Climate Change and Impacts!

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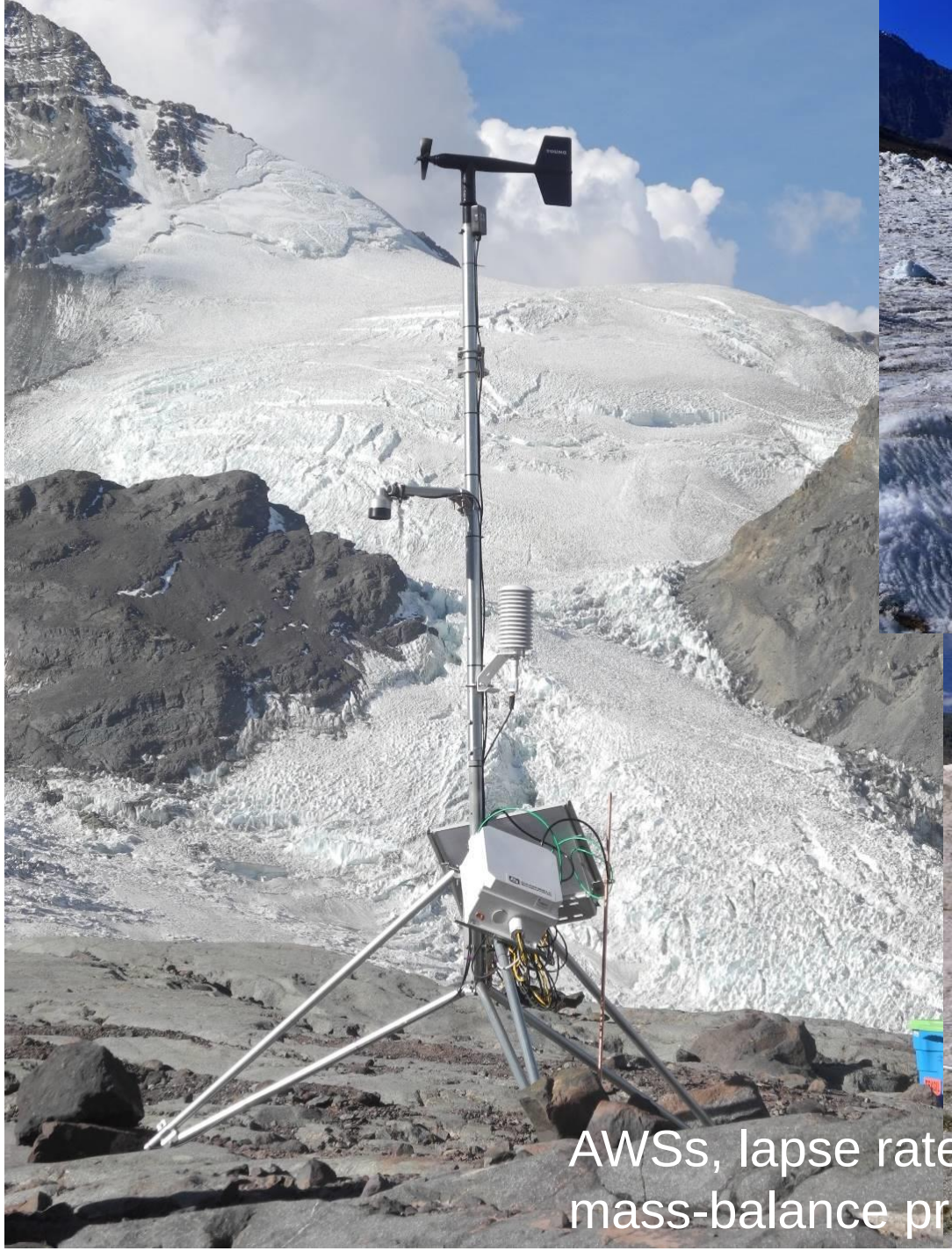
IPCC Lead Author, AR6 (2018–2023)
IPCC Contributing Author, AR5 (2009–2013)

Hvem er vi og hvad arbejder vi med?



AWSs, lapse rate, and mass-balance program

Hvem er vi og hvad arbejder vi med?

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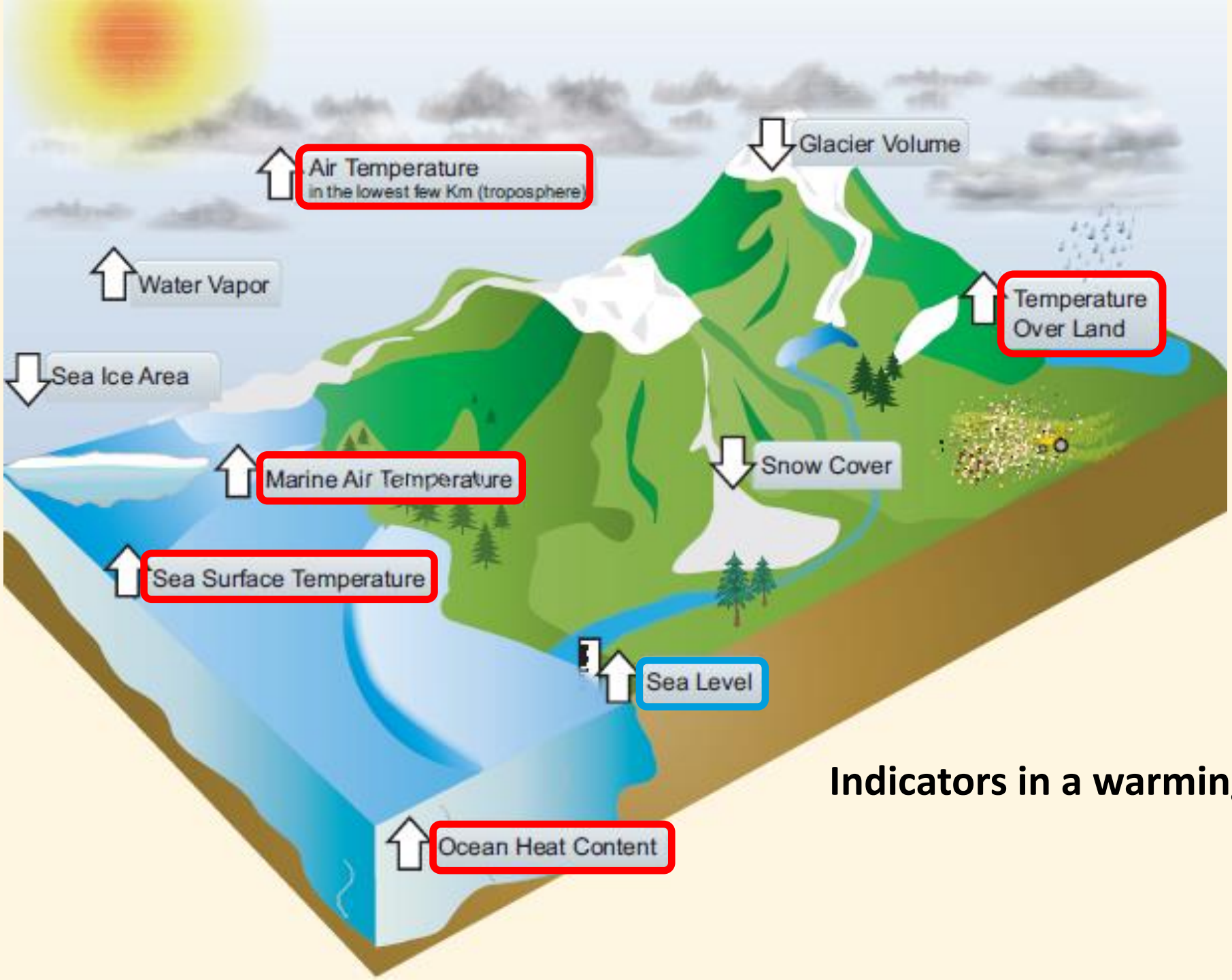
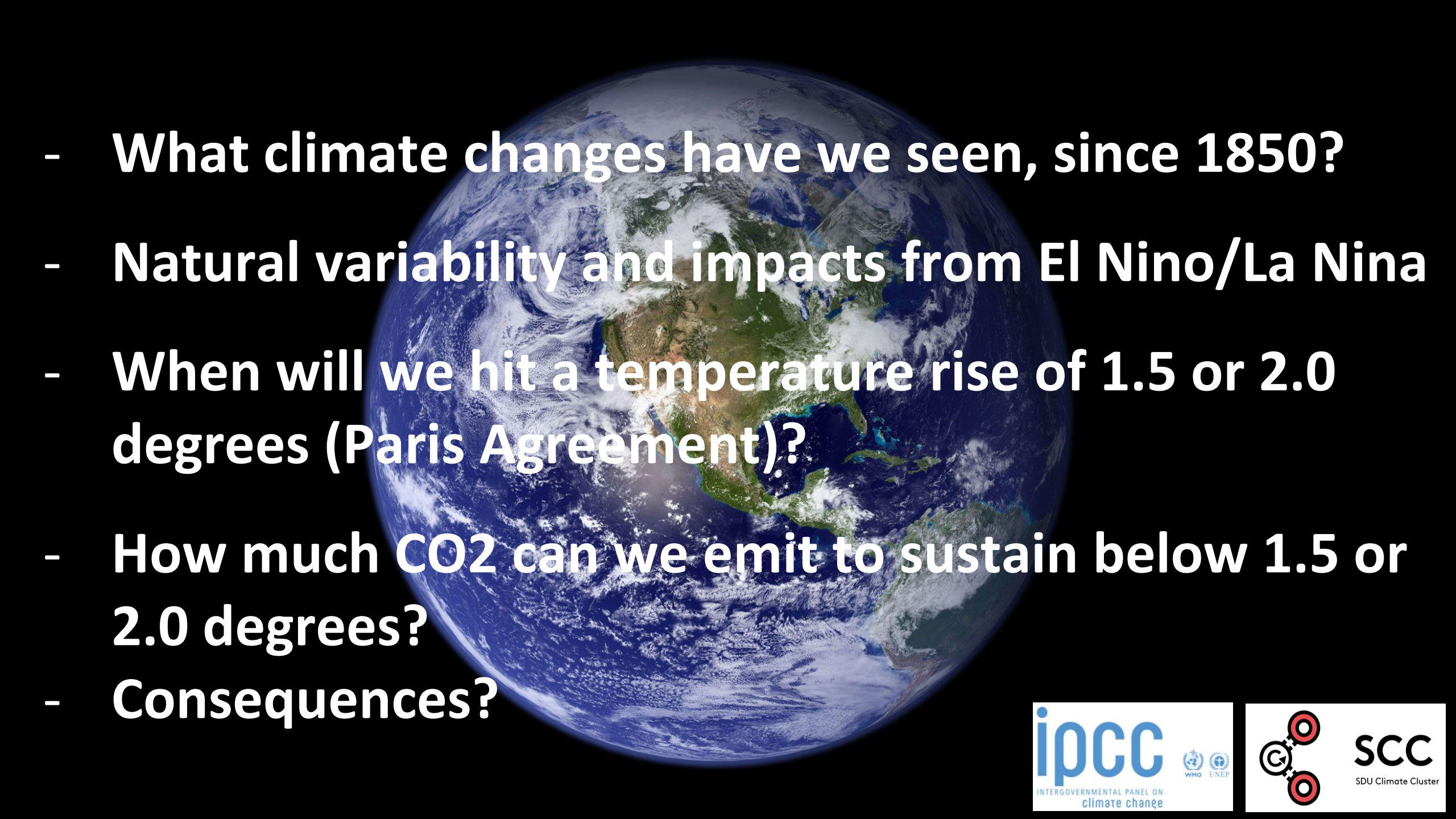


Indicators in a warming climate



- What climate changes have we seen, since 1850?
- Natural variability and impacts from El Nino/La Nina
- When will we hit a temperature rise of 1.5 or 2.0 degrees (Paris Agreement)?
- How much CO2 can we emit to sustain below 1.5 or 2.0 degrees?
- Consequences?

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Vores klima er i forandring – også i Europa

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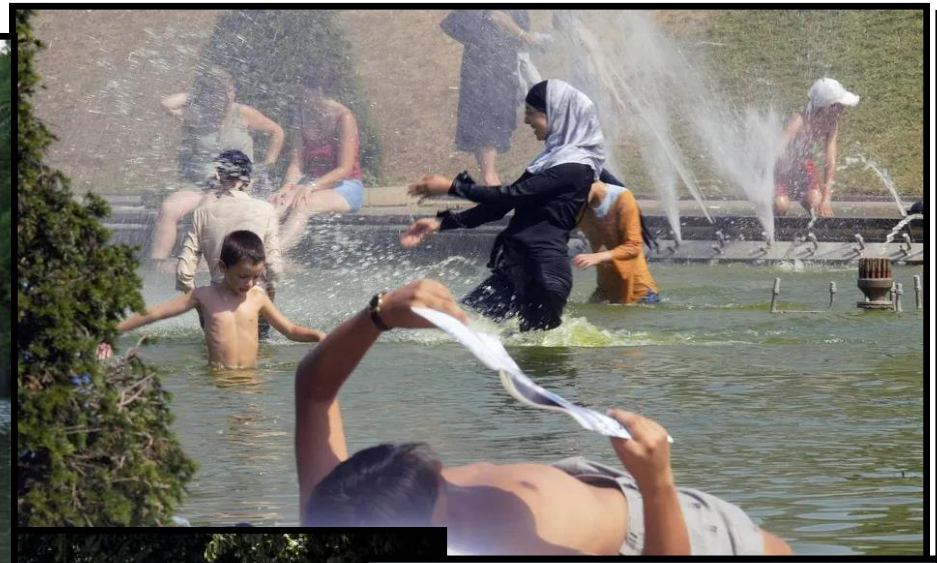
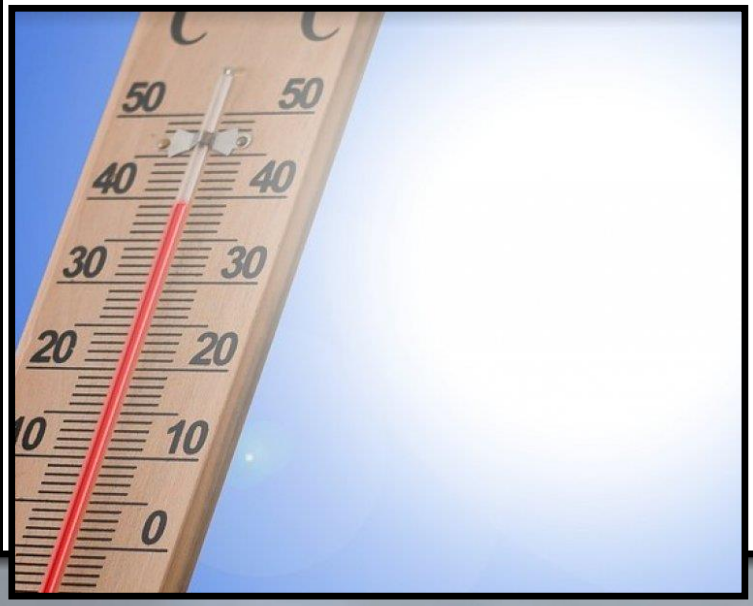
Vores klima er i forandring – også i Danmark





AR6 Synthesis Report: Climate Change 2023

REPORT

The IPCC finalized the Synthesis Report for the Sixth Assessment Report during the Panel's 58th Session held in Interlaken, Switzerland from 13 - 19 March 2023.

READ THE REPORT

CORE WRITING TEAM

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AR6 Synthesis Report

Climate Change 2023

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CO2 concentration is today higher than at any time **in at least 2 million years**

Cumulative net CO2 emissions: **About 42%** occurred between 1990–2019

Human activities have **unequivocally caused global warming** of **1.1°C** since 1850–1900

Surface temperature has increased fast since 1970, looking back 2000 years

Human-caused climate change is **affecting extremes in every region across the globe**

Human influence was *very likely* the main driver of **sea level rise** increases, since at least 1971

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There are gaps between projected emissions from implemented policies and those from NDCs

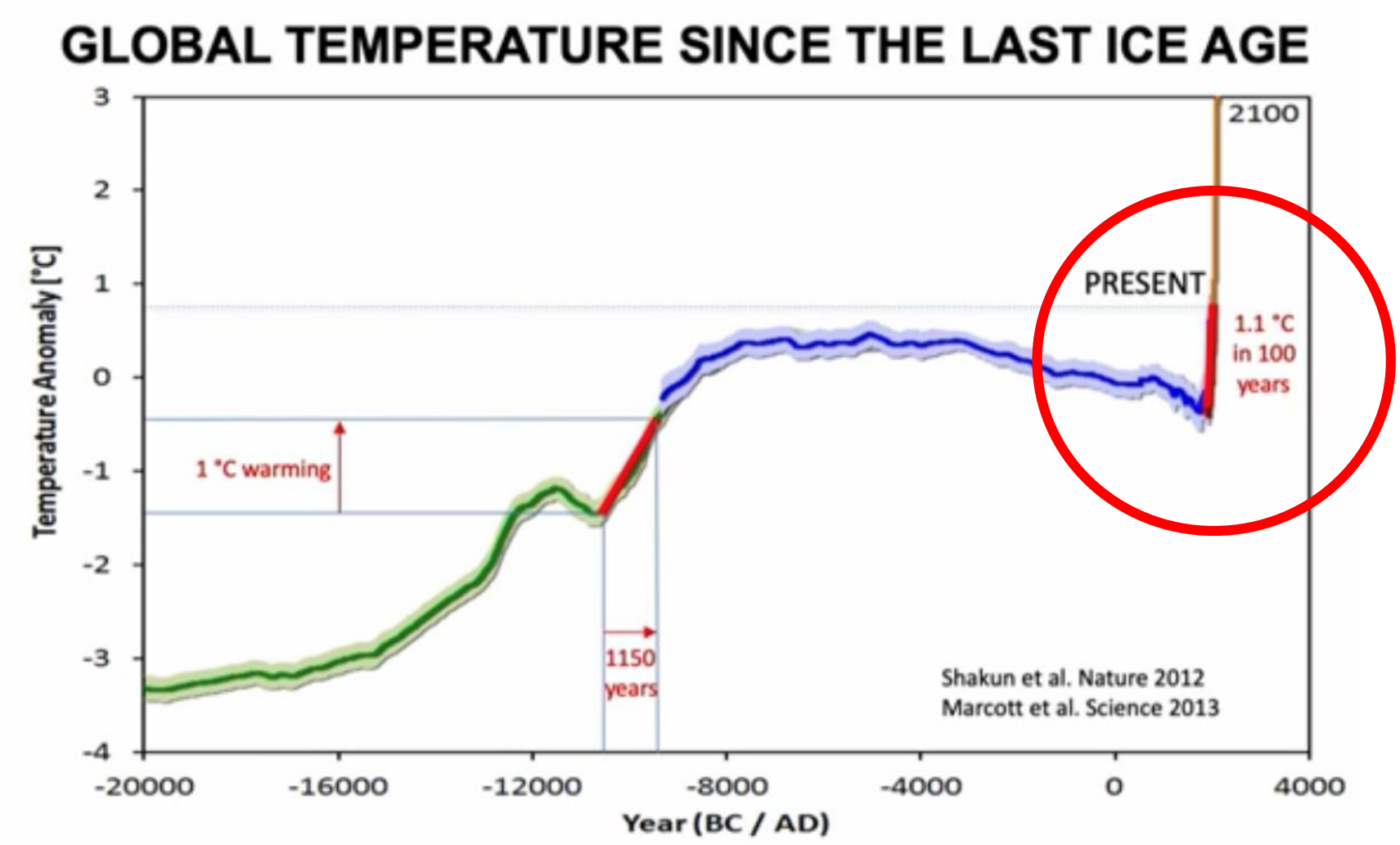
If climate goals are to be achieved, both adaptation and mitigation **financing would need to increase many-fold**

Limit warming to 1.5°C (>50%) with no/limited overshoot, **global GHG emissions are reduced by 43% by 2030**, relative to 2019

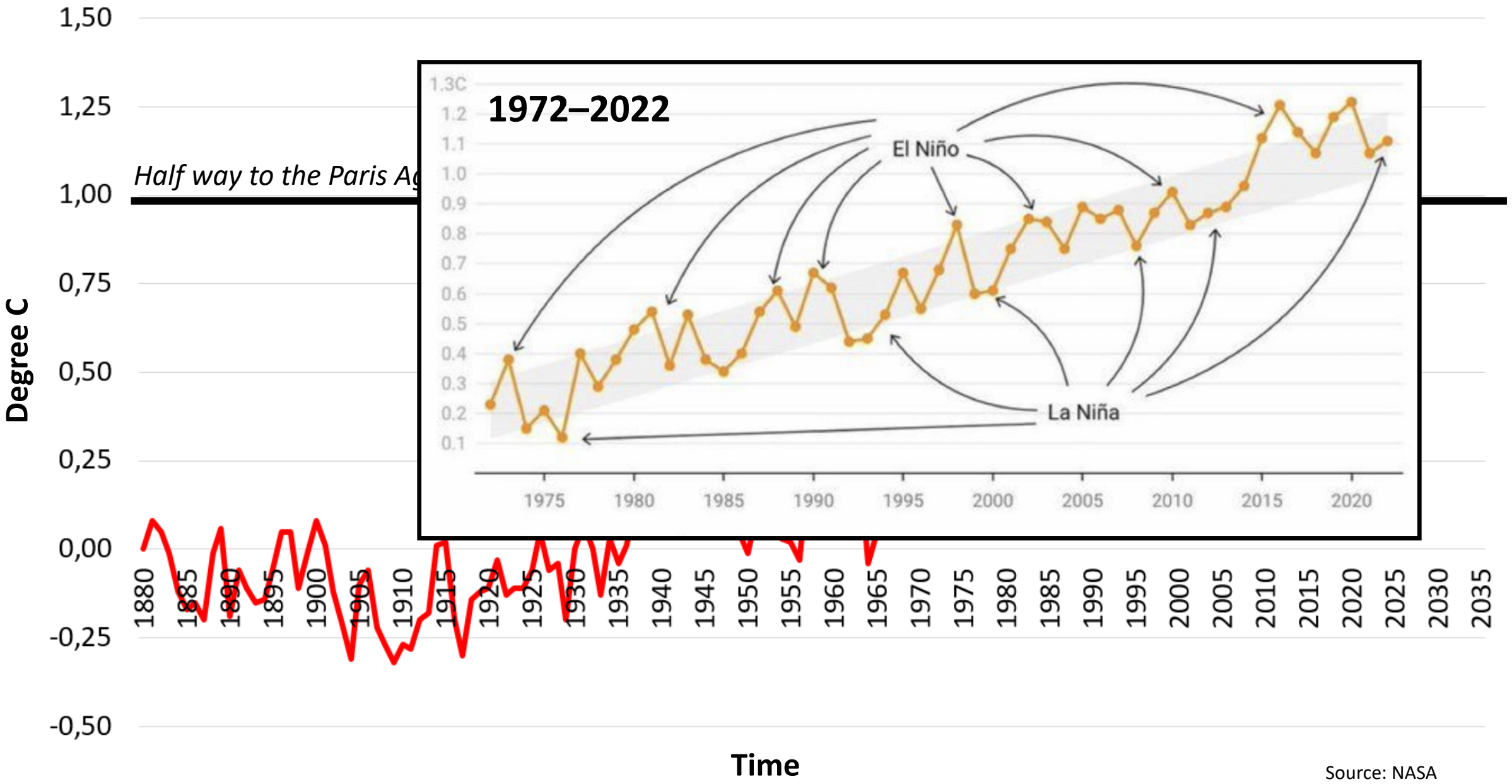
Deep, rapid, and sustained reductions in GHG emissions would lead to a **discernible slowdown in global warming** within around two decades…and

Overshooting 1.5°C will result in **irreversible adverse impacts on certain ecosystems with low resilience**

….would reduce projected losses and damages for humans and ecosystems


GLOBAL TEMPERATURE SINCE THE LAST ICE AGE
Temperature Anomaly [°C]
3
2
1
0
-1
-2
-3
-4
2100
PRESENT
1.1 °C
in 100
years
1 °C warming
1150
years
Shakun et al. Nature 2012
Marcott et al. Science 2013
-20000
-16000
-12000
-8000
-4000
0
4000
Year (BC / AD)

Global Mean Surface Air Temperature, 1880–2022

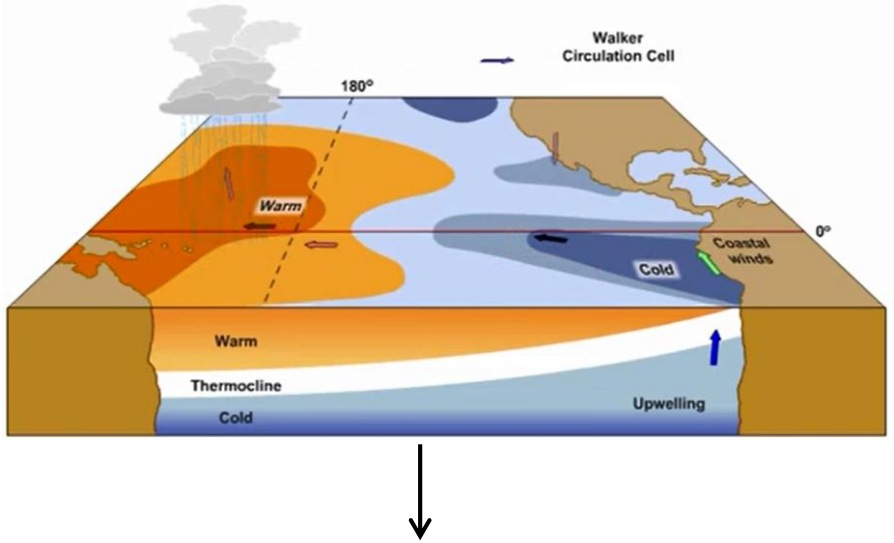


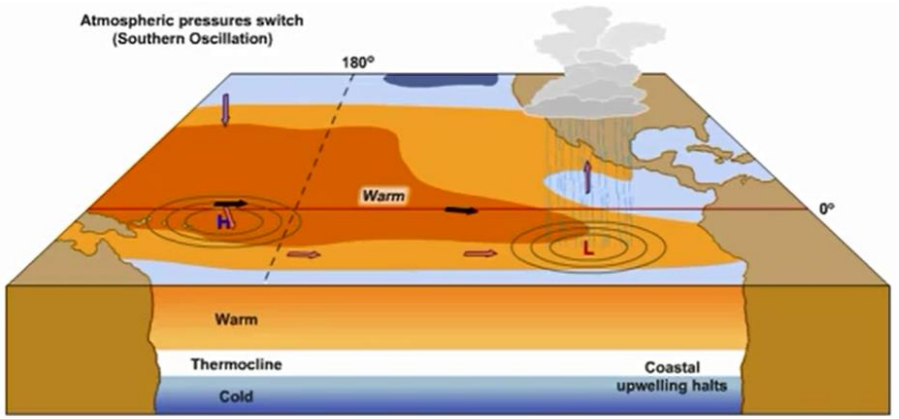
Source: NASA

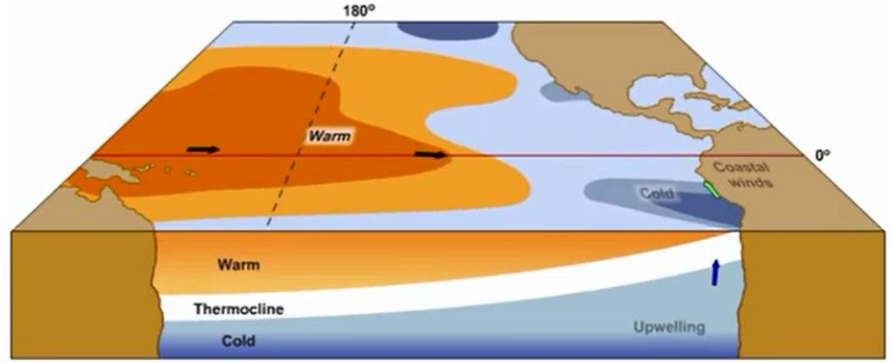
El Nino conditions in the Pacific Ocean

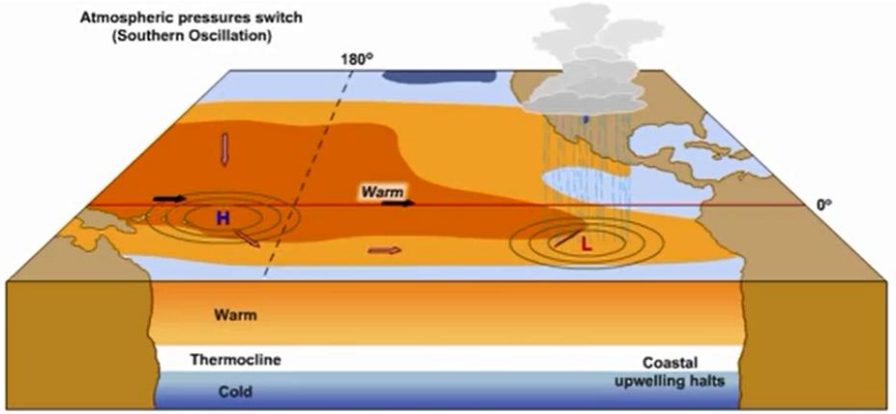
Climate Change

Climate Change and Climate Polity Course





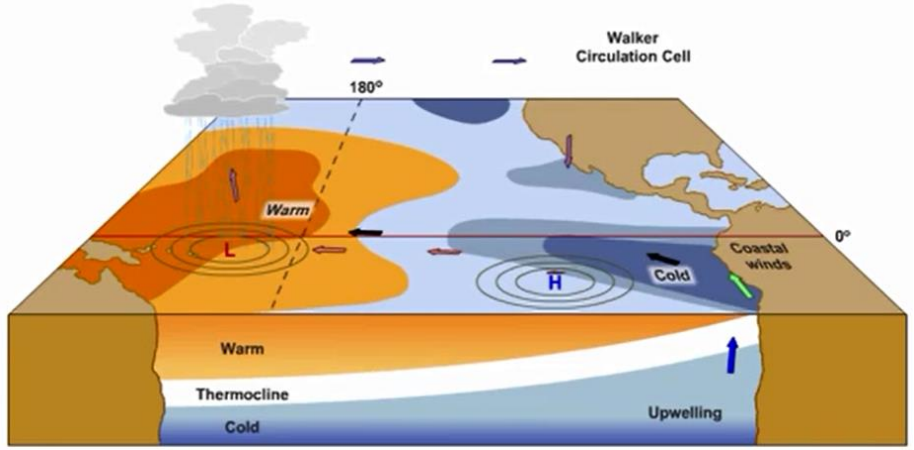


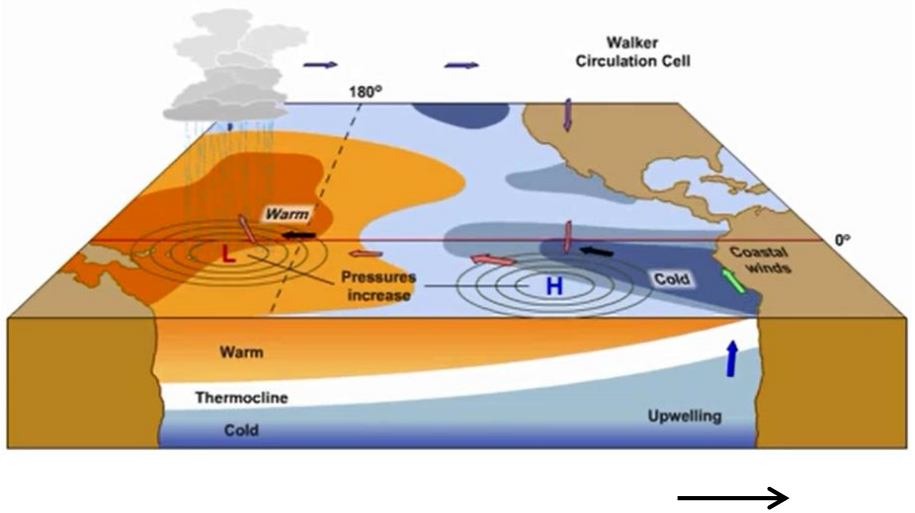


La Nina conditions in the Pacific Ocean

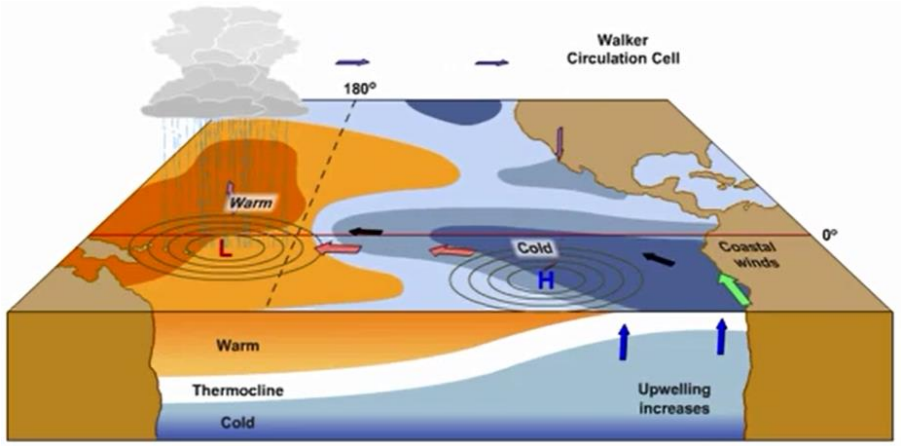
Climate Change

Climate Change and Climate Polity Course





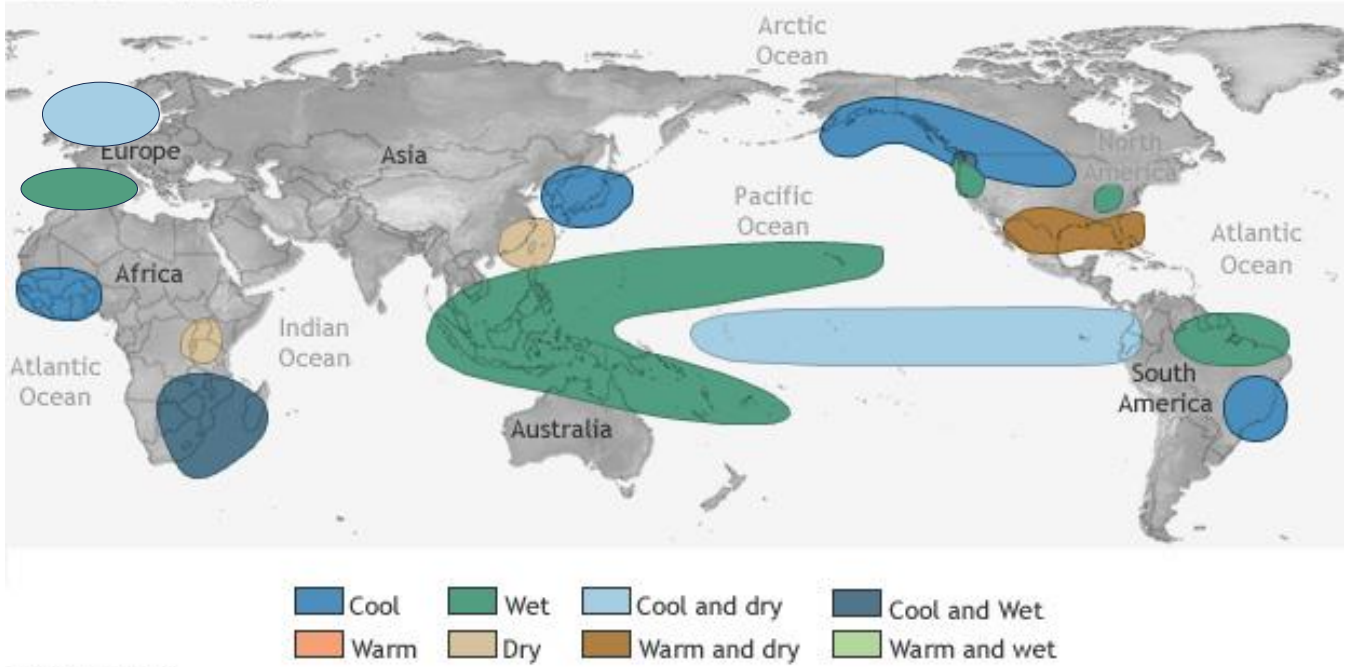
El Niño				La Niña		
Weak	Mod	Strong	Very Strong	Weak	Mod	Strong
1951-52*	1963-64	1957-58	1982-83	1950-51	1955-56	1973-74
1952-53	1986-87	1965-66	1997-98	1954-55	1970-71	1975-76
1953-54	1987-88*	1972-73	2015-16	1964-65	1998-99	1988-89
1958-59	1991-92			1967-68*	1999-00*	
1968-69*	2002-03			1971-72	2007-08	
1969-70	2009-10			1974-75	2010-11*	
1976-77				1983-84		
1977-78				1984-85		
1979-80*				1995-96		
1994-95*				2000-01		
2004-05				2011-12		
2006-07						



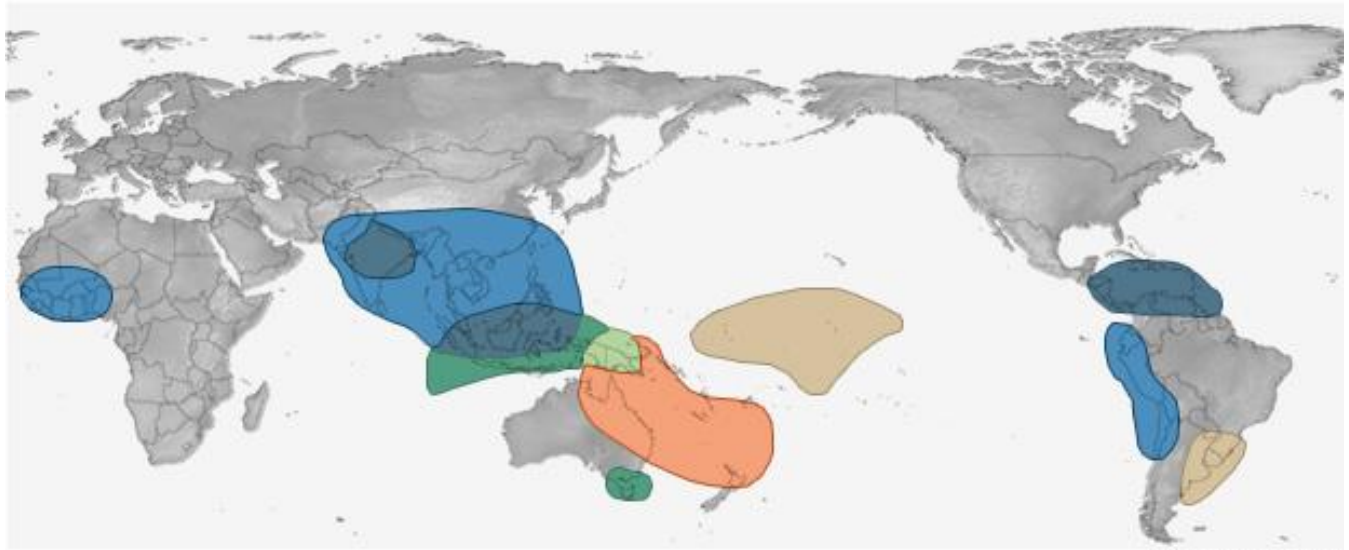
https://www.youtube.com/watch?v=tyPq86yM_Ic

LA NIÑA CLIMATE IMPACTS

December-February

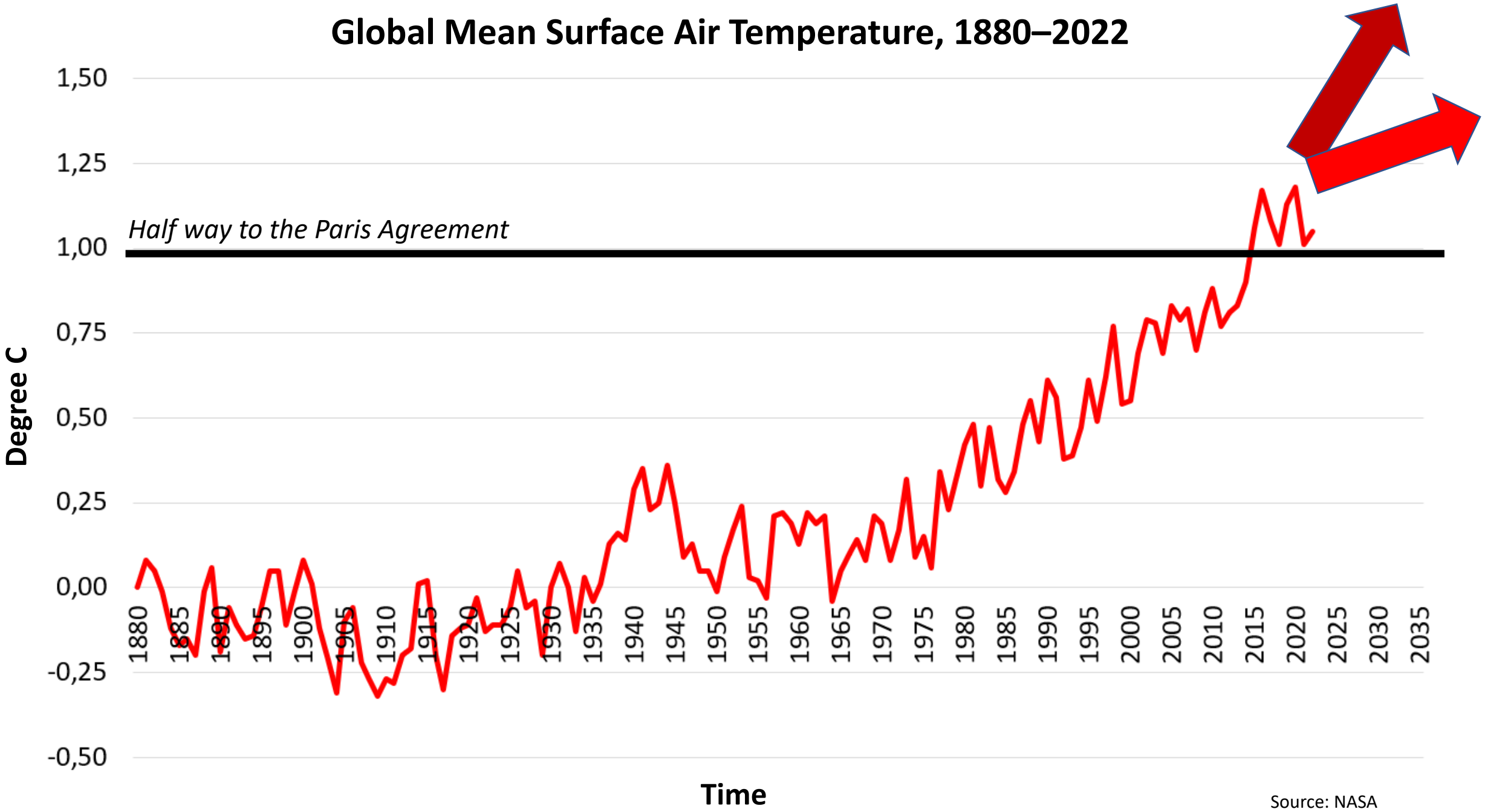


June-August



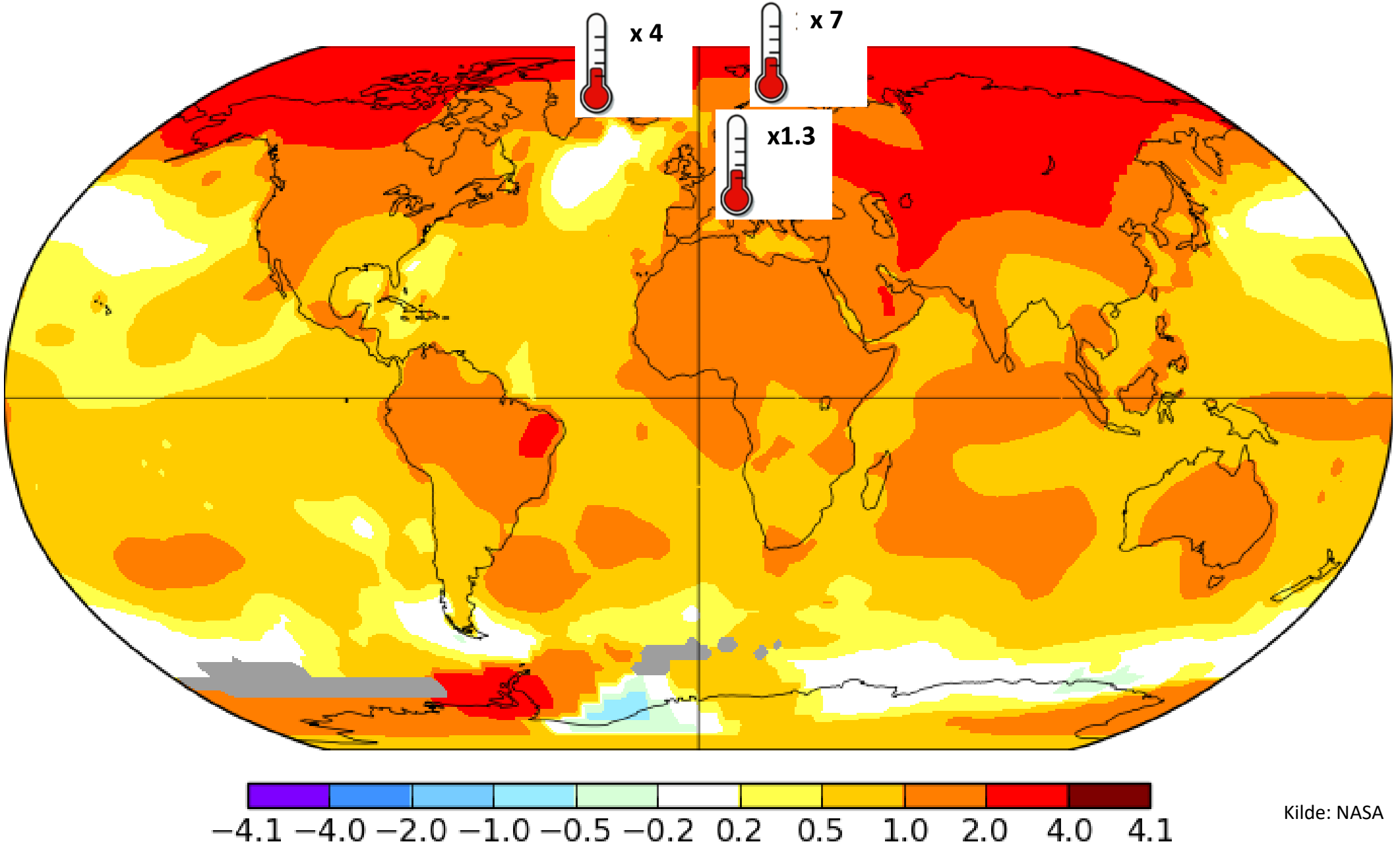
NOAA Climate.gov

Global Mean Surface Air Temperature, 1880–2022

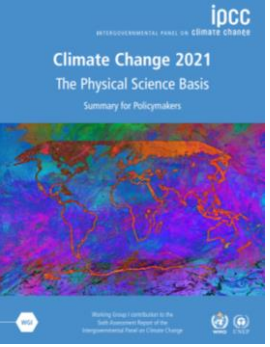


Source: NASA

Global Mean Surface Air Temperature, 1880–2022



Kilde: NASA



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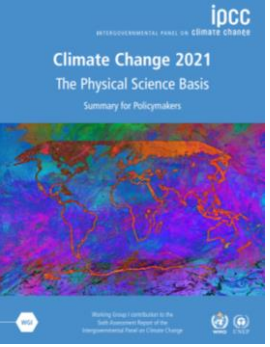
It is **unequivocal** that **human influence has warmed the atmosphere**, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred.

Global surface temperature was **1.09°C** higher in 2011–2020 than 1850–1900 (pre-industrial).

The *likely* range of total human-caused global surface temperature increase from 1850–1900 to 2010–2019, with a best estimate of **1.07°C.**



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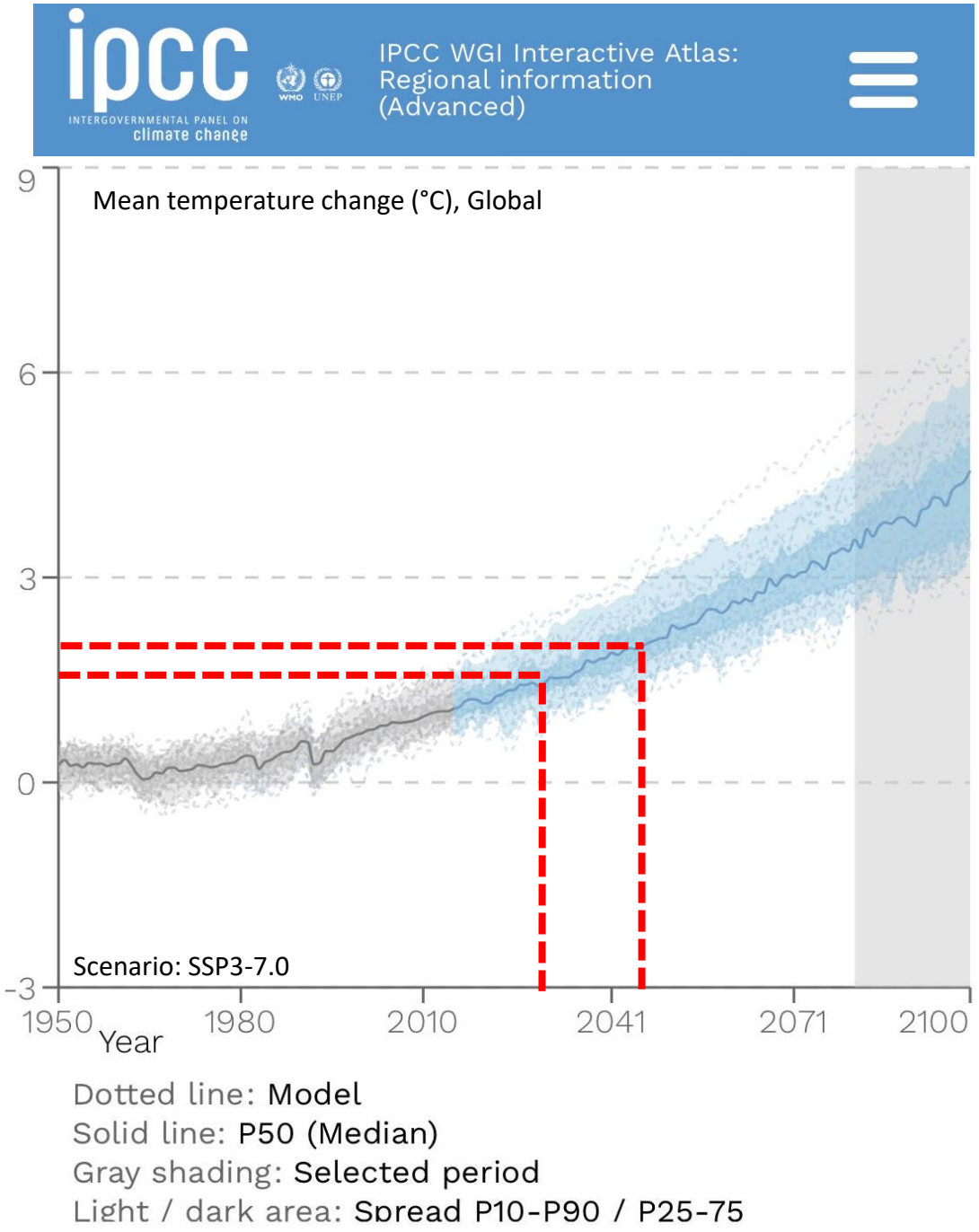
Global surface temperature has increased faster since 1970 than in any other 50-year period over at least the last 2000 years.

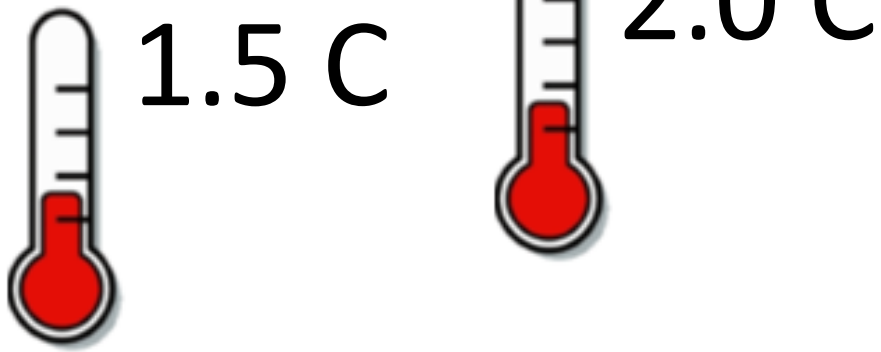
It is *virtually certain* that **hot extremes have become more frequent and more intense** across most land regions since the 1950s, while cold extremes have become less frequent and less severe.

Some recent hot extremes observed over the past decade would have been *extremely* ***unlikely*** **to occur without human influence** on the climate system.

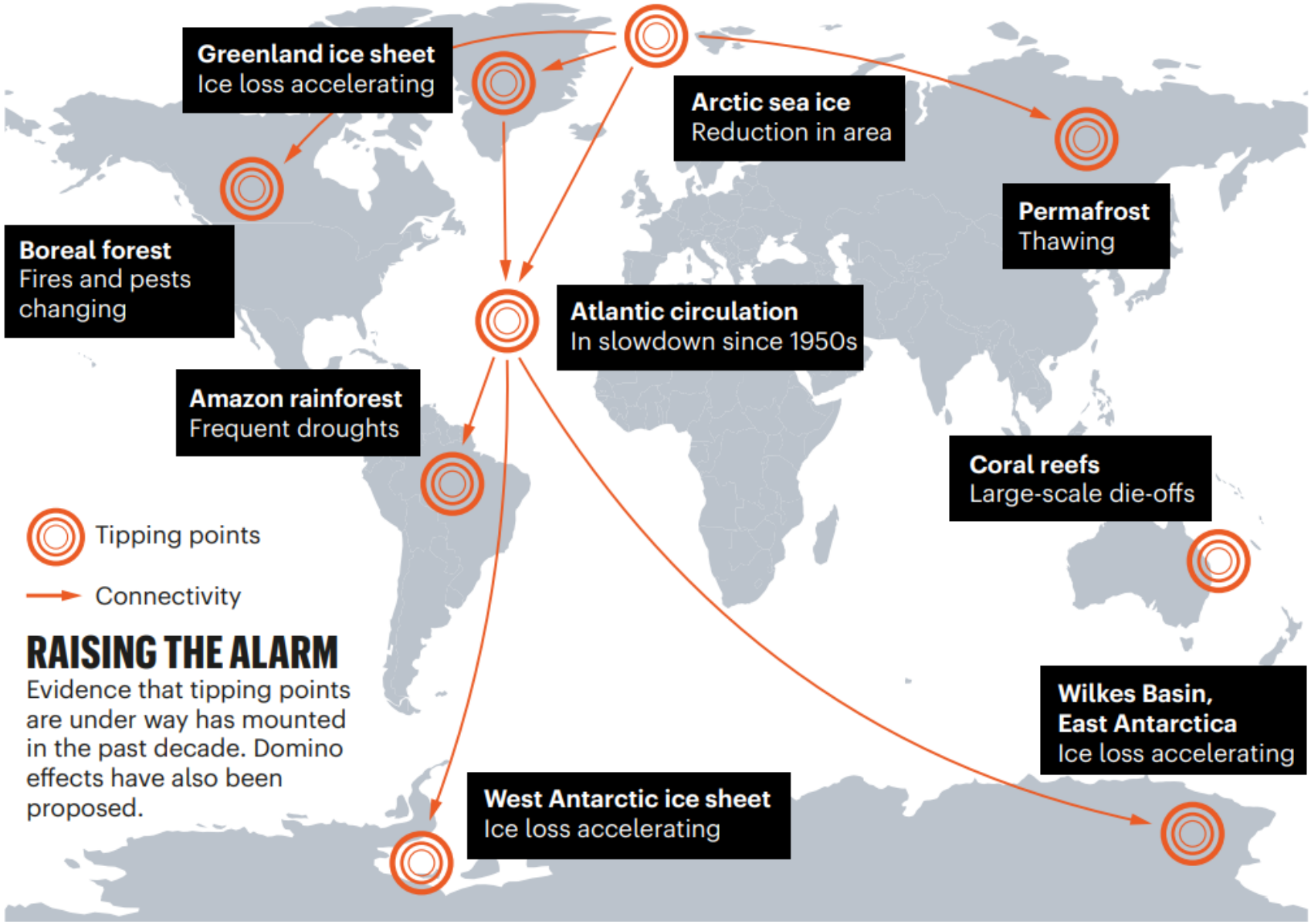


Without a strengthening of policies, global warming of 3.2°C is projected by 2100: **Overshoot will occur**

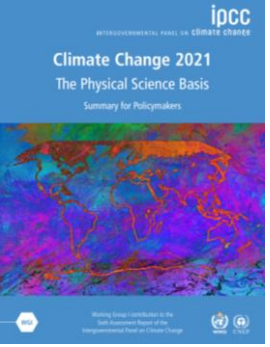
The best estimate of reaching 1.5°C of global warming lies in the **first half of the 2030s**



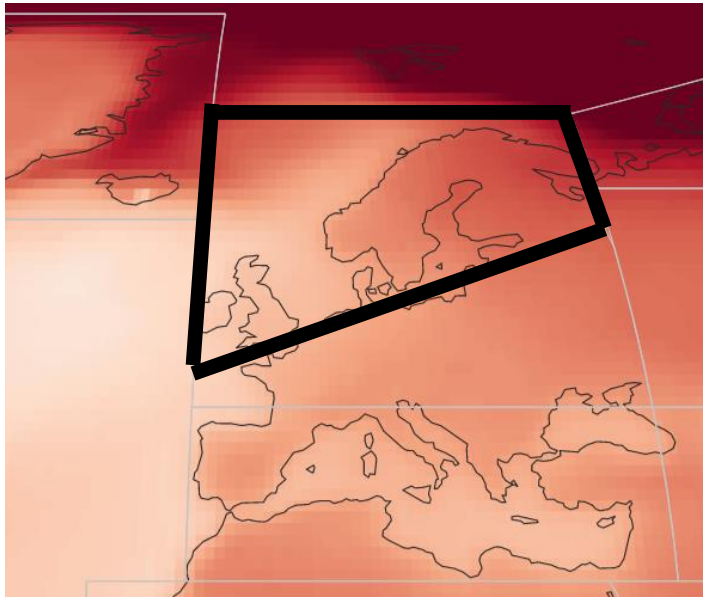
Evidence that tipping point are under way…



Risks associated with large-scale singular events or ***tipping points***, such as ice sheet instability or ecosystem loss from tropical forests, **transition to high risk between 1.5°C–2.5°C** (*medium confidence*) **and to very high risk between 2.5°C–4.0°C** (*low confidence*).



Region: Northern Europe



Realistic: SSP3-7.0

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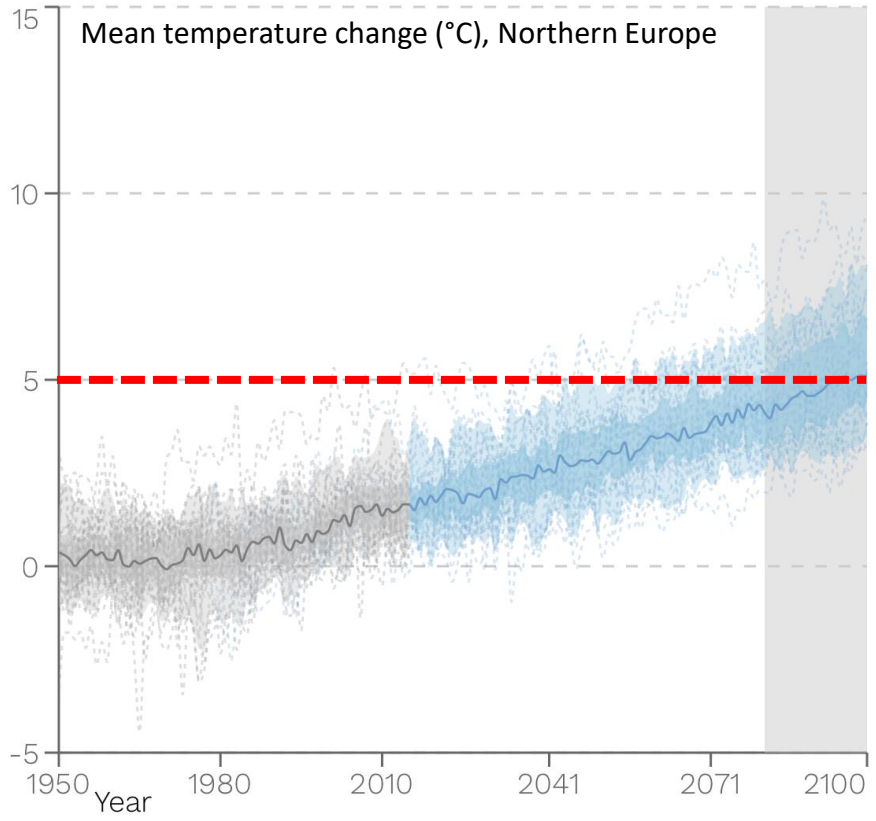
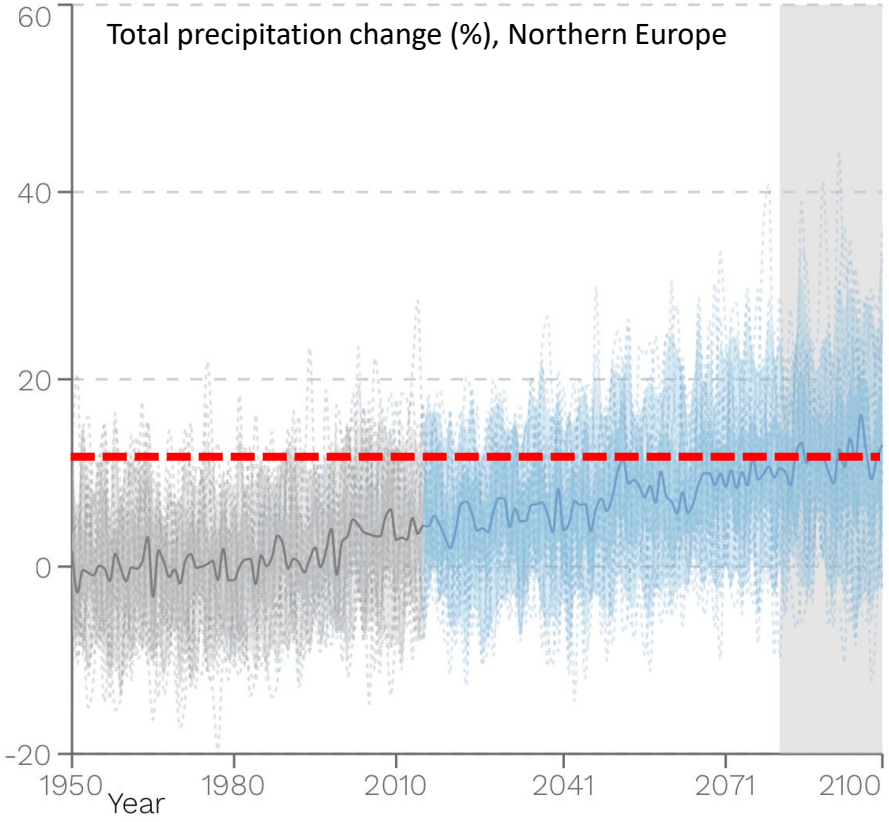
IPCC WGI Interactive Atlas: Regional information (Advanced)



Dotted line: Model
Solid line: P50 (Median)
Gray shading: Selected period
Light / dark area: Spread P10-P90 / P25-75

IPCC WGI Interactive Atlas: Regional information (Advanced)



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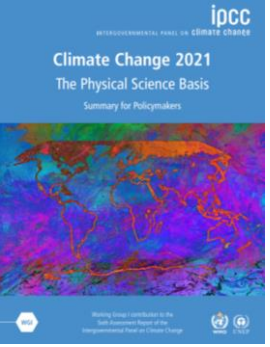

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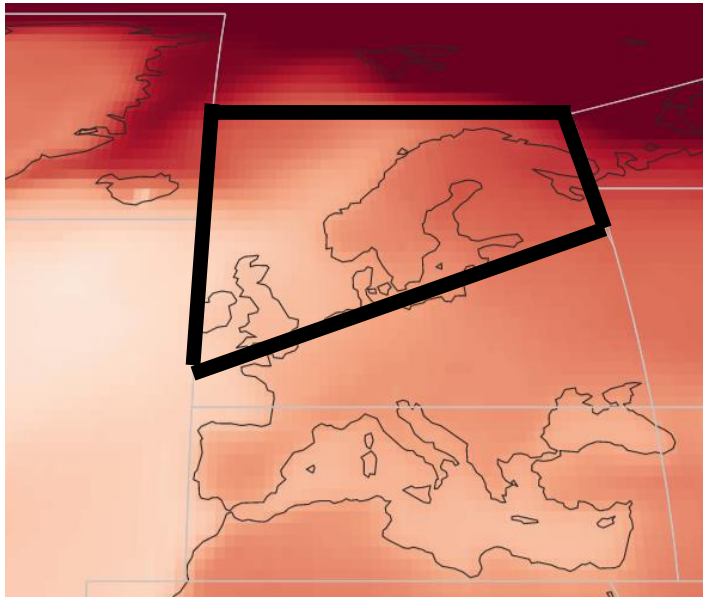

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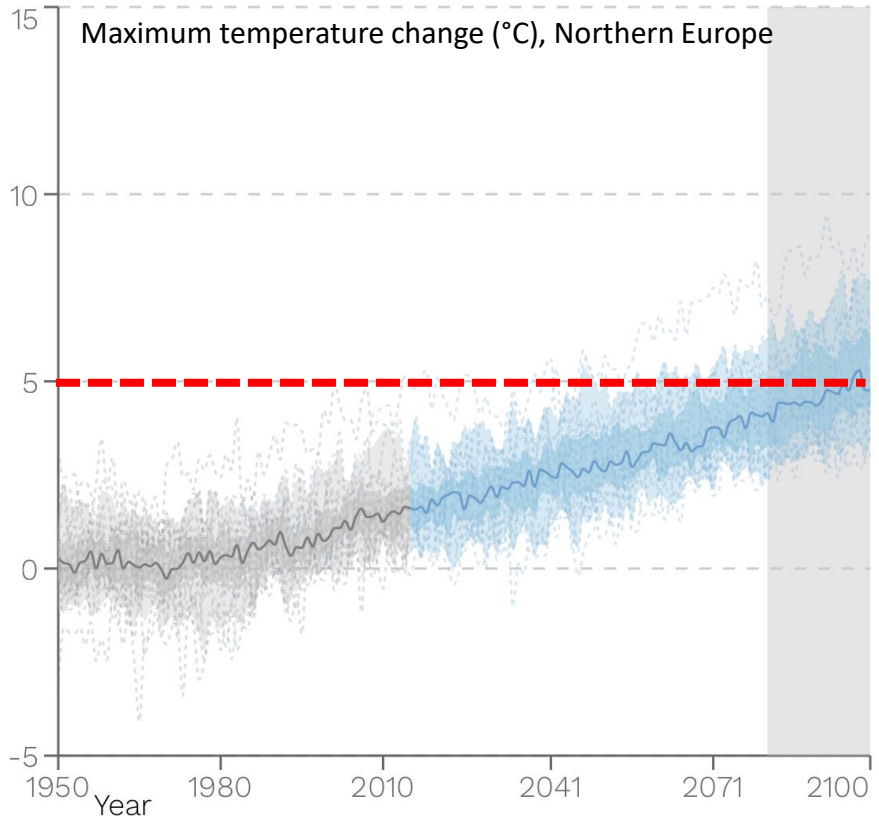

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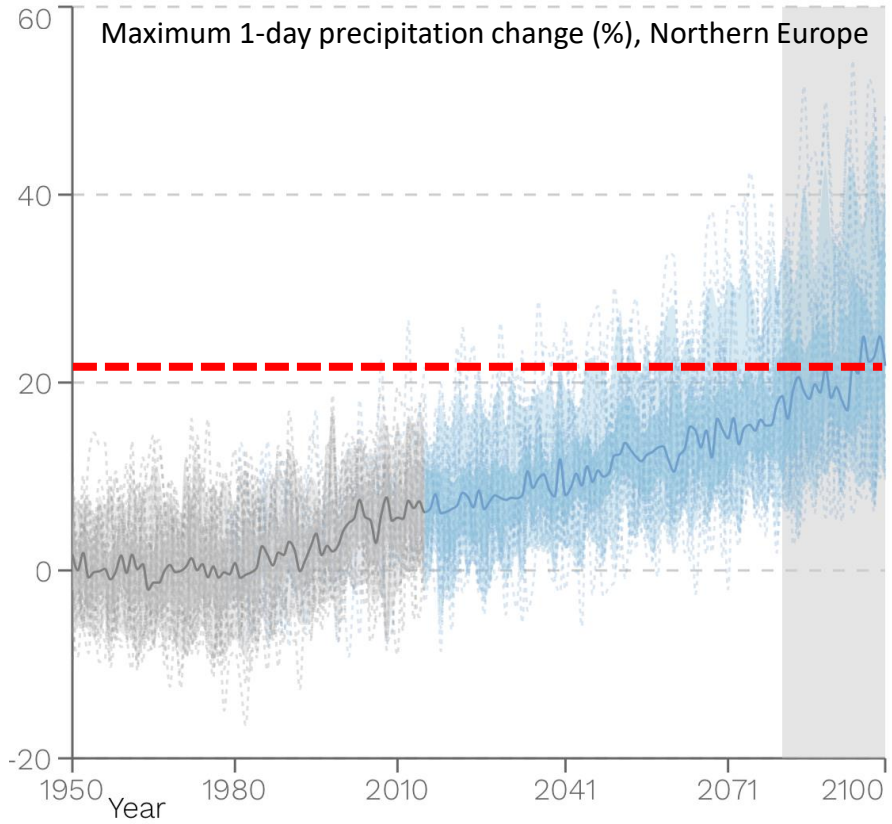

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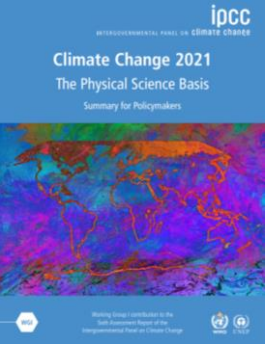
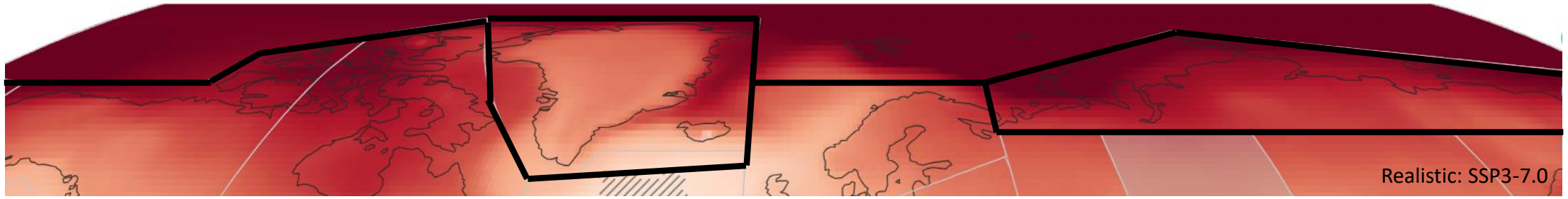
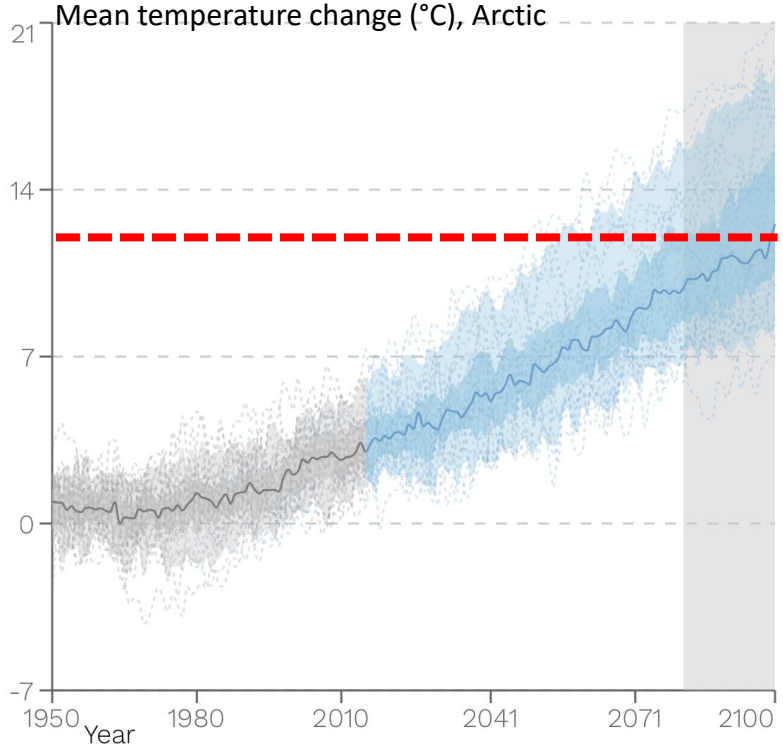


Region: Arctic, Greenland and Sibiria



IPCC WGI Interactive Atlas: Regional information (Advanced)

Mean temperature change (°C), Arctic



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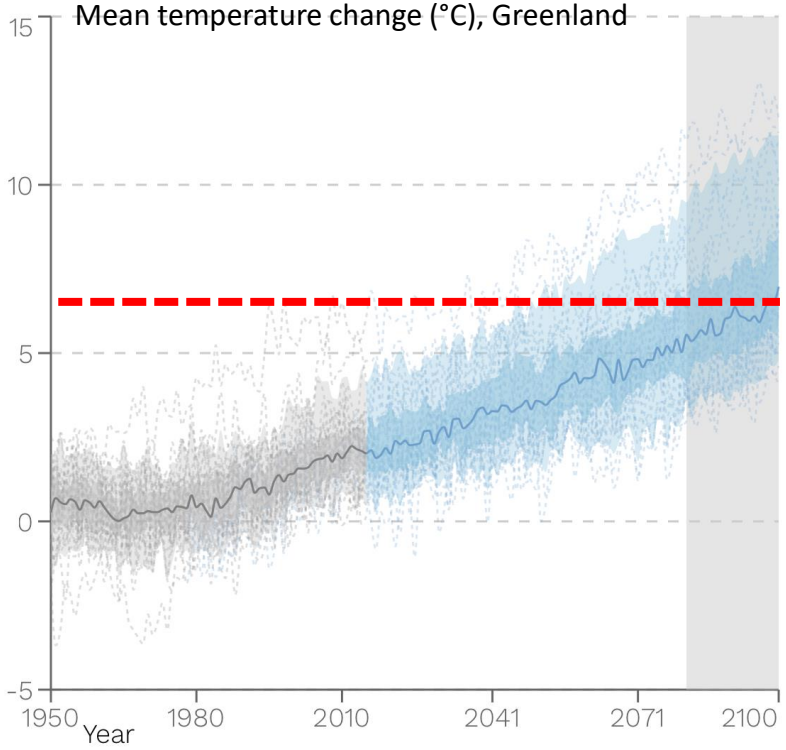
IPCC WGI Interactive Atlas: Regional information (Advanced)

Mean temperature change (°C), Greenland



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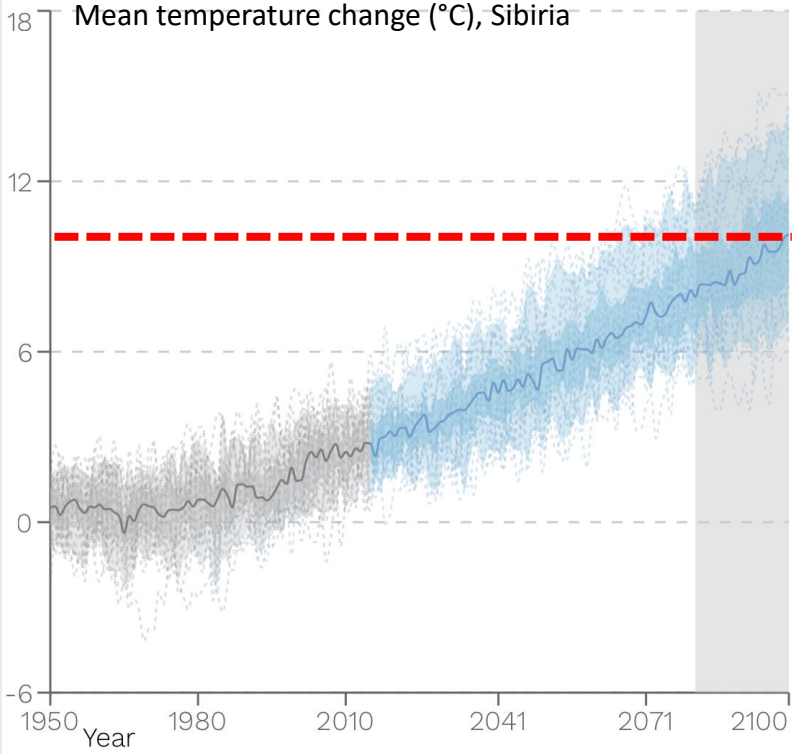
IPCC WGI Interactive Atlas: Regional information (Advanced)

Mean temperature change (°C), Sibiria



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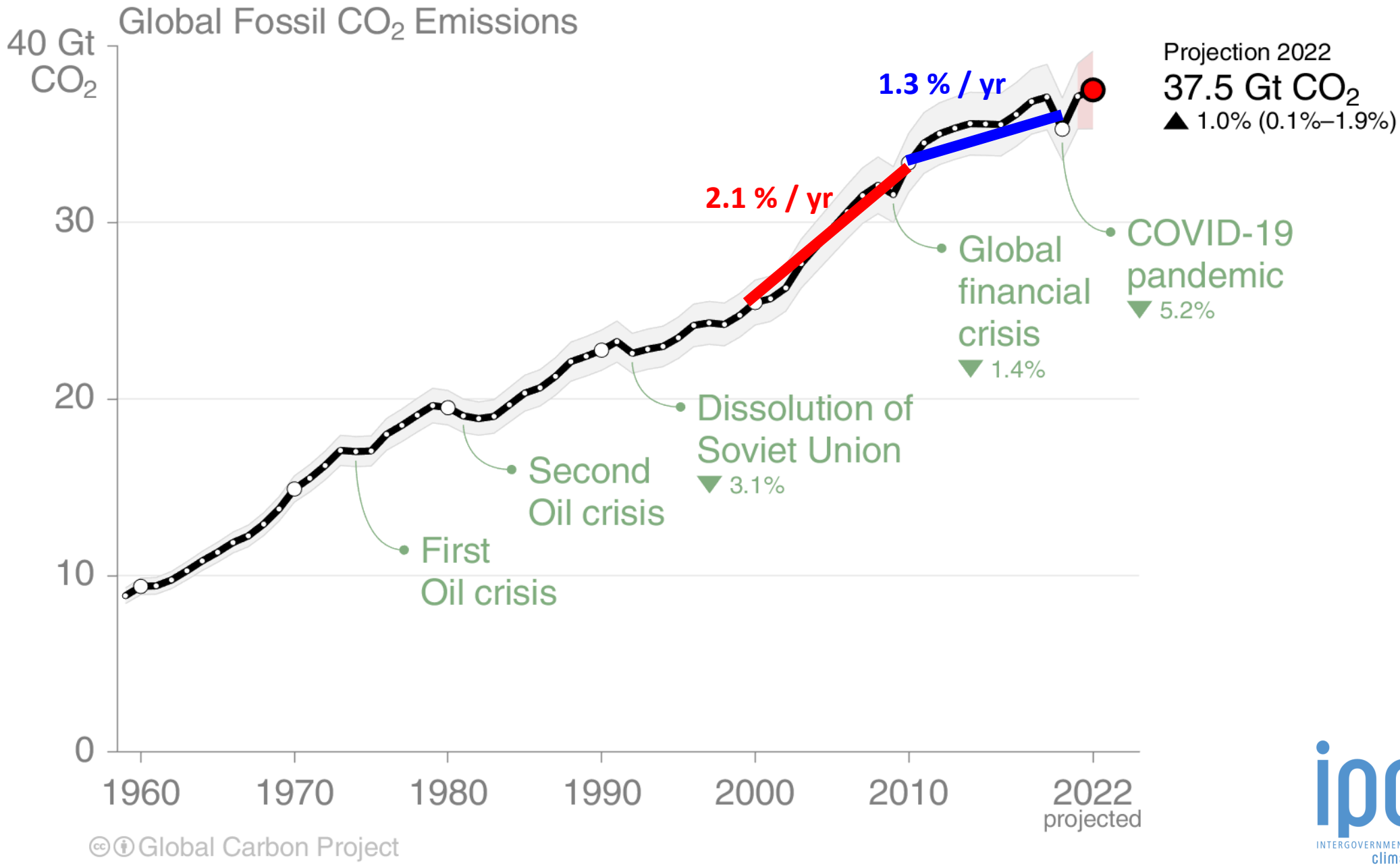
AR6, WG1 (2021):

Estimated remaning carbon budgets from the beginning of 2020 (GtCO2).....it is about likelihood!

Approximate global warming relative to 1850–1900 until temperature limit (°C)[a]	Estimated remaining carbon budgets from the beginning of 2020 ($GtCO_2$) *Likelihood of limiting global warming to temperature limit*[b]				
	17%	*33%*	*50%*	*67%*	*83%*
1.5	900	650	500	400	300
2.0	2300	1700	1350	1150	900



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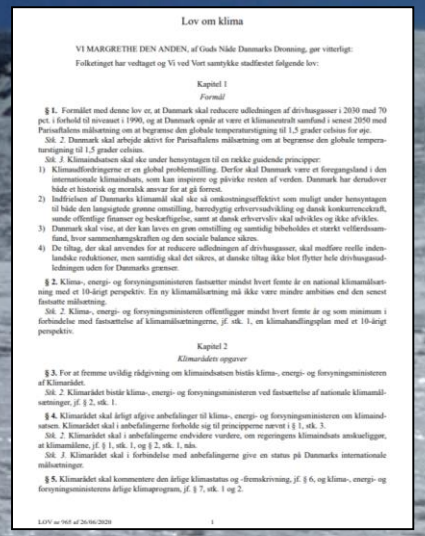


Lov om klima

VI MARGRETHE DEN ANDEN, af Guds Nåde Danmarks Dronning, gør vitterligt:

Folketinget har vedtaget og Vi ved Vort samtykke stadfæstet følgende lov:

Kapitel 1

Formål

§ 1. Formålet med denne lov er, at Danmark skal reducere udledningen af drivhusgasser i 2030 med 70 pct. i forhold til niveauet i 1990, og at Danmark opnår at være et klimaneutralt samfund i senest 2050 med Parisaftalens målsætning om at begrænse den globale temperaturstigning til 1,5 grader celsius for øje.

Stk. 2. Danmark skal arbejde aktivt for Parisaftalens målsætning om at begrænse den globale temperaturstigning til 1,5 grader celsius.

Stk. 3. Klimaindsatsen skal ske under hensyntagen til en række gældende principper:

1) Klimaudfordringerne er en global problemstilling. Derfor skal Danmark være et foregangsland i den internationale klimaindsats, som kan inspirere og påvirke resten af verden. Danmark har derudover både et historisk og moralsk ansvar for at gå forrest.
2) Indfrielsen af Danmarks klimamål skal ske så omkostningseffektivt som muligt under hensyntagen til både den langsigtede grønne omstilling, bæredygtig erhvervsudvikling og dansk konkurrenceevne, sunde offentlige finanser og beskæftigelse, samt at dansk erhvervsliv skal udvikles og ikke afvikles.
3) Danmark skal vise, at der kan laves en grøn omstilling og samtidig bibeholdes et stærkt velfærdssamfund, hvor sammenhængskraften og den sociale balance sikres.
4) De tiltag, der skal anvendes for at reducere udledningen af drivhusgasser, skal medføre reelle indenlandske reduktioner, men samtidig skal det sikres, at danske tiltag ikke blot flytter hele drivhusgasudledningen uden for Danmarks grænser.

§ 2. Klima-, energi- og forsyningsministeren fastsætter mindst hvert femte år en national klimamålsætning med et 10-årigt perspektiv. En ny klimamålsætning må ikke være mindre ambitiøs end den senest fastsatte målsætning.

Stk. 2. Klima-, energi- og forsyningsministeren offentliggør mindst hvert femte år og som minimum i forbindelse med fastsættelse af klimamålsætningerne, jf. stk. 1, en klimahandlingsplan med et 10-årigt perspektiv.

Kapitel 2

Klimarådets opgaver

§ 3. For at fremme uvildig rådgivning om klimaindsatsen bistås klima-, energi- og forsyningsministeren af Klimarådet.

Stk. 2. Klimarådet bistår klima-, energi- og forsyningsministeren ved fastsættelse af nationale klimamålsætninger, jf. § 2, stk. 1.

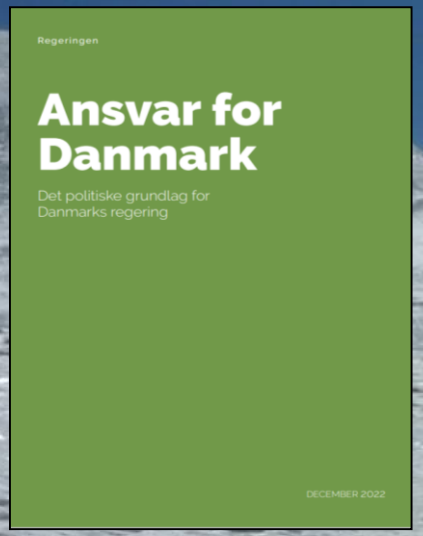
§ 4. Klimarådet skal årligt afgive anbefalinger til klima-, energi- og forsyningsministeren om klimaindsatsen. Klimarådet skal i anbefalingerne forholde sig til principperne nævnt i § 1, stk. 3.

Stk. 2. Klimarådet skal i anbefalingerne endvidere vurdere, om regeringens klimaindsats ansvarliggør, at klimamålene, jf. § 1, stk. 1, og § 2, stk. 1, nås.

Stk. 3. Klimarådet skal i forbindelse med anbefalingerne give en status på Danmarks internationale målsætninger.

§ 5. Klimarådet skal kommentere den årlige klimastatus og -fremskrivning, jf. § 6, og klima-, energi- og forsyningsministerens årlige klimaprogram, jf. § 7, stk. 1 og 2.

LOV nr 965 af 26/06/2020 1

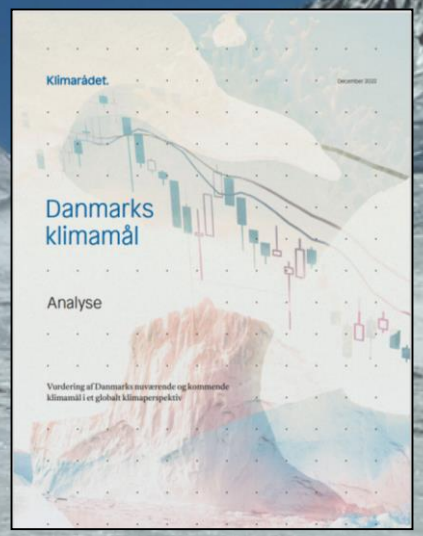


Regeringen

Ansvar for Danmark

Det politiske grundlag for Danmarks regering

DECEMBER 2022



Klimarådet.

December 2022

Danmarks klimamål

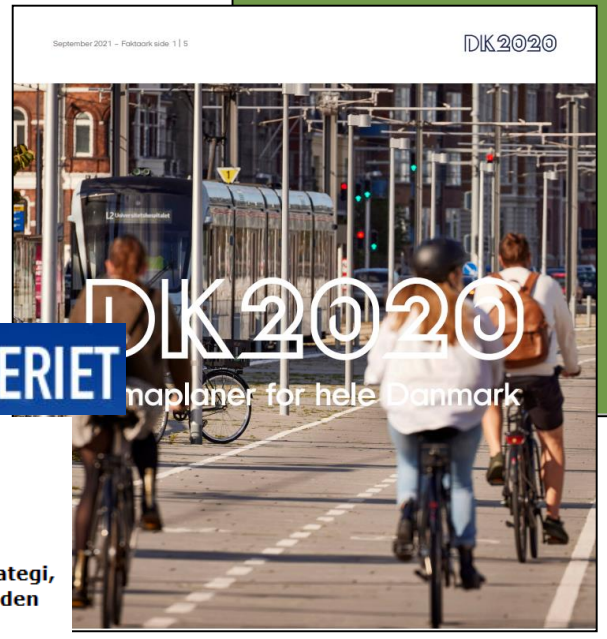
Analyse

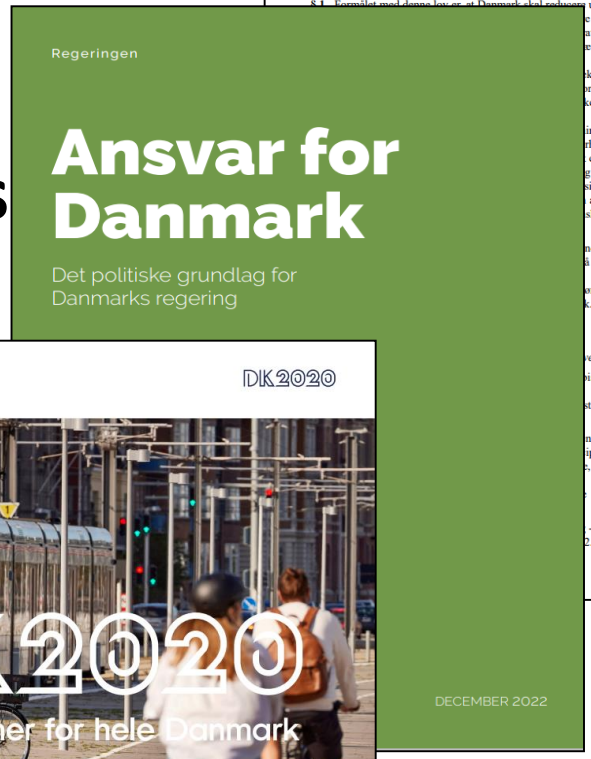
Vurdering af Danmarks nuværende og kommende klimamål i et globalt klimaperspektiv

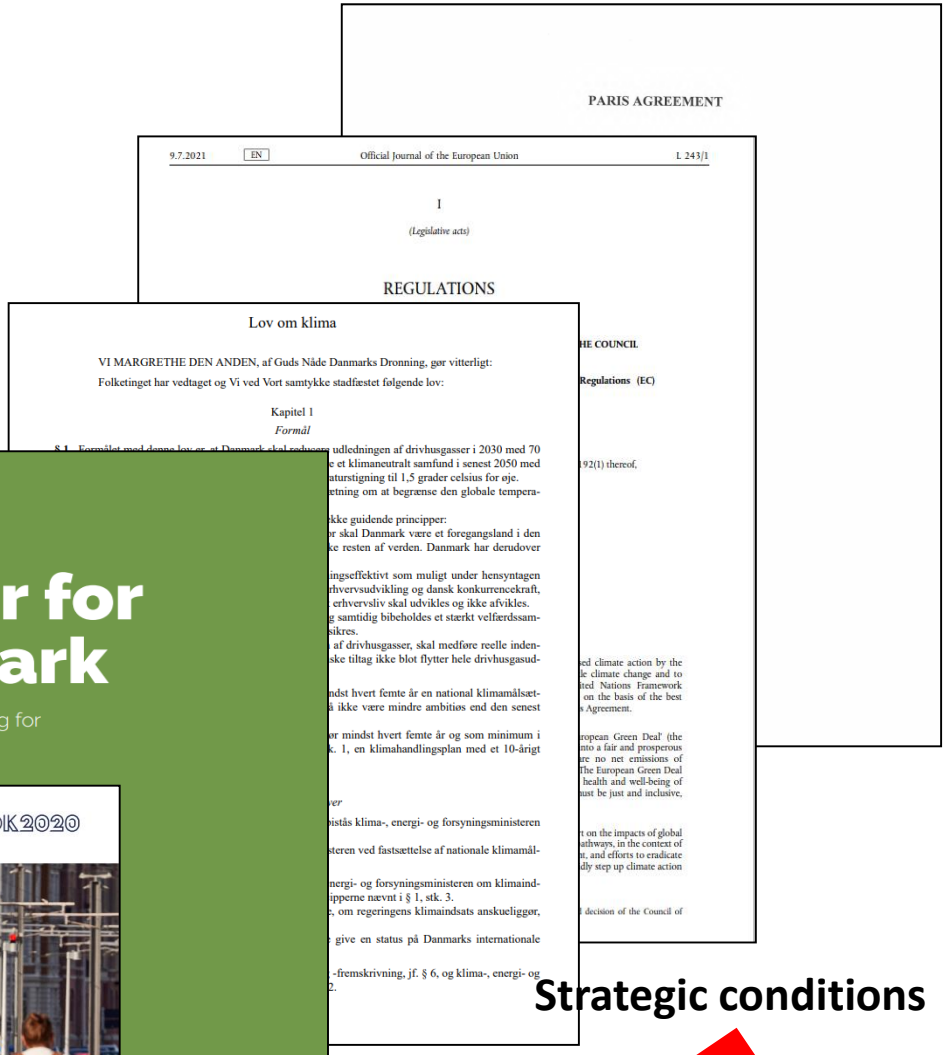
Klimarådet (2023–2050)	Mio tons CO2e	Global middeltemperaturstigning (hvis alle gør som Danmark)
Klimaloven (70% i 2030 ift 1990)	555	1,7 grader (2045–2050)
Regeringsgrundlaget (nettonul i 2045 og 110% i 2050)	473	1,7 grader (2045)
80% i 2030	458	1,6–1,7 grader (2040 –2045)
Nettonul i 2040	440	1,6 grader (2040)
80% i 2030 og nettonul i 2040	382	1,5–1,6 grader (2035–2040)

How to act among strategies?

- Paris Agreement (Global)
- EU Regulations ‘Fit for 55’ (Union)
- Climate Law (National)
- DK2020 Plan (KL-regi)
- Municipalities/Regions/companies







Strategic conditions

Applied conditions


Thank you for your attention…
mernild@sdu.dk
SDU
ipcc
INTERGOVERNMENTAL PANEL ON
climate change
WMO
UNEP
SCC
SDU Climate Cluster

SDU Climate Cluster

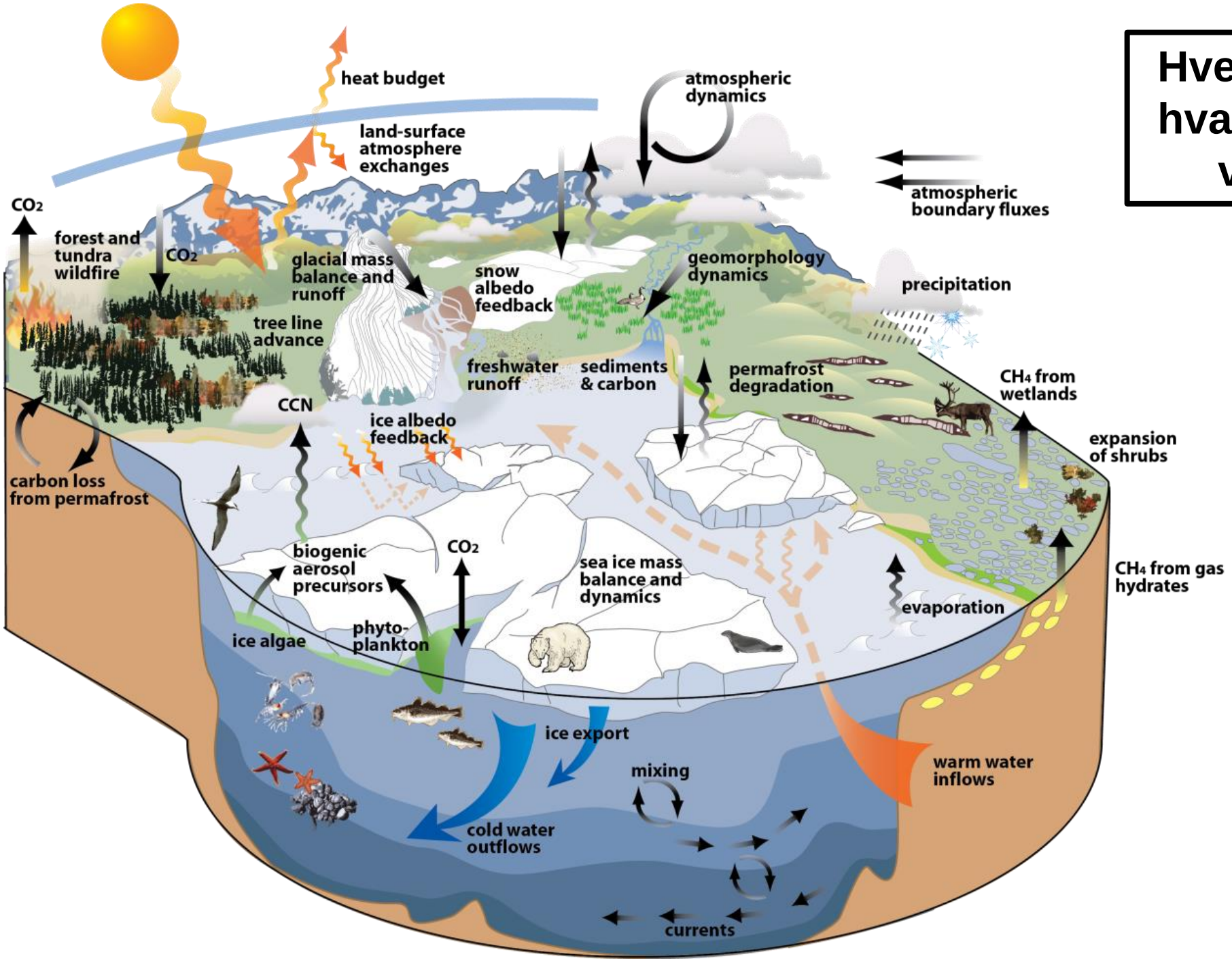
Application deadline 1 September 2023

Research infrastructure

The instrument must be used for co-financing of research infrastructure purchases in order to carry out interdisciplinary climate-related research supporting the mission of the SDU Climate Cluster to contribute to climate neutrality by 2050.

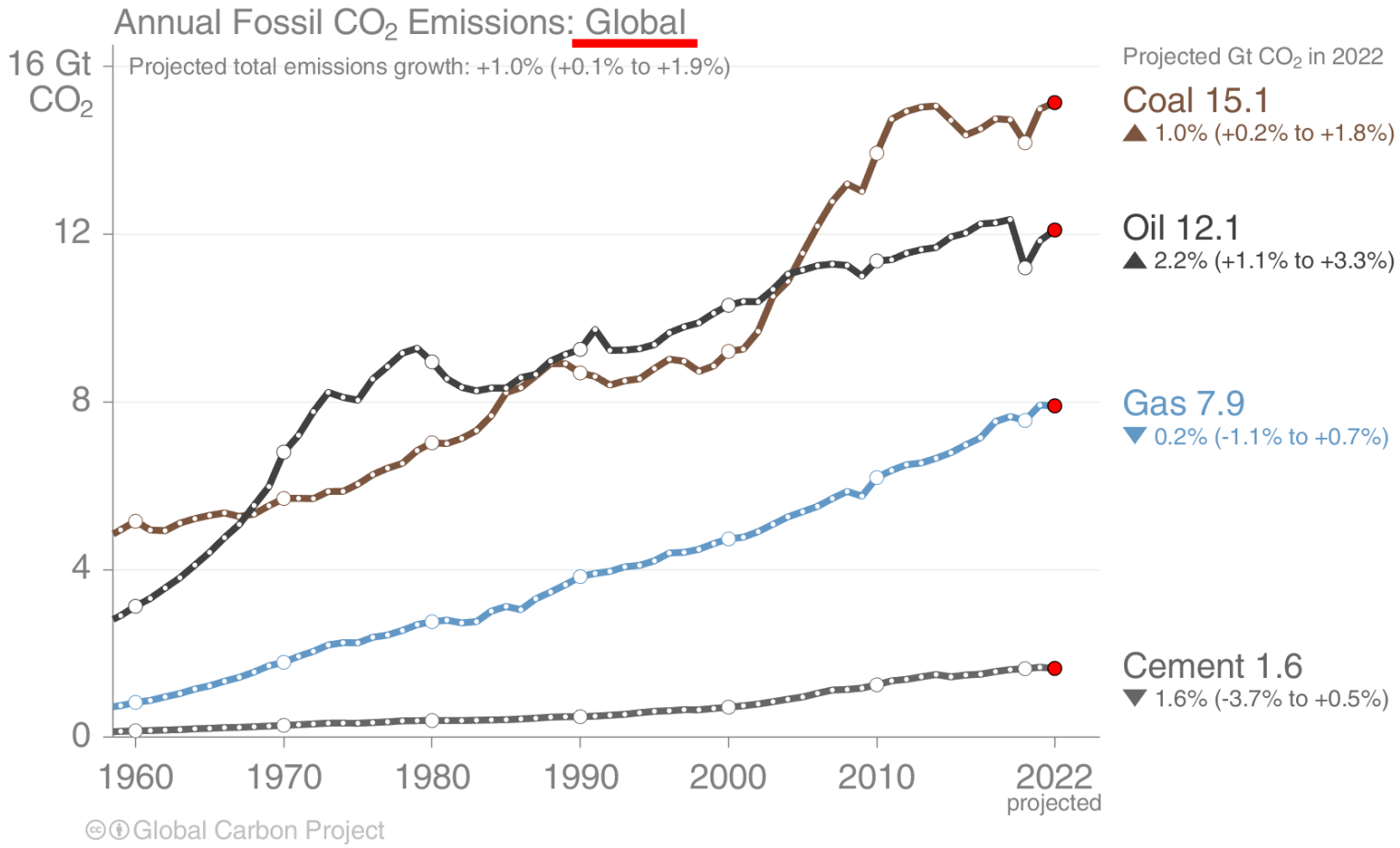
→ **Read more**

Hvem er vi og hvad arbejder vi med?



Fossil CO_2 Emissions by source

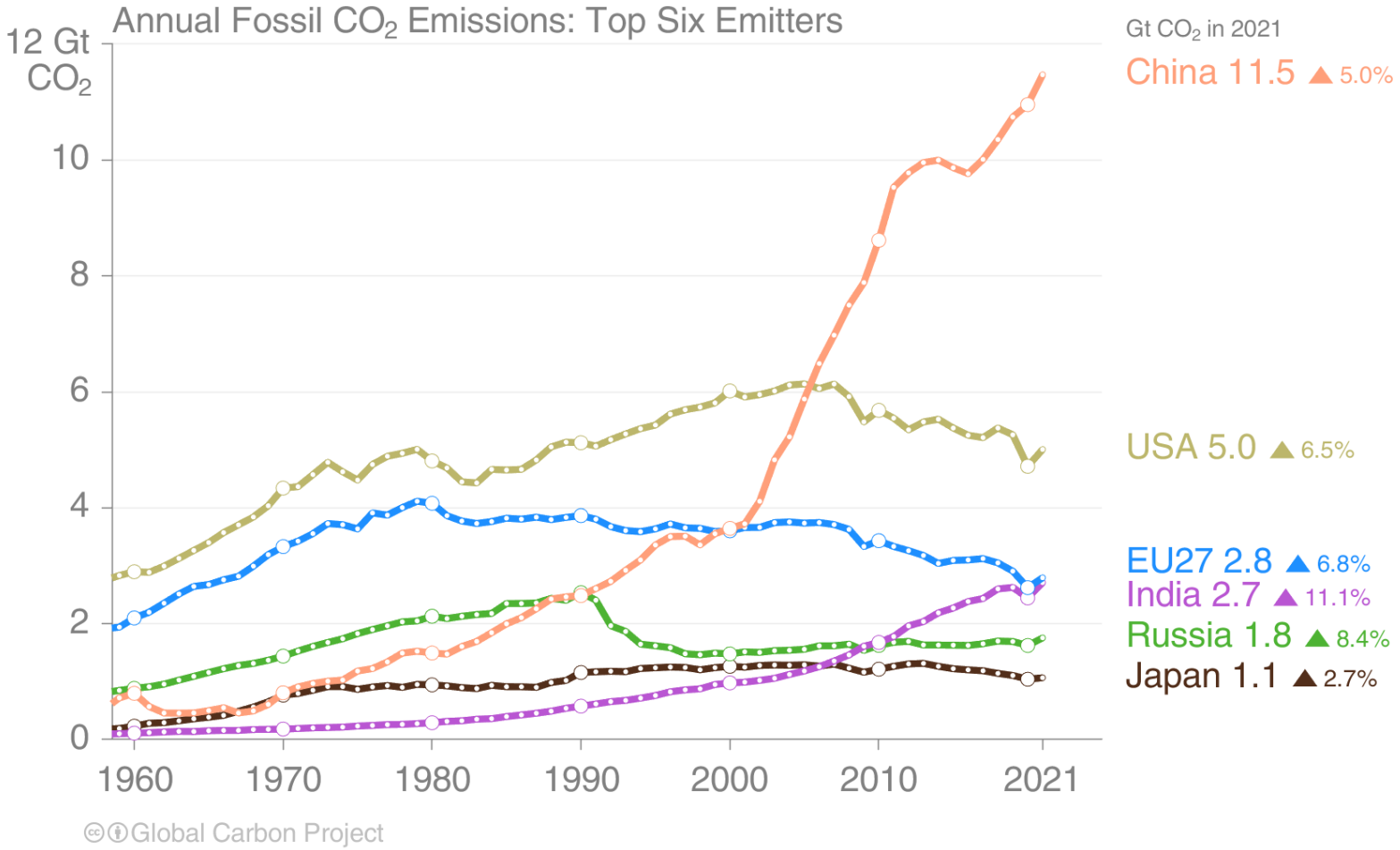
Share of global fossil CO2 emissions in 2021: coal (40%), oil (32%), gas (21%), cement (5%), flaring and others (2%, not shown)
Projection by fuel type is based on monthly data (GCP analysis)



Source: Friedlingstein et al 2022; Global Carbon Project 2022

Top emitters: Fossil CO_2 Emissions to 2021

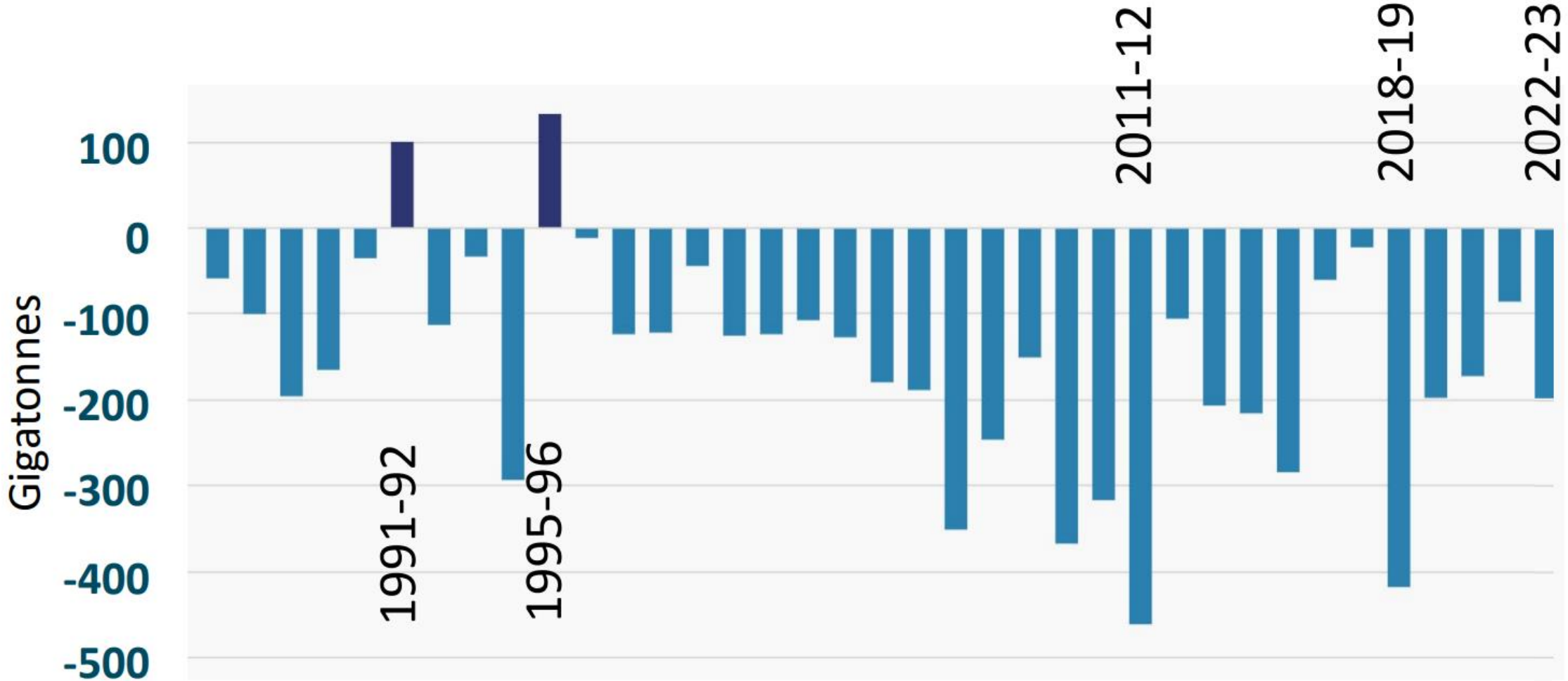
The top six emitters in 2021 covered 67% of global emissions
China 31%, United States 14%, EU27 8%, India 7%, Russia 5%, and Japan 3%



International aviation and maritime shipping (bunker fuels) contributed 2.8% of global emissions in 2021.
Source: Friedlingstein et al 2022; Global Carbon Project 2022

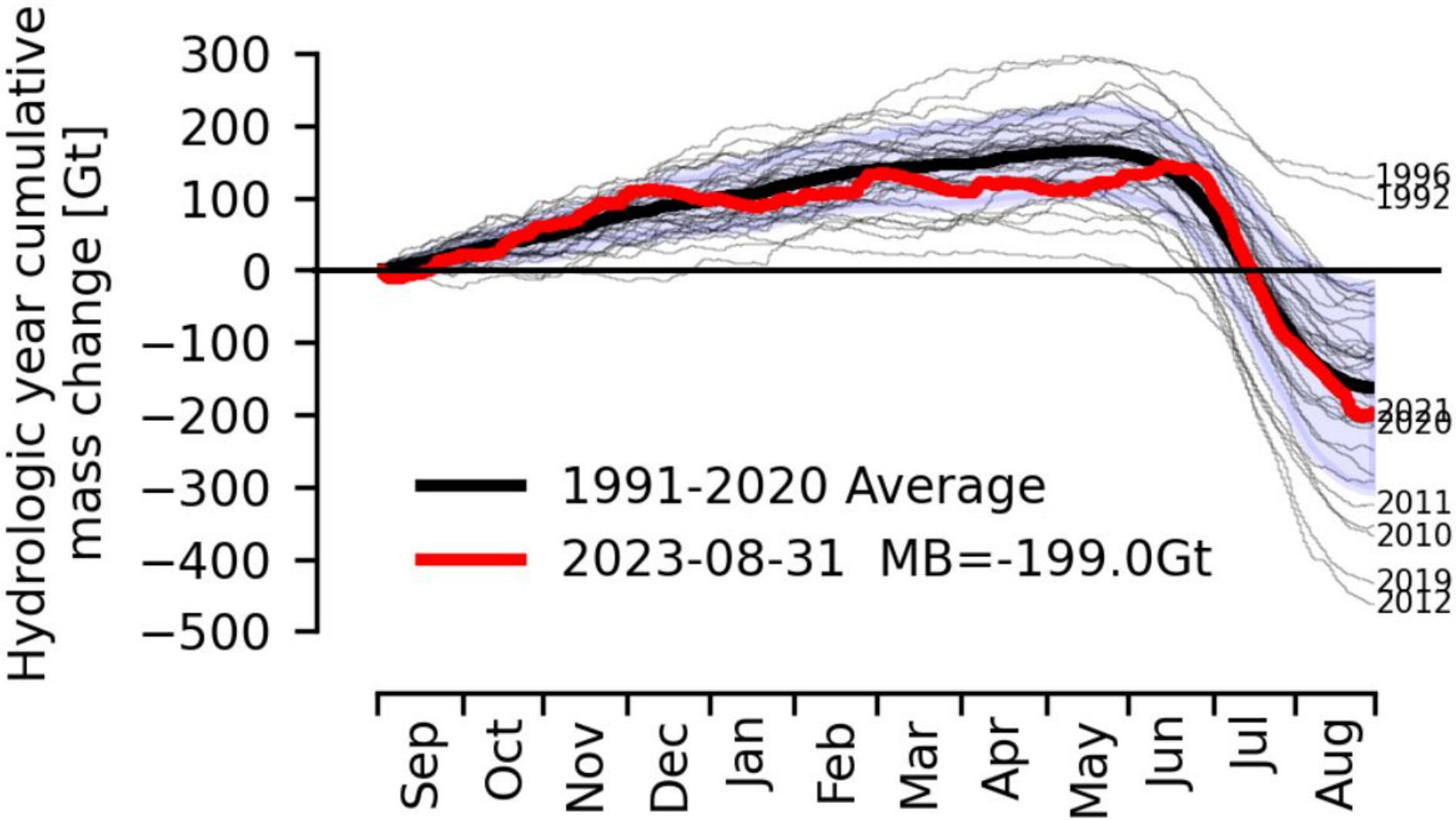
Total mass balance 1986-2023

PROMICE | GC-NET



Total mass balance

PROMICE | GC-NET

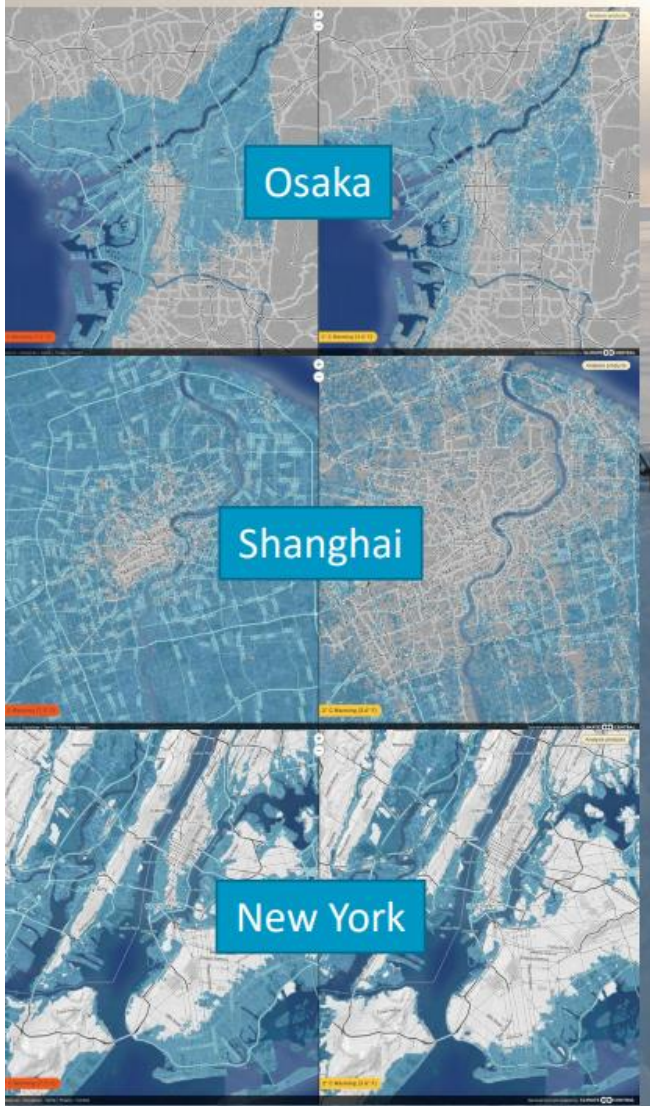


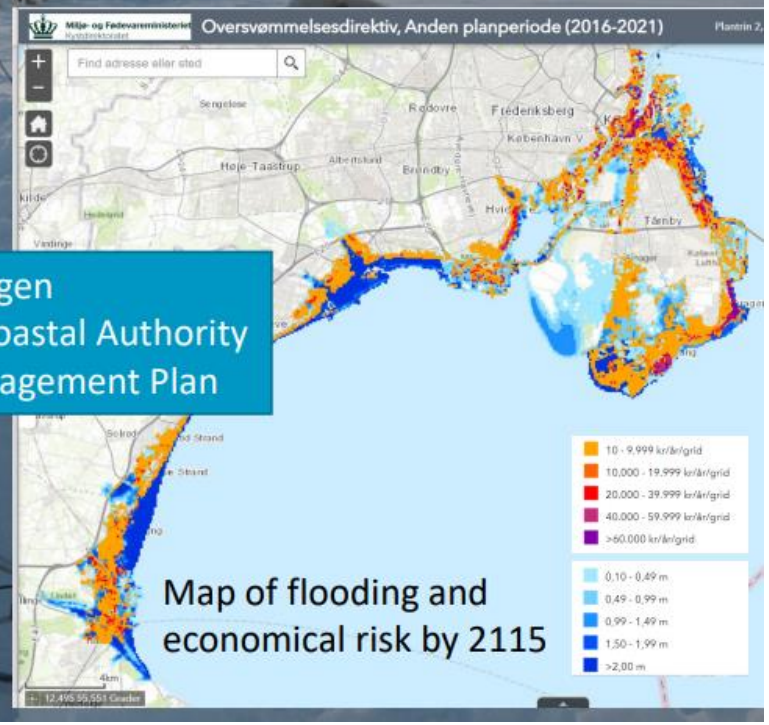
Why monitor the Greenland ice sheet?

- Sensitive to climate change
- The Arctic warming 3-4 x faster
- Planning requires numbers
- Policymaking requires knowledge
- Scenarios depend on models

Scenarios (Strauss et al., 2015)

4 °C vs. 2 °C





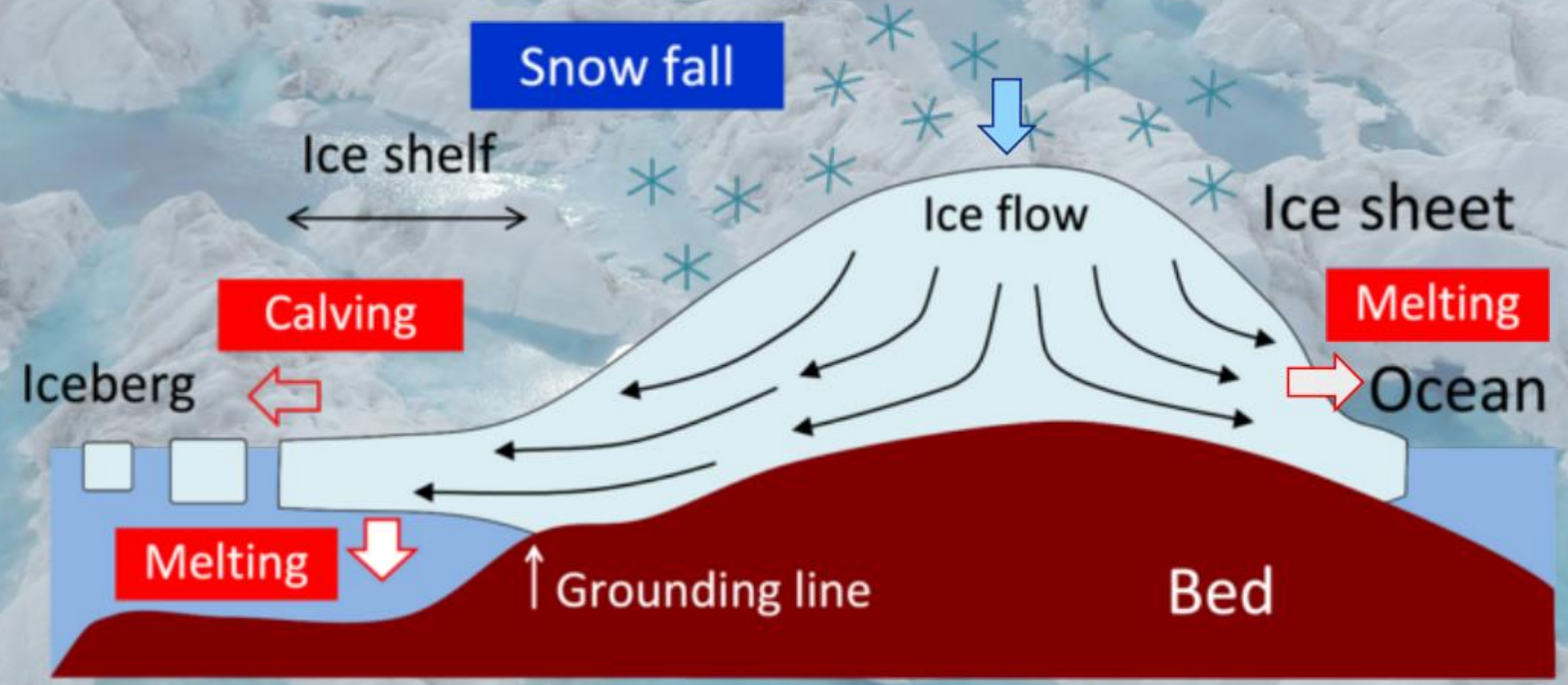
Copenhagen
Danish Coastal Authority
Risk Management Plan

Map of flooding and economical risk by 2115

Hvem er vi og hvad arbejder vi med?

What is ice sheet mass balance?

Climate…..



Hvem er vi og hvad arbejder vi med?

Mass balance of an ice sheet

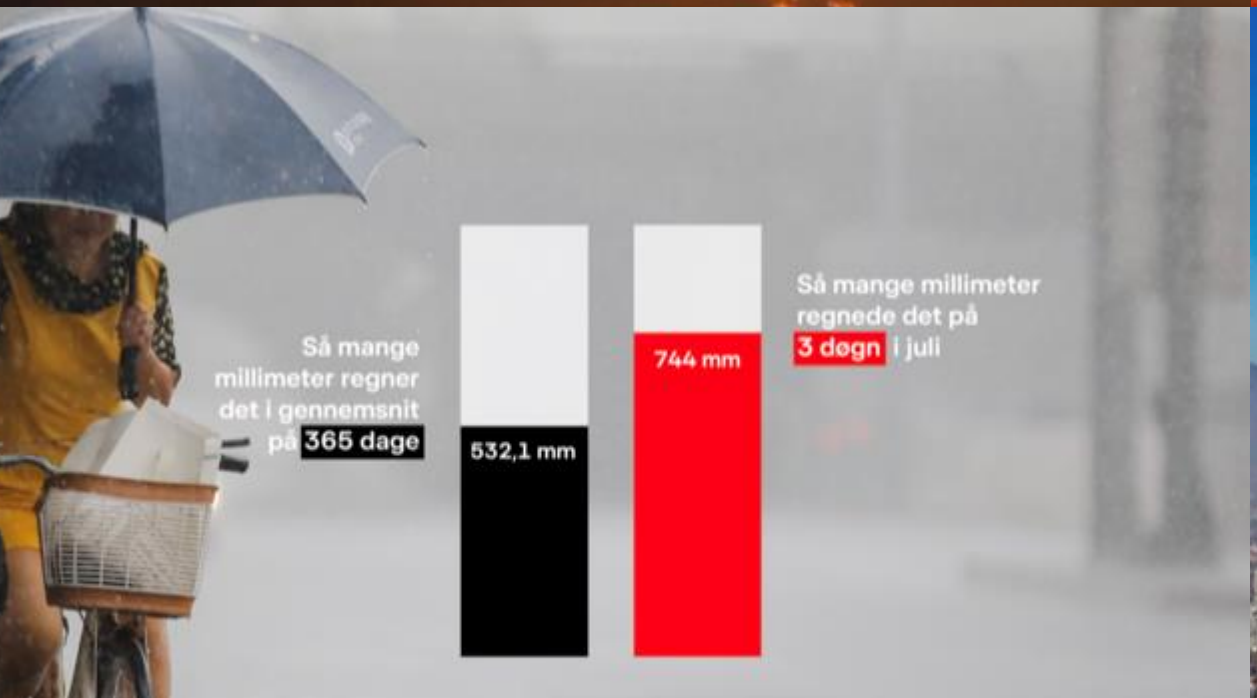

COLORADO


Hvem er vi og hvad arbejder vi med?
Zambia


Nyhetskanalen 2

Brande. Regn. Oversvømmelser.

Global gennemsnitstemperatur for sommermånederne (1980-2023)



Climate Change

Climate Change and Climate Polity Course

Normal conditions in the Pacific Ocean