Climate Change

Compiled by:
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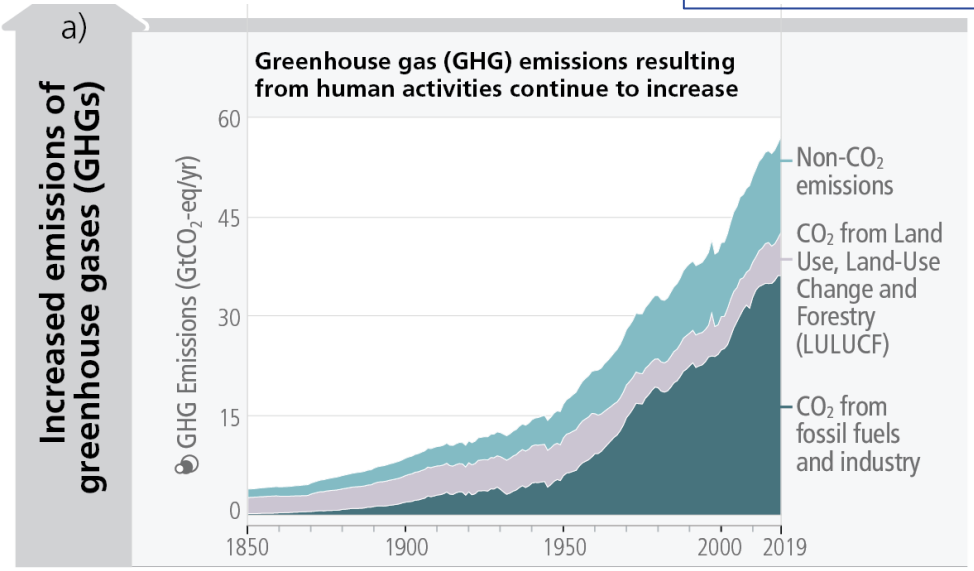
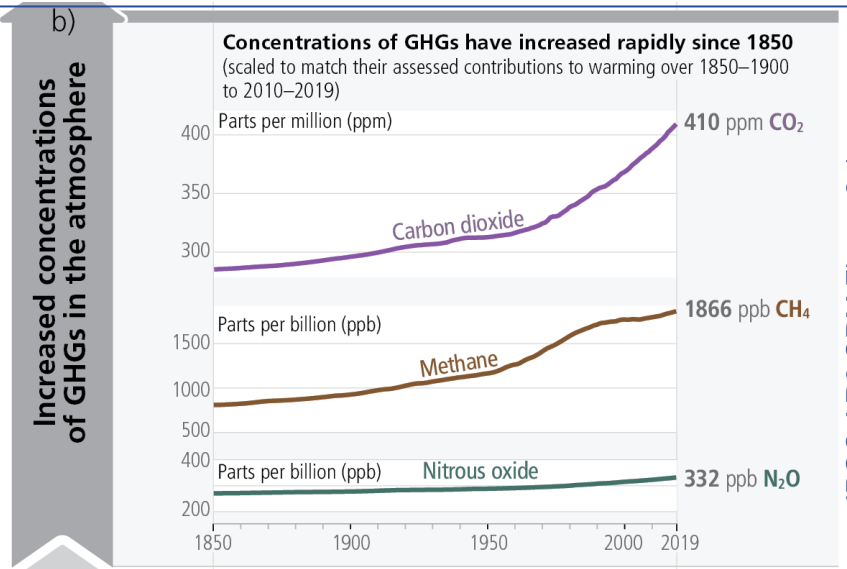
2023-06-06
GEM Camp

Quelle: Ed Hawkins/DWD

Climate Change

Current :
CO_2-level 424 ppm (https://www.co2.earth/daily-co2)
Methane 1922 ppb (https://www.methanelevels.org/)





Source: IPCC AR6 SPM Figure 2.1
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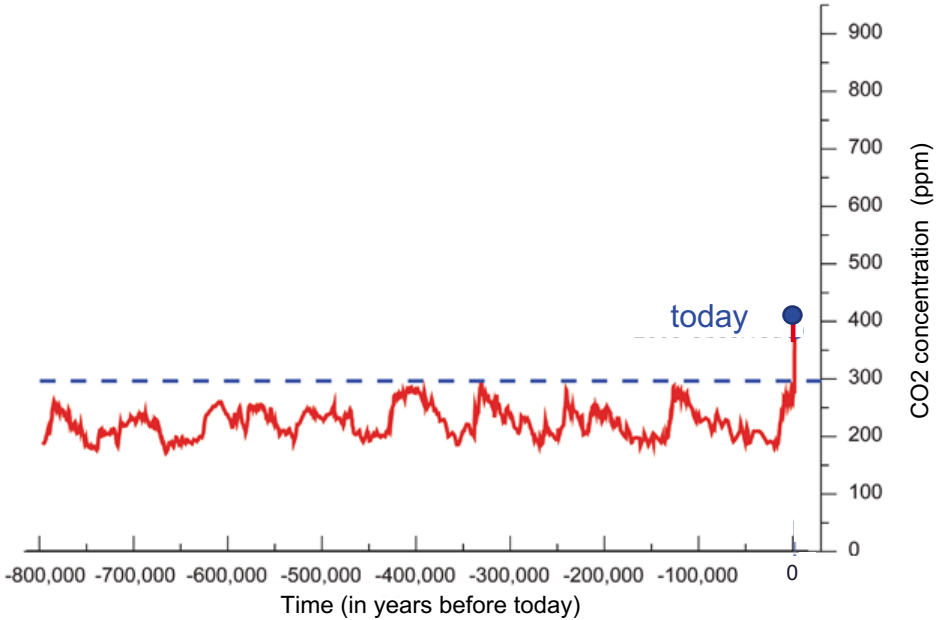
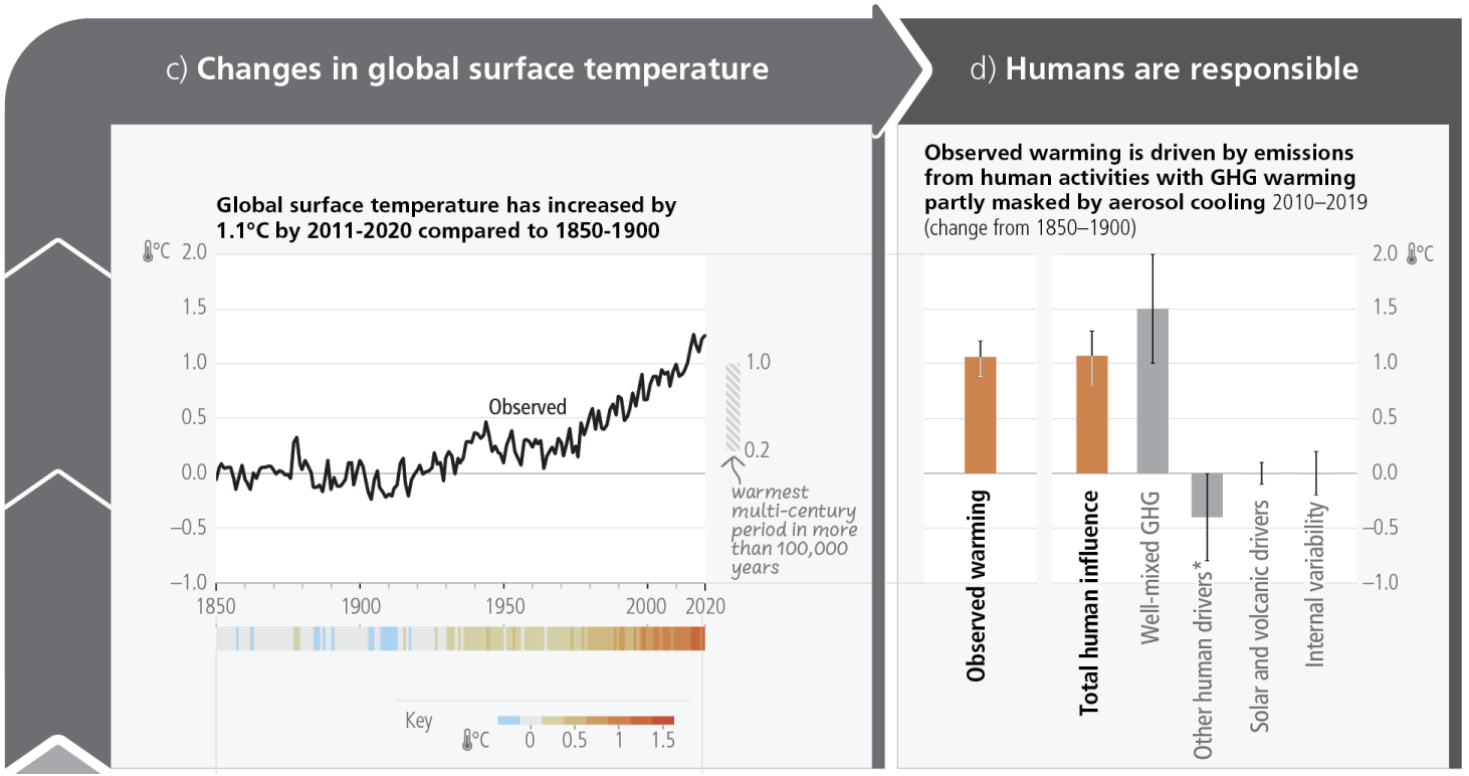
CO_2 concentration over the last 800,000 years



Quelle: Lüthi et al., Tans, IIASA

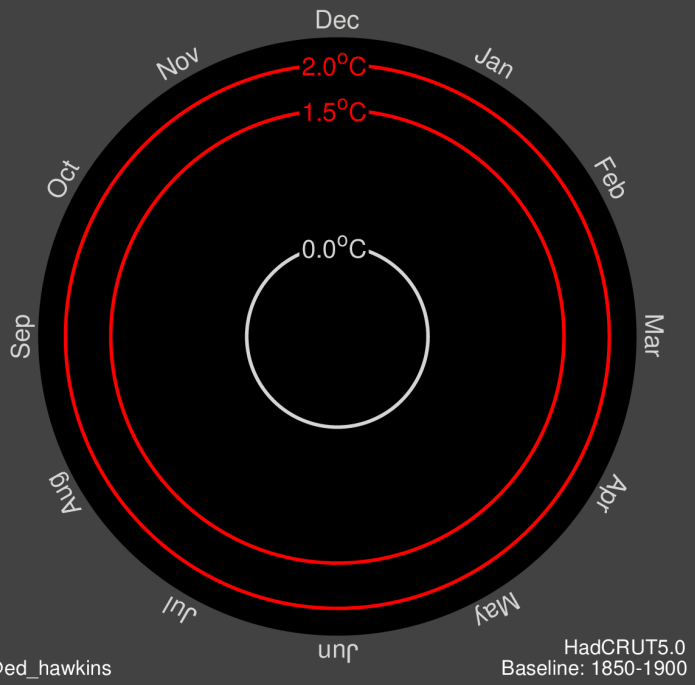
Roger Revelle and Hans Suess,1957

„ . . . human beings are now carrying out a large scale geophysical experiment of a kind that could not have happened in the past …“

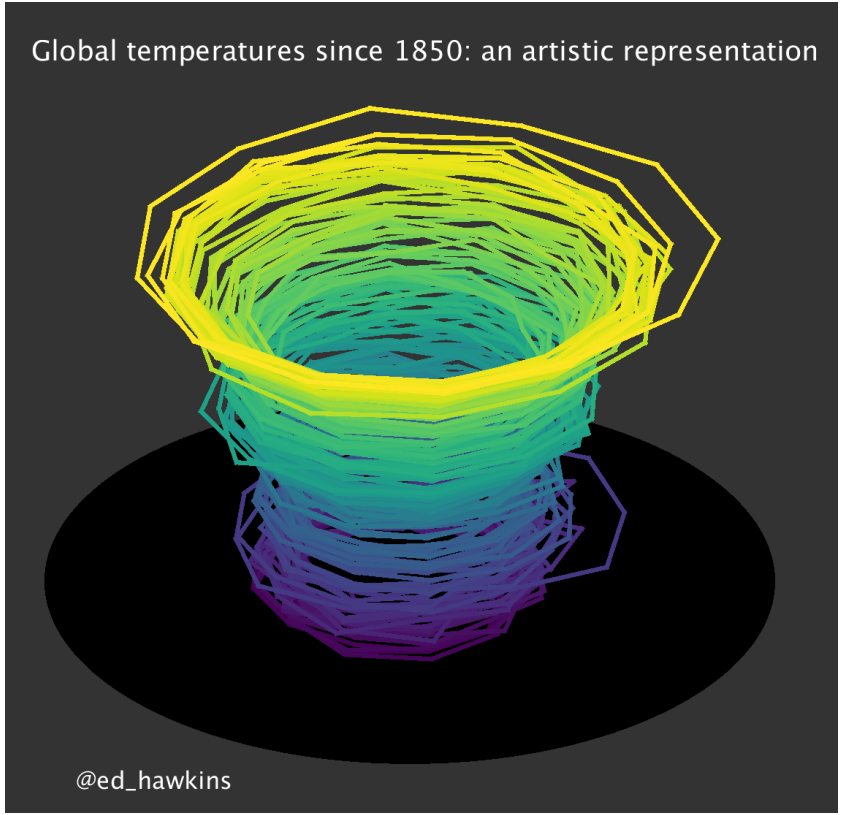


Source: IPCC AR6 SPM Figure 2.1

Global annual mean temperature since 1850 as a spiral



Source: https://www.climate-lab-book.ac.uk/spirals/



Source: https://www.climate-lab-book.ac.uk/spirals/

world weather attribution

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Limited net role for climate change in heavy spring rainfall in Emilia-Romagna

During May 2023, the North Italian region of Emilia-Romagna, particularly the provinces of Bologna, Ravenna, Forli-Cesena, Rimini, experienced severe flooding, following three separate heavy rainfall events on the 2nd, 10th, and 16th of May.

Latest analyses

Extreme humid heat in South Asia in April 2023, largely driven by climate

Extreme April heat in Spain, Portugal, Morocco & Algeria almost

Human-induced climate change increased drought severity in Horn of Africa

Cold spells

Unusual cold spells can occur even in a warming world, and cause disruption to transport, energy & food supplies.

Drought

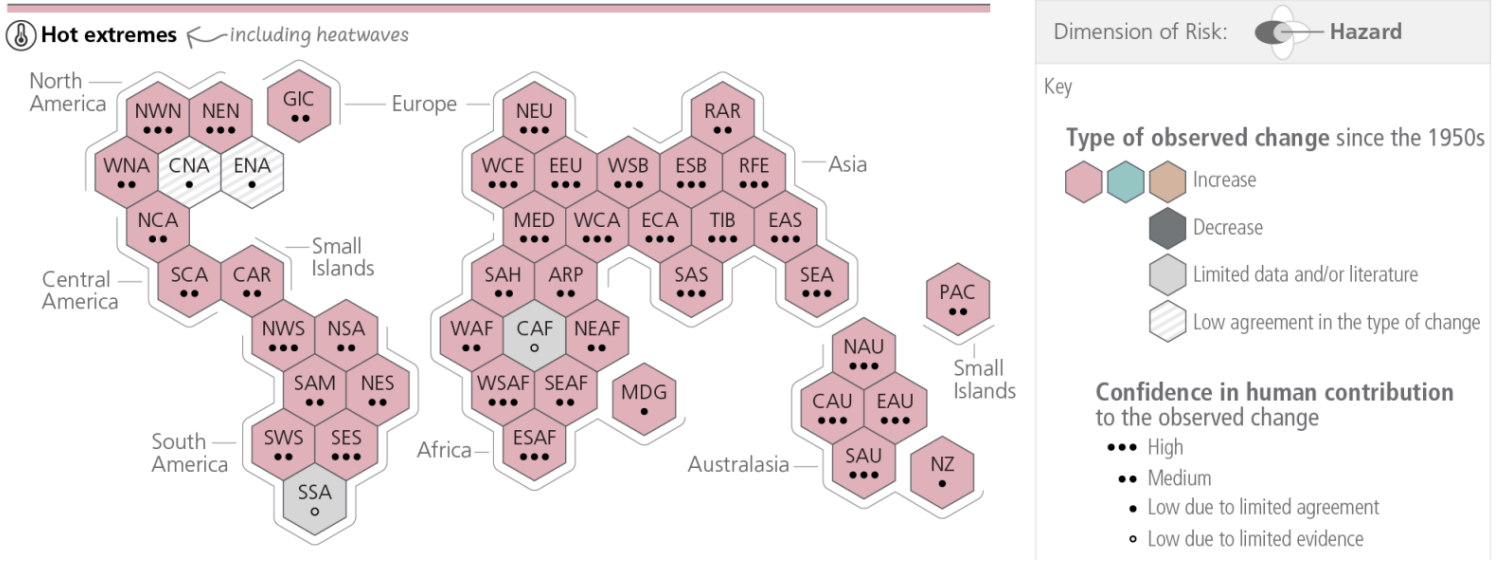
Drought affects people in many ways, from reduced water & food supplies to increasing the risk of wildfires.

Extreme rainfall

Rainfall events from a major storm or hurricane, or intense localised downpours can lead to flooding in any type of location.

Climate change has impacted human and natural systems across the world with those who have generally least contributed to climate change being most vulnerable

a) **Synthesis of assessment of observed change in hot extremes, heavy precipitation and drought, and confidence in human contribution to the observed changes in the world's regions**



Source: IPCC AR6 SPM Figure 2.3
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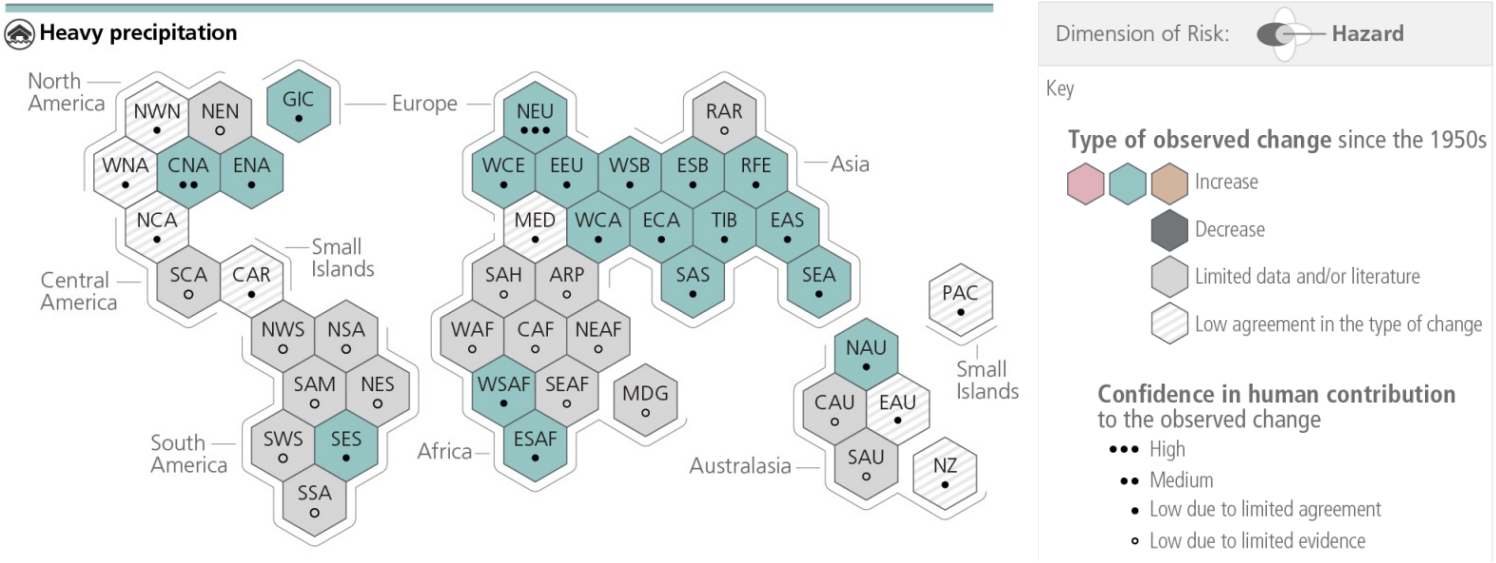

Source: IPCC AR6 SPM Figure 2.3
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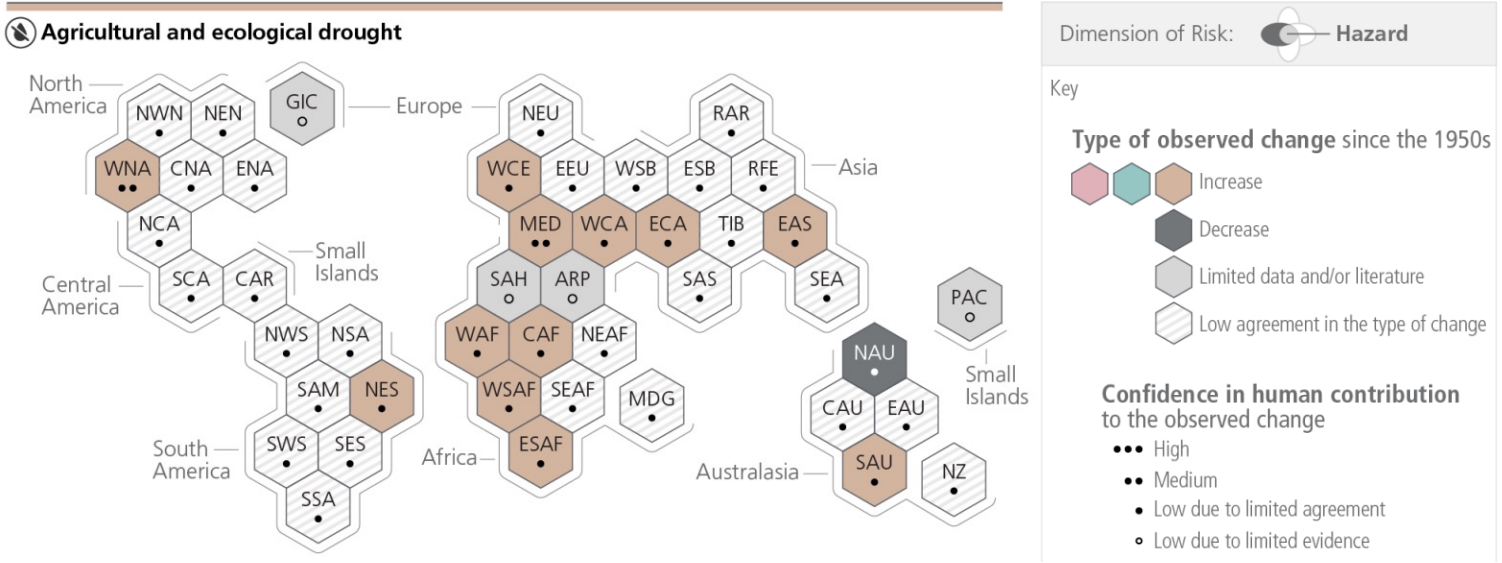

Source: IPCC AR6 SPM Figure 2.3
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Tipping Elements
(often called:

Tipping Points)

big risks in the Earth System

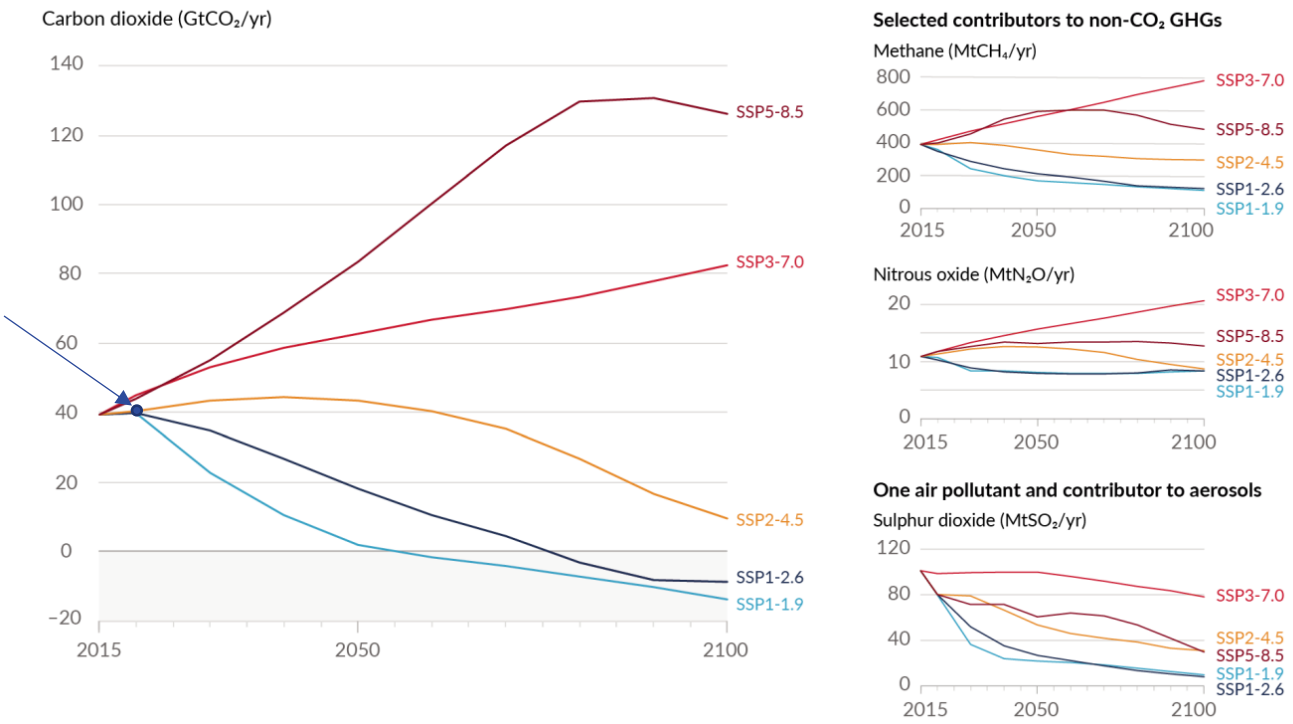
The geographical distribution of global and regional tipping elements, color-coded according to the best estimate for their temperature thresholds, beyond which the element would likely be 'tipped'. Figure designed at PIK, based on Armstrong McKay et al., Science (2022).

Tipping points - problems

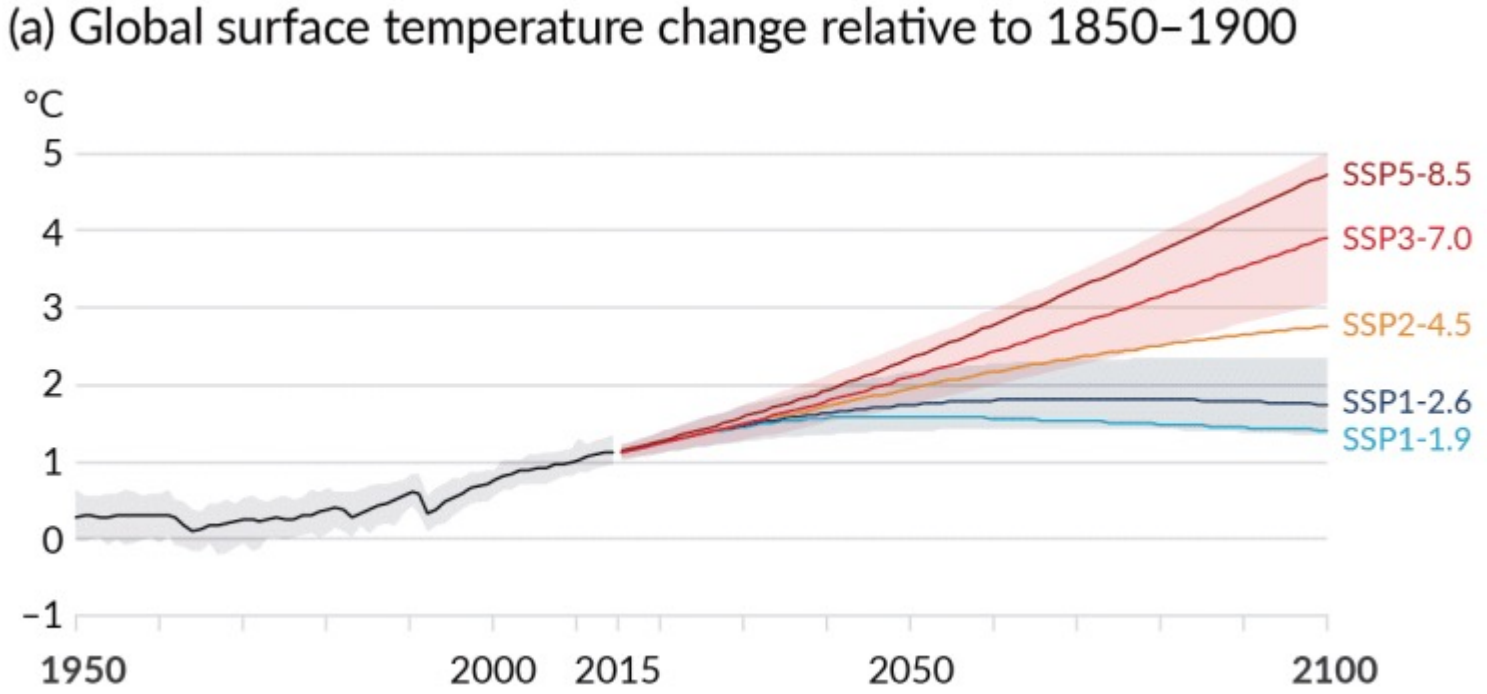
There is no "Day after tomorrow" scenario

- The word tipping implies the rapidity of an unbalanced cart toppling over
  - Components of the Earth system are sluggish on human time scales, and thus many Earth system components change over the course of decades, if not centuries or millennia.
- The word “point,” too, is bound to be misleading: It implies a single, precise, known critical threshold beyond which Earth system components tip
  - critical thresholds are rarely precisely known
- No fixed list
  - Arctic summer sea ice, regional monsoons, seafloor methane hydrates and El Niño have mostly been stricken from lists of tipping elements. In some cases, newly proposed tipping elements have replaced them.

2022: 41.06 $GtCO_2$ fossil fuels and land use change (https://ourworldindata.org/co2-emissions)

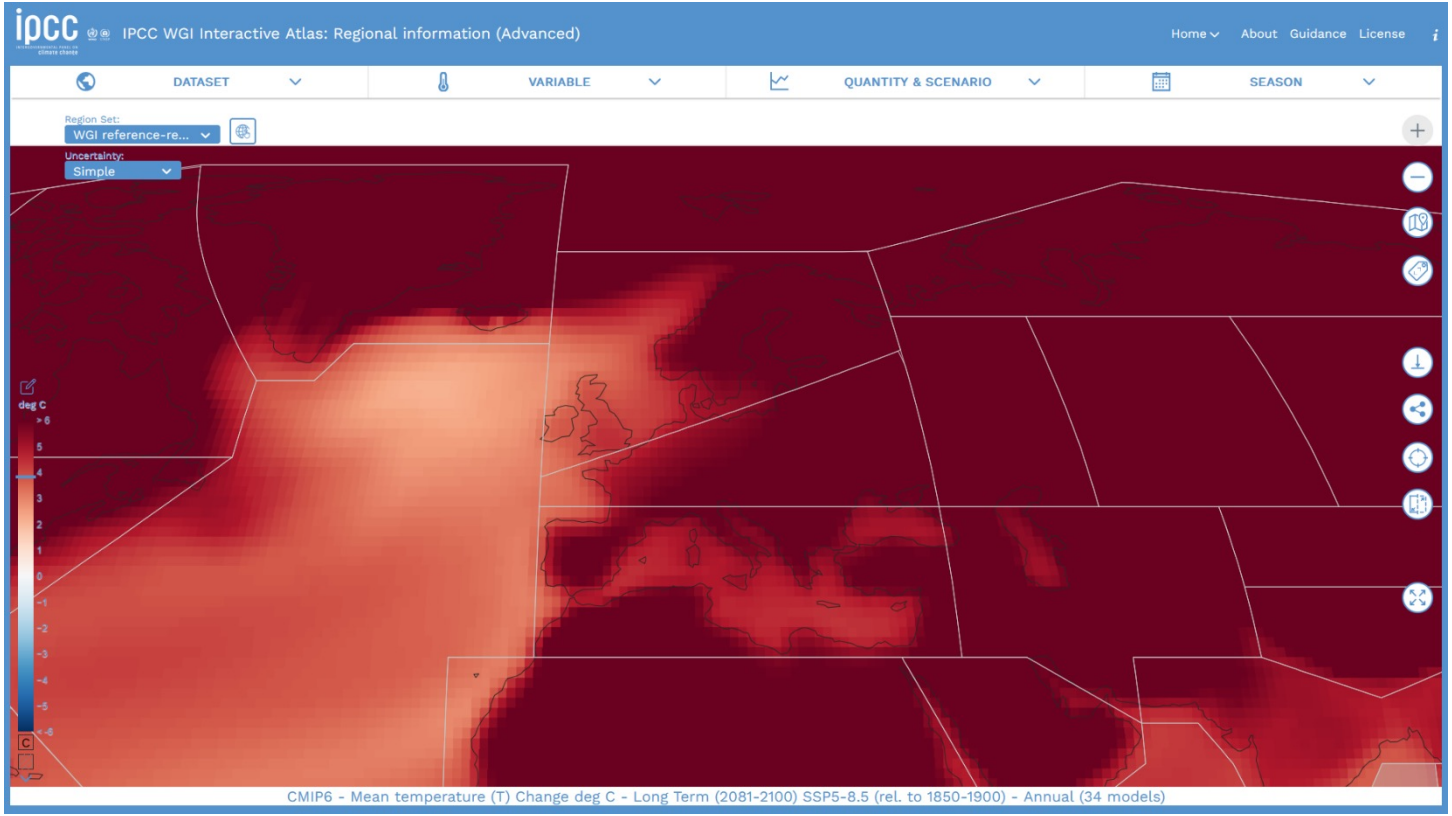


Source: IPCC AR6 WGI SPM Figure 4
© Intergovernmental Panel on Climate Change, 2021



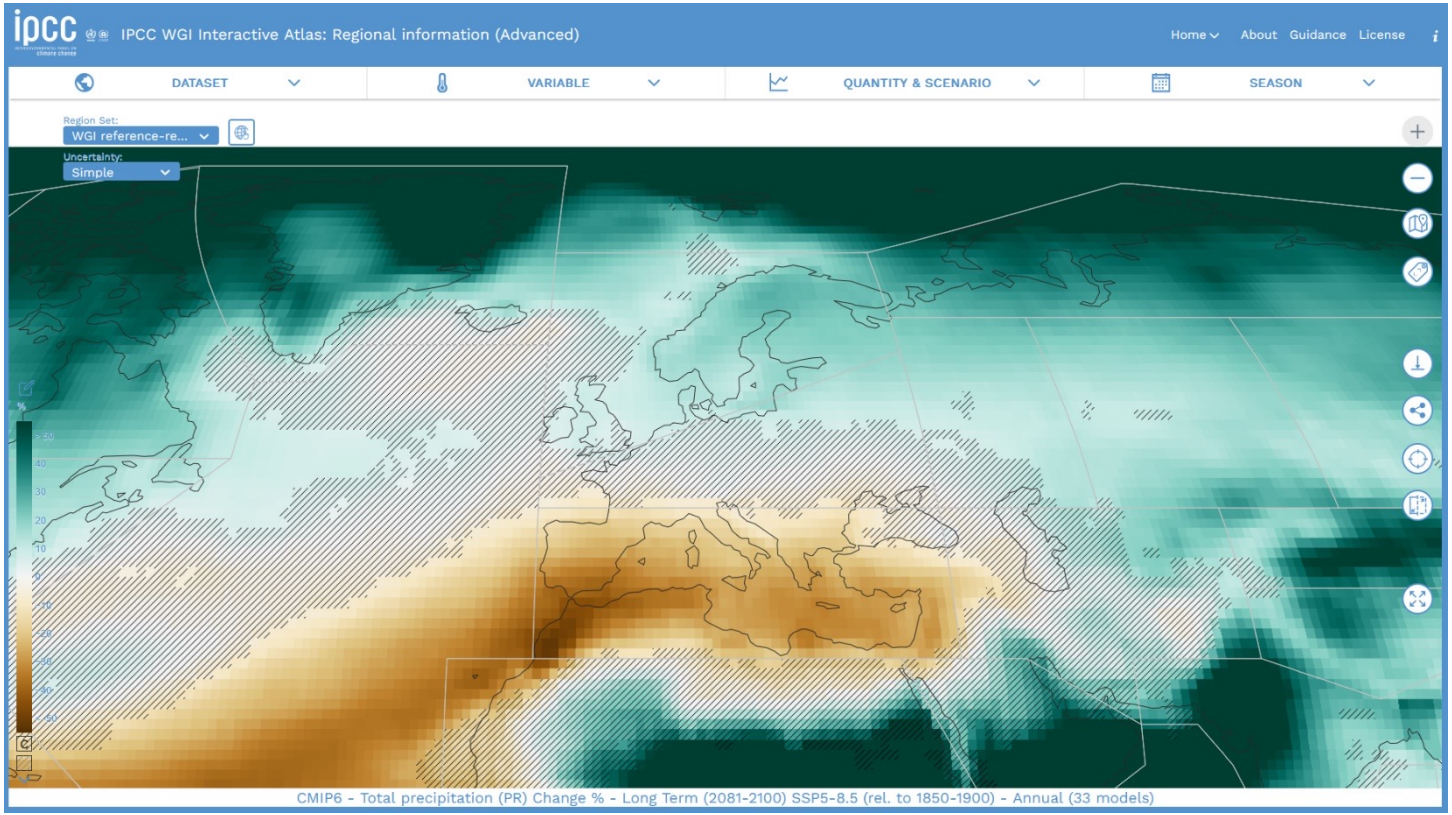
Source: IPCC AR6 WGI SPM Figure 8
© Intergovernmental Panel on Climate Change, 2021

CMIP6 - Mean temperature (T) Change deg C - Long Term (2081-2100) SSP5-8.5 (rel. to 1850-1900) - Annual (34 models)

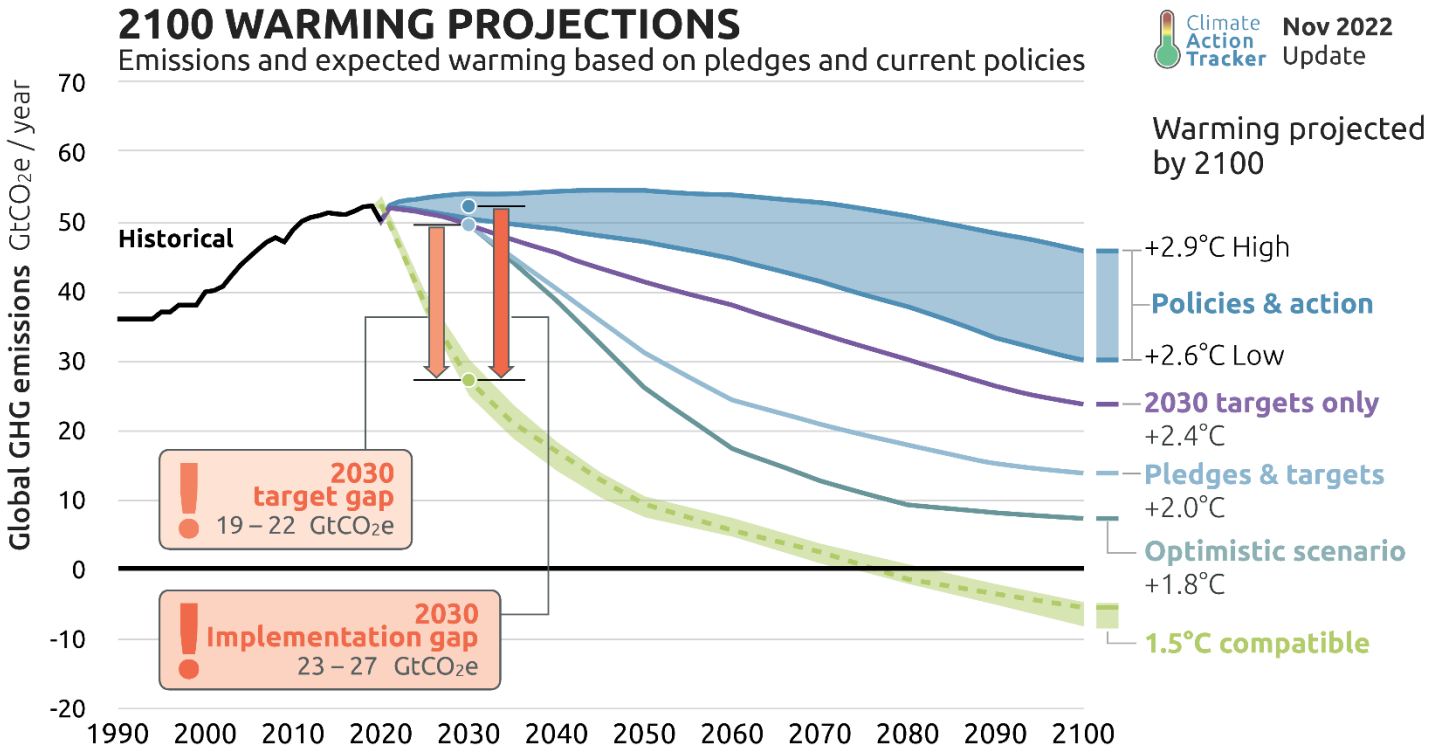


Source: interactive-atlas.ipcc.ch

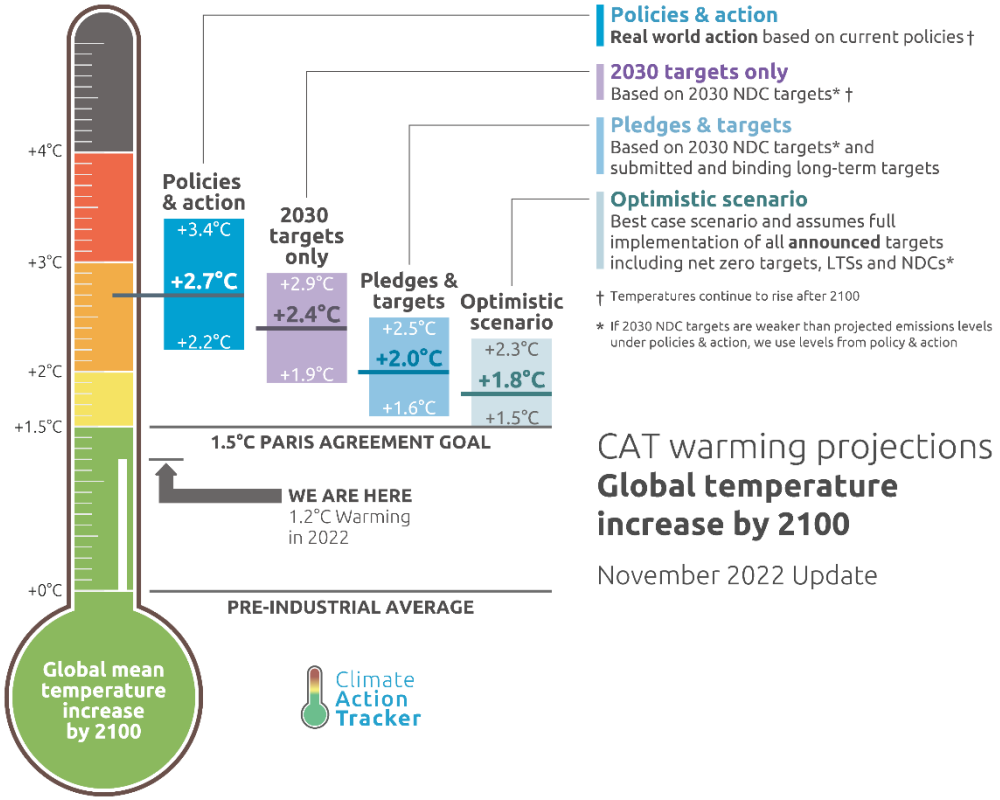
CMIP6 - Total precipitation (PR) Change % - Long Term (2081-2100) SSP5-8.5 (rel. to 1850-1900) - Annual (33 models)



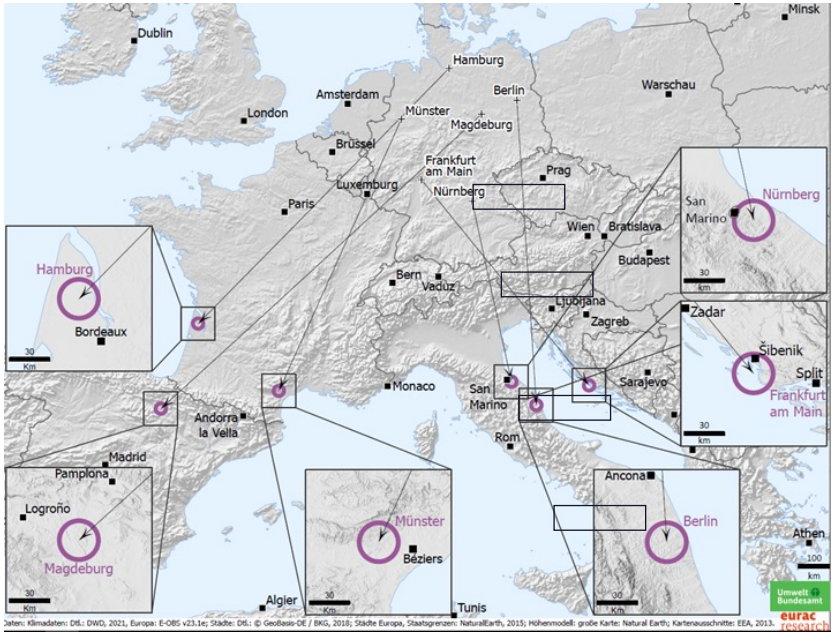
Source: interactive-atlas.ipcc.ch



Climate Action Tracker (2022). 2100 Warming Projections: Emissions and expected warming based on pledges and current policies. November 2022. Available at: https://climateactiontracker.org/global/temperatures/.



Which place has a similar climate today as we expect in the future (RCP8.5)?



Source: Analysing spatial patterns of climate change: climate clusters, hotspots and analogues to support climate risk assessment and communication in Germany
A. Crespi, K. Renner, M. Zebisch, I. Schauser, N. Leps, A. Walter
Climate Services, 2023.
https://doi.org/10.1016/j.cliser.2023.100373

Berlin with a climate like central Italy

- ➔ The infrastructure, the flora and much more are very different
  - ➔ A tremendous amount of change needs to take place in Berlin
- ➔ A city like Berlin very likely has the capacity to adapt
- ➔ The same is not true for many cities / states in the world.

Take home message about climate change

1. Experts agree.
2. It’s real.
3. It’s us.
4. It’s bad.
5. There’s hope.

Source: https://climatecommunication.yale.edu/for-educators/climate-change-basics-five-facts-ten-words/

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