Prof. Paul N. Edwards

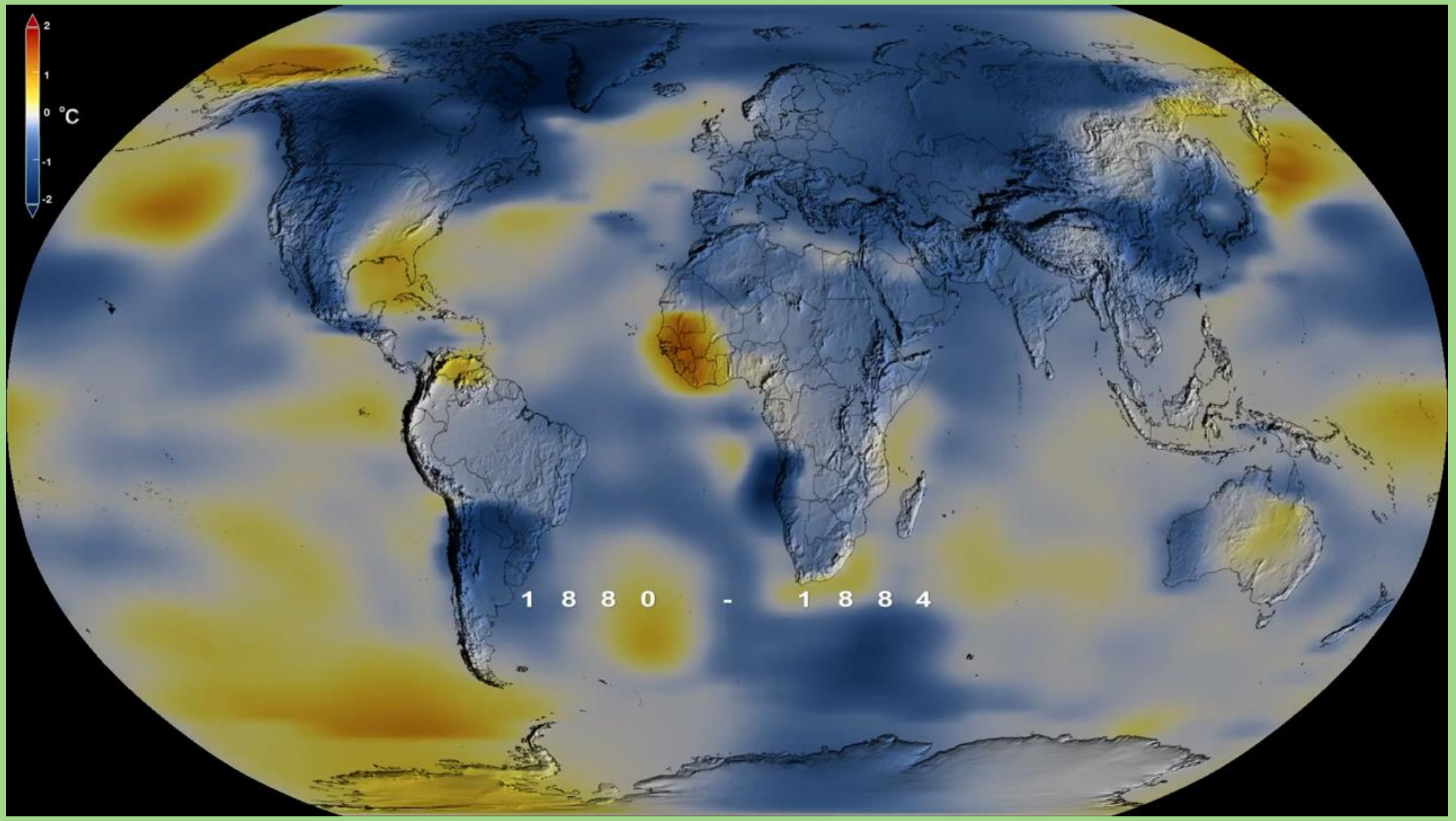
Program in Science, Technology & Society

Stanford Existential Risks Initiative

Stanford University

The climate crisis and the global village

140 years of climate data in 30 seconds



5-year moving averages. Baseline: 1951-1980 average

Source: NASA Goddard Space Flight Center

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Science

Climate change: Last decade confirmed as warmest on record

By Matt McGrath
Environment correspondent

15 January 2020

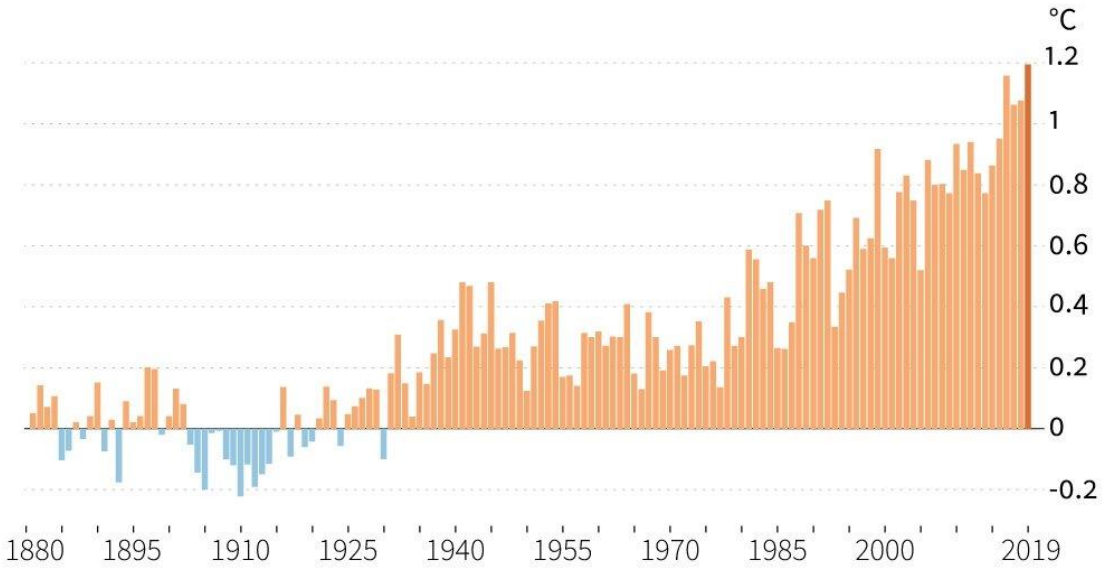
Earth

Jan 14, 2021
RELEASE 21-005

2020 Tied for Warmest Year on Record, NASA Analysis Shows

July 2019: hottest month on record

Temperature in July compared to pre-industrial (1850-1900) average

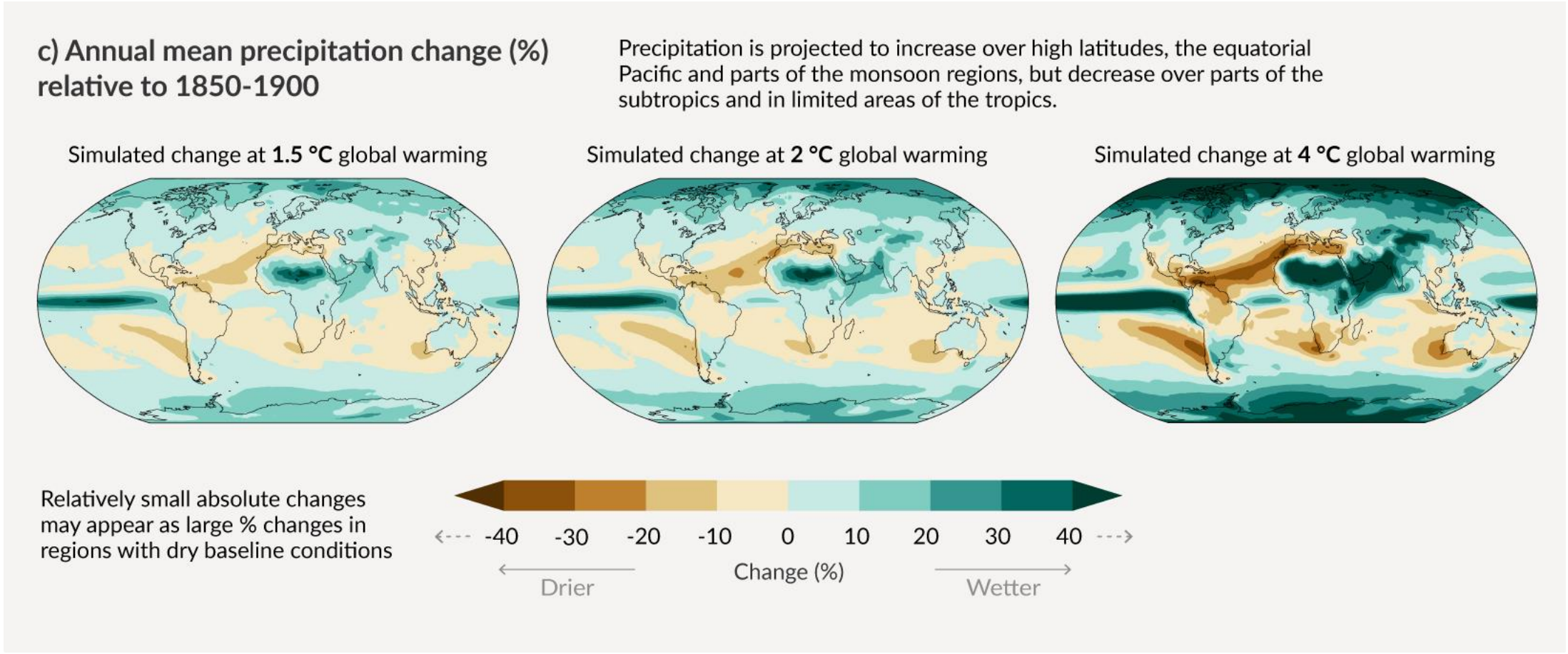


Source: Copernicus Climate Change Service

© AFP

With every increment of global warming, changes get larger in regional mean temperature, precipitation and soil moisture

Figure SPM.5



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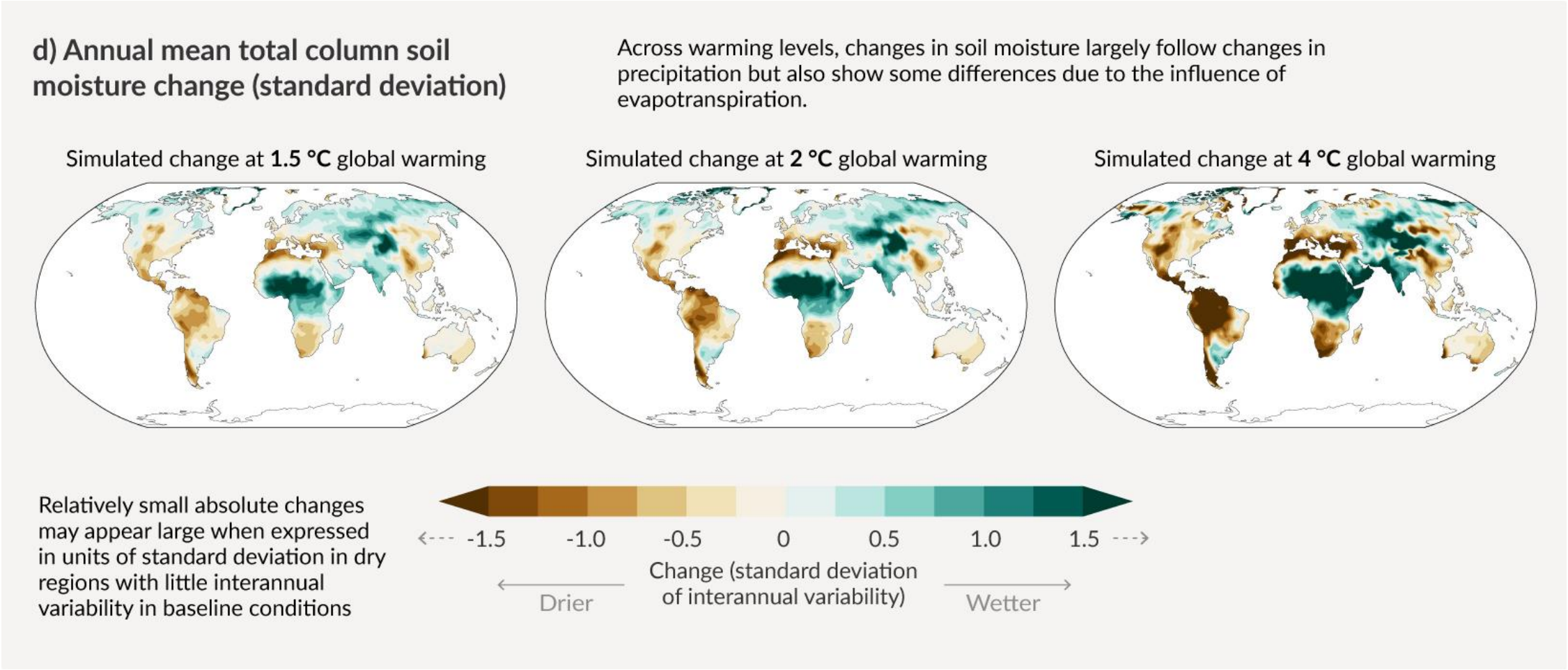
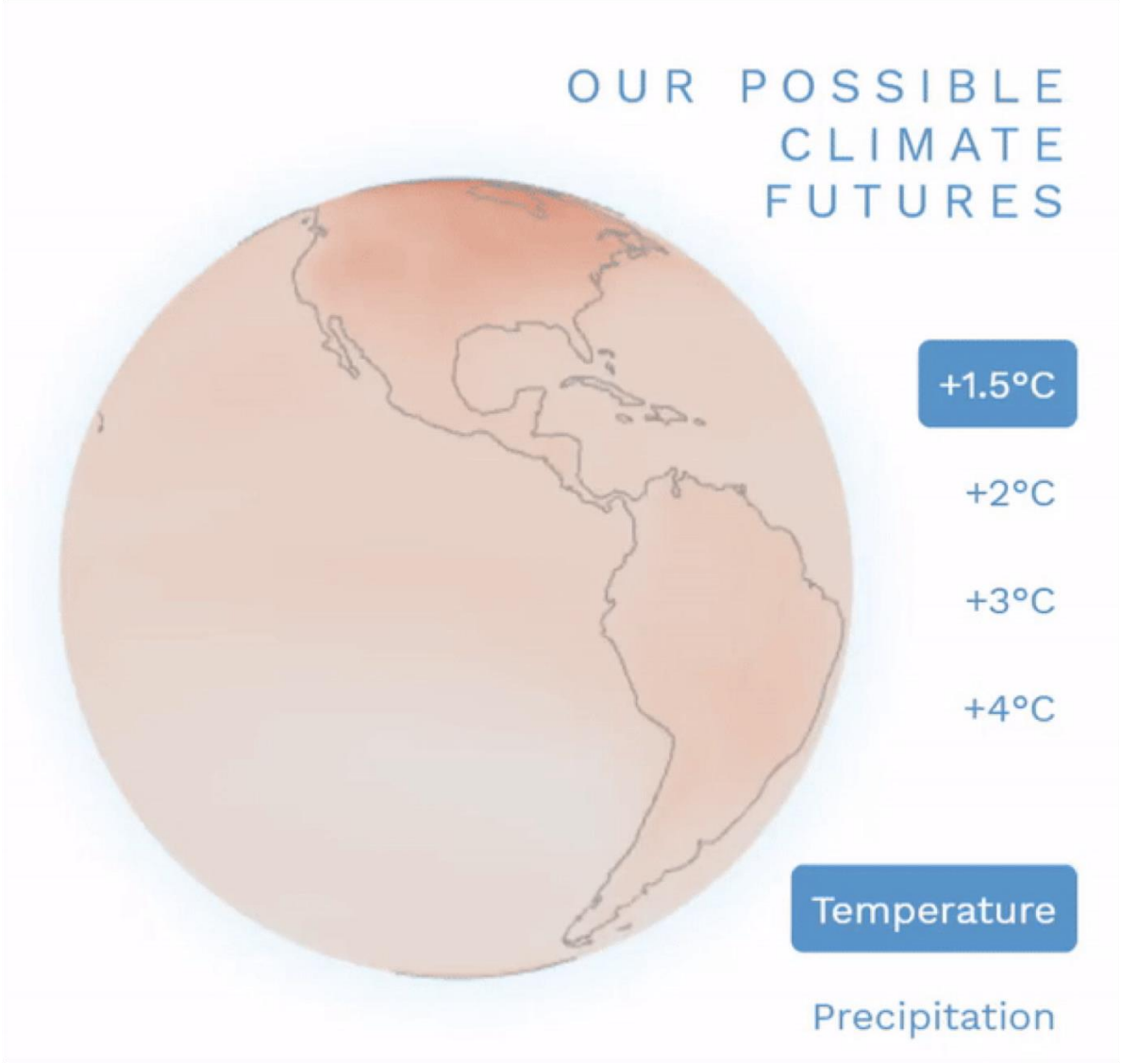


Interactive atlas



https://interactive-atlas.ipcc.ch/

#IPCCData #IPCCAtlas

Lethal wet-bulb temps

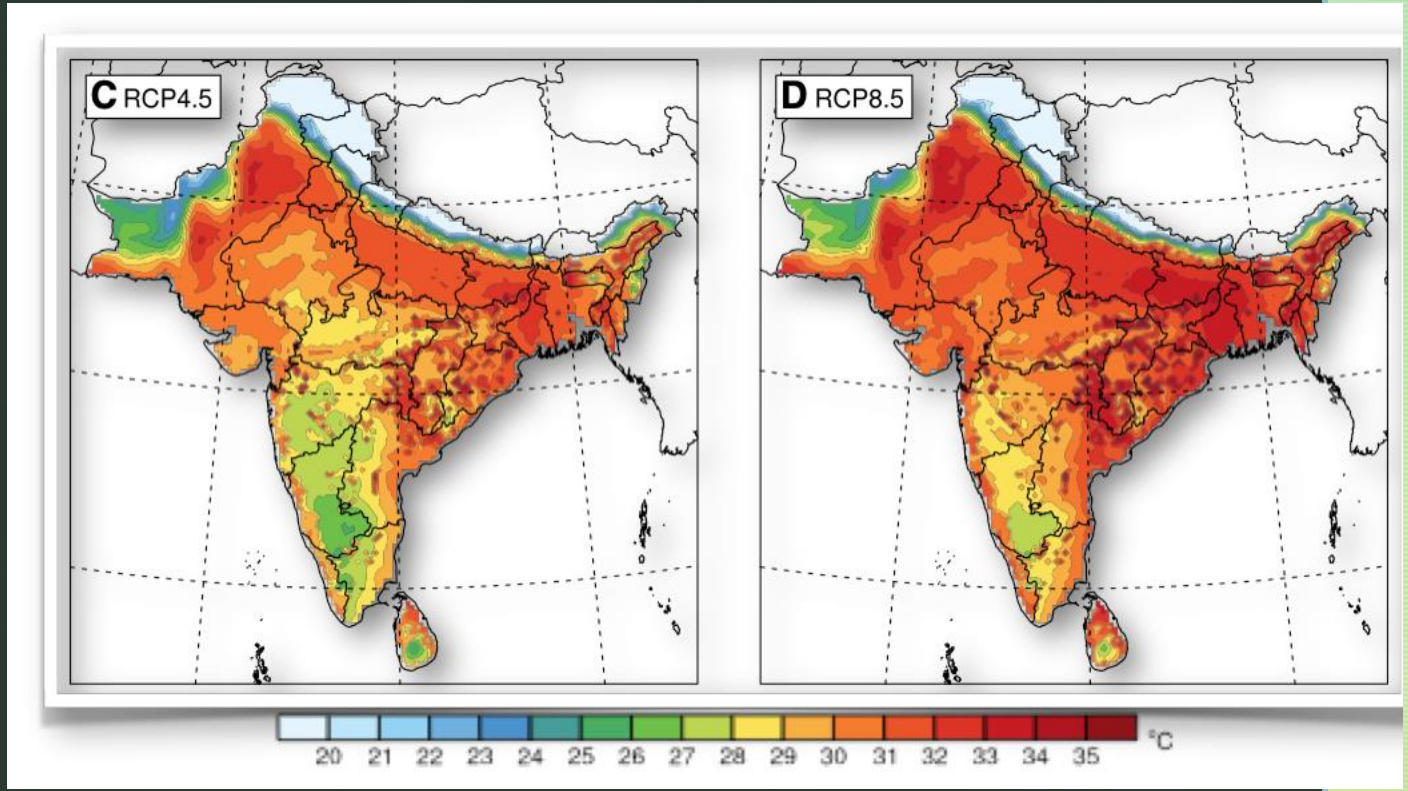
Projections for the Indian subcontinent, 2071-2100

In high humidity, sweating cannot cool a person because the air is already saturated with water and the sweat can't evaporate.

35°C is lethal within 6 hours at 95% humidity

Medium climate policy (partial emissions reductions)

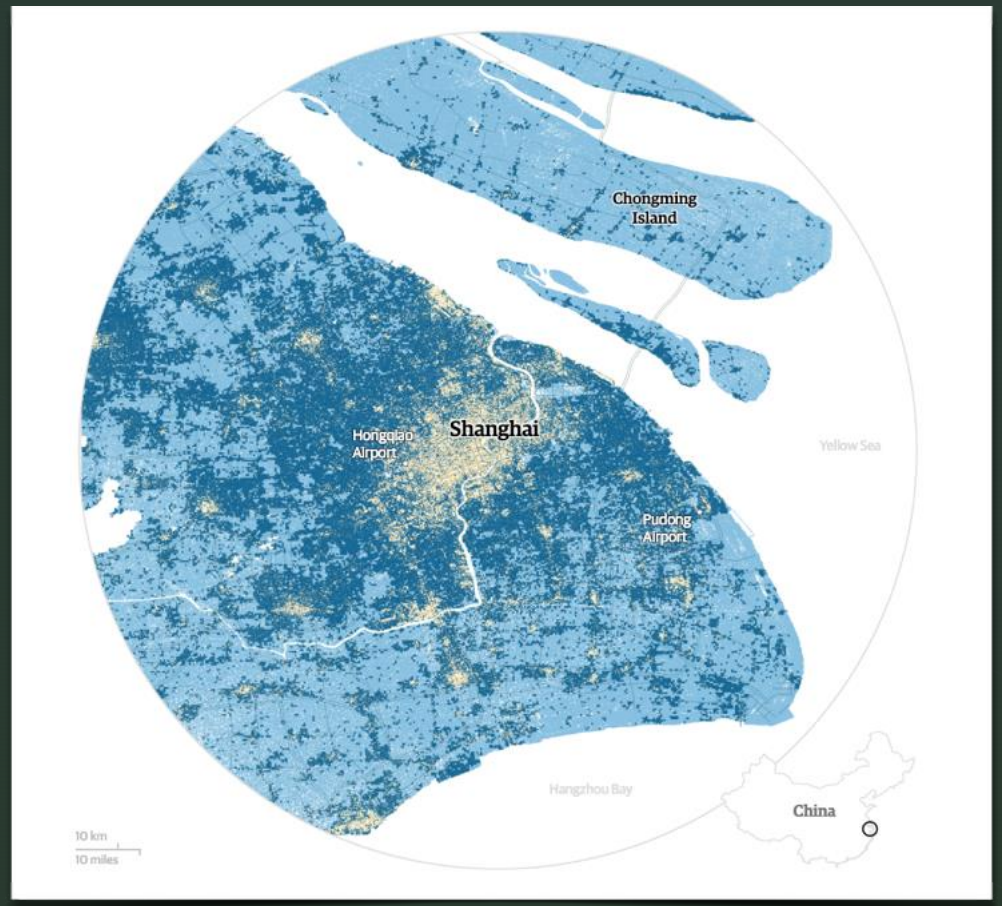
Very high emissions



Source: Im, E. S., J. S. Pal, and E. A. B. Eltahir. 2017. "Deadly Heat Waves Projected in the Densely Populated Agricultural Regions of South Asia." *Science Advances* 3 (8): e1603322.

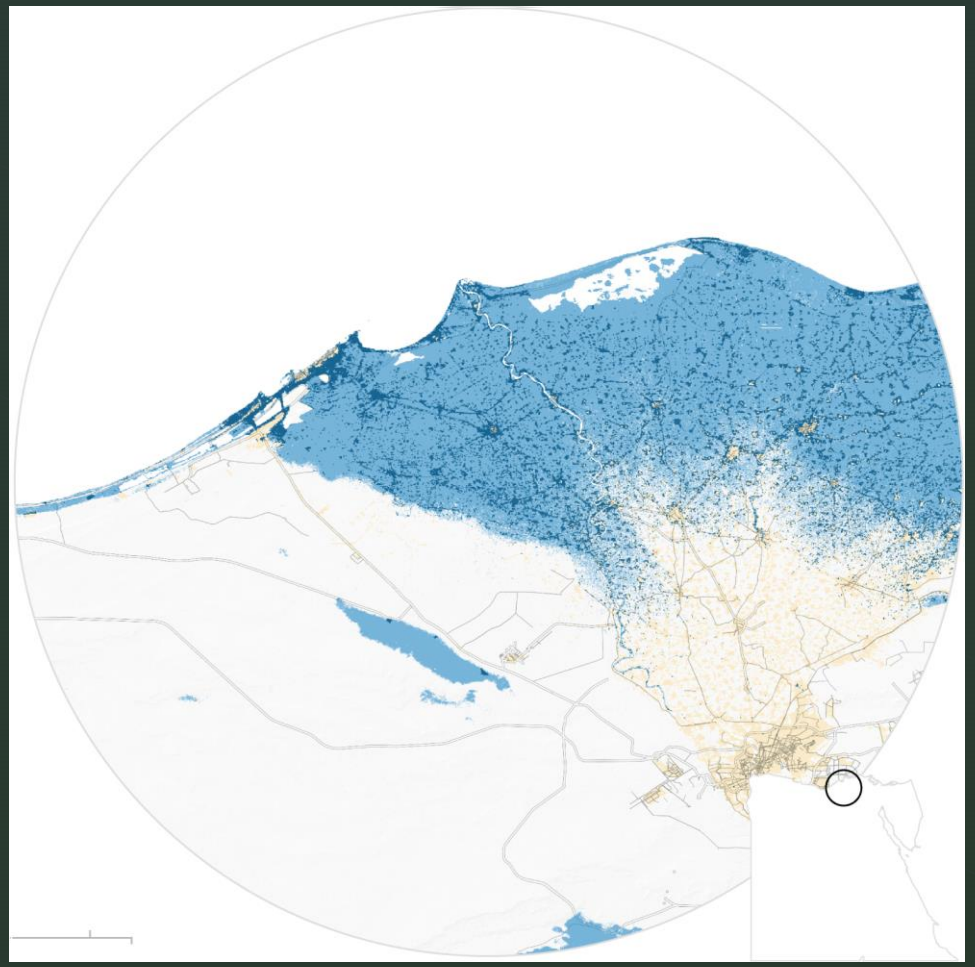
35°C = 95°F

Sea level rise:
Shanghai (17.5 million people) at 3°C



Source: Holder et al., “The three-degree world: the cities that will be drowned by global warming,” *The Guardian*, November 2017

Sea level rise:
Alexandria, Egypt (3 million people) at 3°C



Source: Holder et al., “The three-degree world: the cities that will be drowned by global warming,” *The Guardian*, November 2017

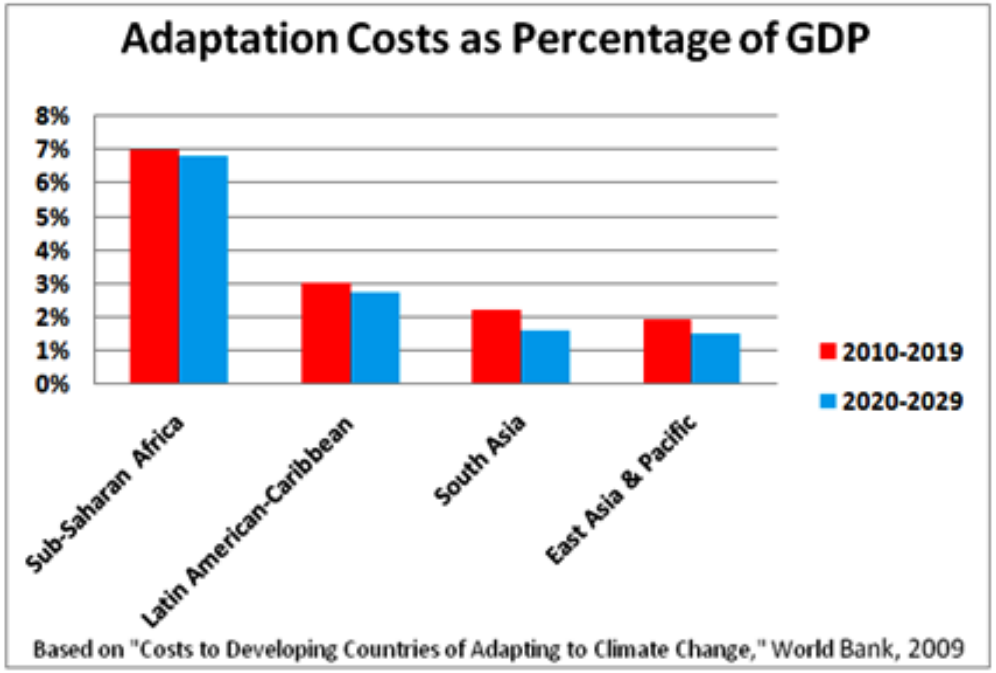
Consequences of climate change

- Geographically widespread – no region untouched
- Most dramatic in the Arctic (largest warming) and the Global South (humid tropical climates could become uninhabitable)
- Disruptive to
  - Seacoasts and flood plains
  - Wetlands
  - Food supplies, especially in subsistence economies
  - Human health: heat waves, insect-borne diseases
  - Forests in dry regions
  - Fisheries, especially shellfish (ocean acidification)

Economic impacts of climate change

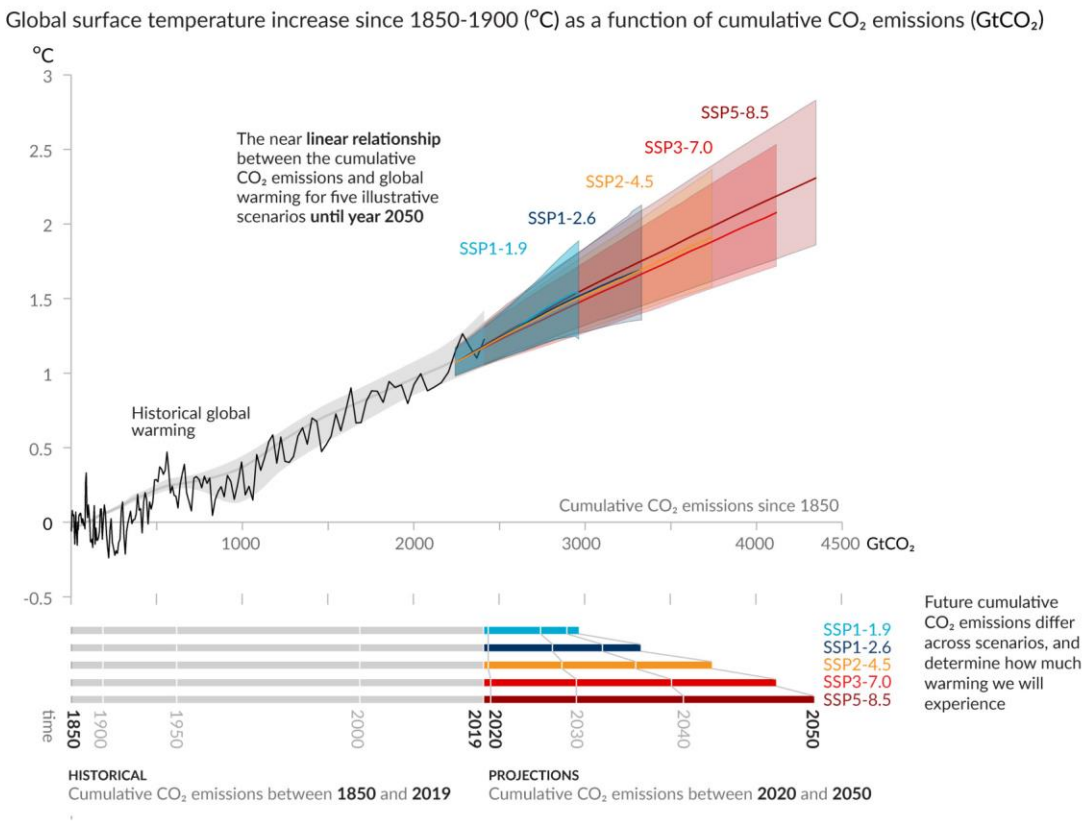
Average real GDP loss by 2050

Source: Economist Intelligence Unit © AFP



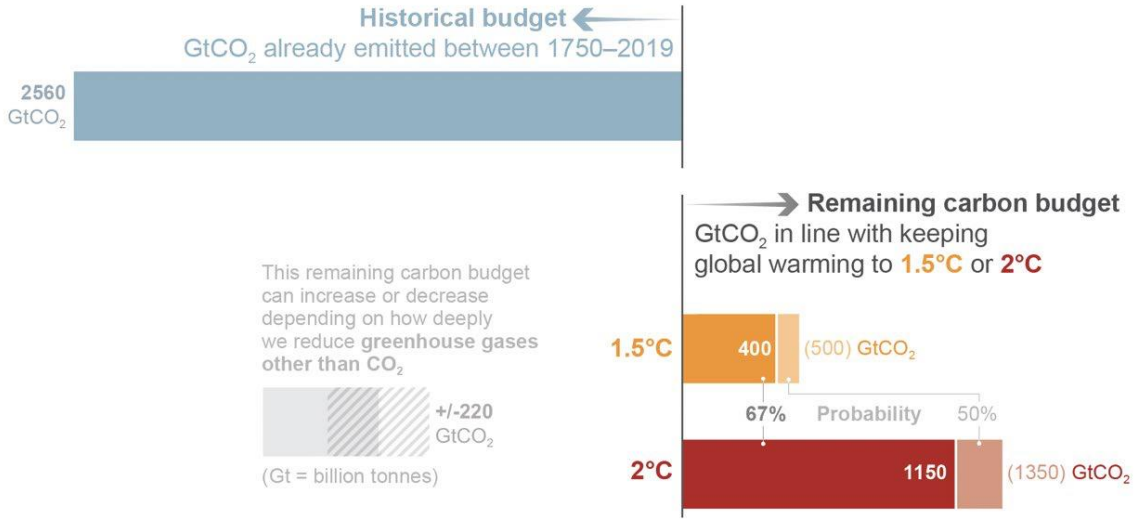
Every tonne of CO_2 emissions adds to global warming

Figure SPM.10



FAQ 5.4: **What are Carbon Budgets?**

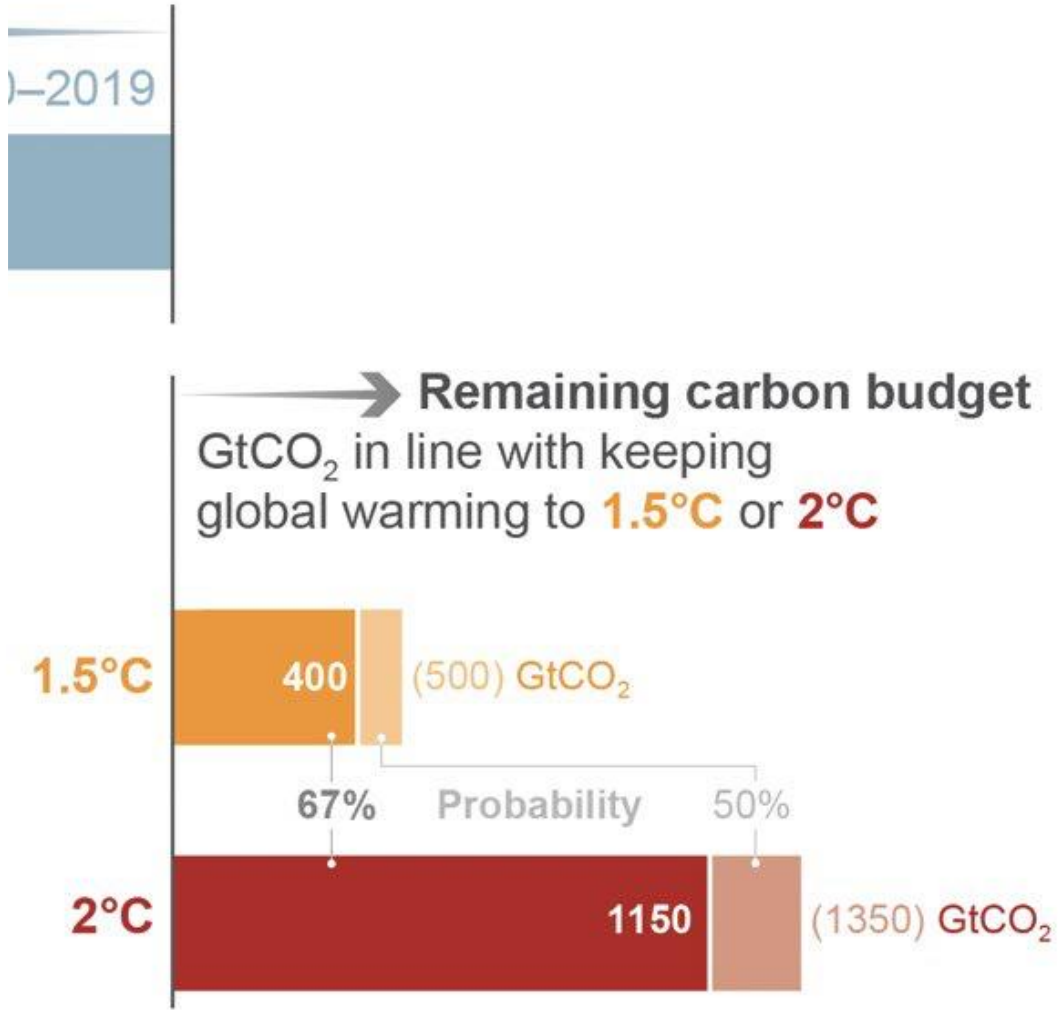
The term carbon budget is used in several ways. Most often the term refers to the total net amount of carbon dioxide (CO_2) that can still be emitted by human activities while limiting global warming to a specified level.



This remaining carbon budget
can increase or decrease
depending on how deeply
we reduce greenhouse gases
other than CO_2

+/-220
$GtCO_2$

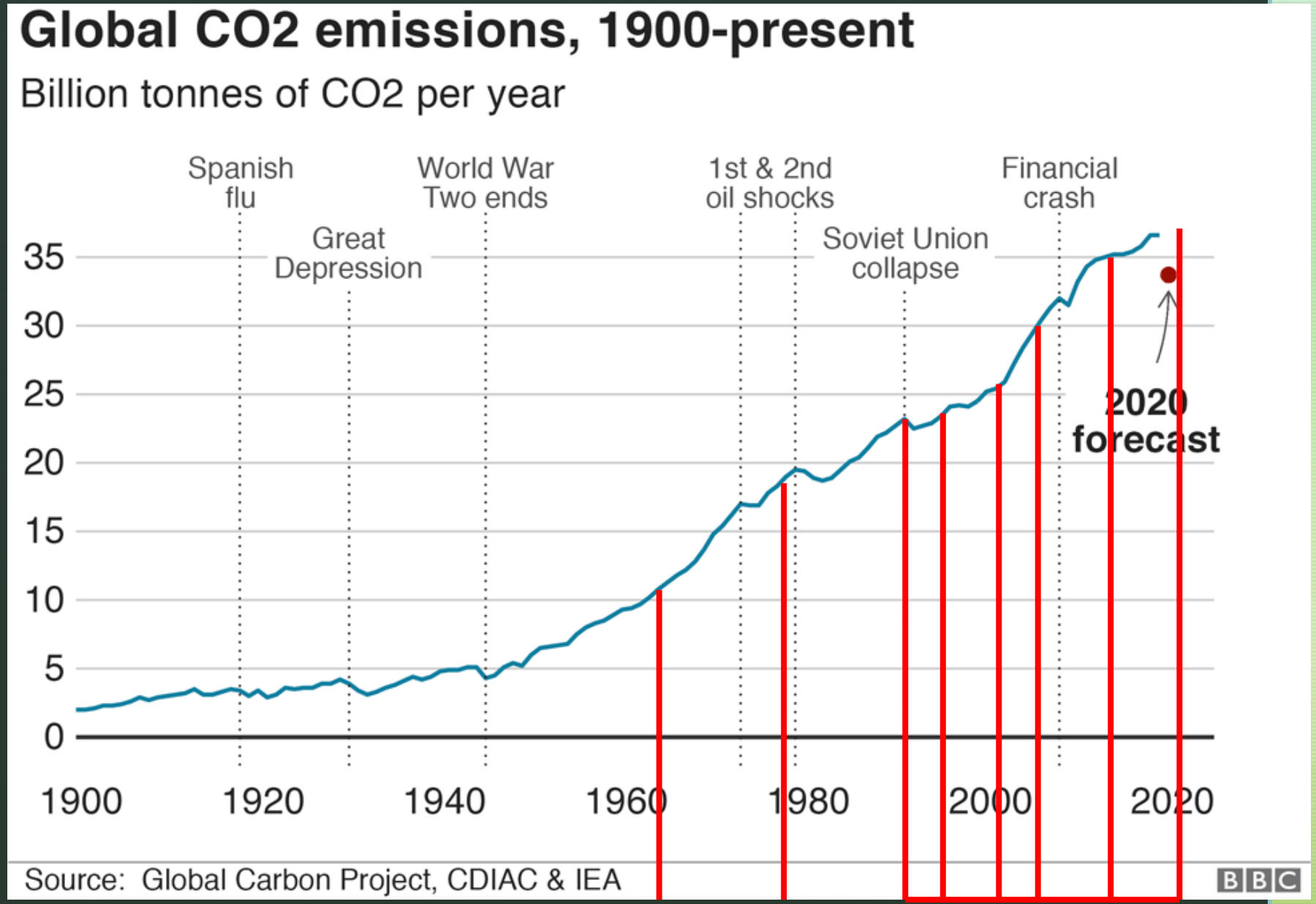
(Gt = billion tonnes)



Climate knowledge

versus

global CO_2 emissions



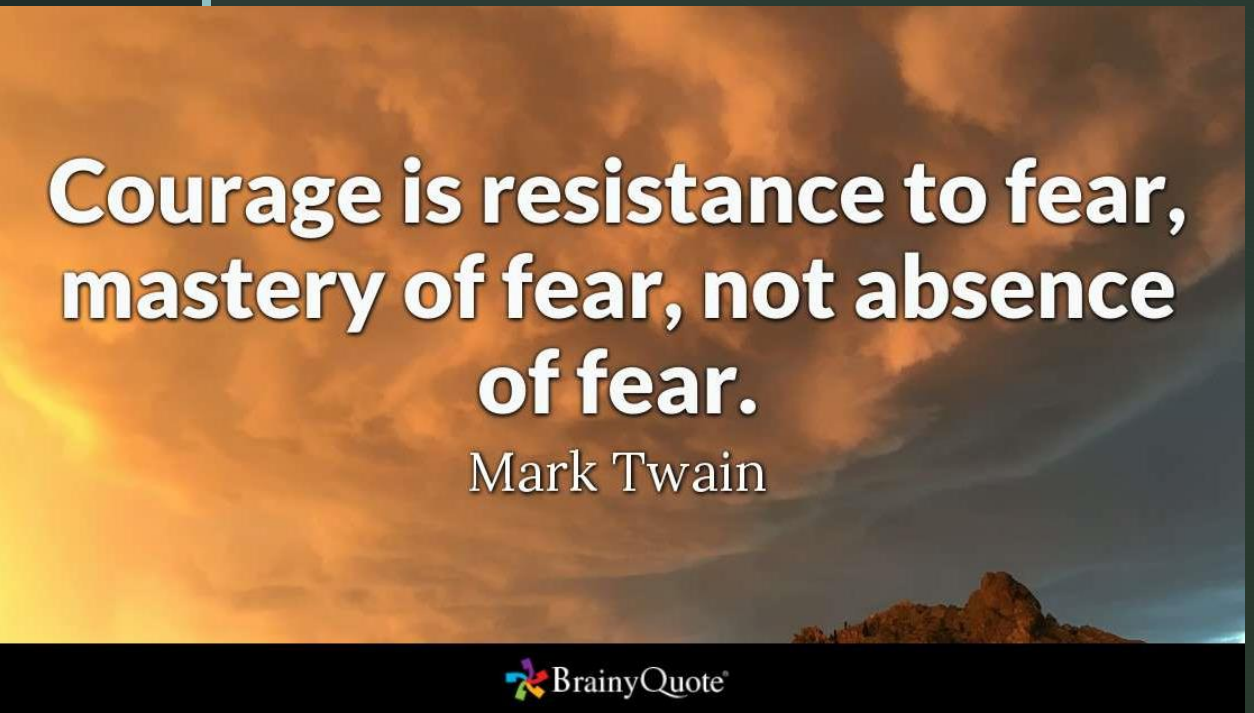
PSAC report on climate change risk

Scientific consensus on climate sensitivity

IPCC reports:
1990, 1995, 2001, 2007, 2013, 2021

Surprising solutions: *Drawdown* modeling (Hawken et al.)

Rank	Solution	Sector	TOTAL ATMOSPHERIC CO2-EQ REDUCTION (GT)	NET COST (BILLIONS US $)	SAVINGS (BILLIONS US $)
1	**Refrigerant Management**	Materials	89.74	N/A	$-902.77
2	**Wind Turbines (Onshore)**	Electricity Generation	84.60	$1,225.37	$7,425.00
3	**Reduced Food Waste**	Food	70.53	N/A	N/A
4	**Plant-Rich Diet**	Food	66.11	N/A	N/A
5	**Tropical Forests**	Land Use	61.23	N/A	N/A
6	**Educating Girls**	Women and Girls	51.48	N/A	N/A
7	**Family Planning**	Women and Girls	51.48	N/A	N/A
8	**Solar Farms**	Electricity Generation	36.90	$-80.60	$5,023.84
9	**Silvopasture**	Food	31.19	$41.59	$699.37
10	**Rooftop Solar**	Electricity Generation	24.60	$453.14	$3,457.63



Can we prevent a climate catastrophe?

People have intentionally taken on great problems and addressed them successfully.

- We ended African slavery
- We eradicated smallpox
- We dismantled 80 percent of nuclear weapons
- We saved the ozone layer from destruction