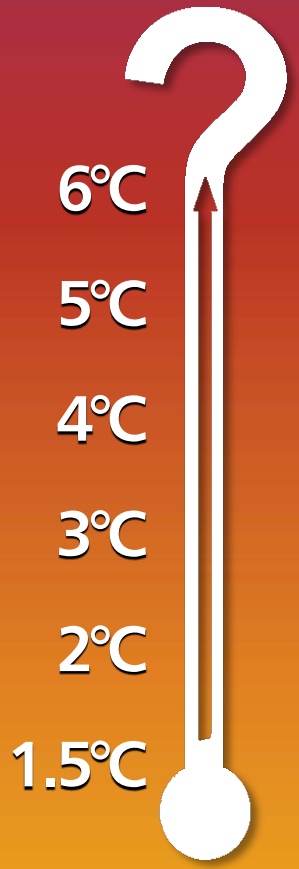
WHAT IF WE MISS THE TARGET?



- Prof Richard Betts (Met Office / University of Exeter)
- Dr Katy Richardson (Met Office)
- Prof John Schellnhuber (PIK)
- Chair: Leo Hickman (Carbon Brief)

helix
www.helixclimate.eu

UNIVERSITY OF EXETER

Met Office Hadley Centre

PIK

CarbonBrief
CLEAR ON CLIMATE

24th Conference of the Parties to the Framework Convention on Climate Change
Katowice, Poland, Wednesday 12th December 2018

Impacts of climate change at 1.5°C, 2°C and 4°C global warming

Results from EU research project HELIX (High-End cLimate Impacts and eXtremes)

Prof Richard Betts

Met Office Hadley Centre & University of Exeter

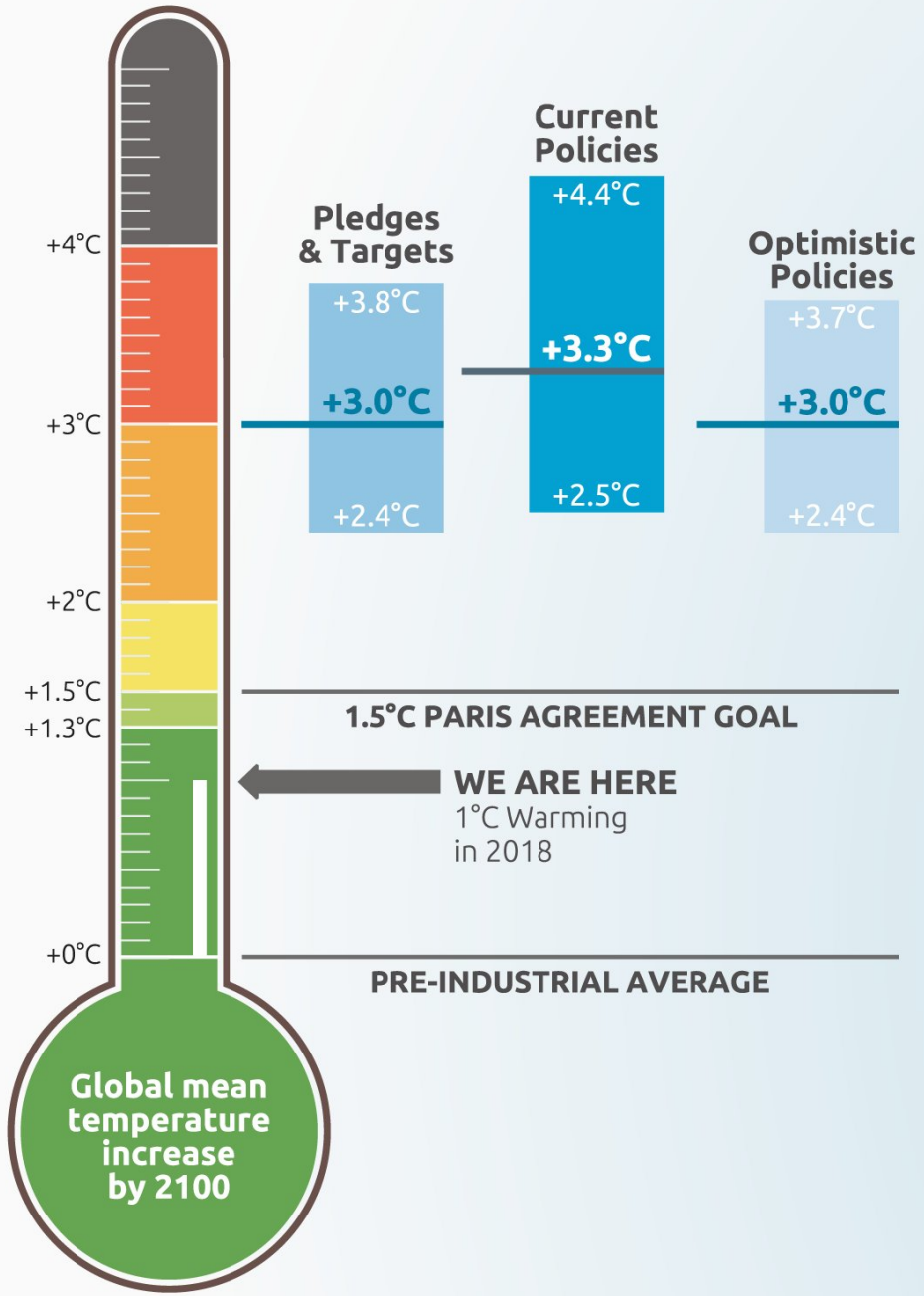
Met Office Hadley Centre

helix www.helixclimate.eu

University of Exeter

Current policies projected to lead to 2.5°C to 4.4°C global warming by 2100

(source: Climate Analytics)



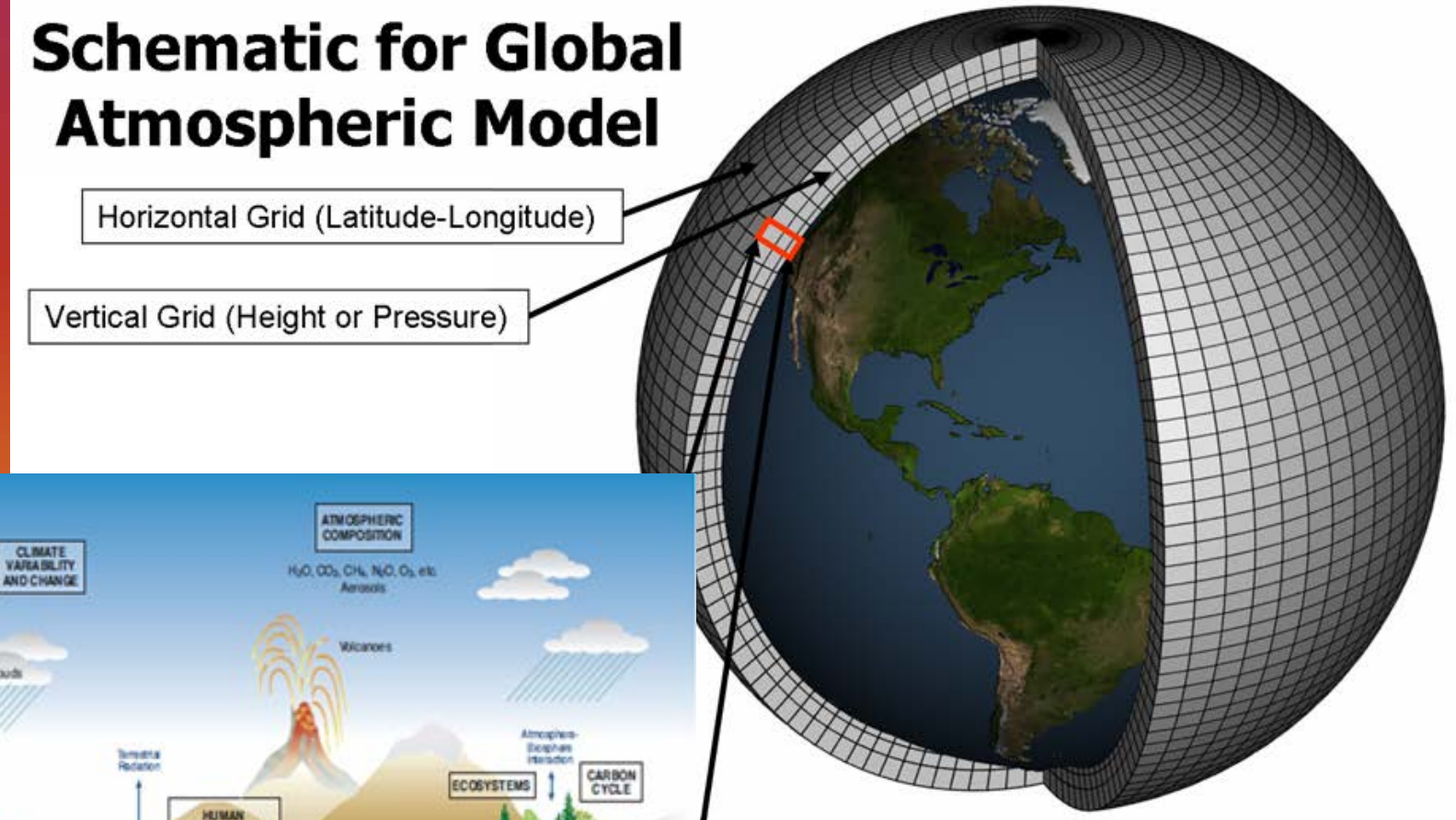
Climate Action Tracker

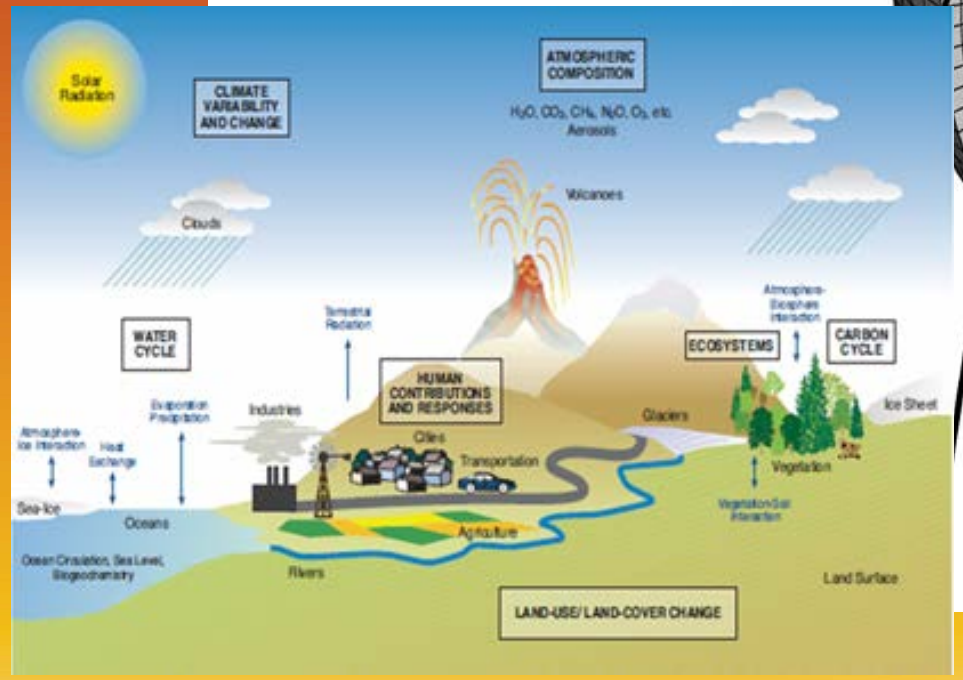
CAT warming projections

Global temperature increase by 2100

December 2018 Update

New, more detailed climate models





HadGEM3: N216 (60km grid) – 6 simulations
EC-Earth: T511 (40km grid) – 7 simulations

Further details: www.helixclimate.eu

Human heat stress: Wet Bulb Globe Temperature

In hot weather, human body relies on sweating to prevent overheating

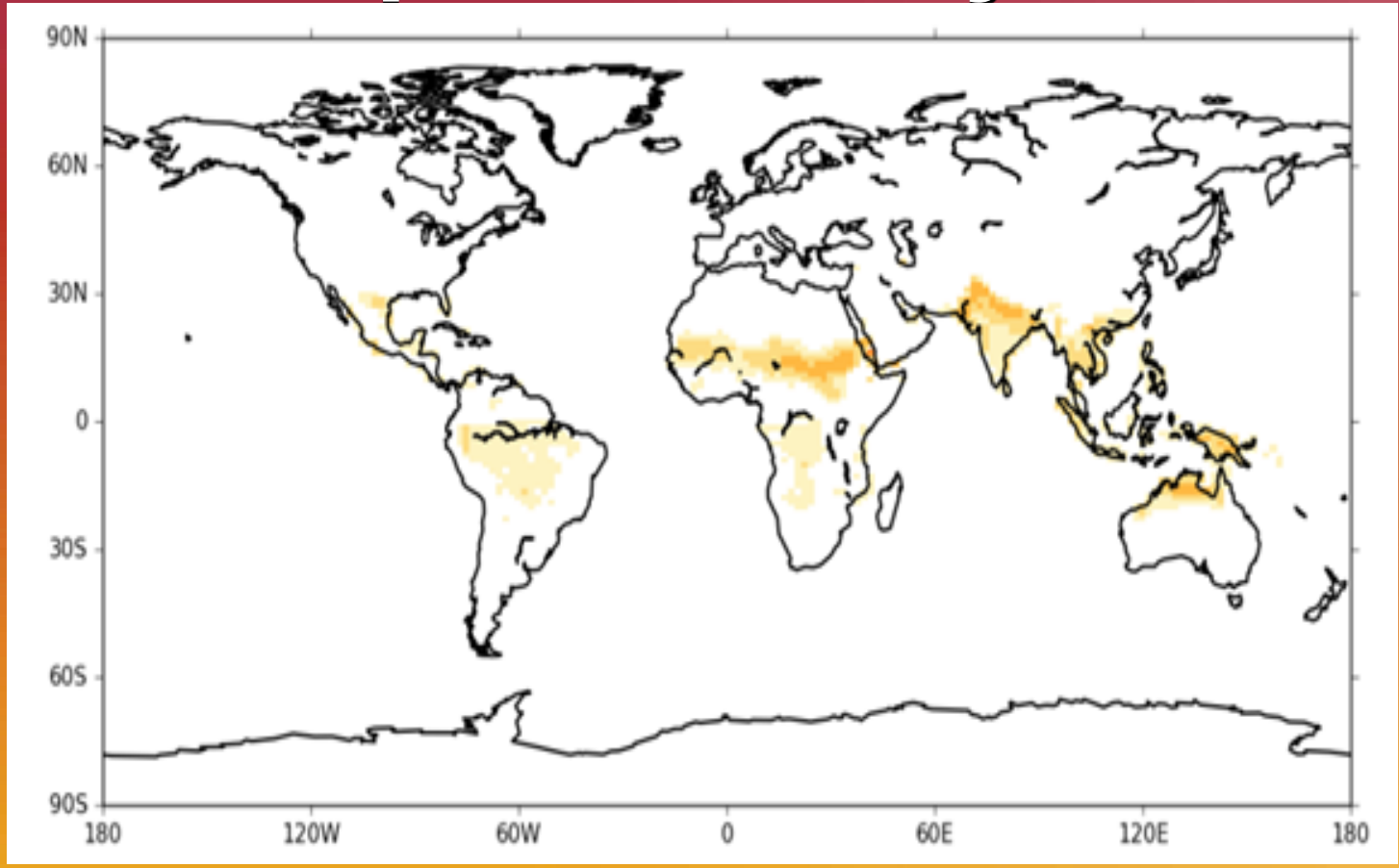
Sweating is limited when weather is humid

Wet Bulb Globe Temperature (WBGT) accounts for effects of temperature and humidity (and solar radiation)

Table II. Military thresholds of WBGT. (*Source: USARIEM*).

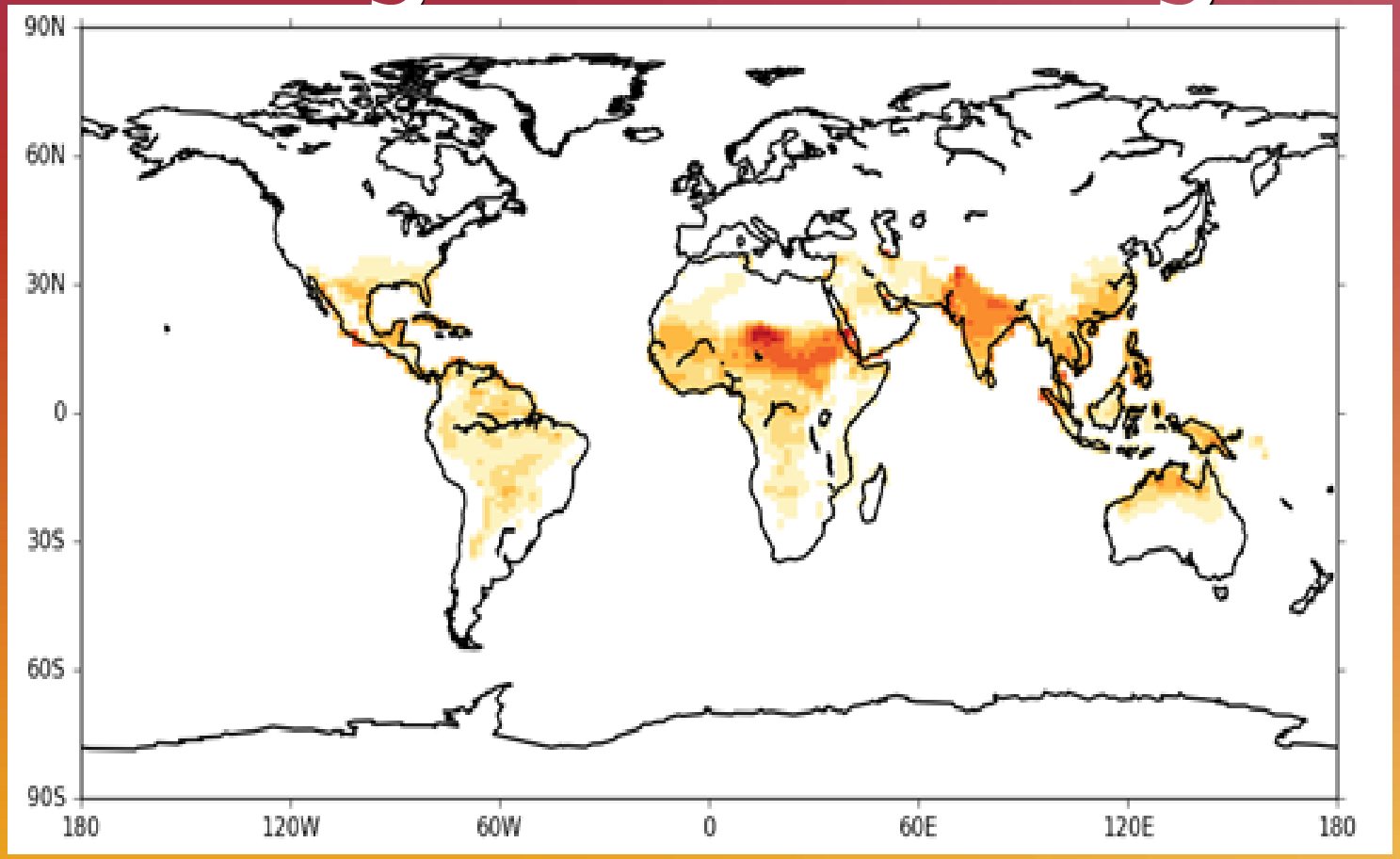
W	Description	Level of Risk
26	Caution over extremely intense physical exertion	Moderate
28	Possible reduction in heavy exercise for non-acclimatised	High
29	Suspension of strenuous exercise for non-acclimatised	–
31	Limited activity for acclimatised	–
32	Suspension of physical training and strenuous exercise for all (excluding essential operational commitments not for training purposes)	Extreme

Human heat stress in hottest month at present day



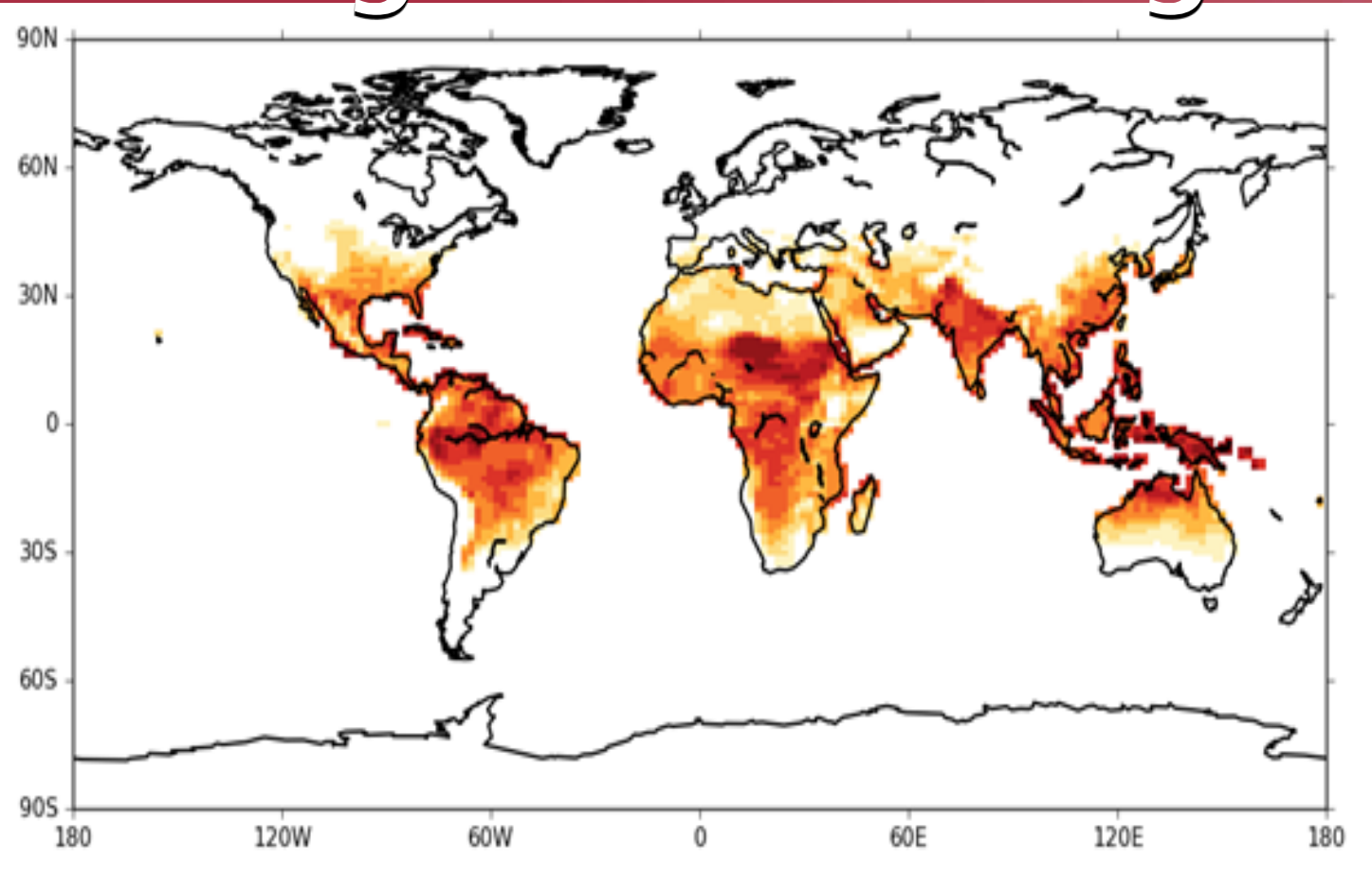
High risk Wet Bulb Globe Temperature (°C) Extreme risk

Human heat stress in hottest month at 2°C global warming



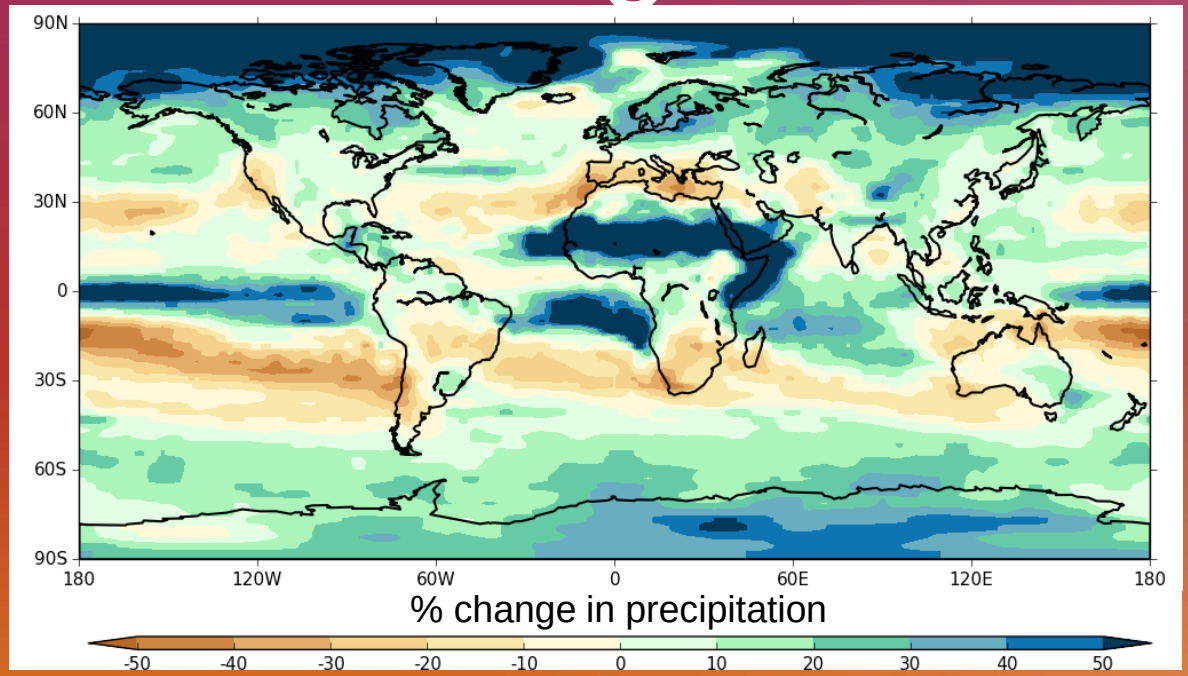
High risk Wet Bulb Globe Temperature (°C) Extreme risk

Human heat stress in hottest month at 4°C global warming



High risk Wet Bulb Globe Temperature (°C) Extreme risk

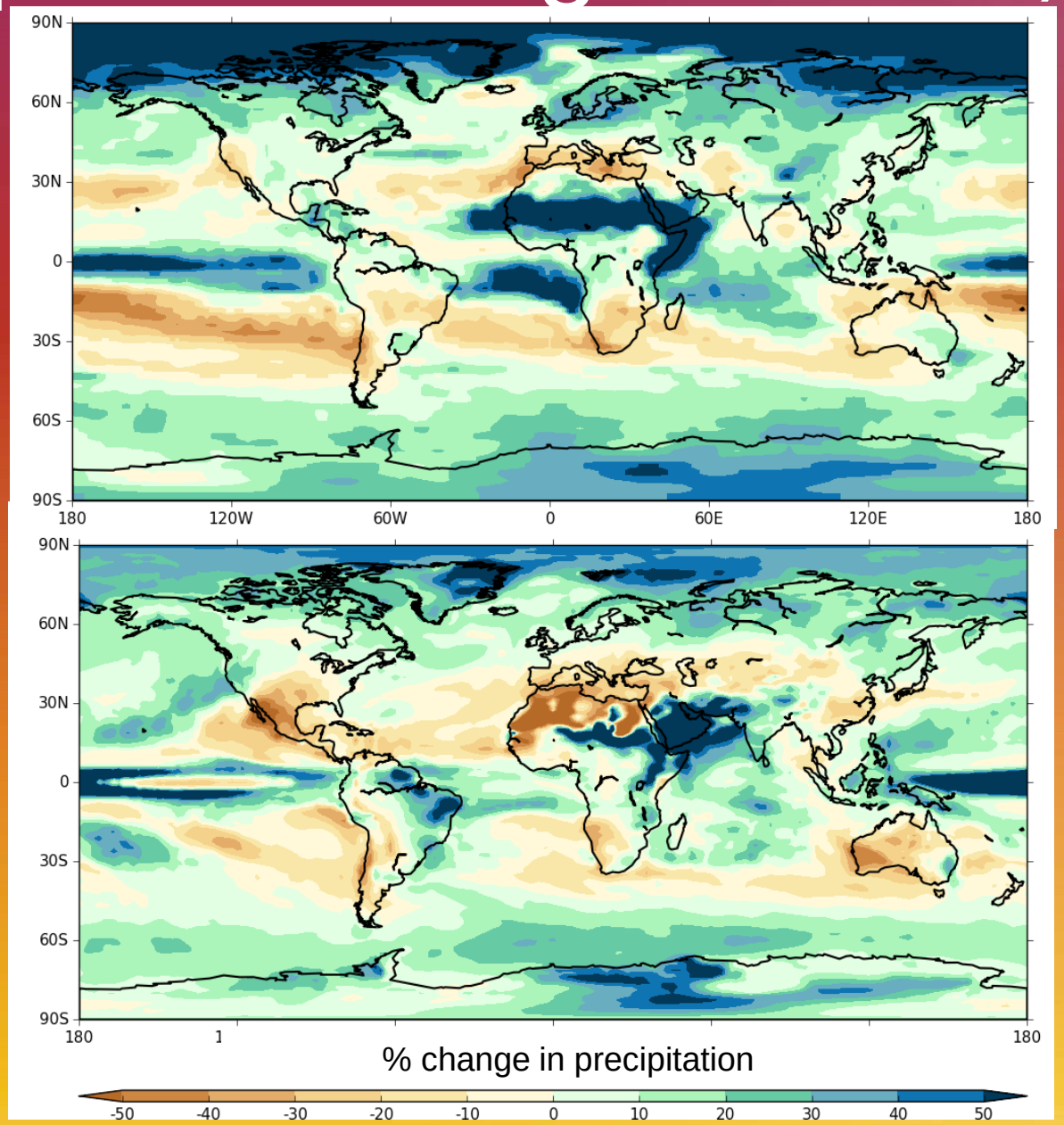
Some places will get wetter, others drier



Climate model simulation 4°C global warming

Some places will get wetter, others drier

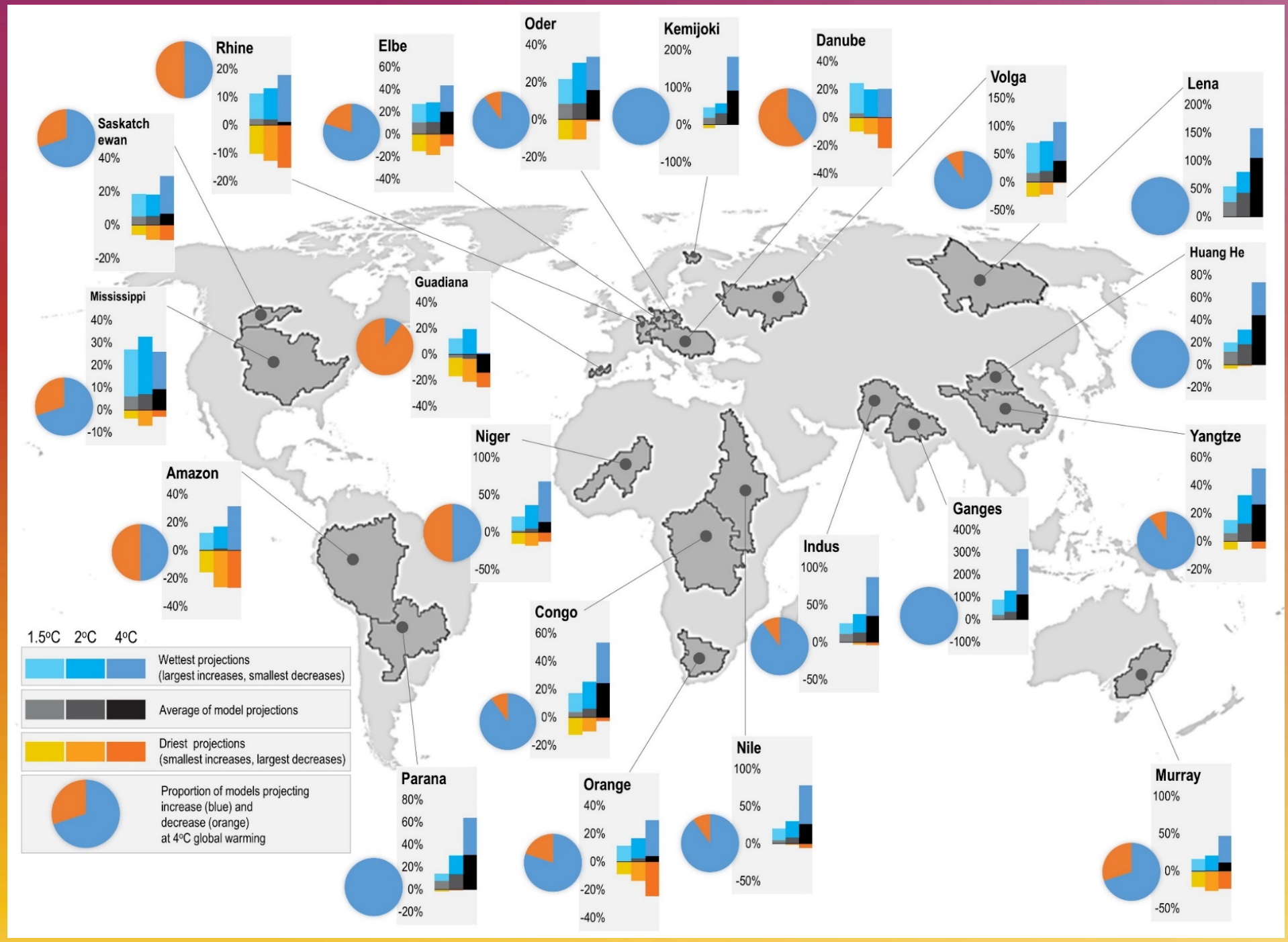
...but it's hard to know which will happen where



Climate model simulation 4°C global warming

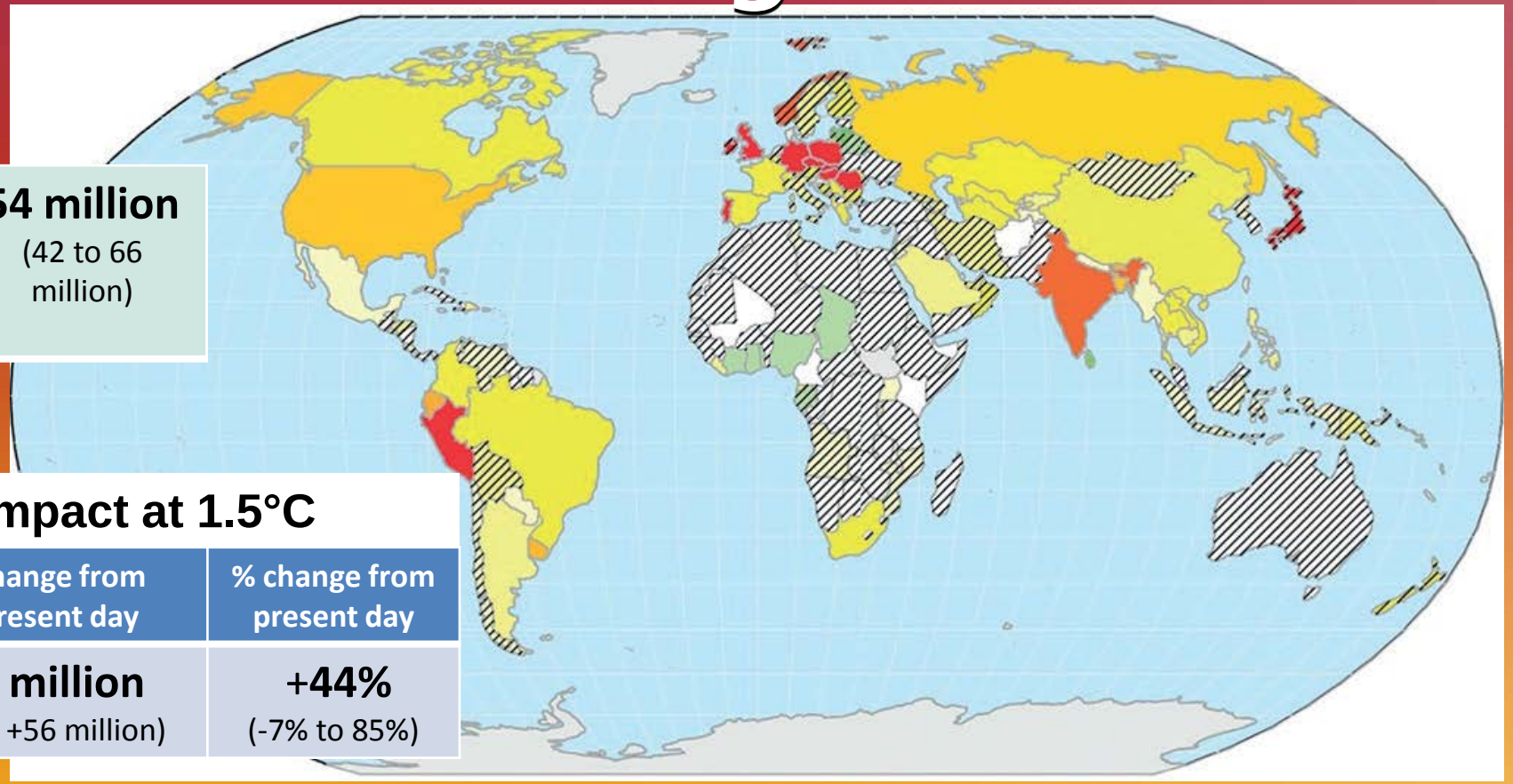
Alternative climate model

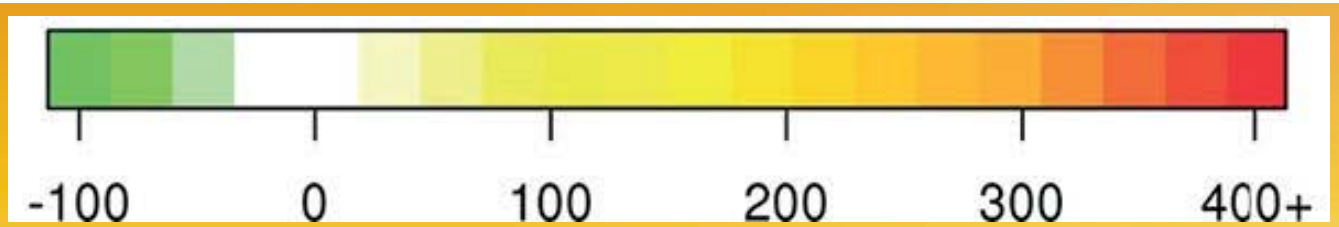
Changes in river flows: drought or flood? Could be either – or both!



% change in people affected by river flooding at 1.5°C

Number of people affected by flooding per year at present day	**54 million** (42 to 66 million)

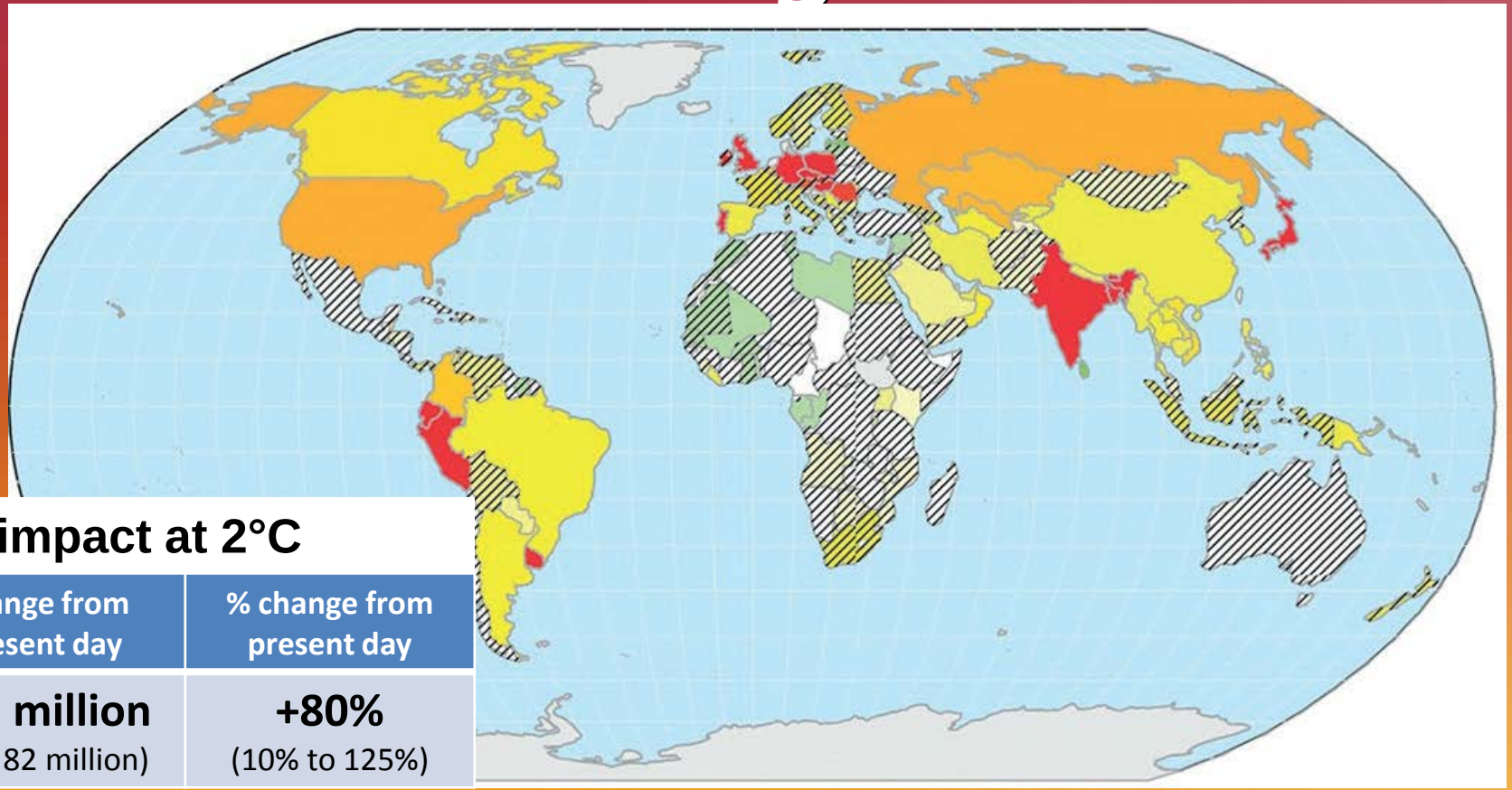




Flooding impact at 1.5°C

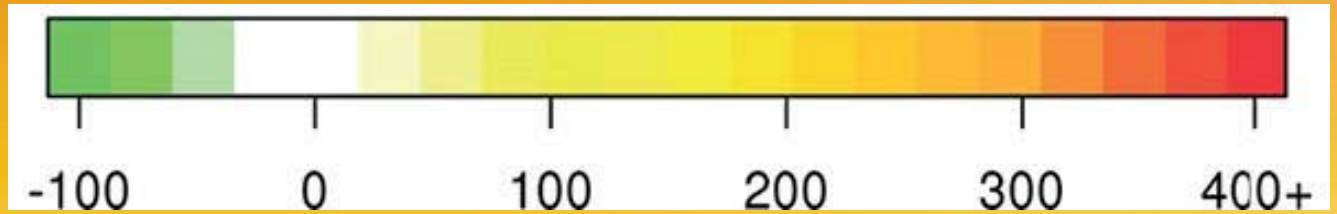
Number of people affected	Change from present day	% change from present day
78 million (39 to 122 million)	**+24 million** (-3 to +56 million)	**+44%** (-7% to 85%)

% change in people affected by river flooding at 2°C

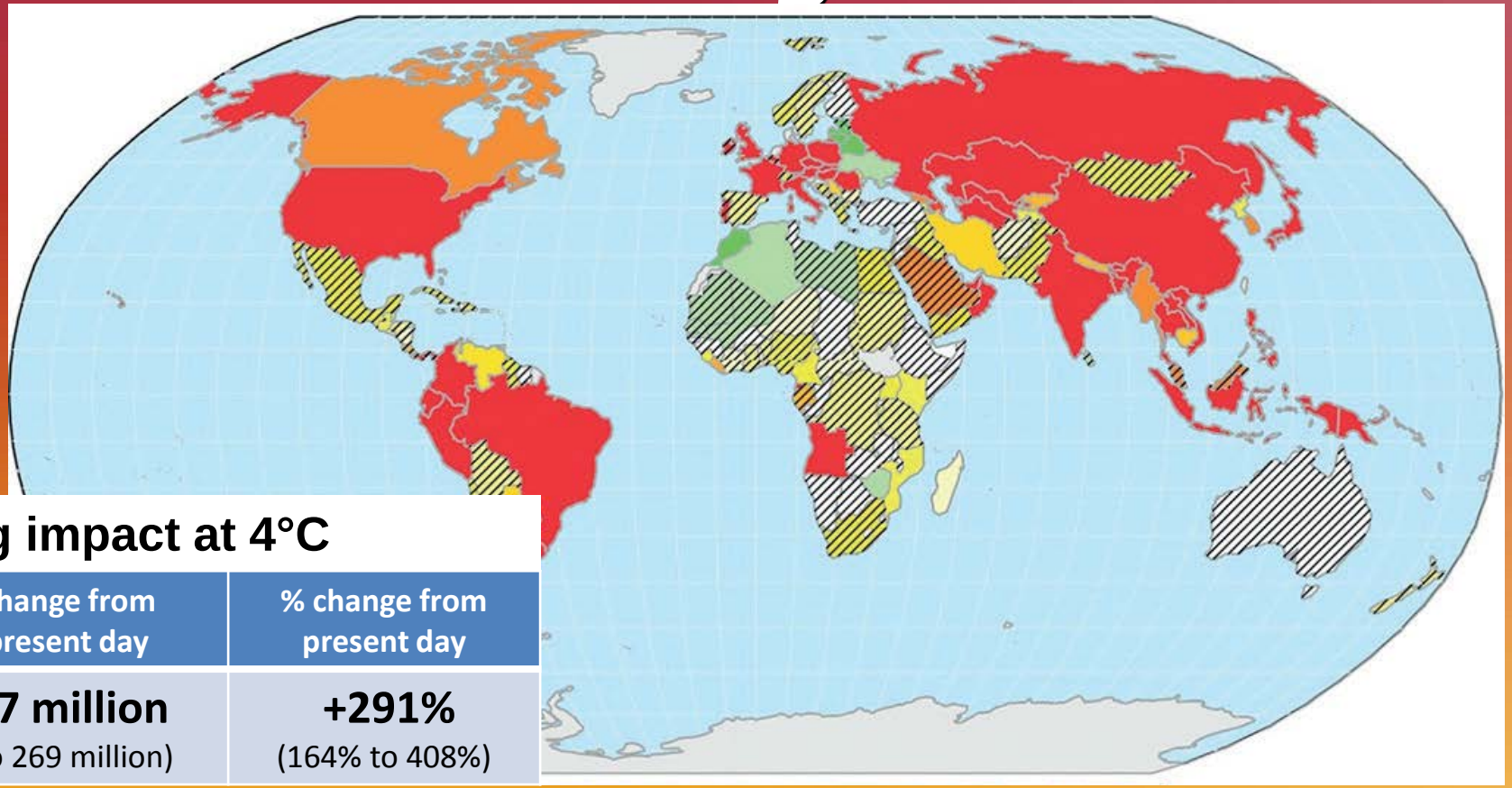


Flooding impact at 2°C

Number of people affected	Change from present day	% change from present day
97 million (46 to 148 million)	**+43 million** (4 to 82 million)	**+80%** (10% to 125%)

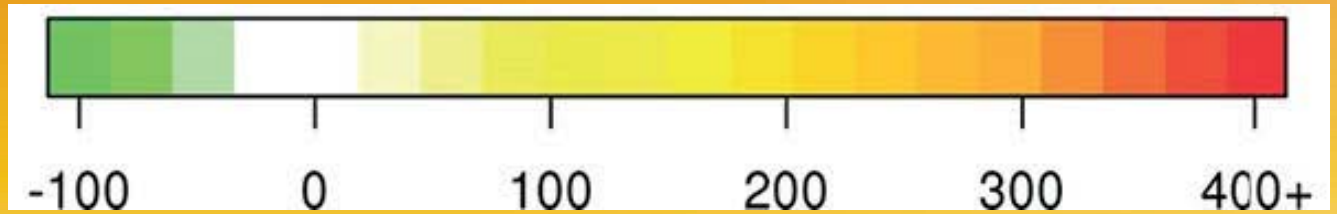


% change in people affected by river flooding at 4°C

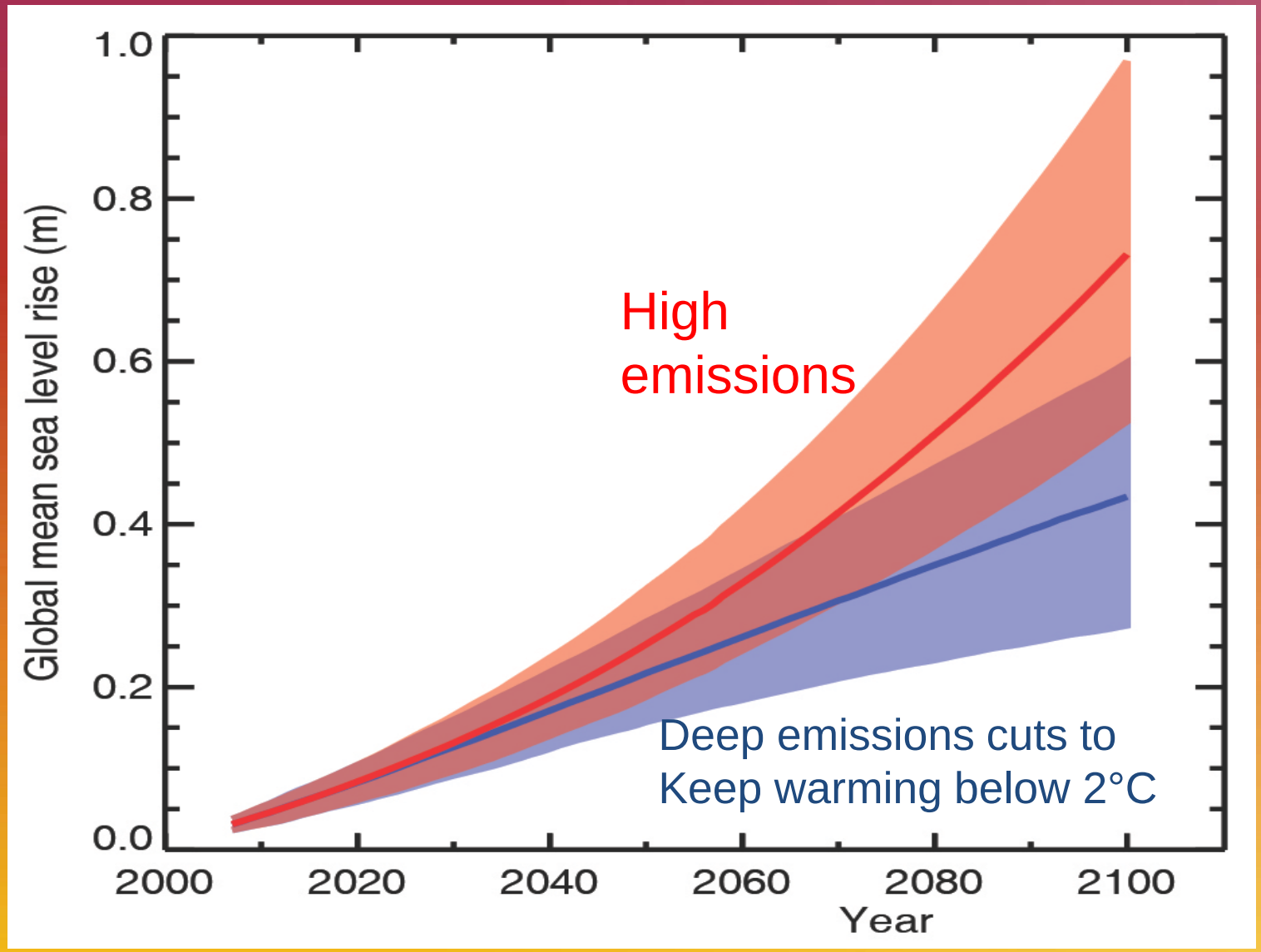


Flooding impact at 4°C

Number of people affected	Change from present day	% change from present day
211 million (111 to 335 million)	**+157 million** (69 to 269 million)	**+291%** (164% to 408%)



Projected future sea level rise



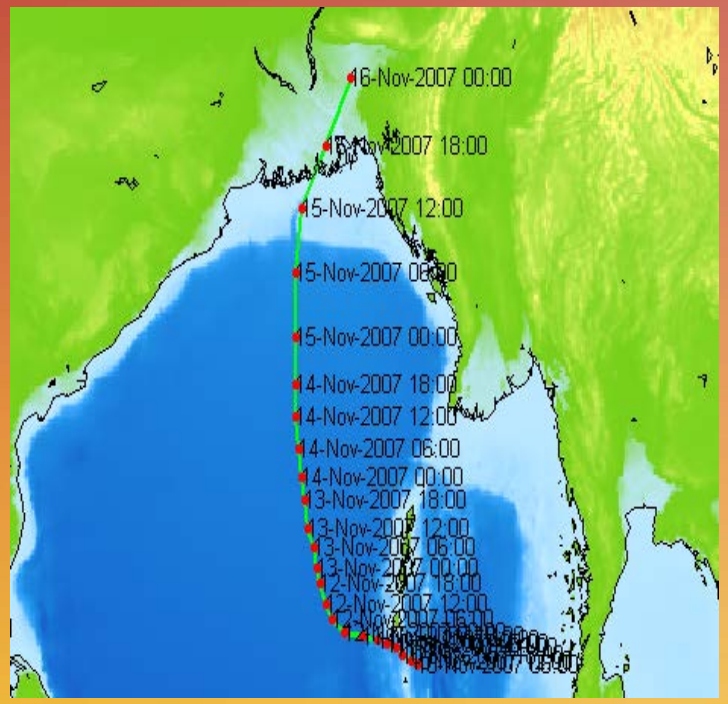
Possible larger rise if parts of Antarctic ice sheet collapse

IPCC (2013)

Sea level rise and storm surge inundation – what if past storms occurred with higher sea levels?

Category 4 cyclone SIDR hit Bangladesh coast on 15 November 2007

Cyclone SIDR Image



TRACK of SIDR

Impacts of cyclone like Sidr (2007) with additional background sea level rise

Background sea level rise (m)	Inundated Area (km^2)	Percent of Bangladesh inundated	Affected Population (million)
0 (cyclone only)	1484	1.2	1.9

Impacts of cyclone like Sidr (2007) with additional background sea level rise

Background sea level rise (m)	Inundated Area (km^2)	Percent of Bangladesh inundated	Affected Population (million)
0 (cyclone only)	1484	1.2	1.9
0.5	3380	2.6	4.1

Impacts of cyclone like Sidr (2007) with additional background sea level rise

Background sea level rise (m)	Inundated Area (km^2)	Percent of Bangladesh inundated	Affected Population (million)
0 (cyclone only)	1484	1.2	1.9
0.5	3380	2.6	4.1
1	5777	4.4	7.0

Impacts of cyclone like Sidr (2007) with additional background sea level rise

Background sea level rise (m)	Inundated Area (km^2)	Percent of Bangladesh inundated	Affected Population (million)
0 (cyclone only)	1484	1.2	1.9
0.5	3380	2.6	4.1
1	5777	4.4	7.0
1.5	7588	5.8	9.1

Summary

- Impacts of climate change generally become more severe at higher levels of warming

- 1.5℃ : people affected by river flooding: + 20 million

- 2℃ : people affected by river flooding: +40 million
- Heat stress reaches high risk across much of tropics

- 4℃: people affected: +150 million
- Heat stress reaches extreme risk across much of tropics, high risk in parts of mid-latitudes

- 0.5m sea level rise (possible by 2100 with 2℃ warming) would double the number of people in Bangladesh affected by a Sidr-like cyclone.
- Higher impacts for larger rises – eg. 7 million people for 1m sea level rise