

Extreme climate and society

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UNIL, Lausanne, February 9, 2024



We are in a climate crisis: And the situation worsens every year...



Europe,
2022



Pakistan,
2022

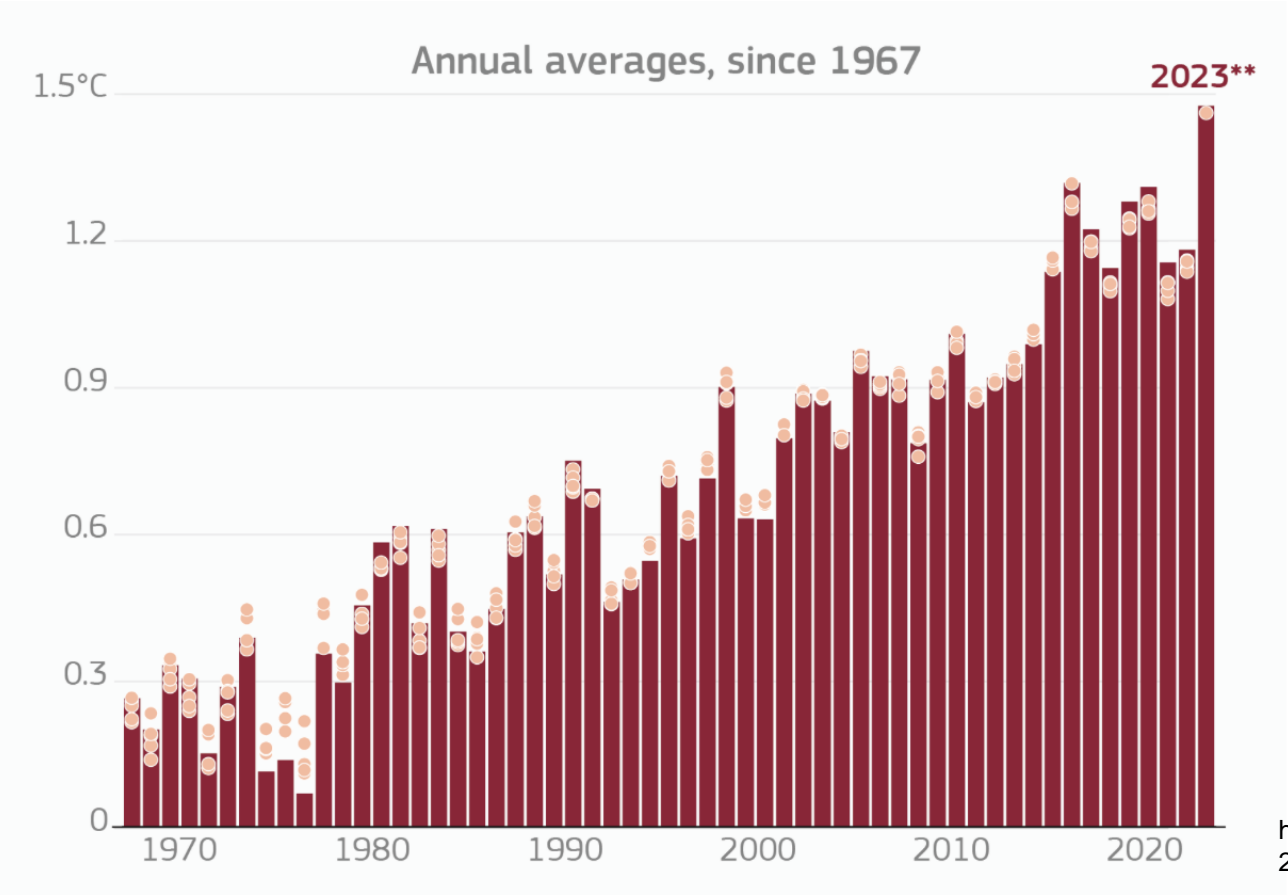


Canada,
2023



Libya,
2023

We are in a climate crisis: And the situation worsens every year...



GLOBAL CLIMATE HIGHLIGHTS 2023

Copernicus: 2023 is the hottest year on record, with global temperatures close to the 1.5°C limit

Home / Press releases

19th January 2024

[f](#) [t](#) [in](#)

<https://climate.copernicus.eu/copernicus-2023-hottest-year-record>

The world just marked a year above a critical climate limit scientists have warned about

February 8th, 2024

By [Angela Dewan](#), CNN

🕒 2 minute read · Updated 8:37 AM EST, Thu February 8, 2024



Firefighters in the hills of Valparaiso, Chile on February 3, 2024, as the country suffers its most lethal fires on record. Javier Torres/AFP/Getty Images

Climate crisis

'A critical moment': UN warns world will miss climate targets unless fossil fuels phased out

September 8th, 2023

Governments failing to cut emissions fast enough to meet Paris agreement goals and avoid disaster, major report says

● **Analysis: A chasm laid bare**

Fiona Harvey *Environment editor*

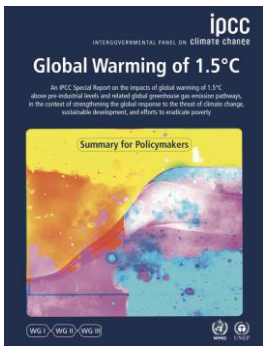
Fri 8 Sep 2023 17:01 BST



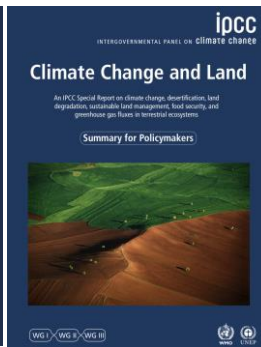
📷 The need to phase out fossil fuels has not been explicitly adopted by the UN before.
Photograph: Rex Wholster/Alamy

December 2023

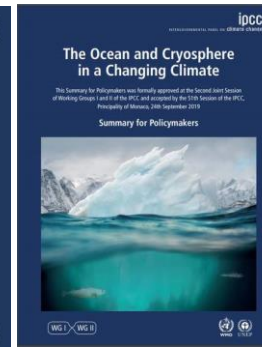
UNFCCC Climate Conference:
“transition away from fossil fuels”



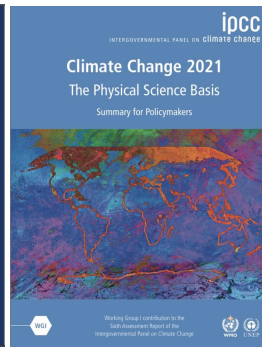
2018



2019



2019



2021



2022



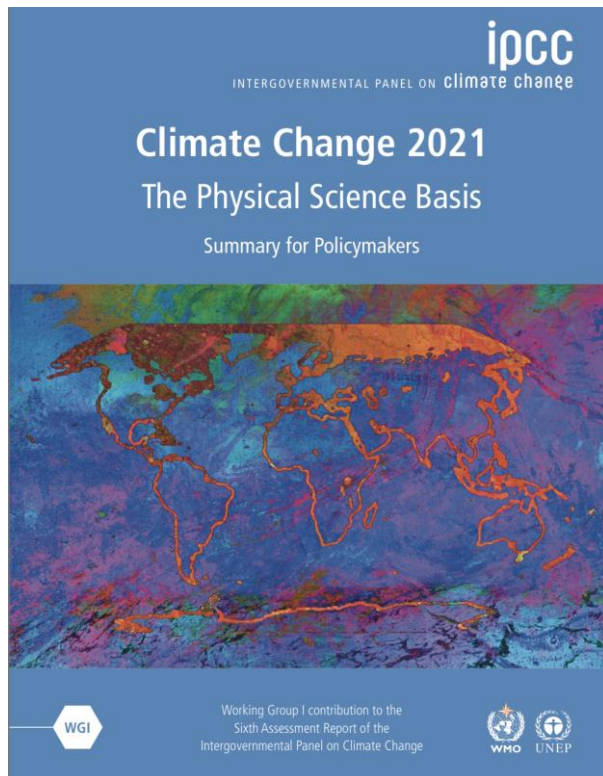
2022



2023

IPCC 6th Assessment Report: The Scientific Basis

<https://www.ipcc.ch/report/ar6/wg1/>



234 lead authors from 65 countries

>14'000 references

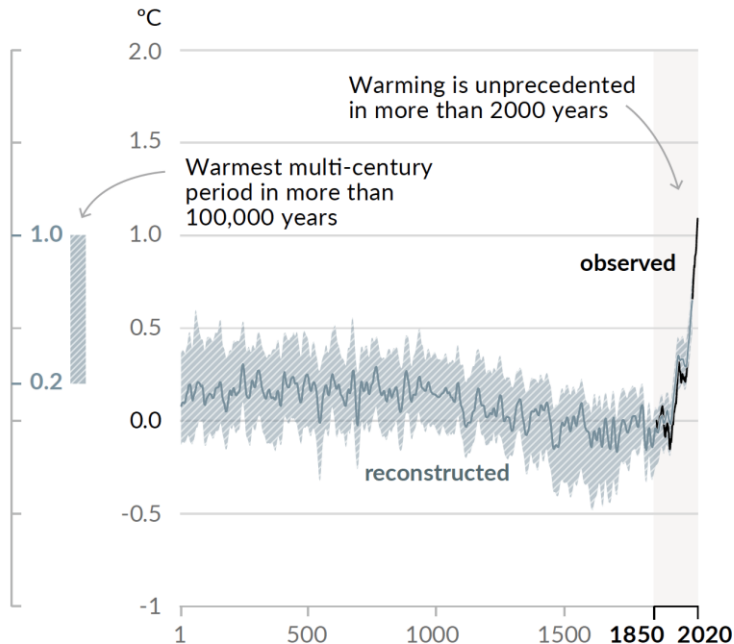
>78'000 comments

>2'000 pages

Summary for Policymakers: 10 pages

Changes in global surface temperature relative to 1850-1900

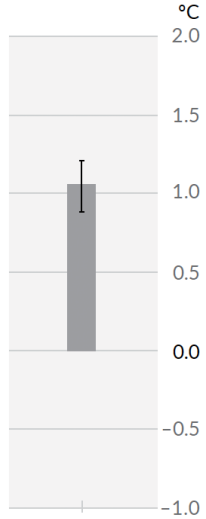
Change in global surface temperature (decadal average)
as **reconstructed** (1-2000) and **observed** (1850-2020)



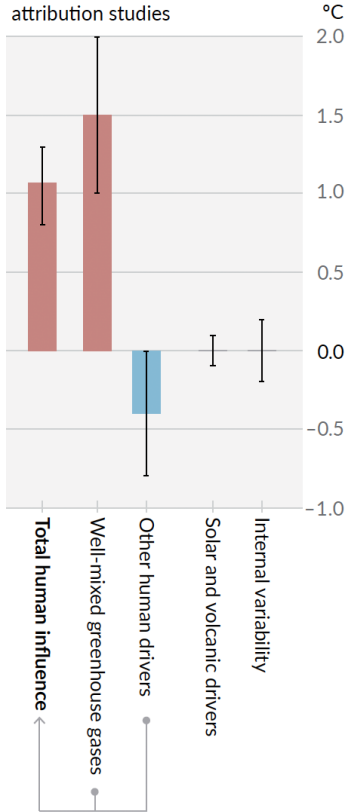
- We already had **1.1°C** of global warming in 2011-2020 compared to 1850-1900
- This temperature level **is unprecedented in more than 100'000 years**
- The largest part of this warming is **irreversible** for several hundreds of human generations

(IPCC AR6 WG1, Fig. SPM.1)

(a) Observed warming 2010–2019 relative to 1850–1900



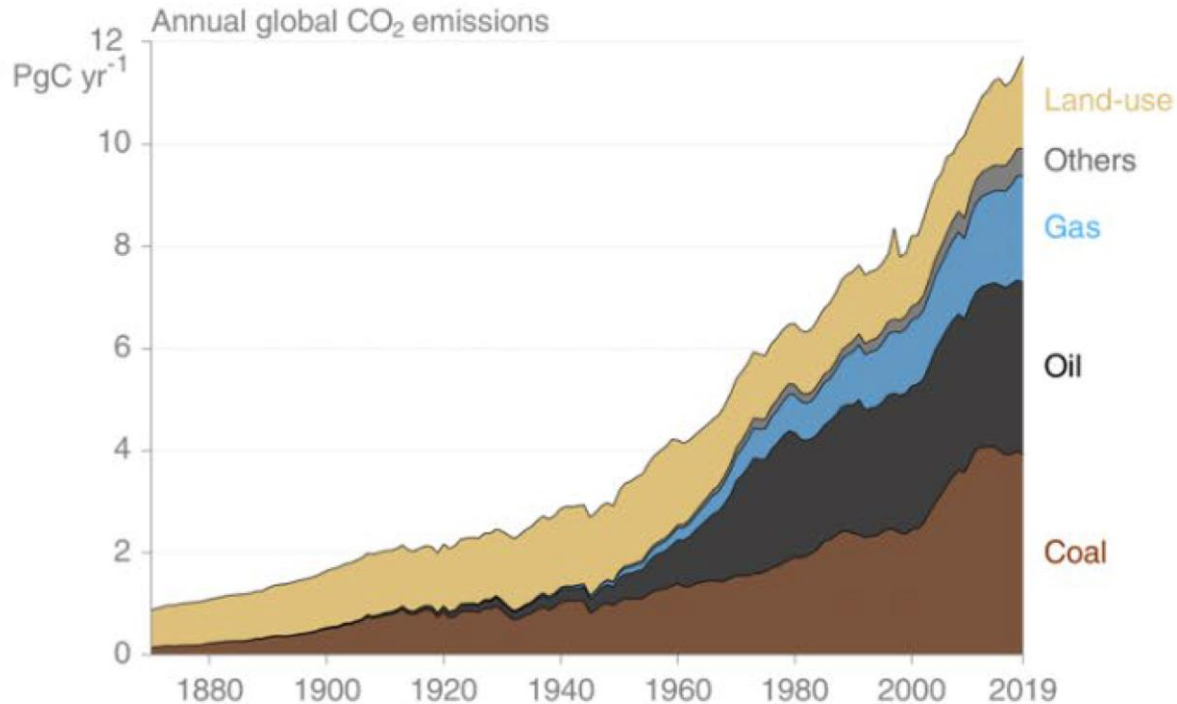
(b) Aggregated contributions to 2010–2019 warming relative to 1850–1900, assessed from attribution studies



- Best estimate of **contribution of human emissions: All of observed warming**

(IPCC AR6 WG1, Fig. SPM.2)

The cause of human-induced global warming is clear



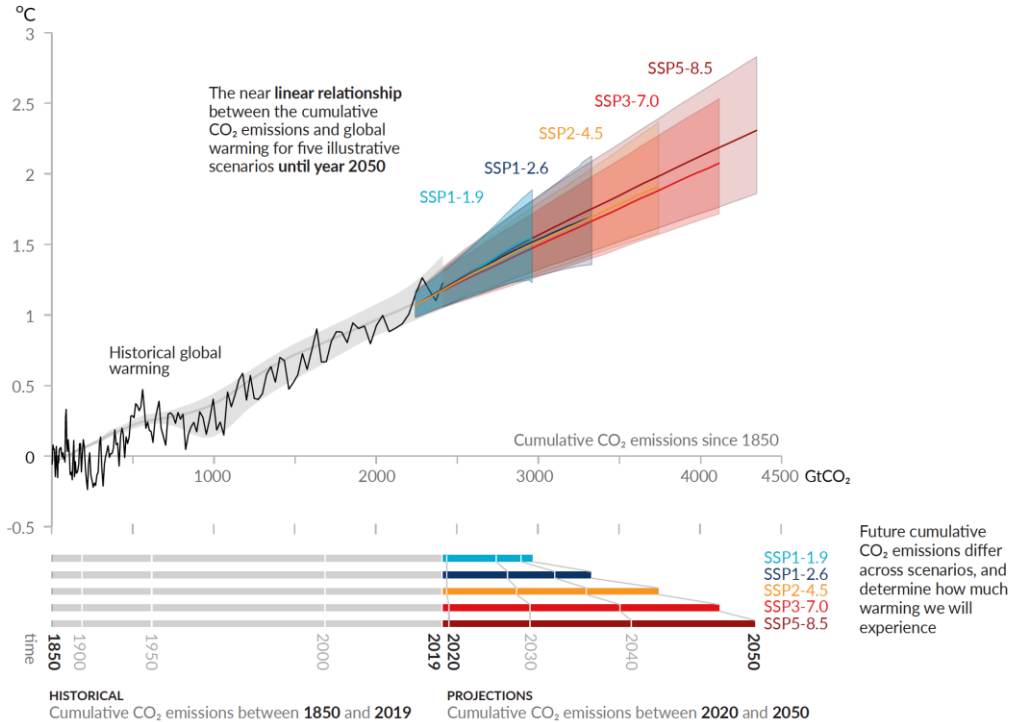
- Sources of CO₂ emissions:
- Burning of fossil fuels
 - Land use (deforestation)

The climate crisis is an energy crisis

(IPCC AR6 WG1, Chapter 5: Figs. 5.6 and 5.5)

Every tonne of CO₂ emissions adds to global warming

Global surface temperature increase since 1850-1900 (°C) as a function of cumulative CO₂ emissions (GtCO₂)



Every additional emissions of CO₂ lead to additional global warming

Very small remaining CO₂ budget for a stabilisation at ca. 1.5°C (1.6°C)

(IPCC AR6 WG1, Fig. SPM.10)

Evidence of observed changes in extremes has **strengthened**

- Human-induced climate change is already affecting many weather and climate extremes in **every region** across the globe
- Some **recent hot extreme events would have been extremely unlikely** to occur without human influence on the climate system

(IPCC AR6 WG1; based on Chapter 11, Seneviratne, Zhang, et al. 2021)



Temperature extremes



Heavy precipitation



Floods



Droughts





Storms



Compound events

Climate change is already affecting **every inhabited region across the globe**: No region is spared from changes in climate extremes



West-Central Europe, where Switzerland is located, is a **hotspot** of changes in climate extremes

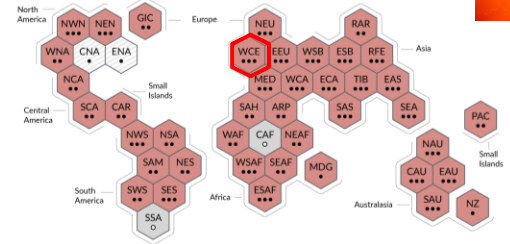
-  Low agreement in the type of change
-  Limited data and/or literature

- Confidence in human contribution to the observed change**
- High
 - Medium
 - Low due to limited agreement
 - Low due to limited evidence



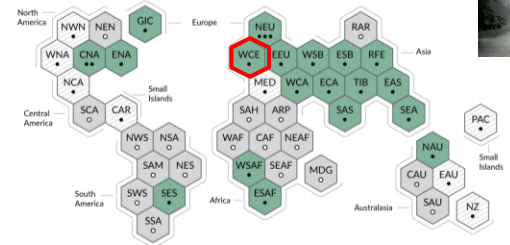
Hot extremes

-  Increase (41)
-  Decrease (0)



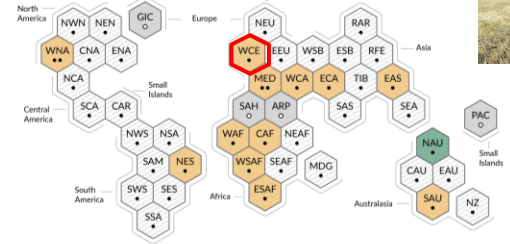
Extreme rainfall

-  Increase (19)
-  Decrease (0)



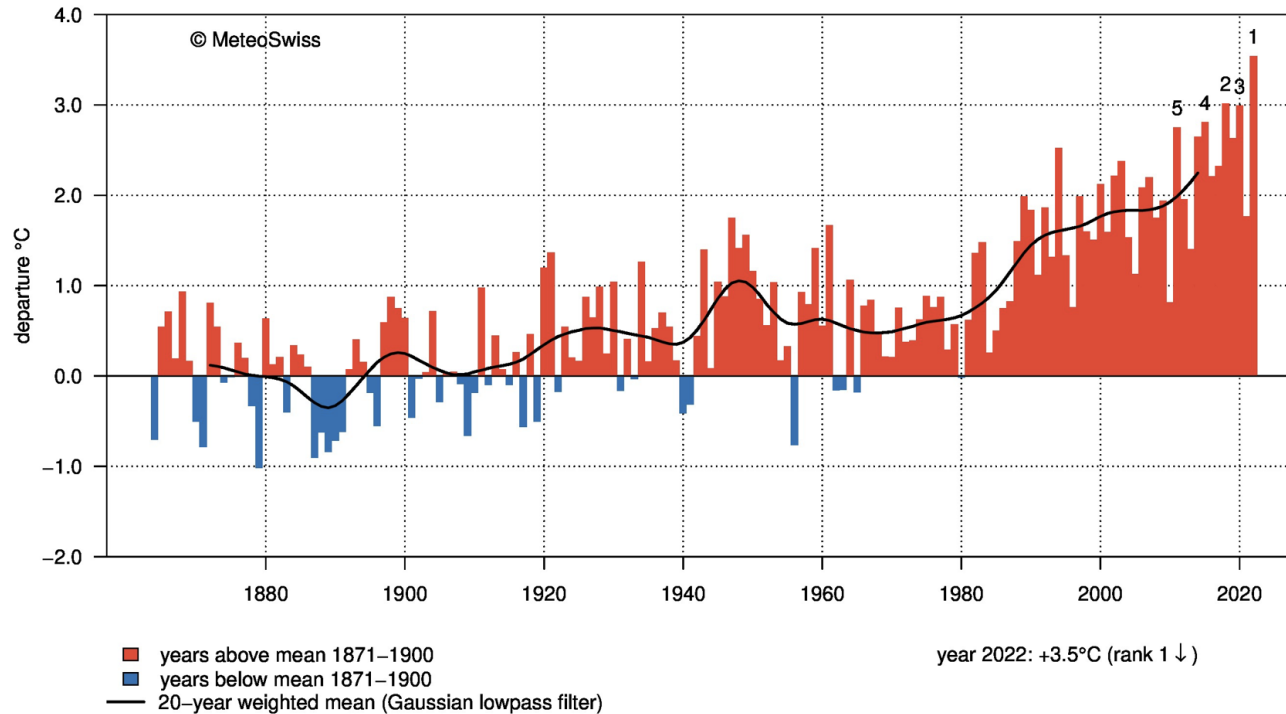
Drought

-  Increase (12)
-  Decrease (1)

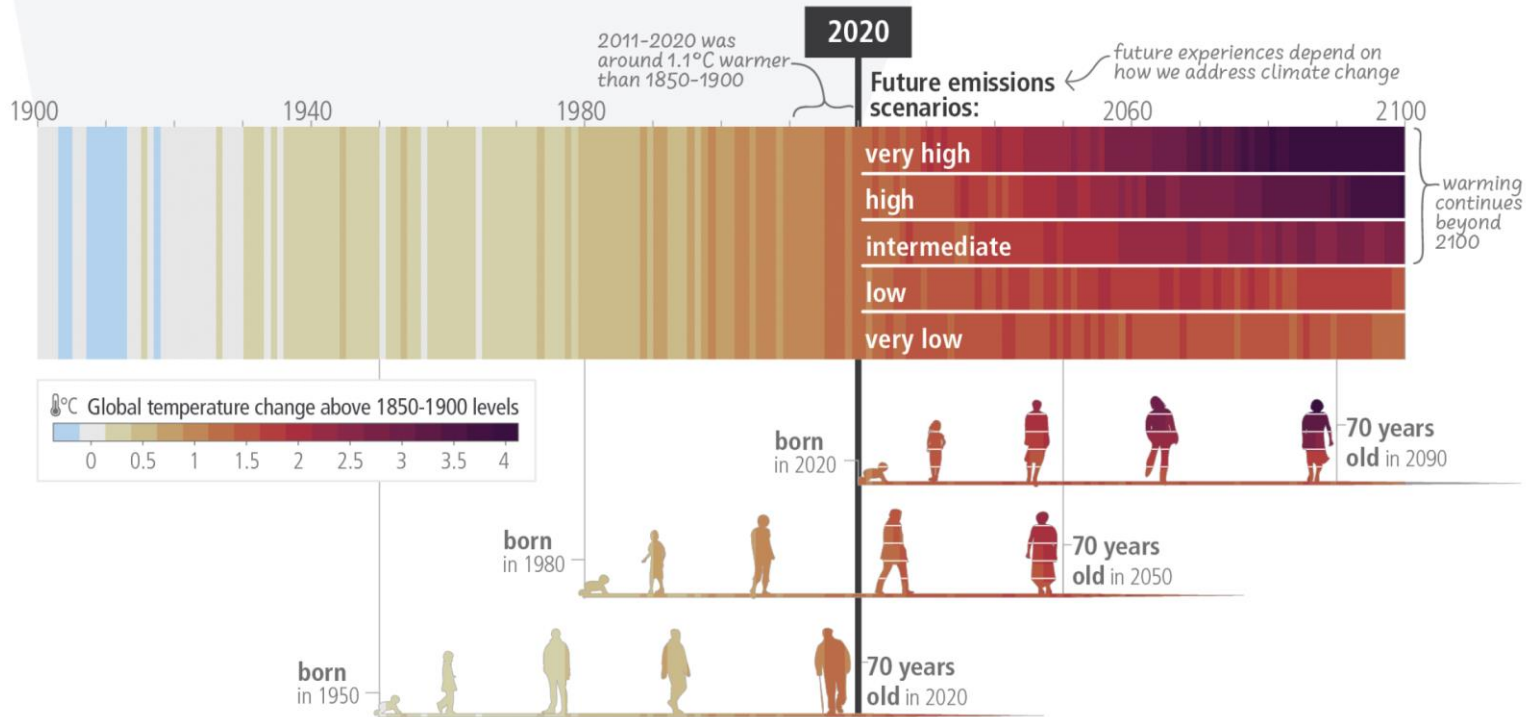


Observed warming in Switzerland is twice larger than the observed global warming: +2.5°C since 1864

Annual temperature – Switzerland – 1864–2022
departure from the mean 1871–1900



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



(IPCC AR6 SYR, Figure SPM.1)

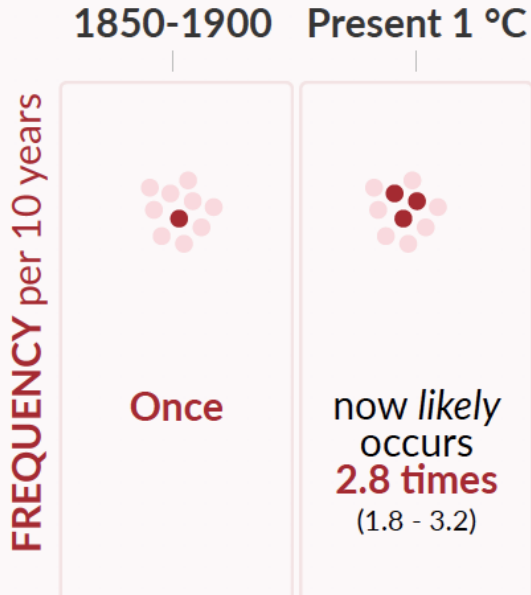
A limitation of global warming to +1.5°C compared to +2°C allows to avoid substantial additional changes in extremes and impacts

- Increase in hot extremes in most inhabited regions of the world
- Heavier precipitation in several regions
- Increased drying in some regions (e.g. Mediterranean, Southern Africa)
- Irreversible impacts (increase of sea level rise, extinction of some animal and plant species, in particular coral reefs)



(IPCC SR15, 2018; IPCC AR6, 2021)

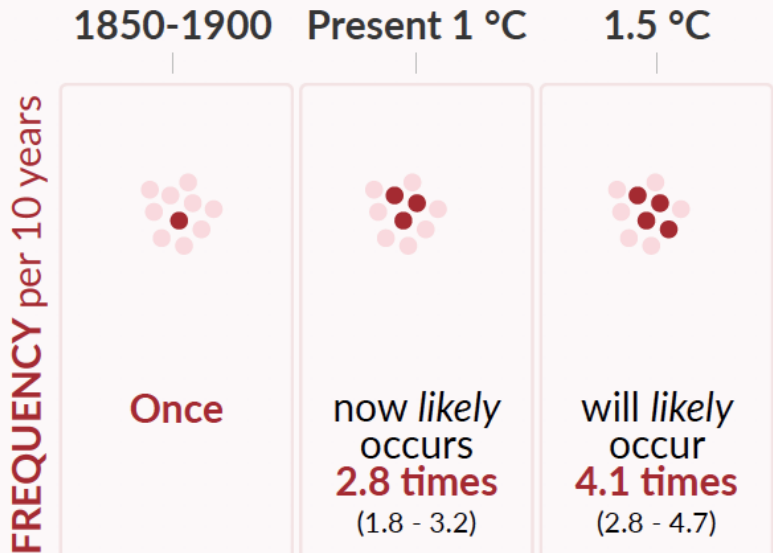
Frequency and increase in intensity of extreme temperature event that occurred **once in 10 years** on average in a climate without human influence



Projected **changes in extremes are larger** in frequency and intensity **with every additional increment of global warming**

Frequency and increase in intensity of extreme temperature event that occurred **once in 10 years** on average in a climate without human influence

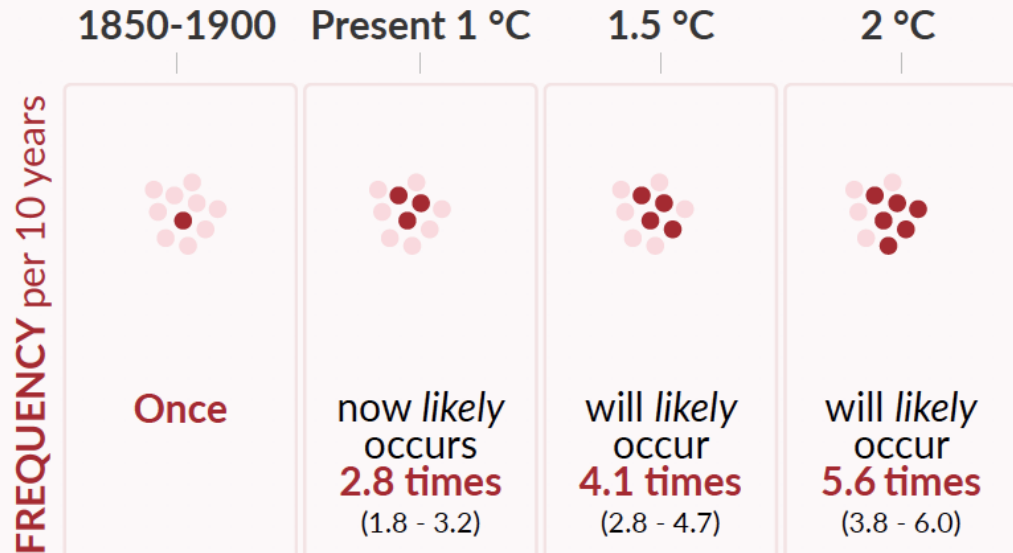
Future global warming levels



Projected **changes in extremes are larger** in frequency and intensity **with every additional increment of global warming**

Frequency and increase in intensity of extreme temperature event that occurred **once in 10 years** on average in a climate without human influence

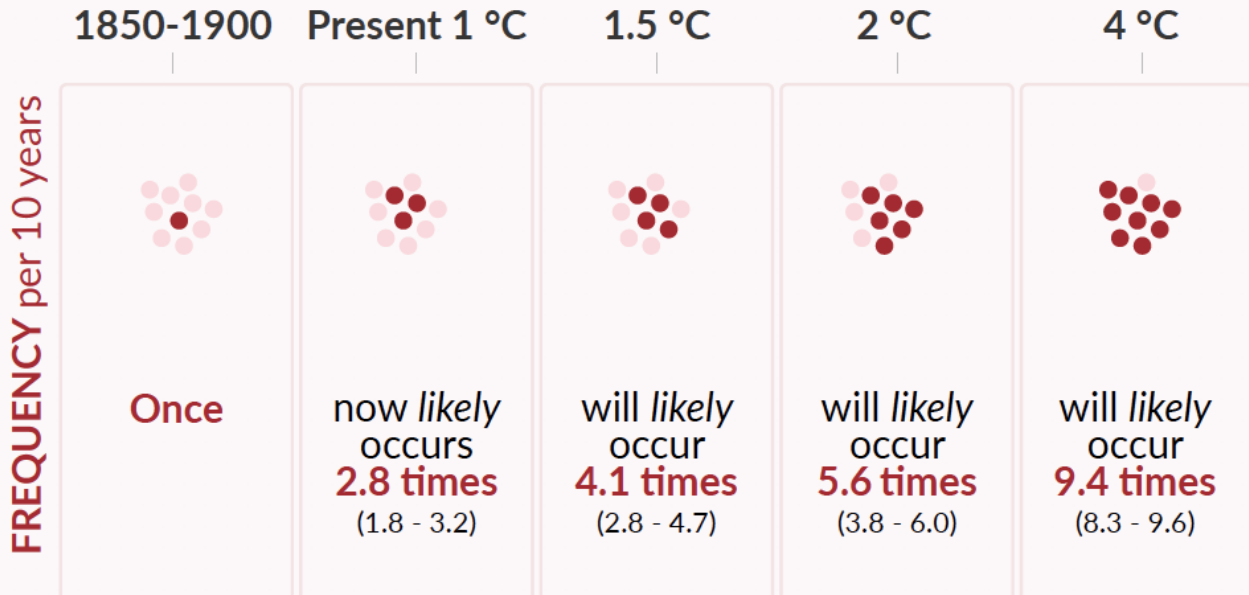
Future global warming levels



Projected **changes in extremes are larger** in frequency and intensity **with every additional increment of global warming**

Frequency and increase in intensity of extreme temperature event that occurred **once in 10 years** on average in a climate without human influence

Future global warming levels



Projected **changes in extremes are larger** in frequency and intensity **with every additional increment of global warming**

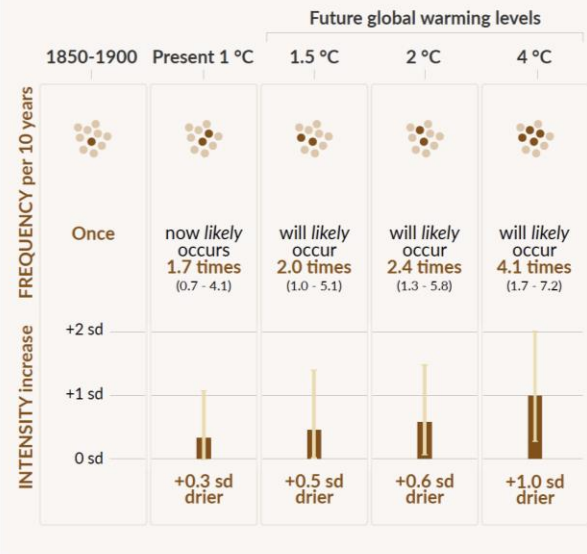
(IPCC AR6 WG1, Fig. SPM.6; based on Chapter 11, Seneviratne, Zhang, et al. 2021)

Projected changes in extremes are larger in frequency and intensity with every additional increment of global warming

Agricultural & ecological droughts in drying regions

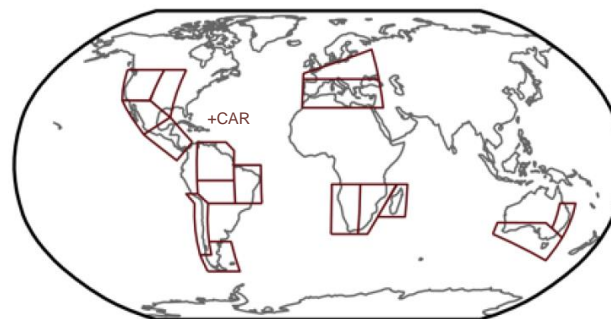
10-year event

Frequency and increase in intensity of an agricultural and ecological drought event that occurred **once** in 10 years on average across drying regions in a climate without human influence



Regions with assessed drying at 2°C of global warming

Drying regions



(IPCC AR6 WG1, Fig. SPM.6; based on Chapter 11, Seneviratne, Zhang et al. 2021)

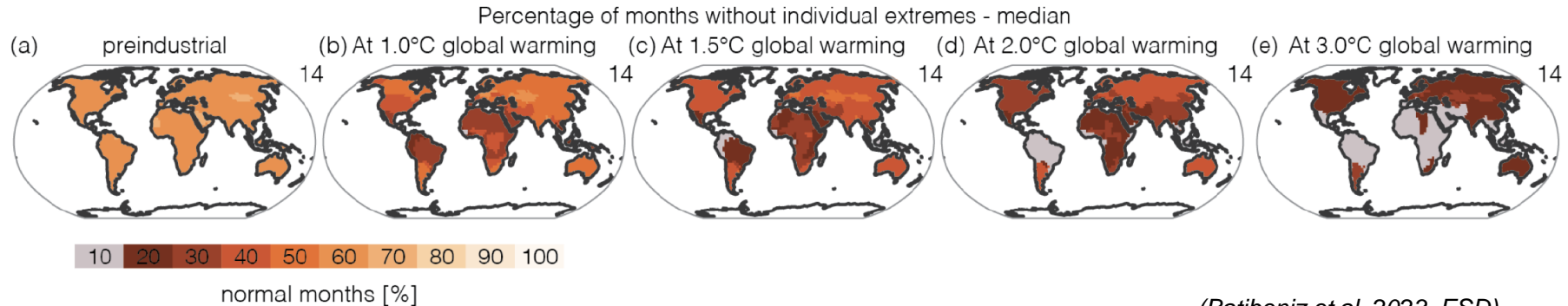
Multiple changes in extremes, compound events

- **Concurrent heatwaves and droughts & fire weather conditions**
- **Compound flooding** (e.g. in coastal areas)
- **Concurrent extremes at multiple locations:** More frequent, including **in crop-producing areas** at 2°C and above compared to 1.5°C global warming



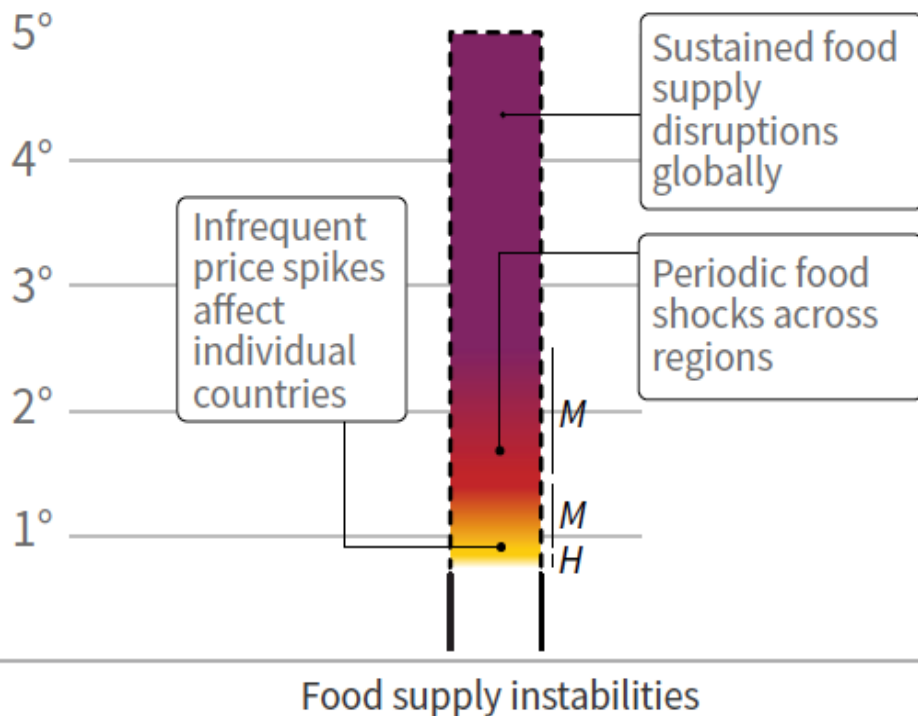
(IPCC AR6 WG1; based on Chapter 11, Seneviratne, Zhang, et al. 2021)

Changes in multiple extreme events means that we experience less and less “normal conditions”



(Batibeniz et al. 2023, ESD)

Need to consider the risks from a global crisis: Disruptions of supply chains, global economic impacts, risks of conflicts



High risks for global food supply instabilities already above 1.5°C

(IPCC Land report: <https://www.ipcc.ch/srccl>)

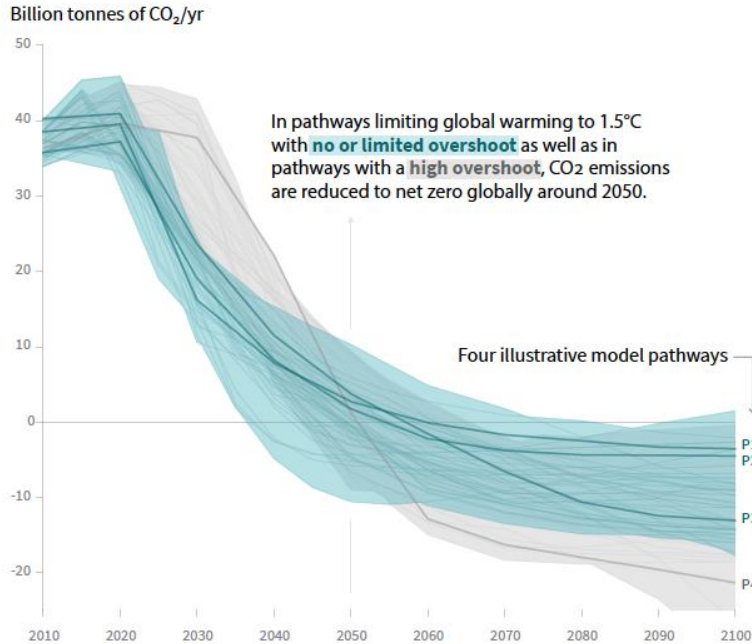


modified from <https://pxhere.com/fr/photo/858113>



It's time for the
emergency break

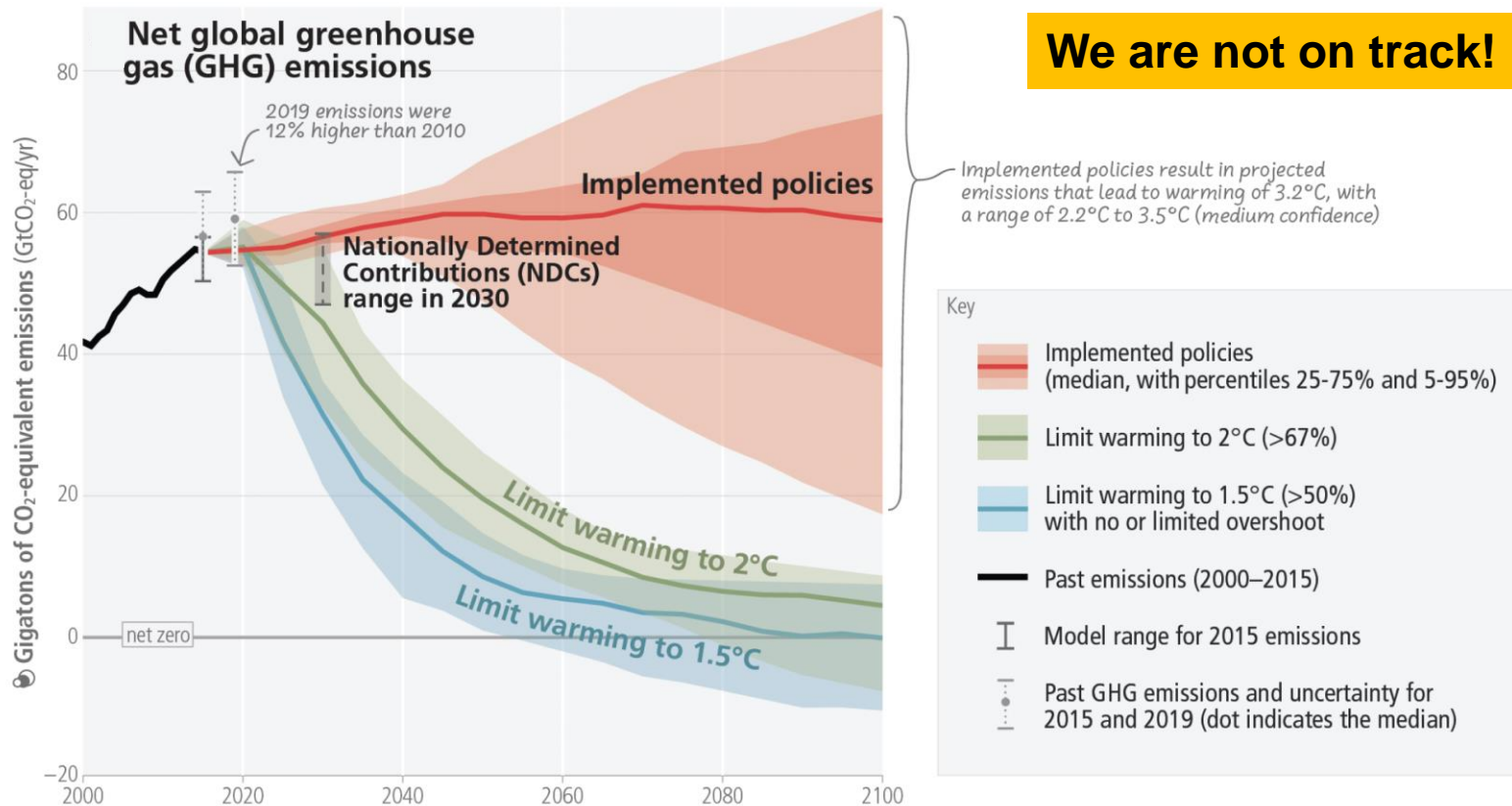
Global total net CO₂ emissions



(IPCC SR15)

Stabilization to ~1.5°C requires changes which are unprecedented in terms of scale:

- **Immediate reduction of CO₂ emissions on global scale (until 2030: ~50% of 2010)**
- **Net-zero CO₂ emissions at the latest in 2040 (66% probability) – 2050 (50% probability)**
- **“Negative emissions”** after reaching net-zero CO₂: **At most 10%** of present-day emissions



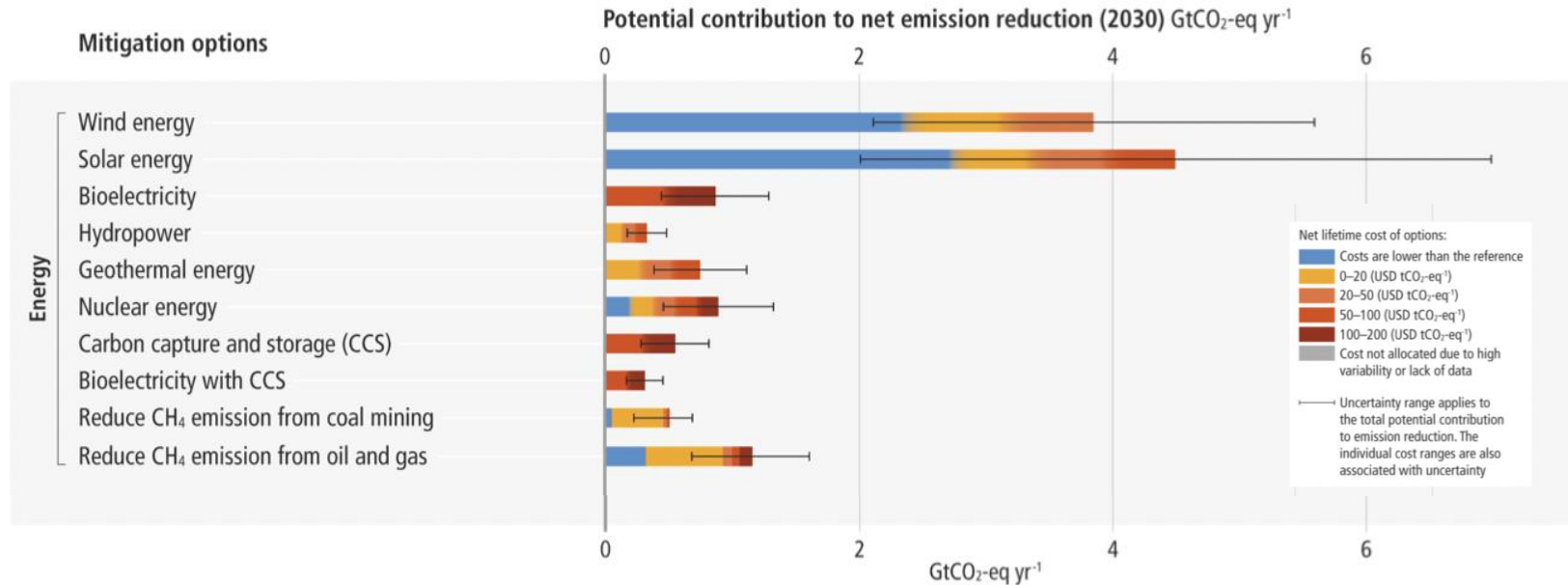
“Global GHG emissions are projected to peak between 2020 and at the latest before 2025 in global modelled pathways that limit warming to 1.5°C (>50%) with no or limited overshoot” (IPCC AR6 WG3)

(IPCC AR6 SYR, Figure SPM.5a)

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Many solutions exist and can help us make the first steps to decarbonisation!

Many options available now in all sectors are estimated to offer substantial potential to reduce net emissions by 2030. Relative potentials and costs will vary across countries and in the longer term compared to 2030.





Conclusions

- It is worth limiting global warming to 1.5°C: This aim is stated in the 2015 Paris agreement and confirmed in the 2021 Glasgow climate pact.
First essential step: Halve CO₂ emissions until 2030!
- **The window to act is closing rapidly.** For a stabilization of global warming at about 1.5°C, we need immediate action, including 9-10% reductions of CO₂ every year from now on until 2030.
- **We need more research and exchange at the interface between climate extremes and society:**
 - Climate litigation
 - Economic impacts of climate extremes
 - Psychology, Sociology, Climate communication

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EVERY ACTION MATTERS
EVERY BIT OF WARMING MATTERS
EVERY YEAR MATTERS
EVERY CHOICE MATTERS