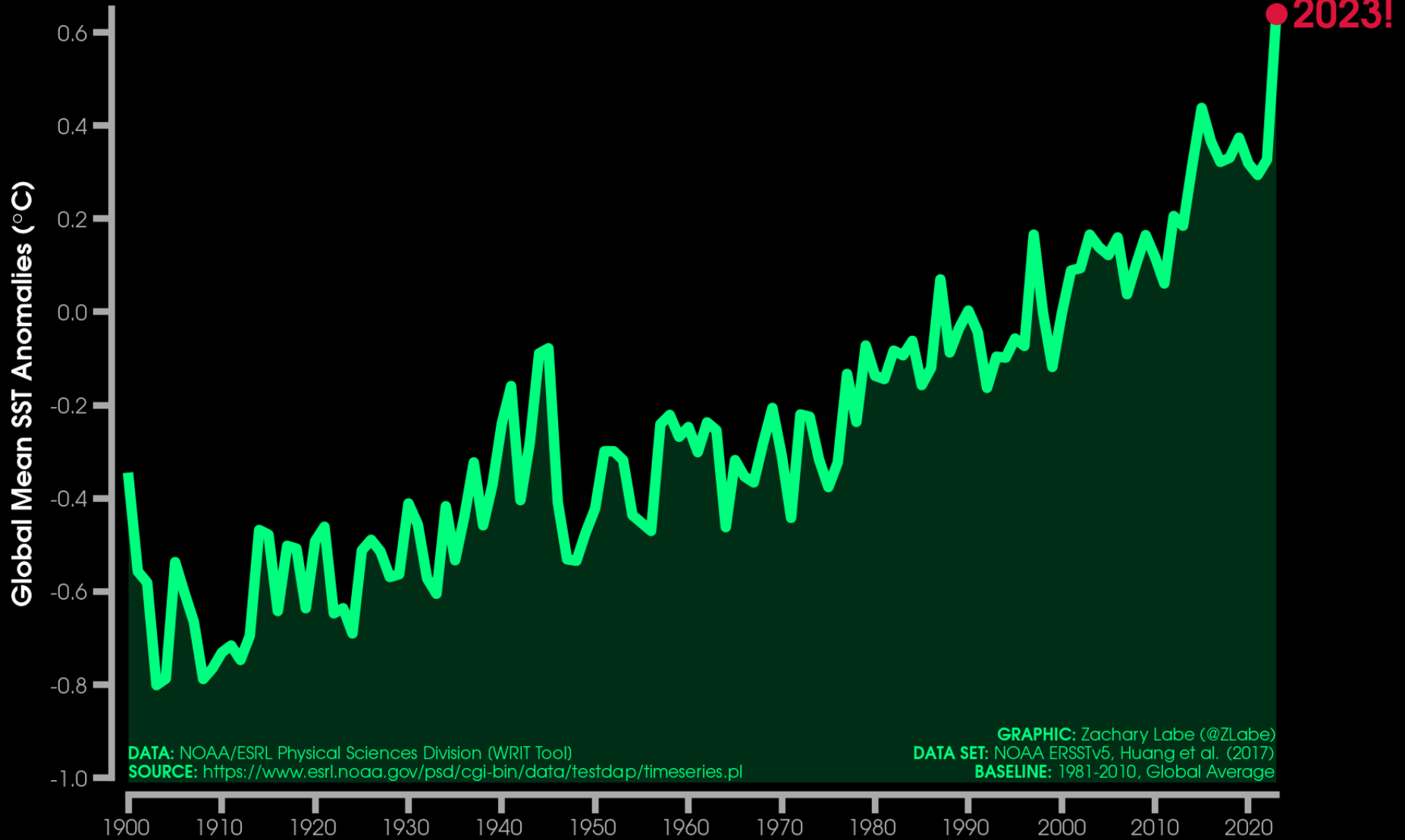
Monthly global surface air temperature anomalies

Data: ERA5 1940-2024 • Reference period: 1850-1900 • Credit: C3S/ECMWF



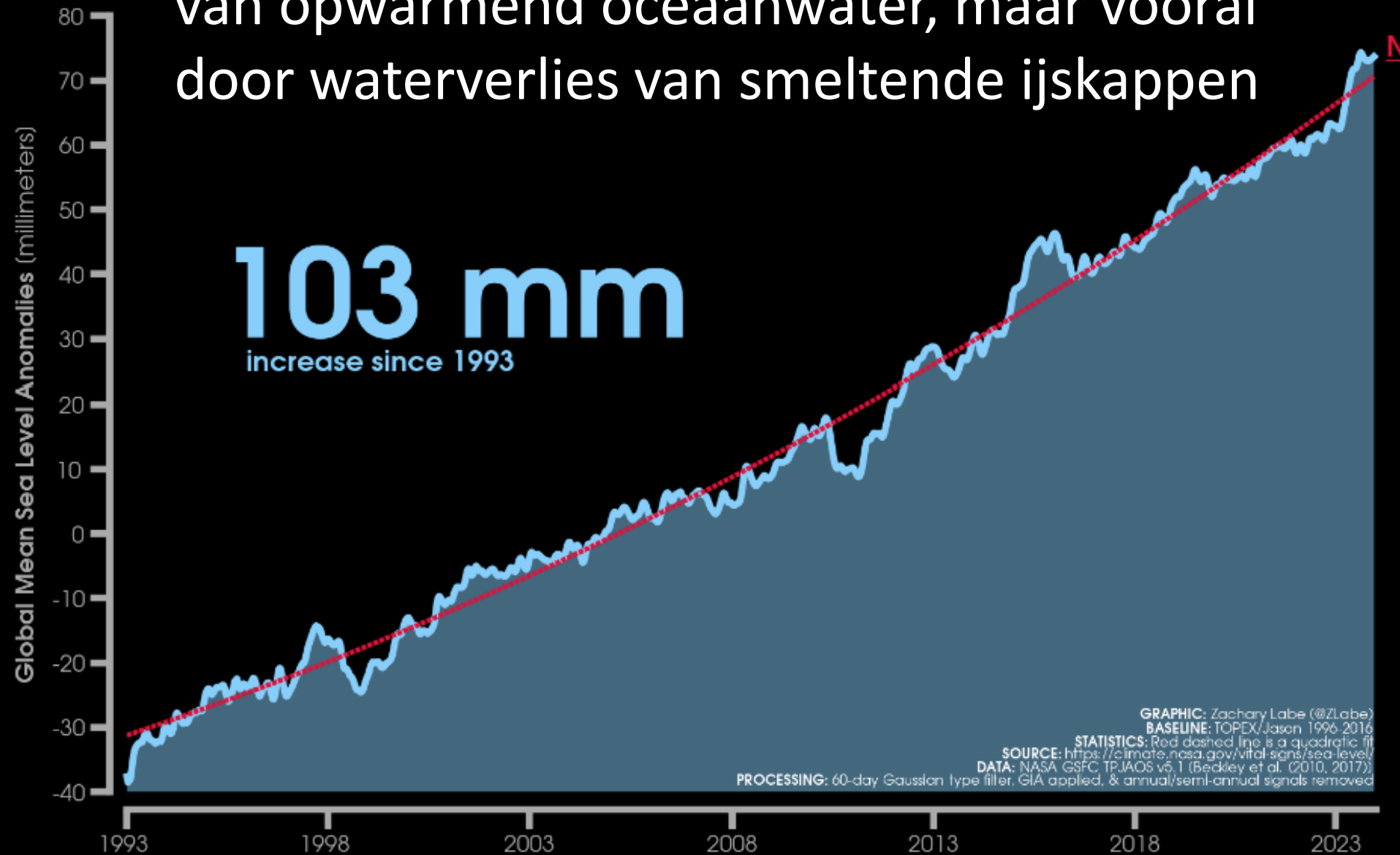
Sinds juni 2023 hebben we 10 maanden record hoge wereldwijde temperaturen, warmer dan alle metingen sinds 1940.

Oppervlakte temperatuur van de oceanen in september



periode 1900 tot 2023

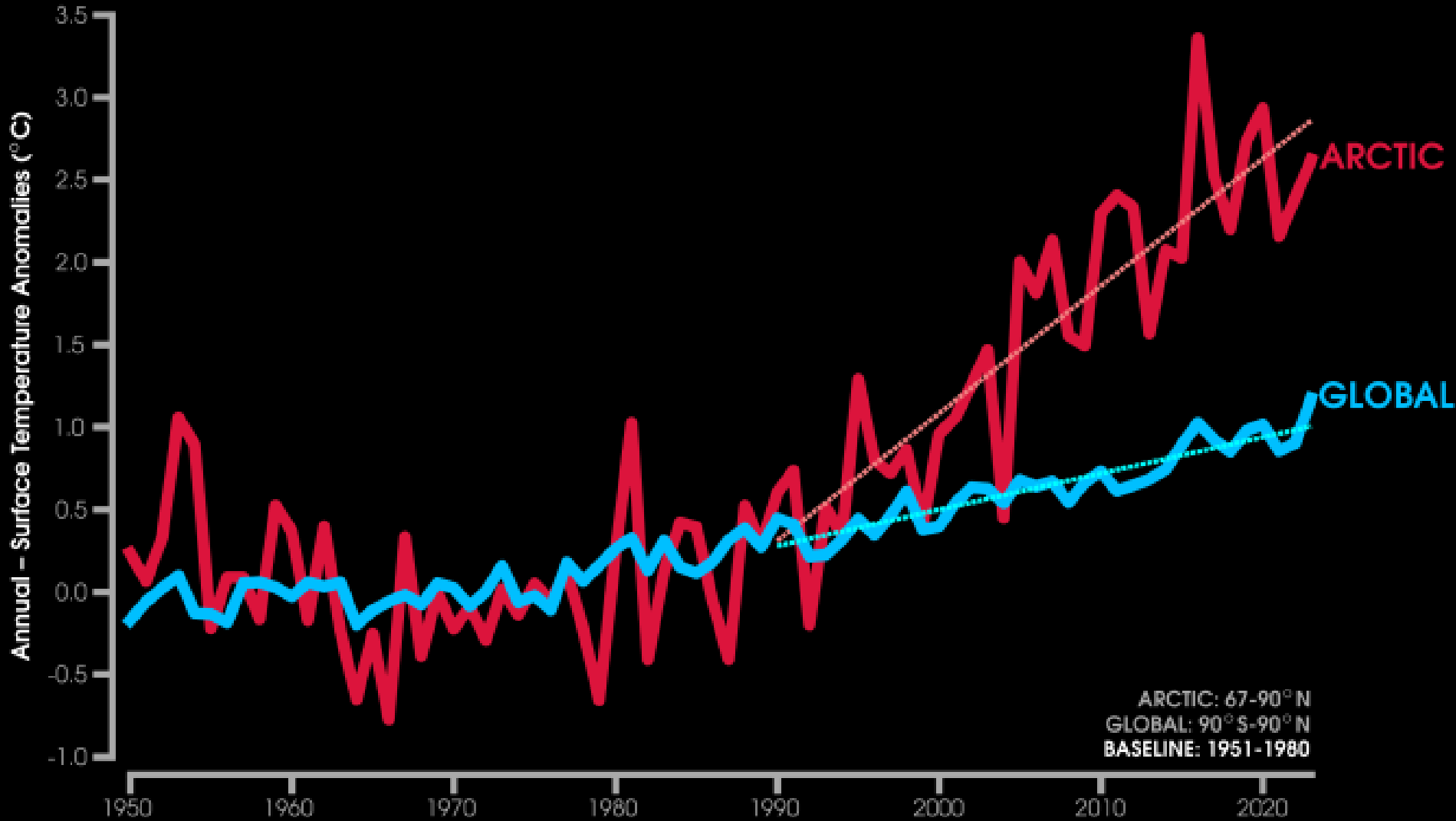
Stijgende zeespiegel door het uitzetten van opwarmend oceaanwater, maar vooral door waterverlies van smeltende ijskappen



Jan1993

Dec 2024

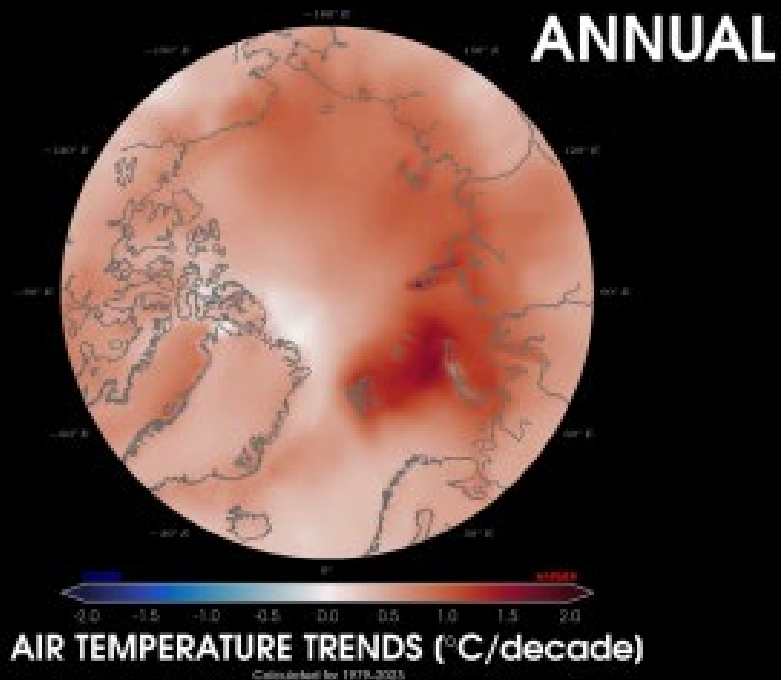
ARCTIC AMPLIFICATION



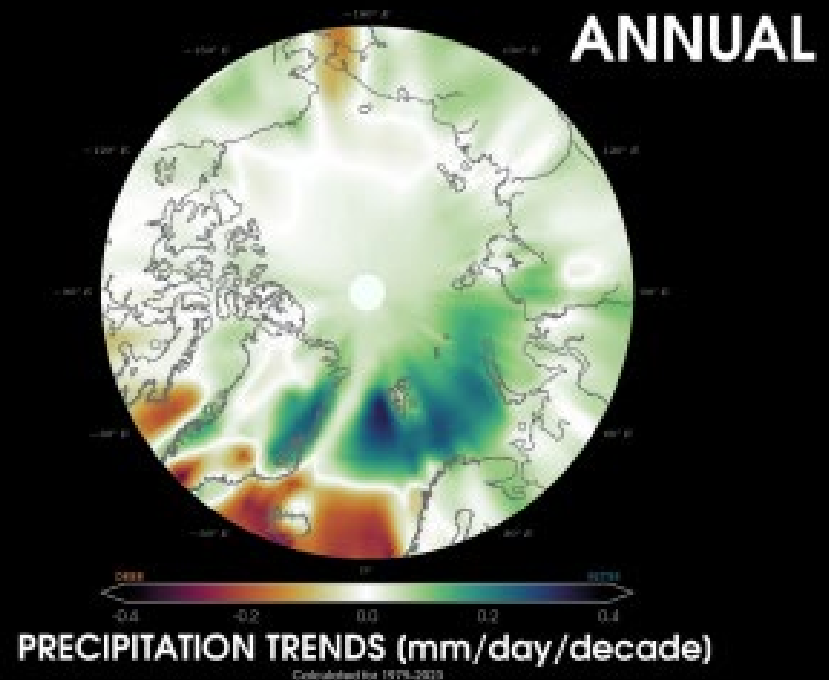
ARCTIC: 67-90° N
GLOBAL: 90° S-90° N
BASELINE: 1951-1980

DATA: NOAA/ESRL Physical Sciences Division (NASA/GISS GISTEMPv4)
SOURCE: <https://www.esrl.noaa.gov/psd/cgi-bin/data/tost/dap/timeseries.pl>

GRAPHIC: Zachary Labe (@ZLabe)



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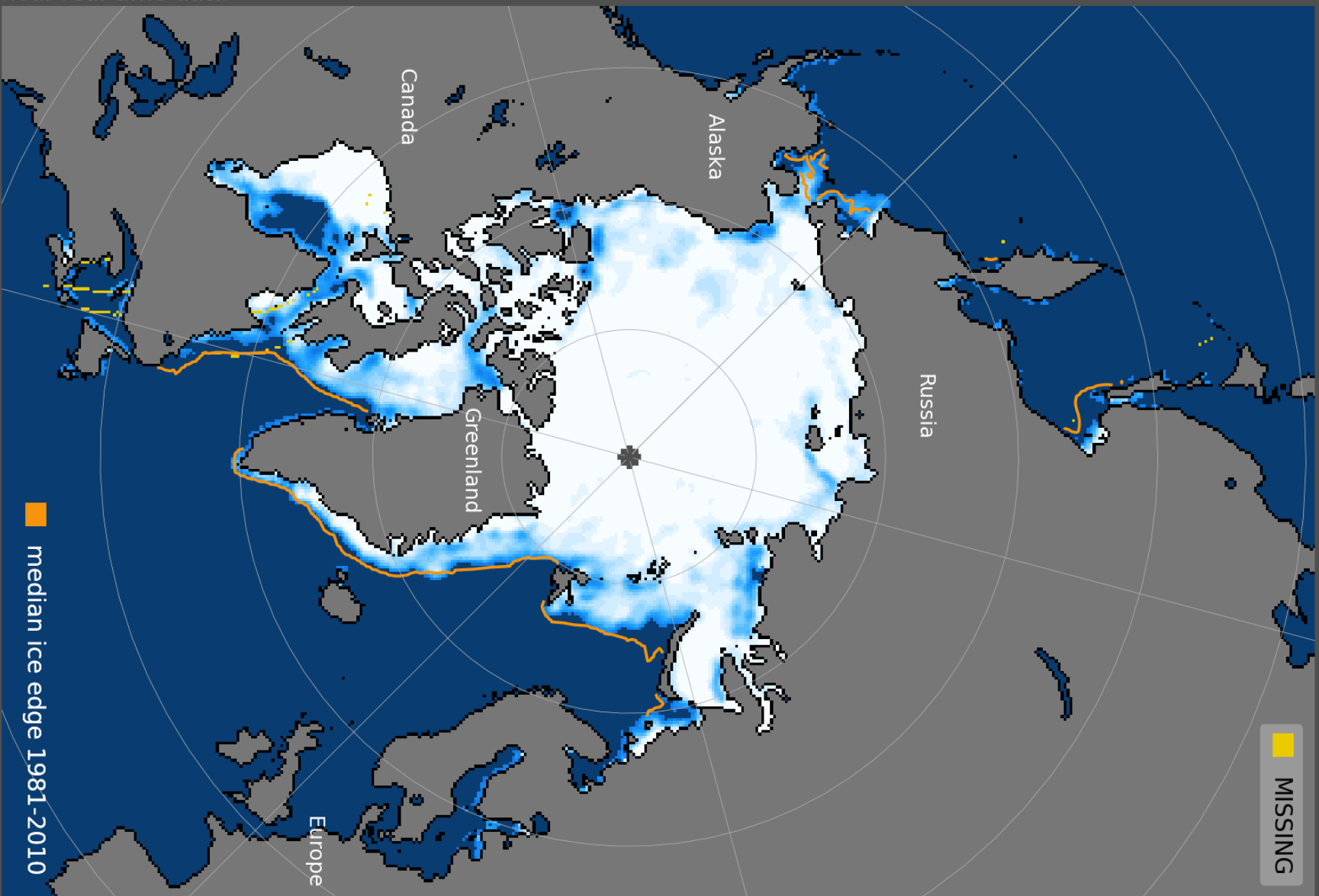
Large changes near Spitsbergen, a location where relatively a lot of ice has disappeared.

video: zeeijs in wording



Sea Ice Concentration, 22 May 2024

near-real-time data



MISSING

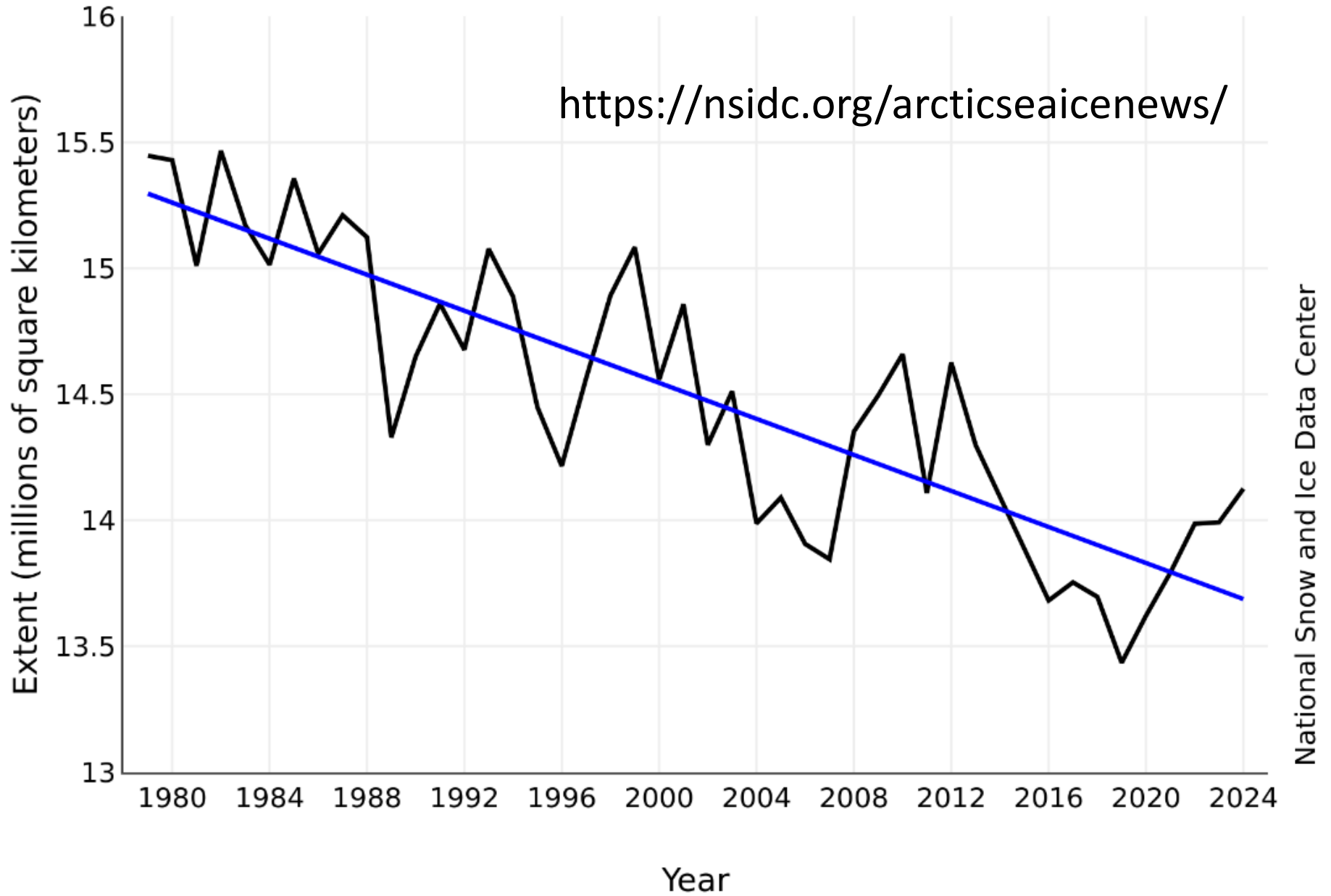
median ice edge 1981-2010

National Snow and Ice Data Center, University of Colorado Boulder



Average Monthly Arctic Sea Ice Extent

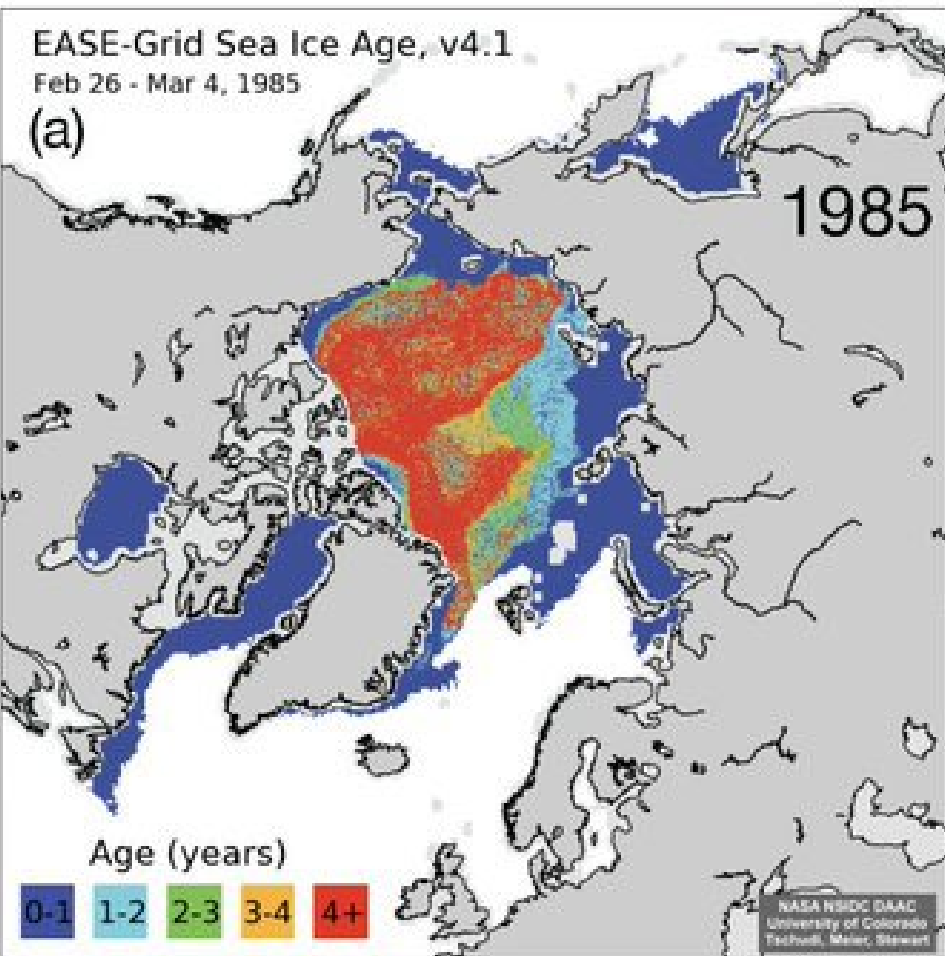
April 1979 - 2024



EASE-Grid Sea Ice Age, v4.1

Feb 26 - Mar 4, 1985

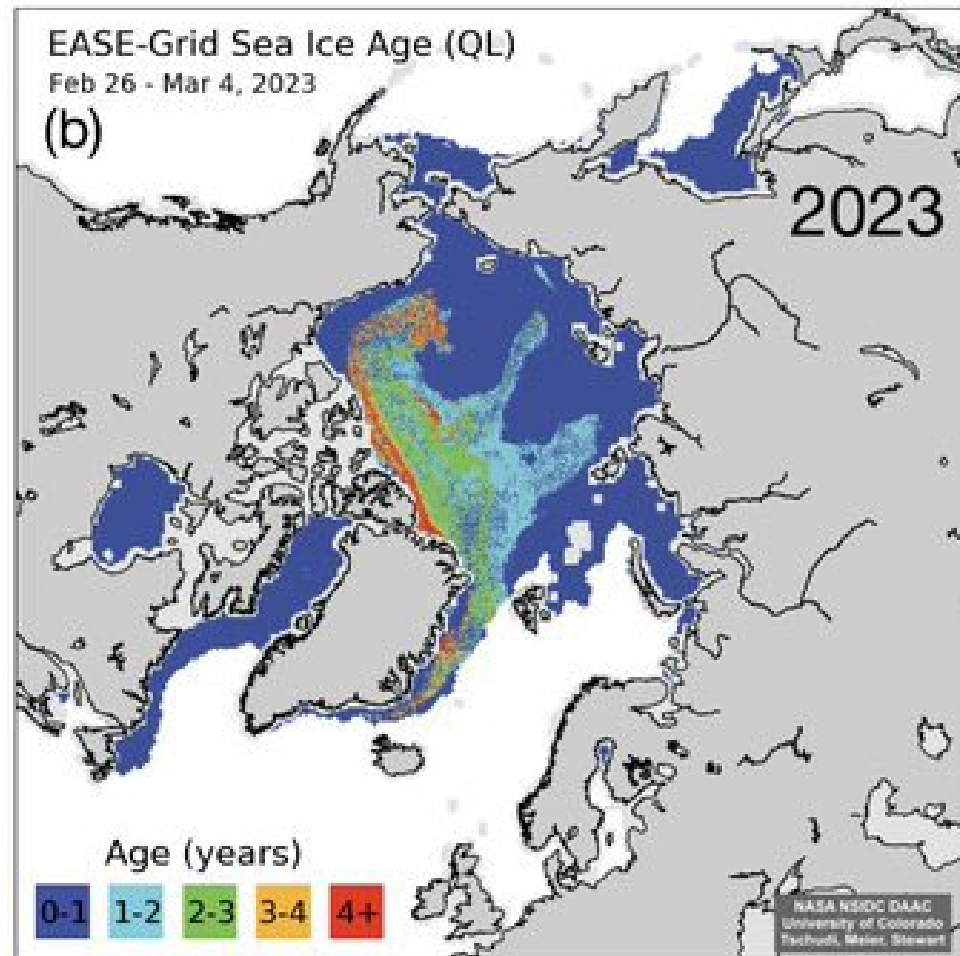
(a)



EASE-Grid Sea Ice Age (QL)

Feb 26 - Mar 4, 2023

(b)



Ijsdikte in de Arctische Oceaan:

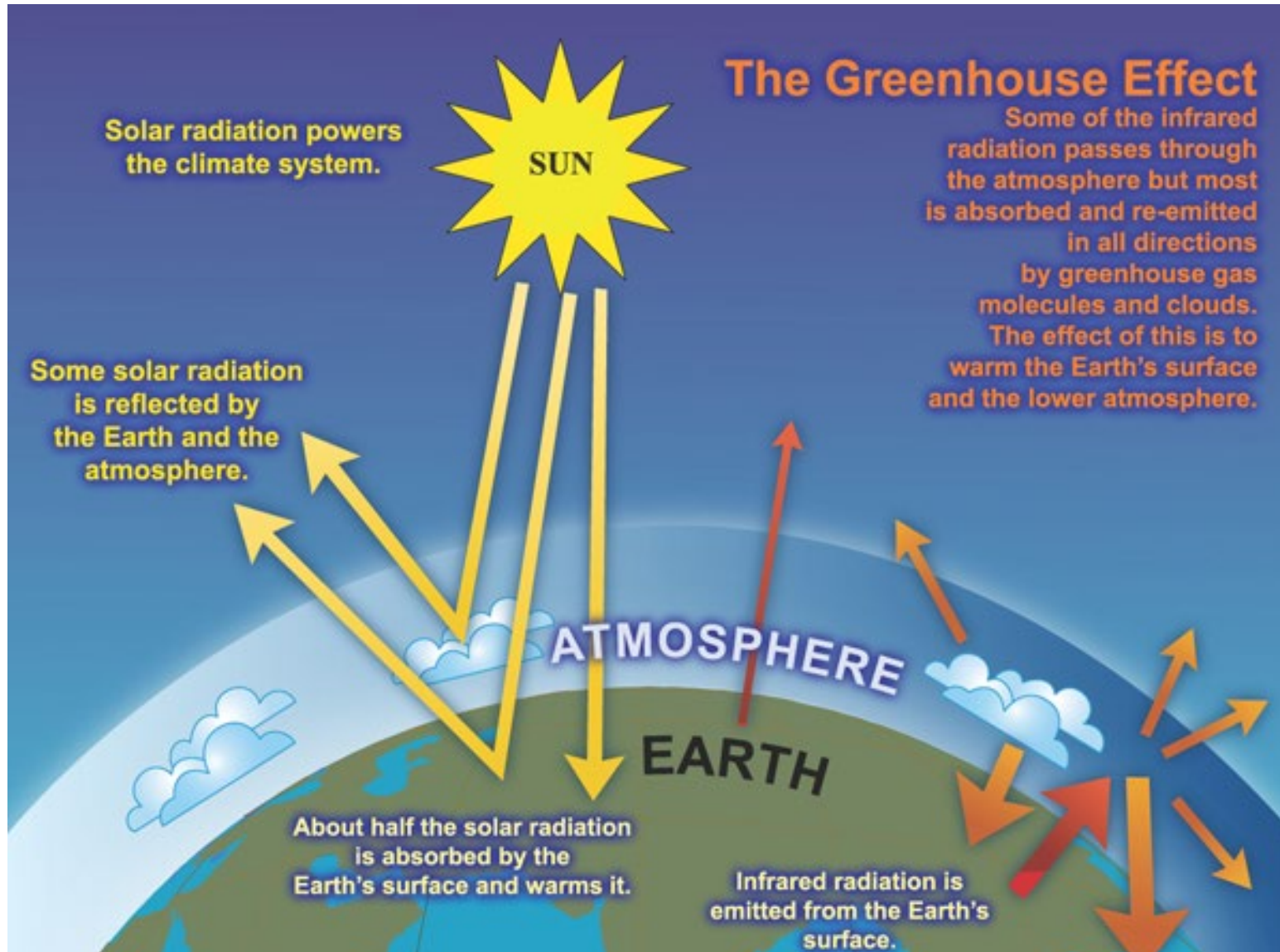
In 1980 was 35% ouder dan 4 jaar

In 2023 was dat slechts 3%

Broeikasgassen maken de aarde leefbaar

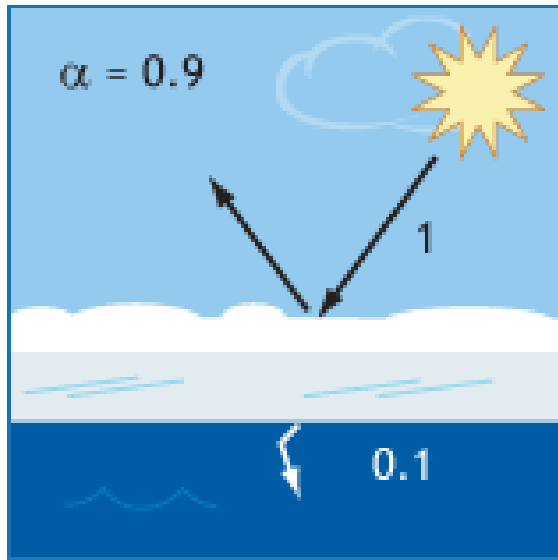
zonder = - 18 °C

met = +15 °C

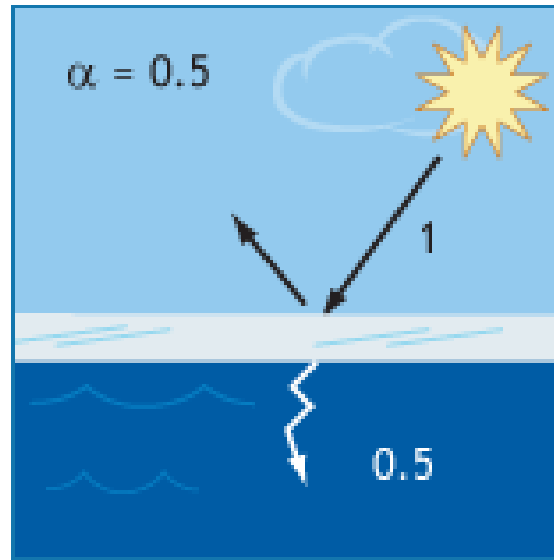


albedo fraction reflected of incoming radiation

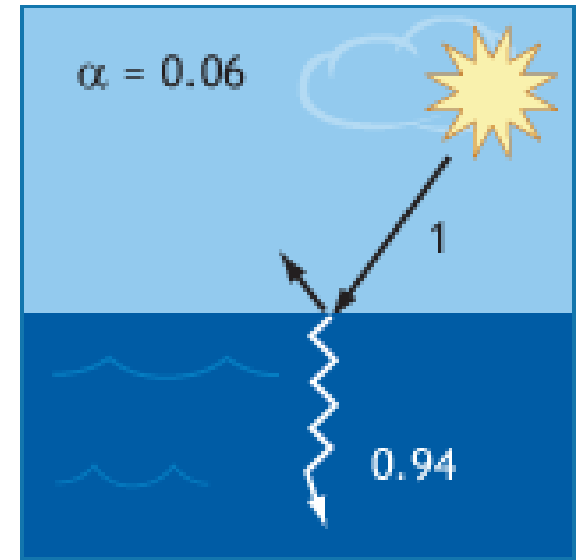
Ice with Snow



Bare Ice



Open Ocean



- Sea ice covers the Arctic ocean and block heat exchange to the atmosphere from warmer water
- No ice, warms the atmosphere.
- Warm air contains more water vapour.
- Watervapour warms the atmosphere (like CO_2).

Compound	Formula	Concentration in atmosphere ^[28] (ppm)	Contribution (%)
Water vapor	H ₂ O	increased global heating with a similar amount as CO ₂	
Carbon dioxide	CO ₂	~400	9–26%
Methane	CH ₄	~1.8	4–9%
Ozone	O ₃	2–8 ^(B)	3–7%

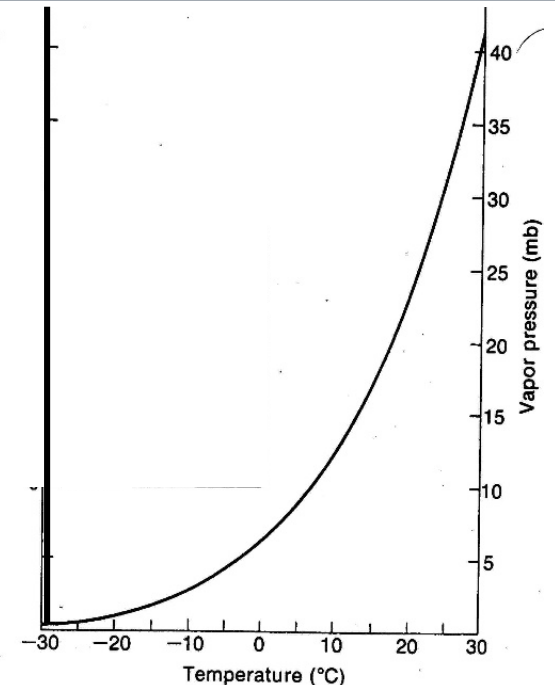
notes:

(A) Water vapor strongly varies locally^[29]

(B) The concentration in stratosphere. About 90% of the ozone in Earth's atmosphere is contained in the stratosphere.

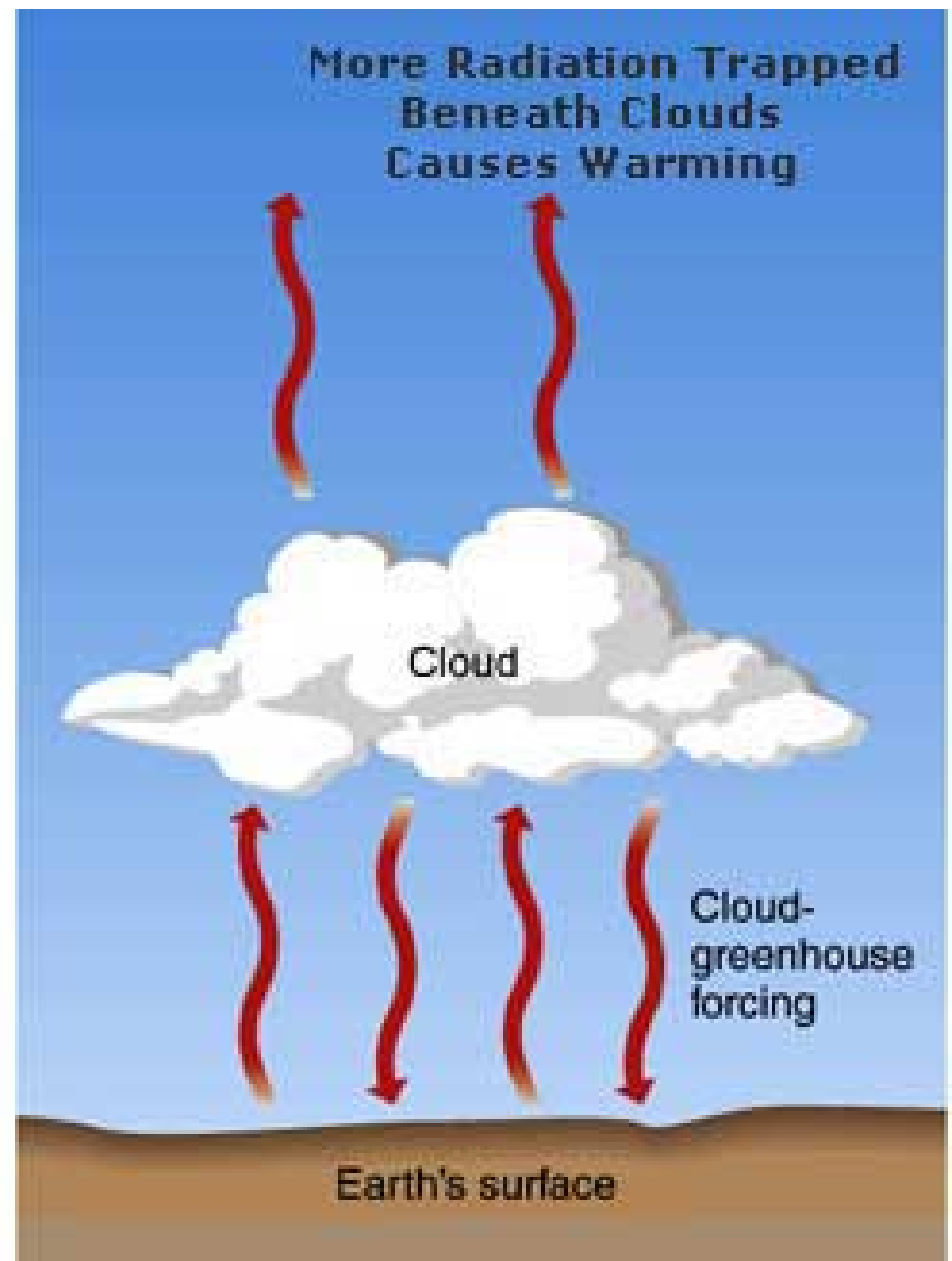
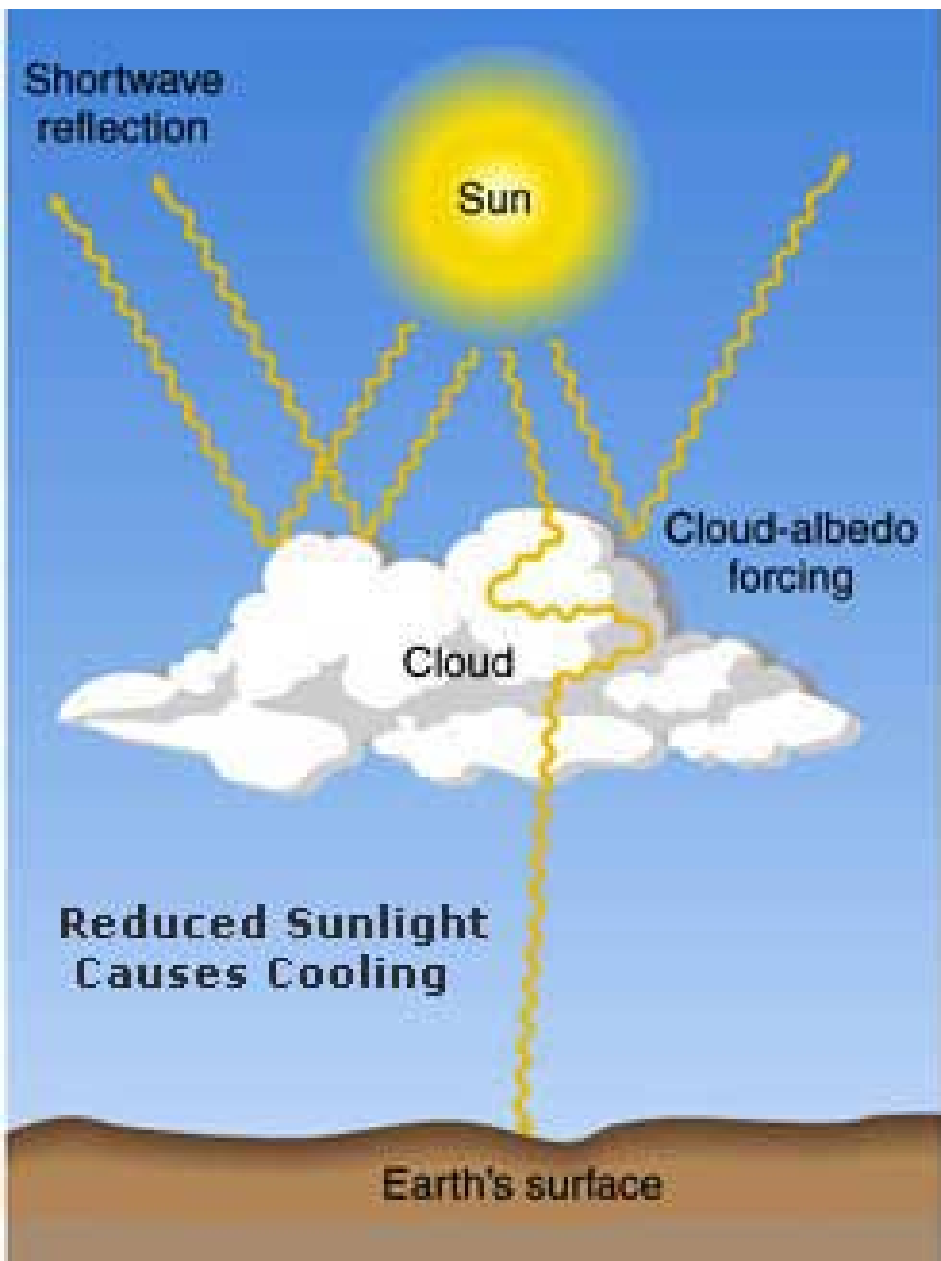
Waterdamp zorgt ook voor opwarming van de atmosfeer maar is geen klimaatgas, door de lokale variatie en de plotselinge condensatie.

Warme lucht kan meer waterdamp bevatten waardoor het ook meer kan regenen.

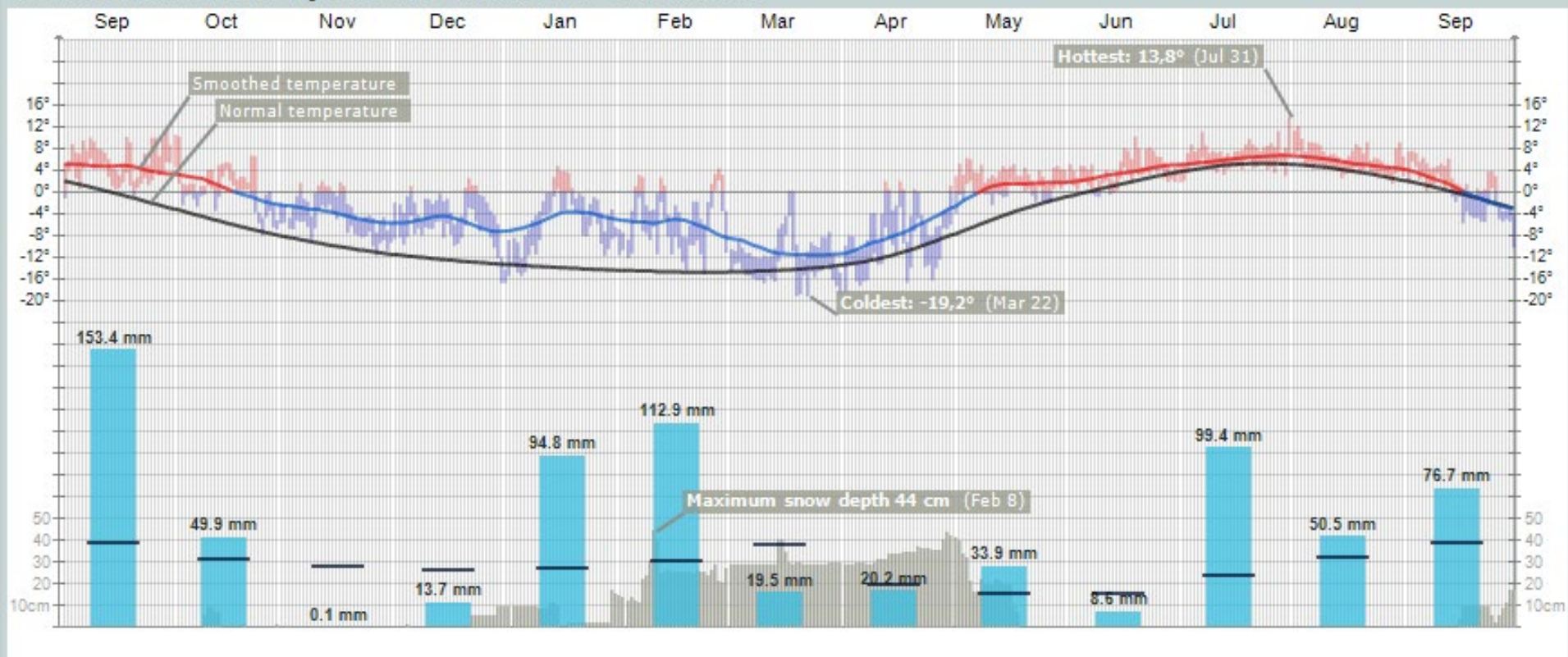


Effect of clouds

The Arctic has 24 hours daylight in summer and 24 hours darkness in winter



Weather statistics for Ny-Ålesund September 2017 – September 2018



[www.yr.no / Ny-Ålesund / statistics](http://www.yr.no/Ny-Ålesund/statistics)



NETHERLANDS
ARCTIC STATION
NY-ÅLESUND SPITSBERGEN

geen ijs in het fjord
regen op sneeuw -> ijzel













Photo: Christophe Brochard



Photo: Christophe Brochard



Photo: Christophe Brochard





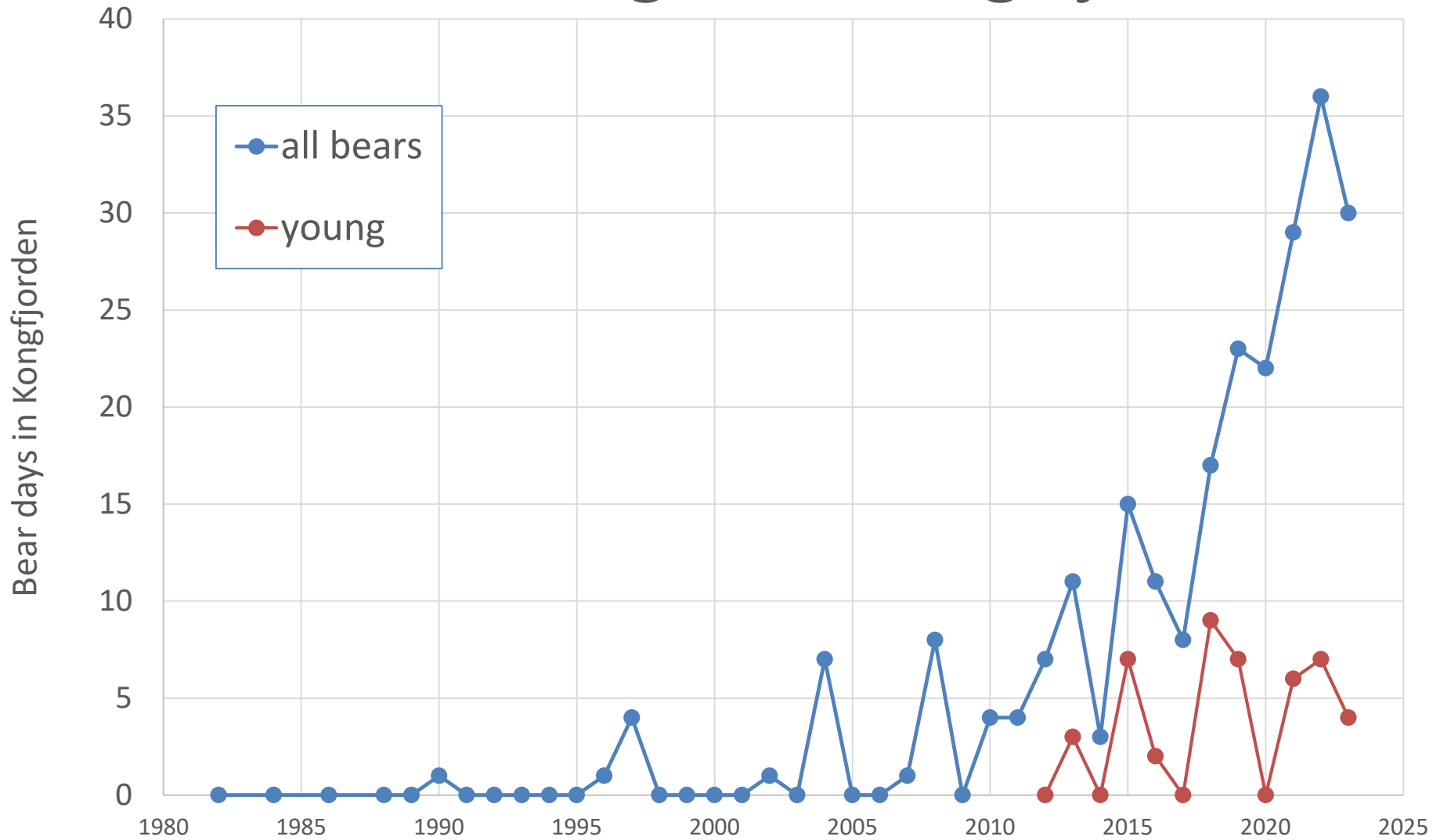
Polar bears fond of goose eggs

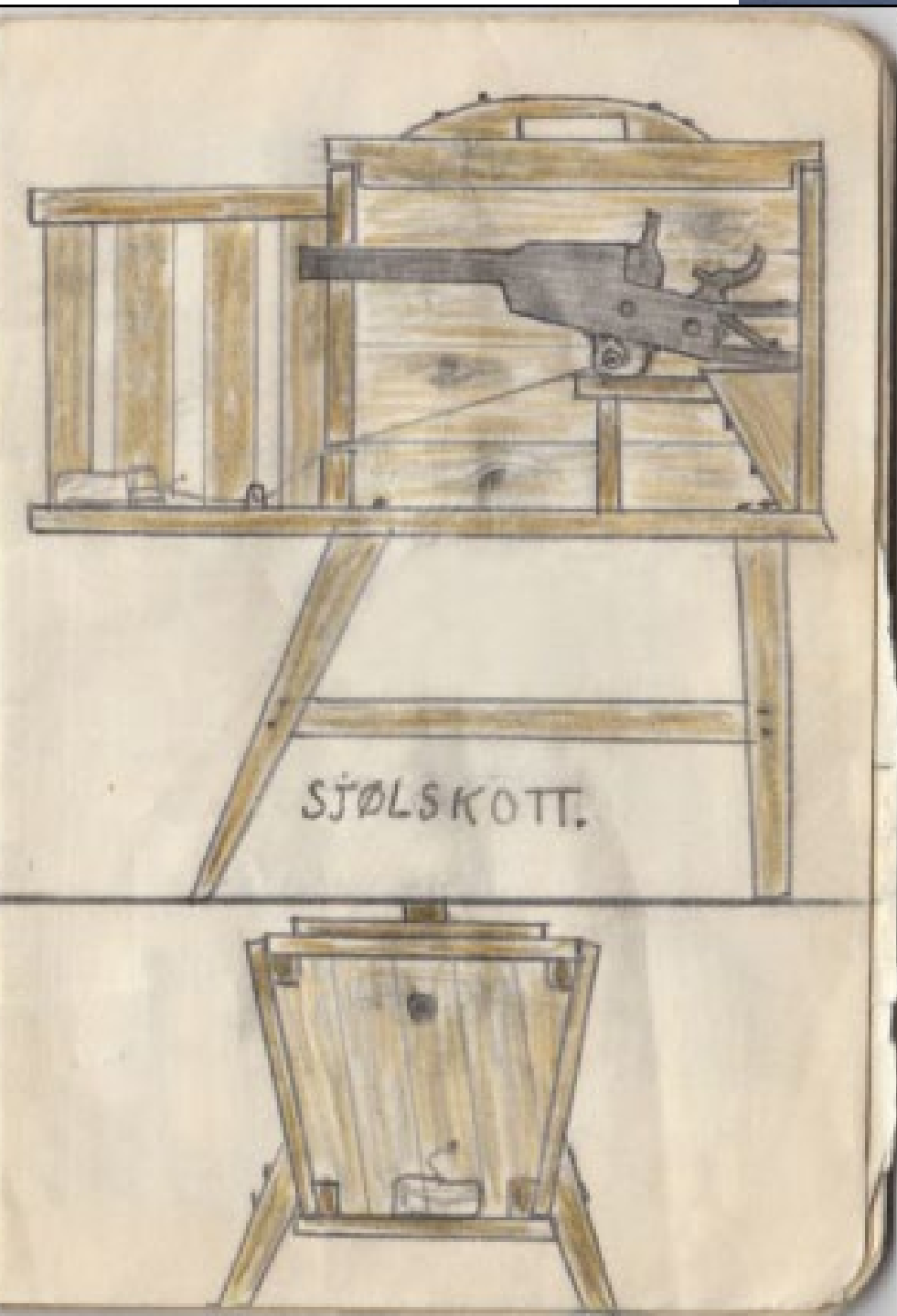


Nordenskiöldkysten goose research 2012

Video by Jouke Prop, Ezinge, University of Groningen
<https://www.youtube.com/watch?v=uUGYZX9gTyA>

Ijsbeerdagen in Kongsfjord





Sinds 1972 herstelt de populatie ijsberen van de jacht, nu is klimaatverandering een volgende bedreiging.



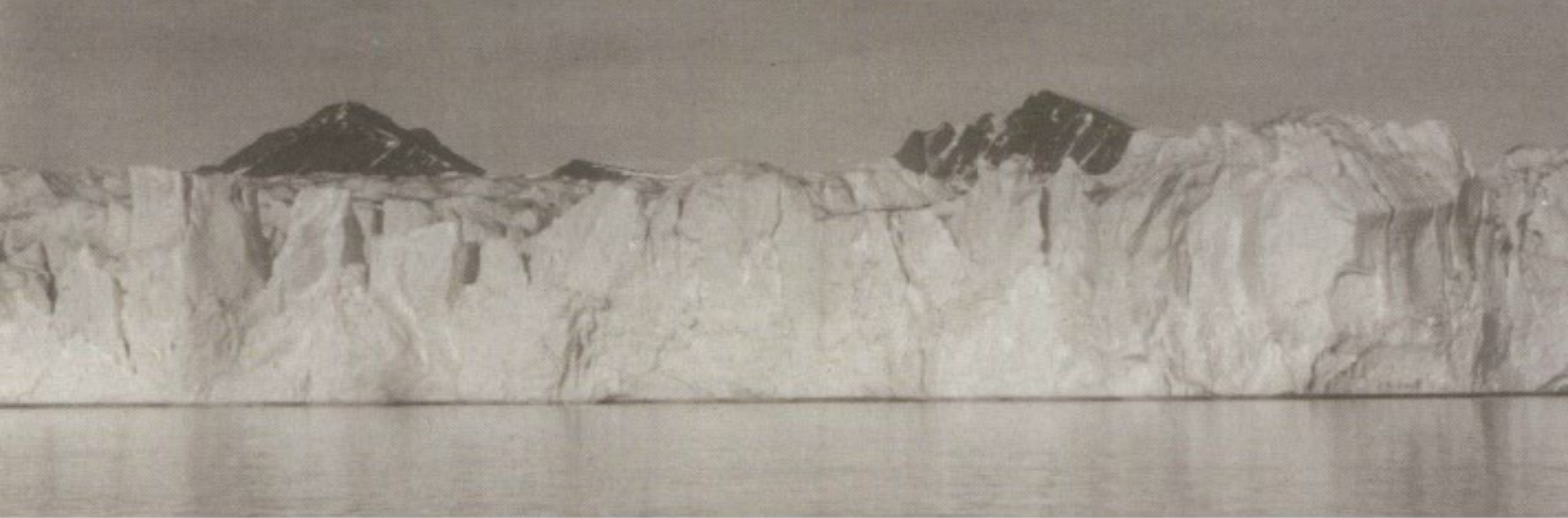
Source: YouTube: BBC earth – the hunt

1918



2002





Blomstrandbreen glacier 1918 ↑ 2002 ↓ Greenpeace Magazine 2002(4)

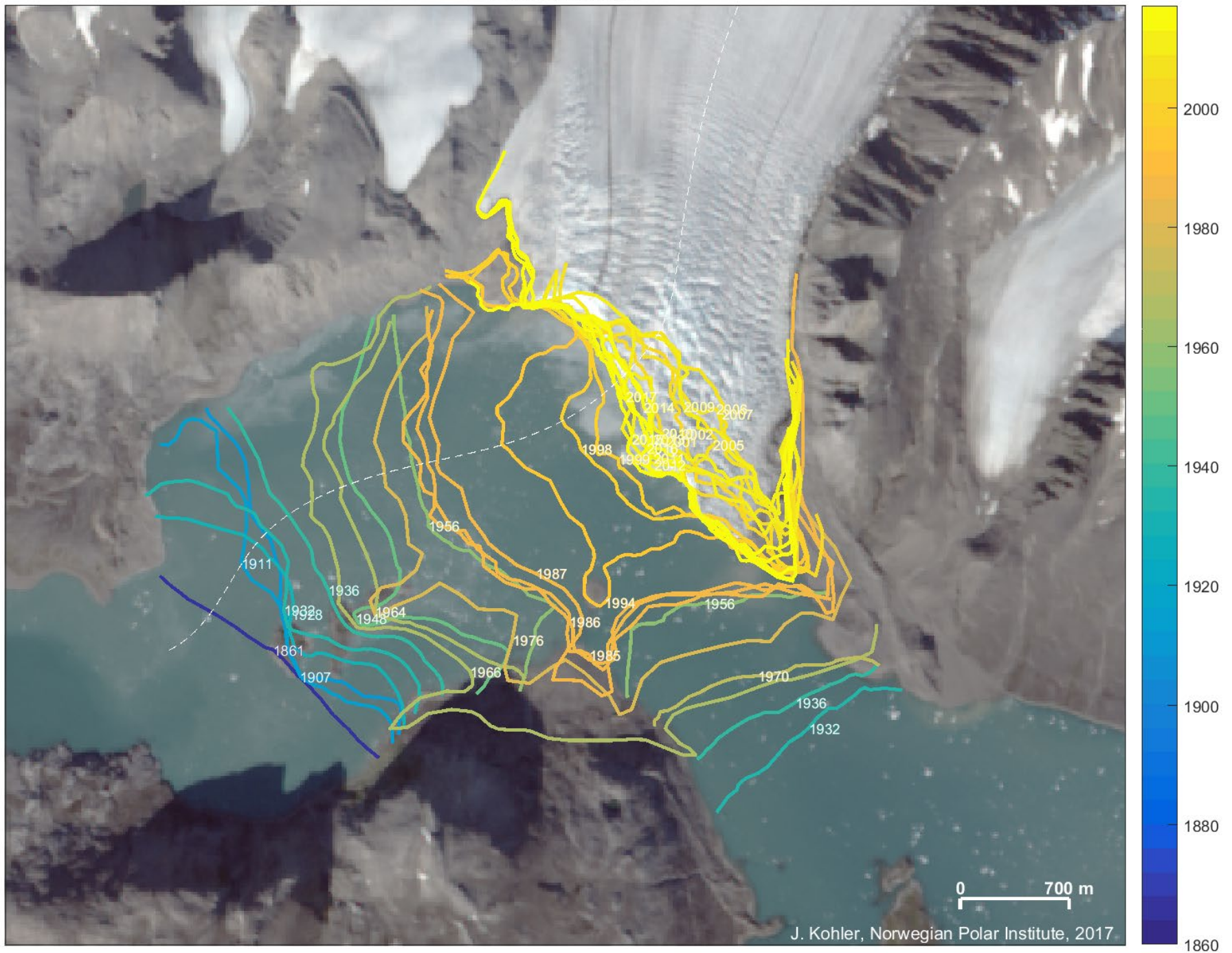


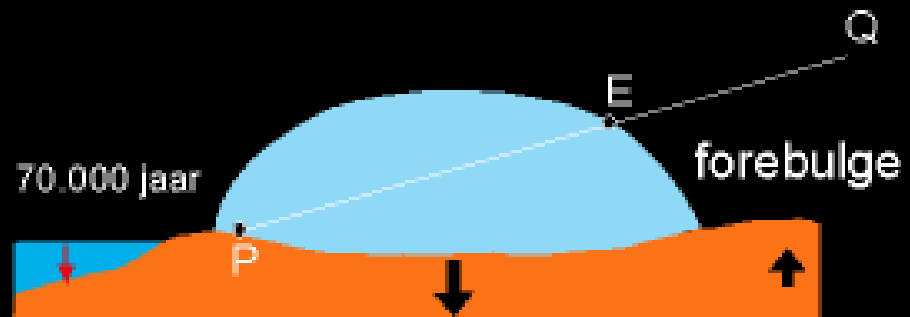
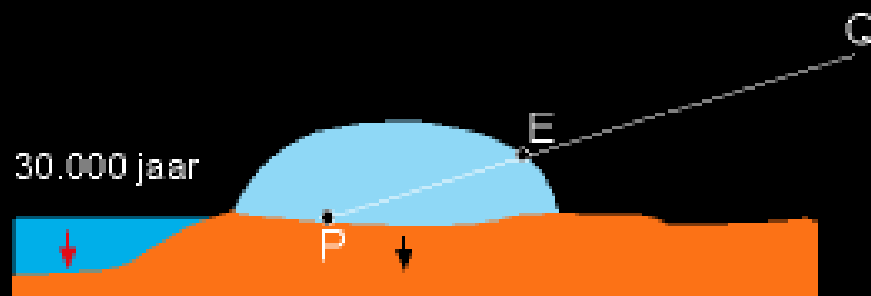
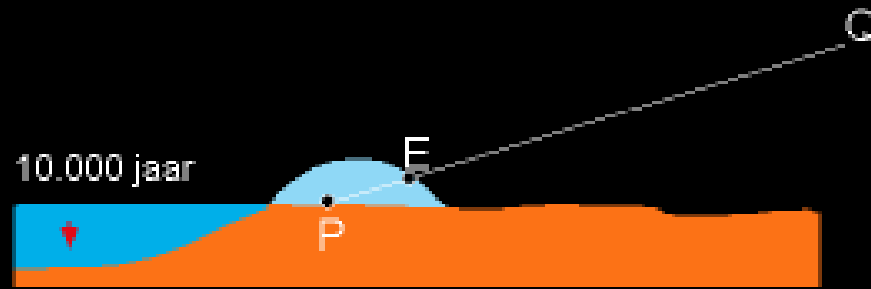
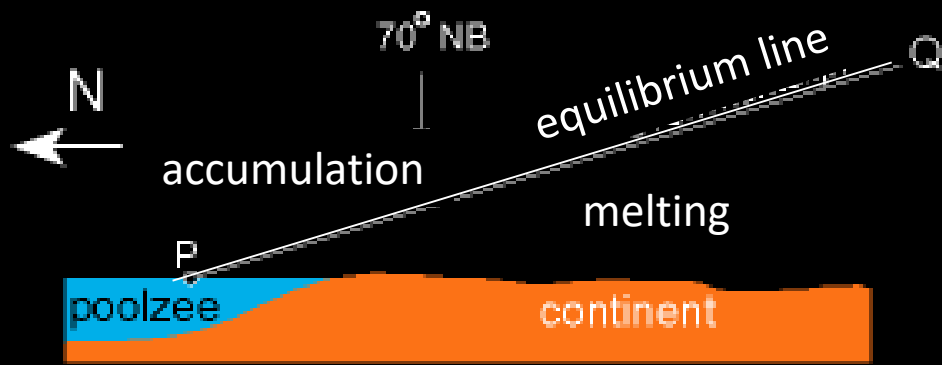




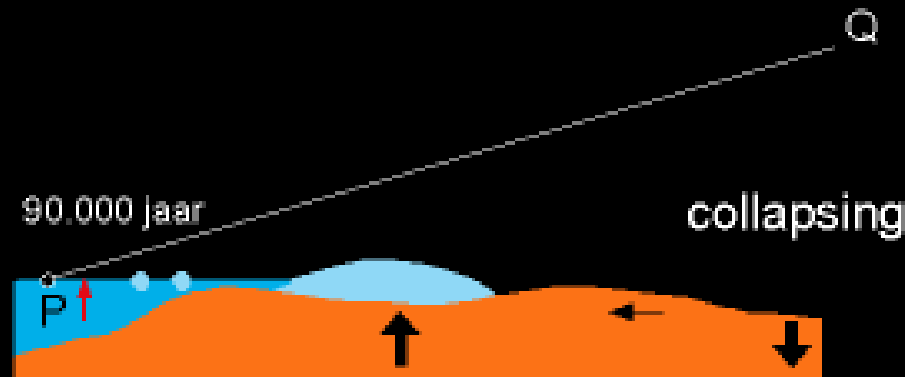
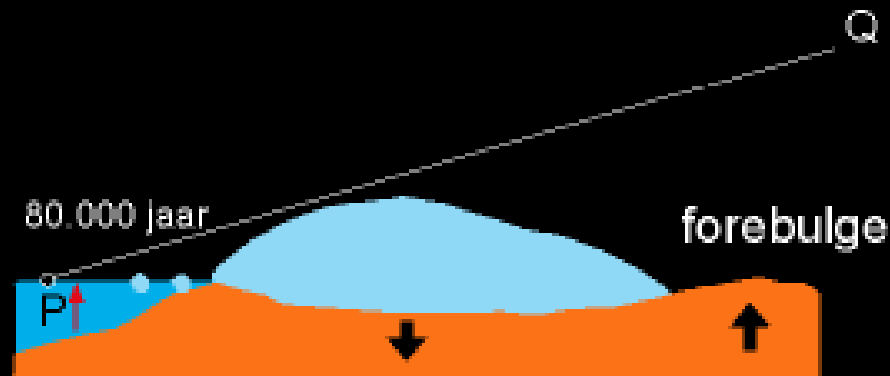
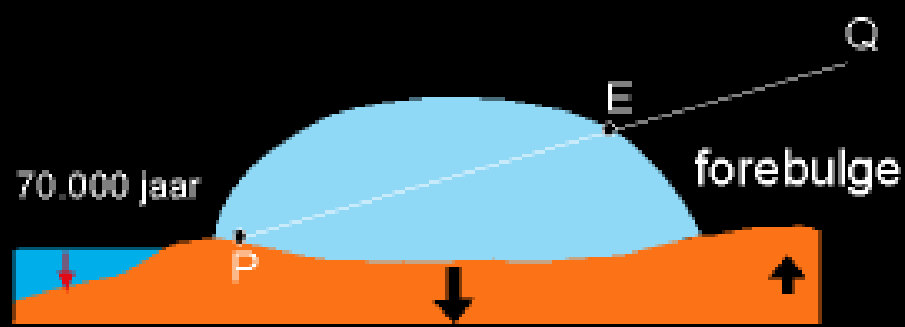
video: vallend gletsjerijs

Blomstrandbreen





After Oerlemans 1979



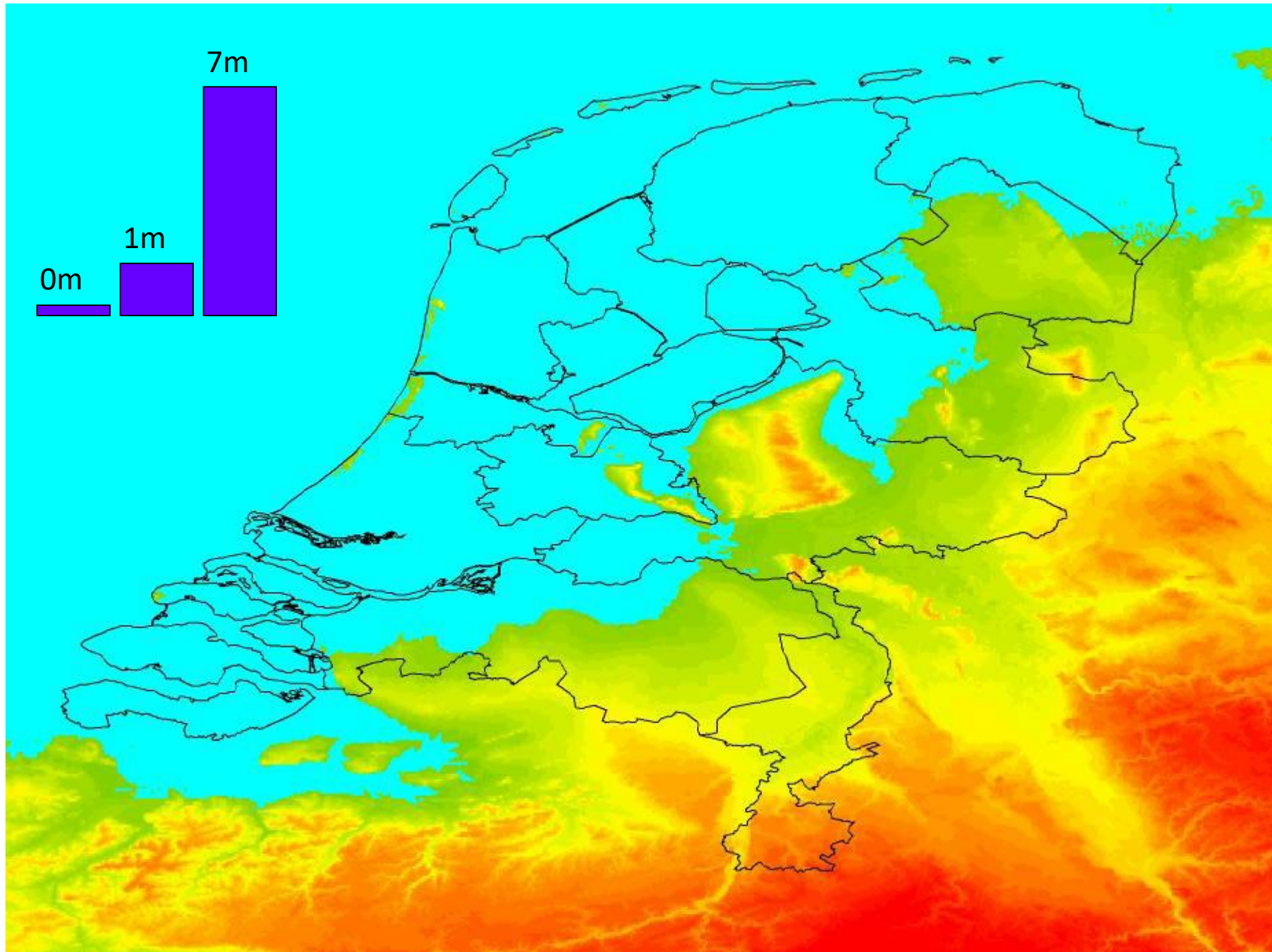
Tipping point

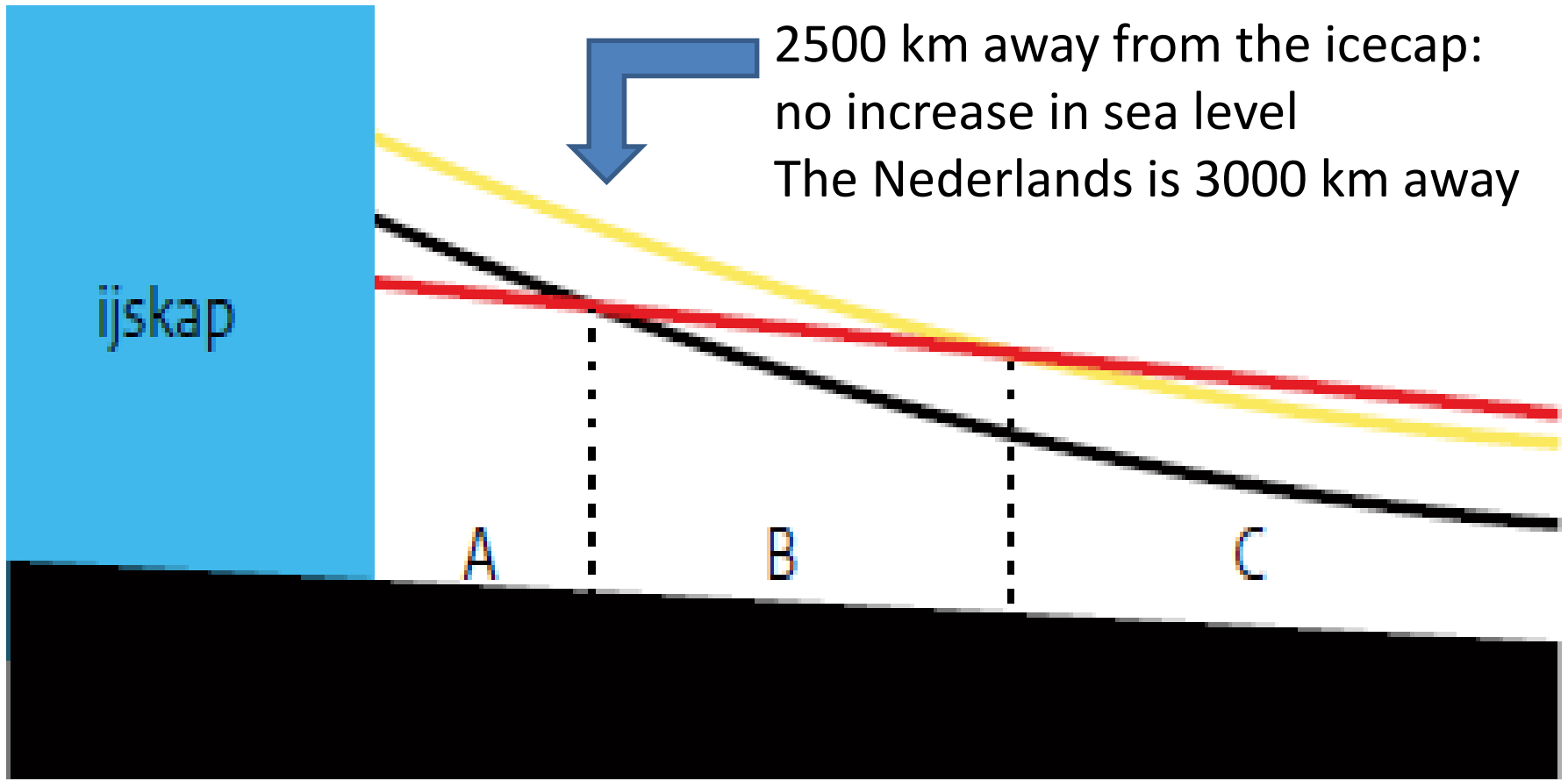
Dynamics of ice caps: Greenland and Antarctica






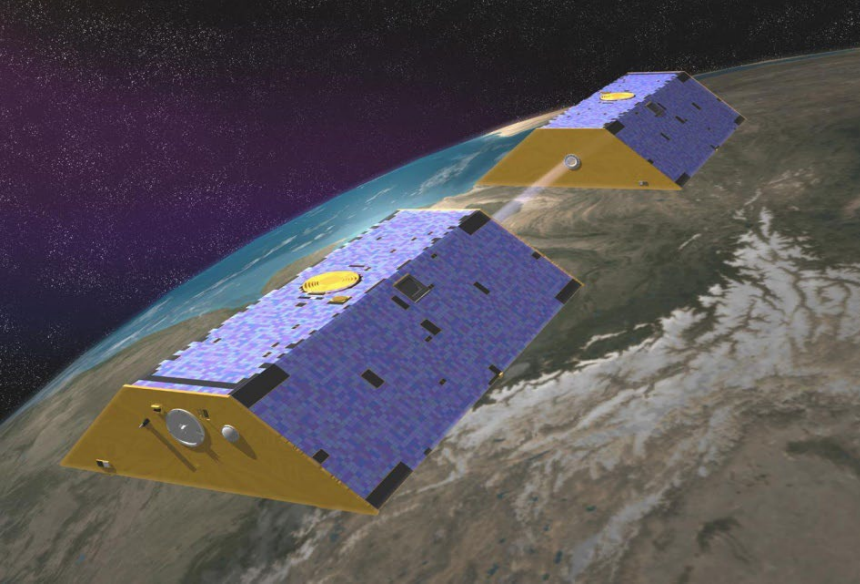
Al Gore

An Inconvenient Truth (2006)





-  Original sea level when ice cap attracts water
-  7 meter sea level rise when Greenland icecap has melted
-  Sea level without gravity from the ice cap



ANTARCTICA MASS VARIATION SINCE 2002

Data source: Ice mass measurement by NASA's GRACE satellites. Gap represents time between missions.
Credit: NASA

RATE OF CHANGE

↓ 140

billion metric tons per year since 2002



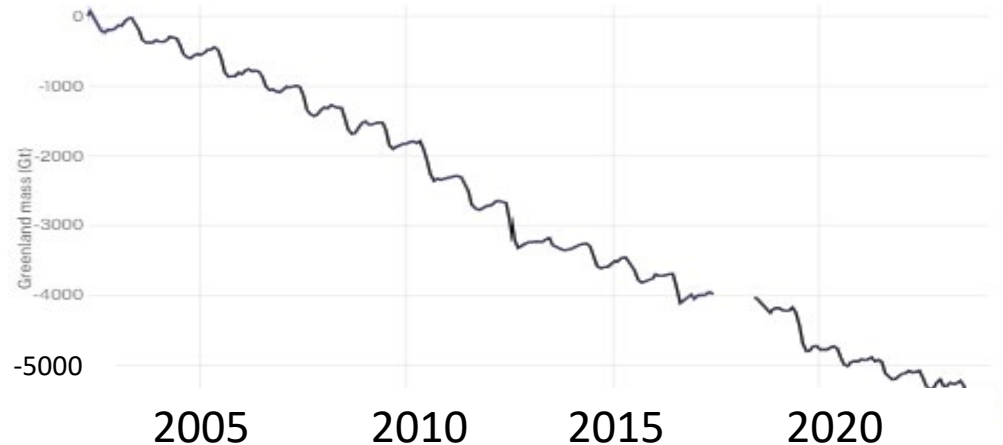
GREENLAND MASS VARIATION SINCE 2002

Data source: Ice mass measurement by NASA's GRACE satellites. Gap represents time between missions.
Credit: NASA

RATE OF CHANGE

↓ 268

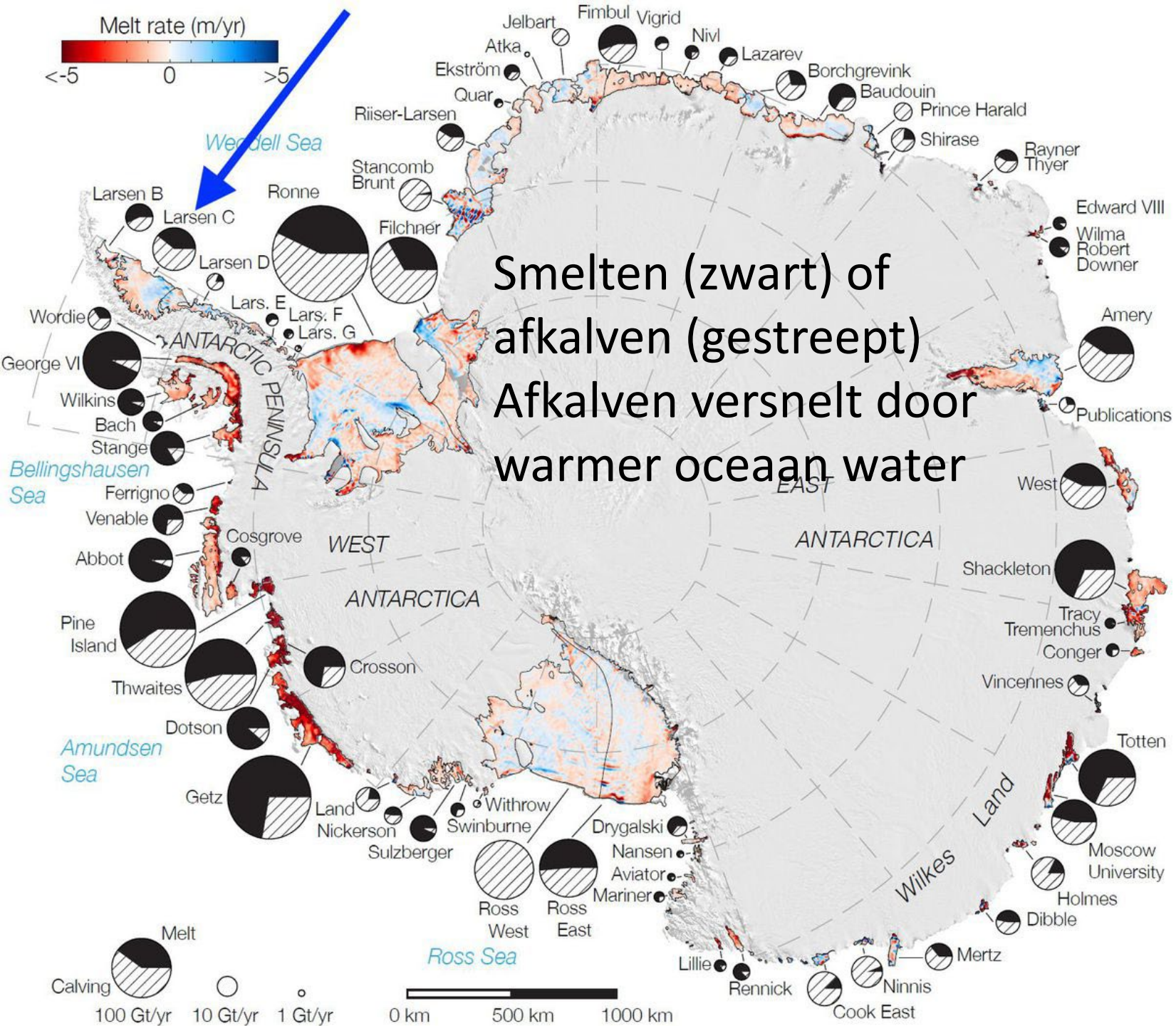
billion metric tons per year since 2002



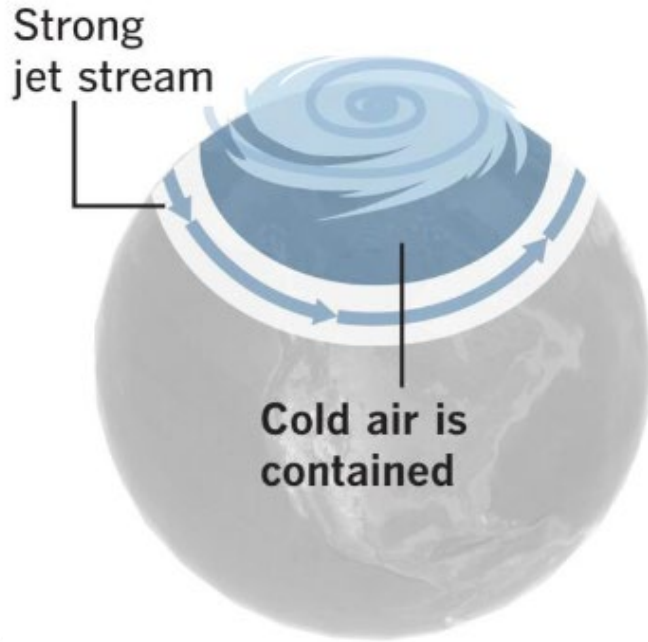
Massa maakt zwaartekracht
Ijs op land is lokaal extra
massa

Veranderingen in ijsmassa is
te meten met satellieten
(payload name Grace)

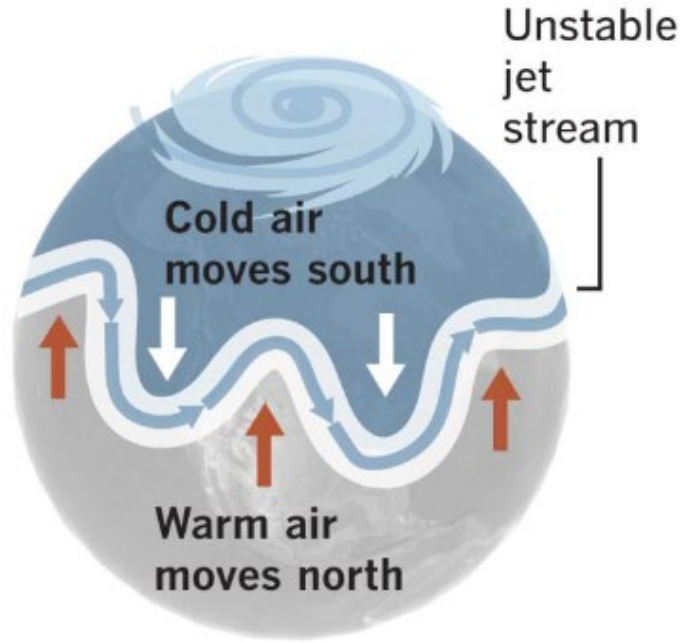
Grafieken van mei 2002 tot en met jan.2024
Eenheden: bilion metric tonnes per year
=miljoen ton = 10^{12} kg



Stable polar vortex



Wavy polar vortex

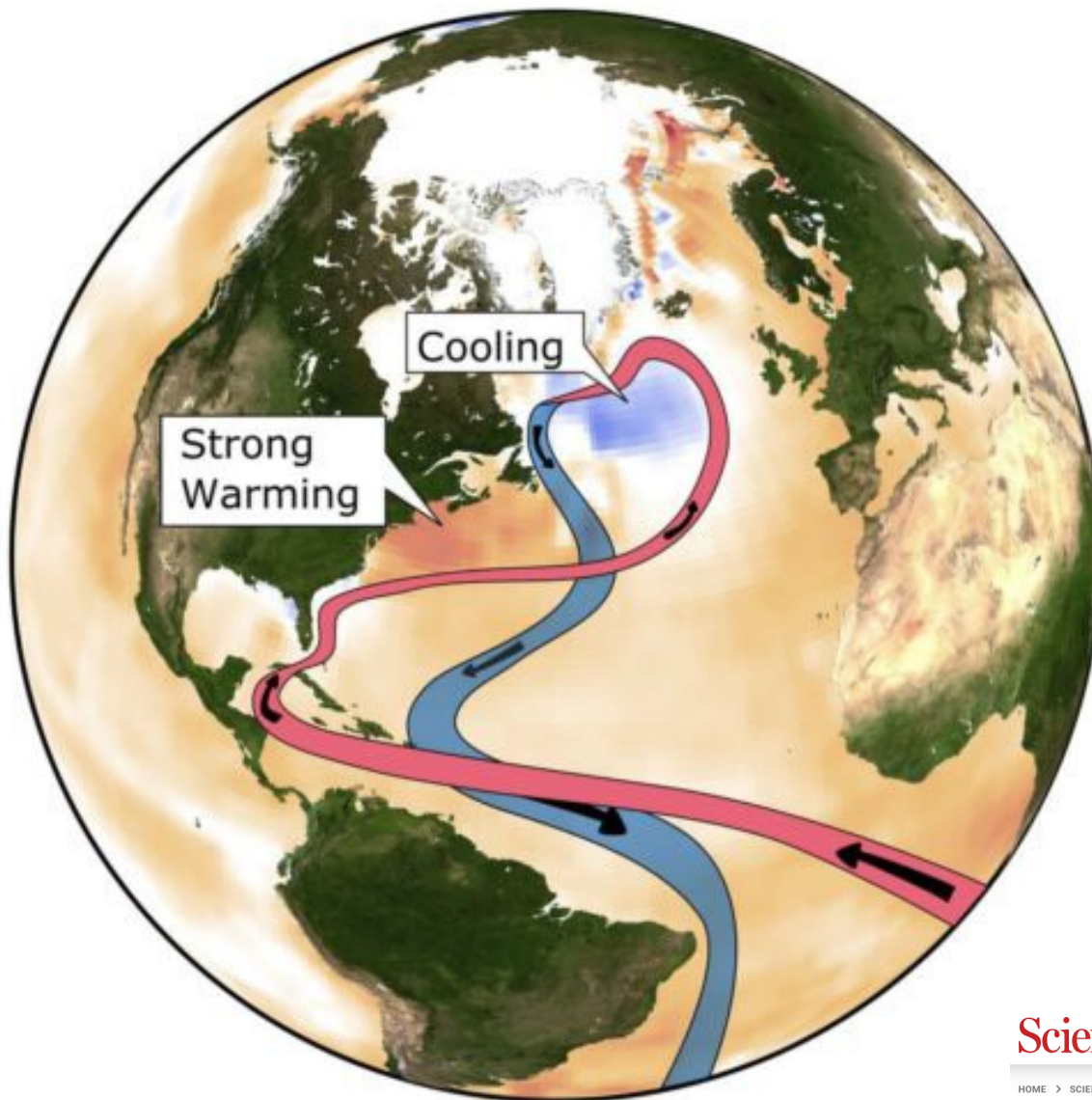


Gaat de polaire draaikolk meer slingeren door een afnemend temperatuurverschil tussen noordpool en onze streken? Gevolg: extreem weer met snelle overgangen.

Characteristics of stratospheric polar vortex fluctuations associated with sea ice variability in the Arctic winter

Climate Dynamics (2020) 54:3599–3611

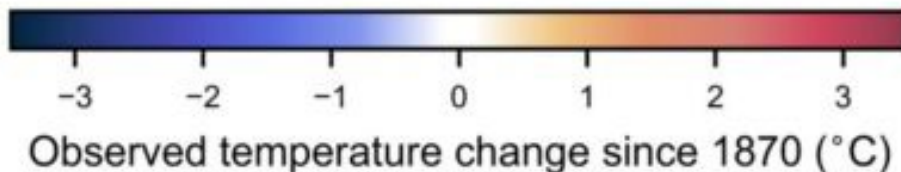
<https://doi.org/10.1007/s00382-020-05191-9>



Verschuift de warme
golfstroom naar het
westen, waardoor
Europa koeler
blijft?



AMOC – Atlantic Meridional
Overturning Circulation



ScienceAdvances

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HOME > SCIENCE ADVANCES > VOL. 10, NO. 6 > PHYSICS-BASED EARLY WARNING SIGNAL SHOWS THAT AMOC IS ON TIPPING COURSE

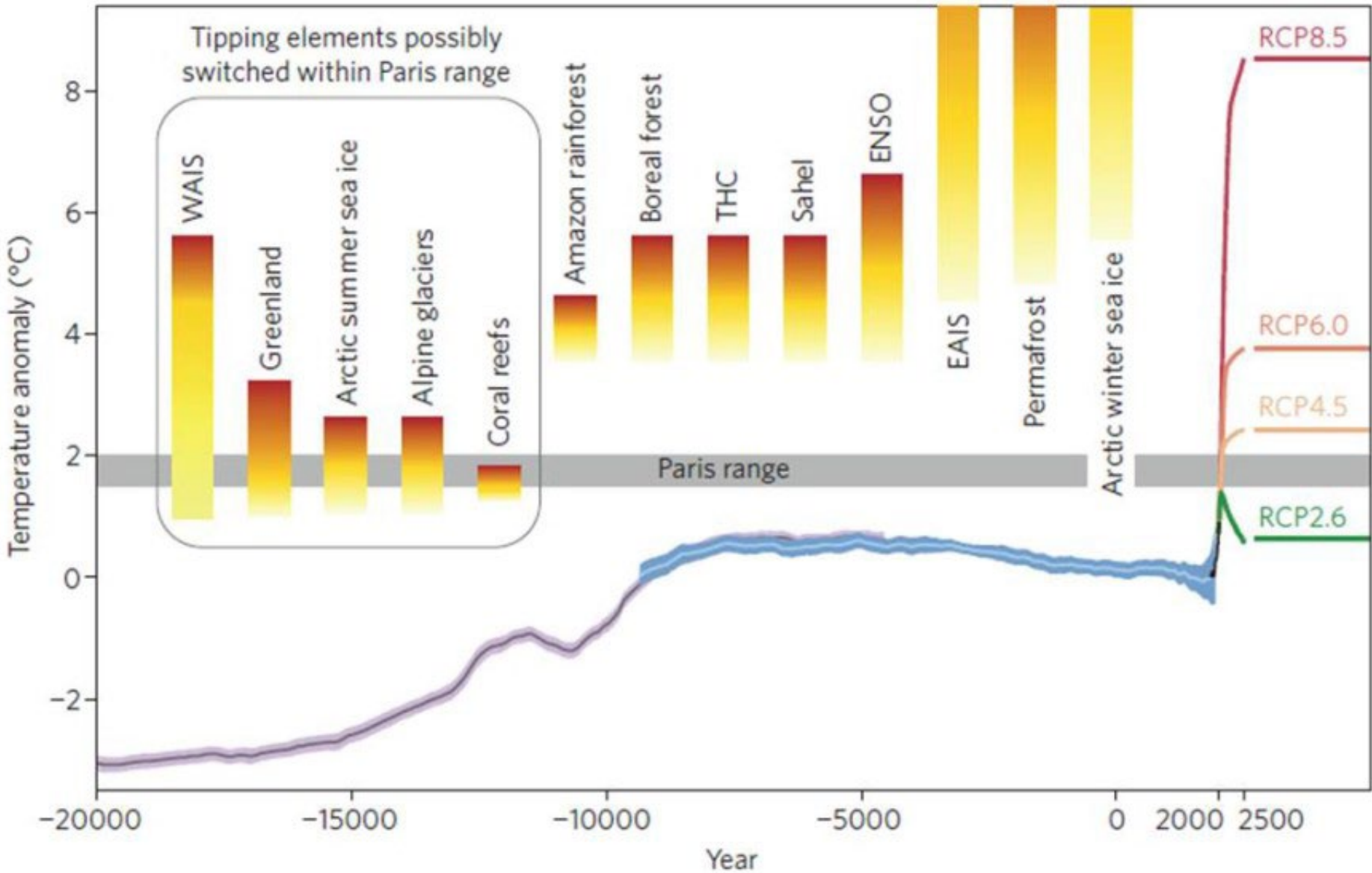
RESEARCH ARTICLE | OCEANOGRAPHY

f X in

Physics-based early warning signal shows that AMOC is on tipping course

RENÉ M. VAN WESTEN · MICHAEL KLIPHUIS · AND HENK A. DIJKSTRA [Authors Info & Affiliations](#)

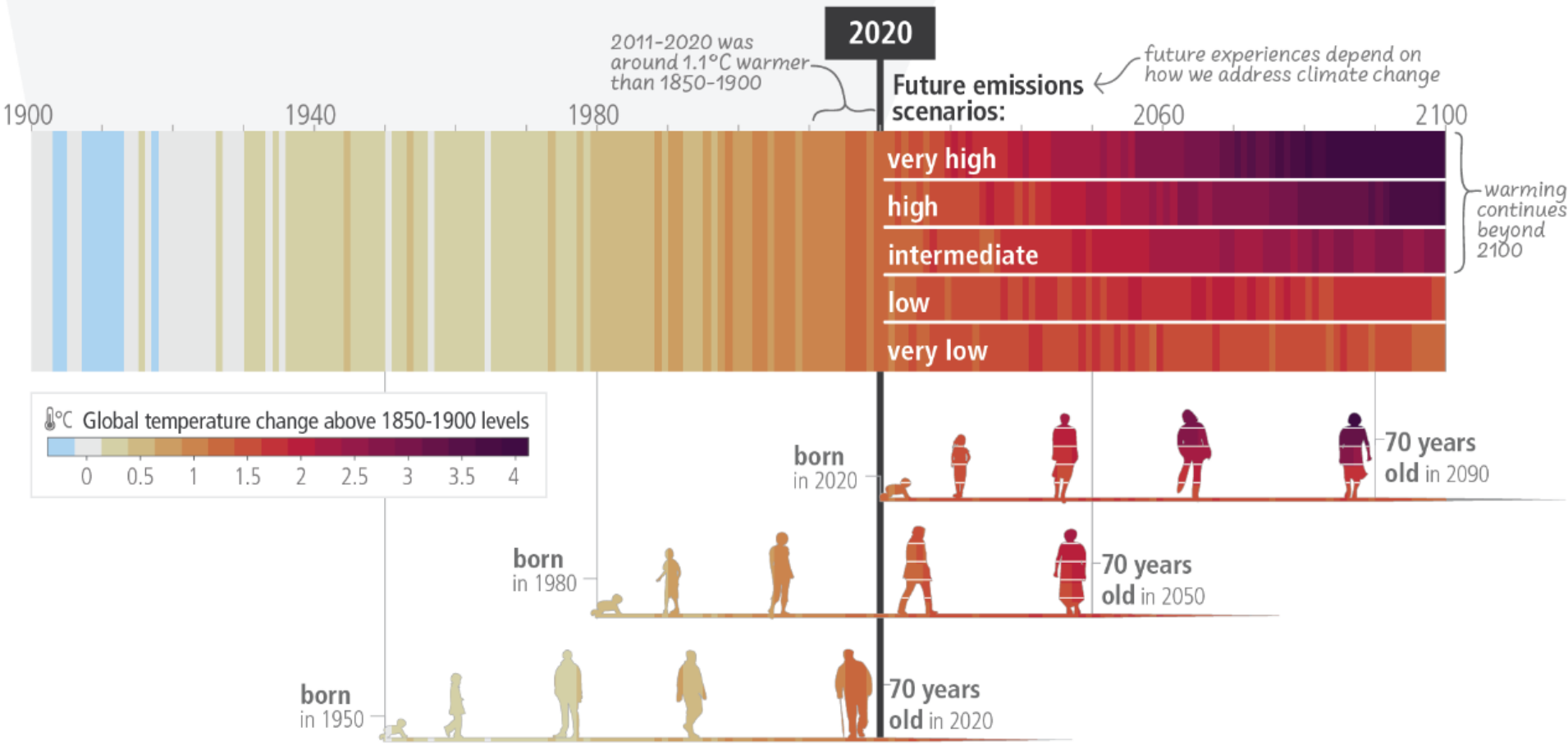
Global consequences of climate change



Schellnhuber HJ, Stefan Rahmstorf S & Winkelmann R (2016) Why the right climate target was agreed in Paris. Nature Climate Change 6: 649-653

AR6 Synthesis Report: Climate Change 2023

c) The extent to which current and future generations will experience a hotter and different world depends on choices now and in the near-term





STEP INTO THE ARCTIC

<https://www.arcticexplorer.nl>

<https://www.poolstation.nl/360>

Dank voor jullie belangstelling



<https://www.poolstation.nl>

<https://www.poolstation.nl/360>