The global state of knowledge on climate change and responses

Based on the IPCC SIXTH ASSESSMENT REPORT

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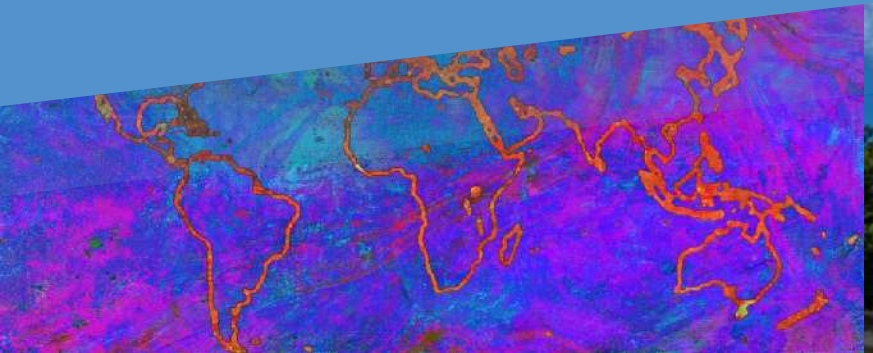
Vice-chair, Working Group III

Agricultural Climate Change Conference
NZAGRC, Palmerston North , 28 Feb 2022



Working Group I: Science
Working Group II: Impacts, Adaptation, Vulnerability
Working Group III: Mitigation

WGI: 234 authors
WGII: 270 authors
WGIII: 278 authors

WGI: 67 countries
WGII: 66 countries
WGIII: 65 countries

WGI: > 14,000 scientific papers
WGII: > 34,000 scientific papers
WGIII: > 18,000 scientific papers

WGI: 78,008 review comments
WGII: 62,418 review comments
WGIII: 59,212 review comments

[Credit: NASA]

> The scale of recent changes across the climate system as a whole – and the present state of many aspects of the climate system – are **unprecedented** over many centuries to many thousands of years.

[Credit: Yoda Adaman | Unsplash]

> It is **unequivocal** that human activities are causing climate change, making extreme climate events, including heat waves, heavy rainfall, and droughts, more frequent and severe.

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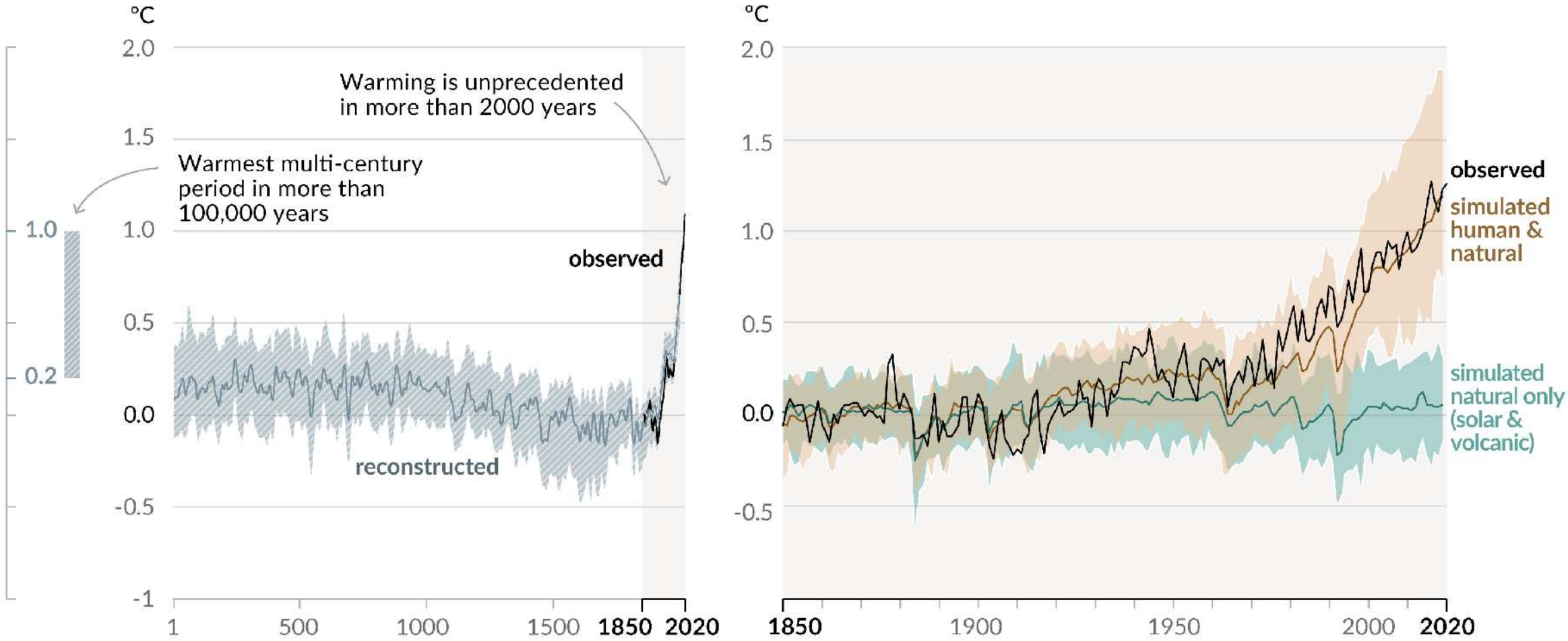
Changes in global surface temperature relative to 1850-1900

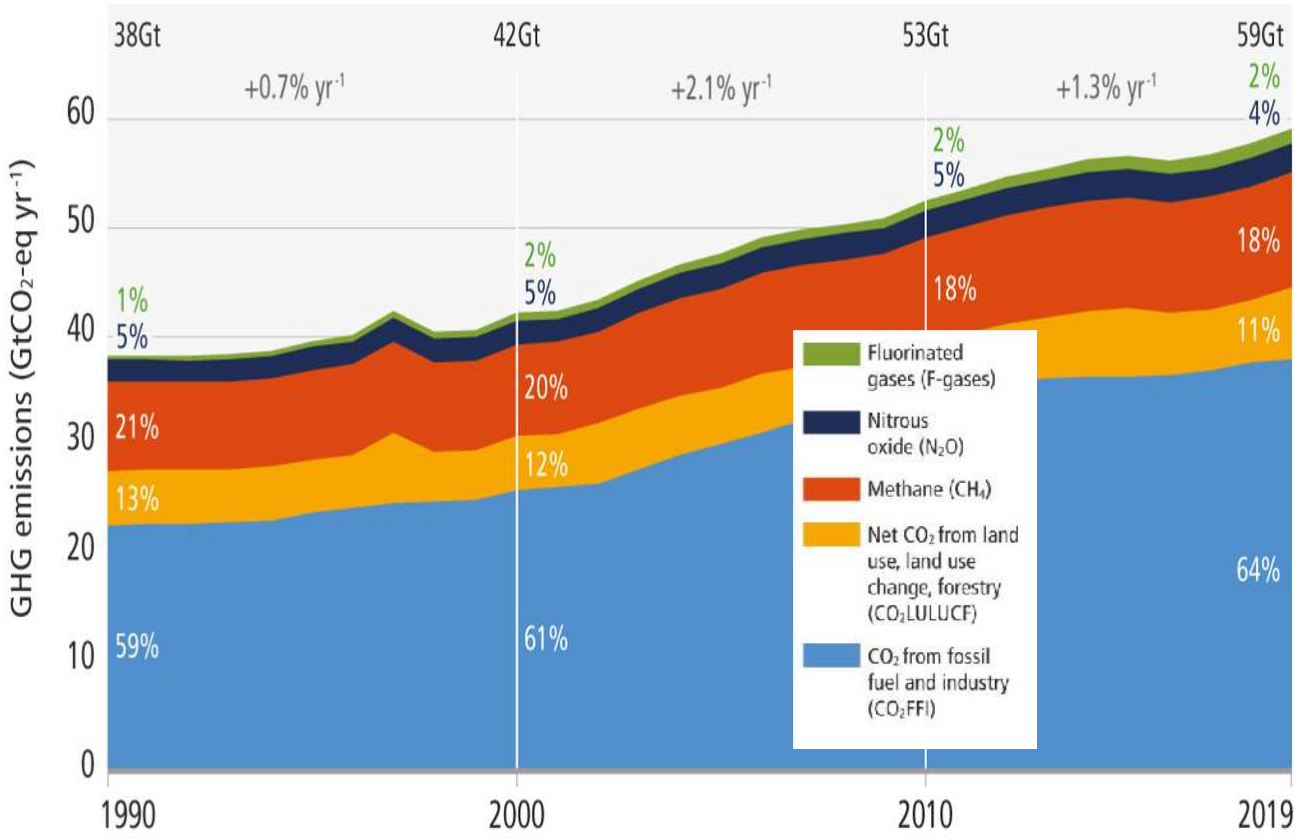
a) Change in global surface temperature (decadal average) as reconstructed (1-2000) and **observed** (1850-2020)

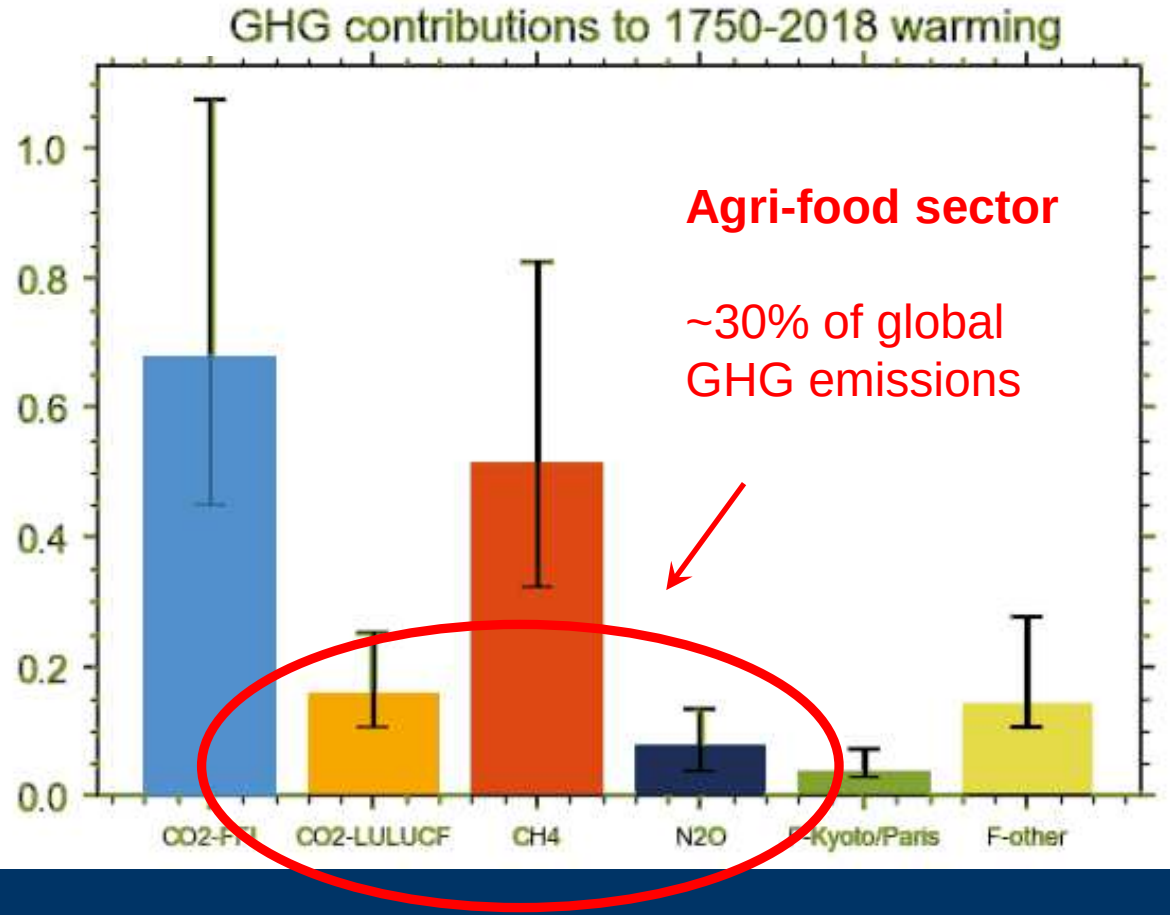
b) Change in global surface temperature (annual average) as **observed** and simulated using human & natural and only natural factors (both 1850-2020)



IPCC WGI Figure SPM.1

Emissions are at their highest level in human history





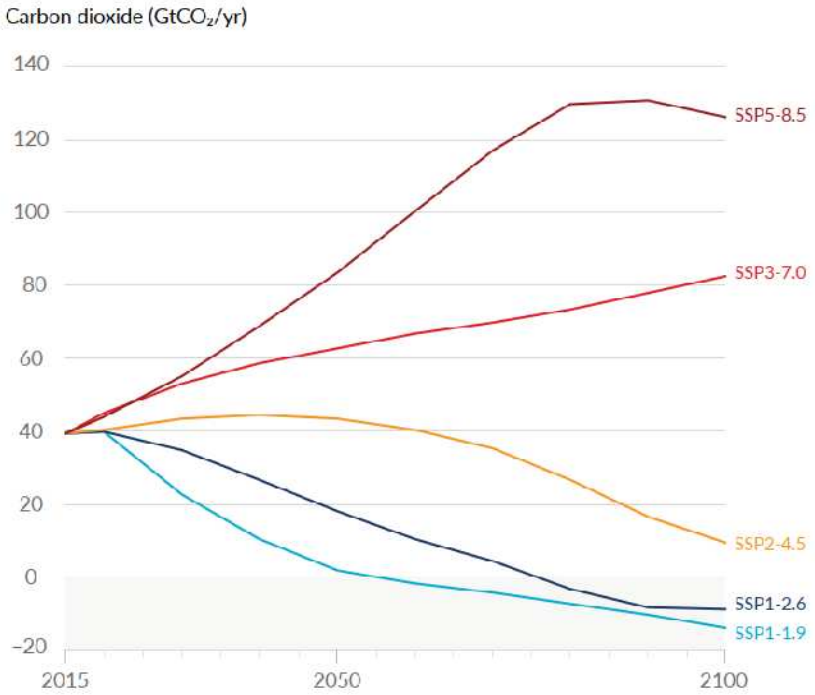
[IPCC WGIII Figure SPM.1; Chapter 2, Figure 2.4; Chapter 12.4]

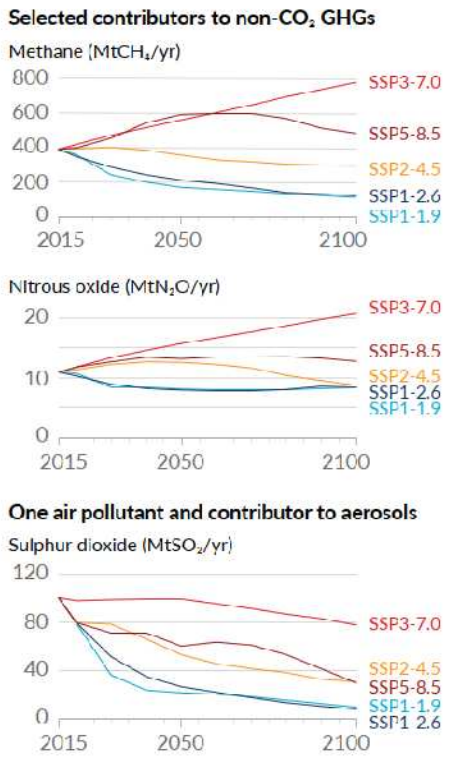
[Credit: Hong Nguyen | Unsplash]

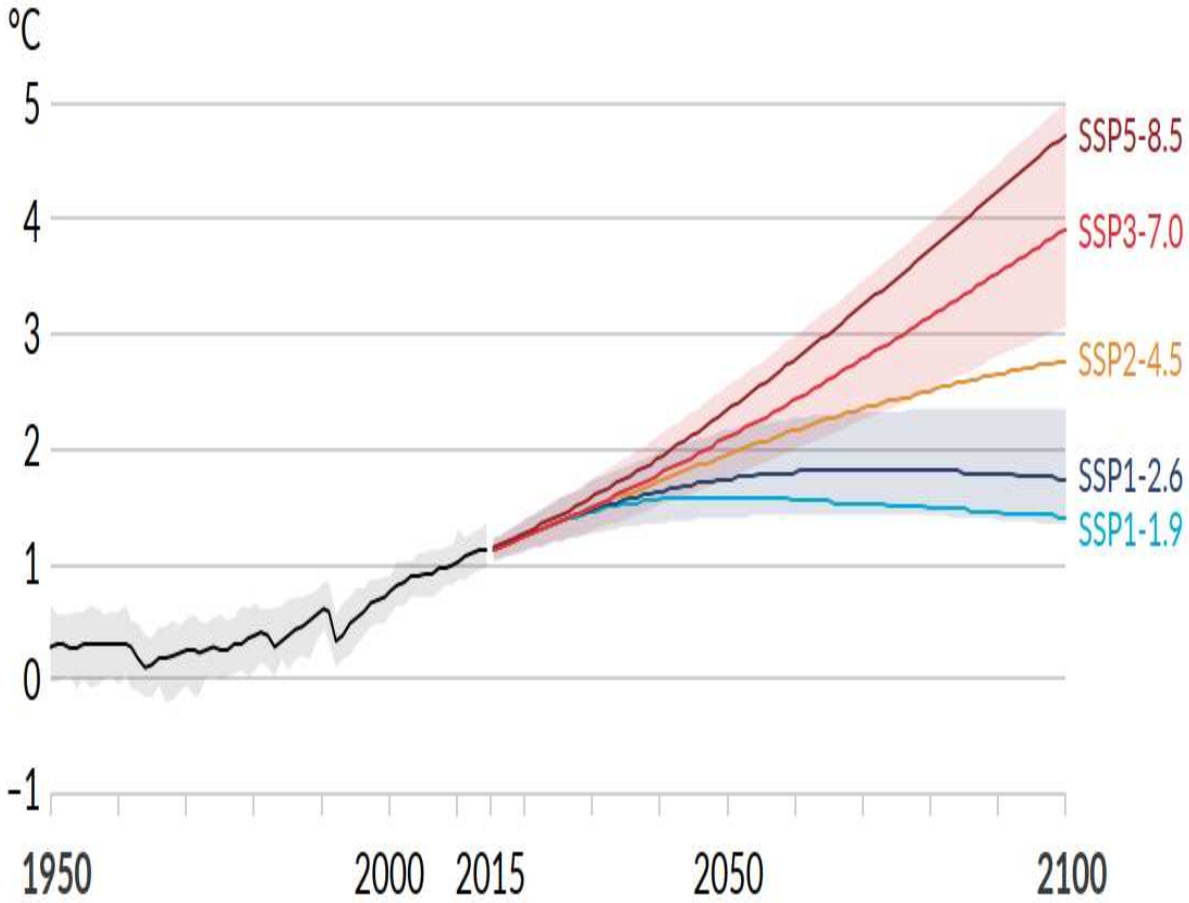
"Climate change is already affecting every region on Earth, in multiple ways.

The changes we experience will increase with further warming.

Future emissions cause future additional warming, with total warming dominated by past and future CO_2 emissions

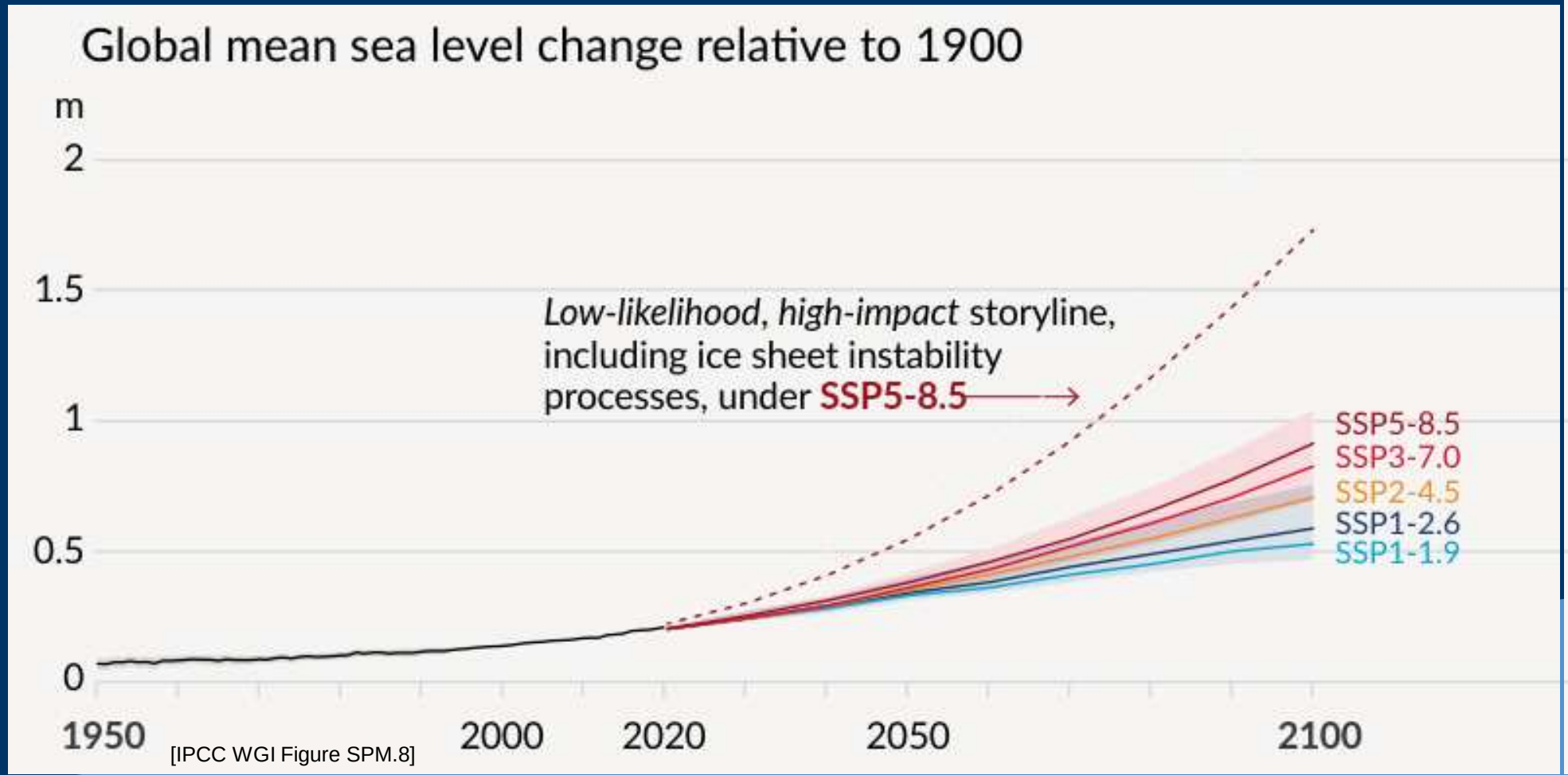




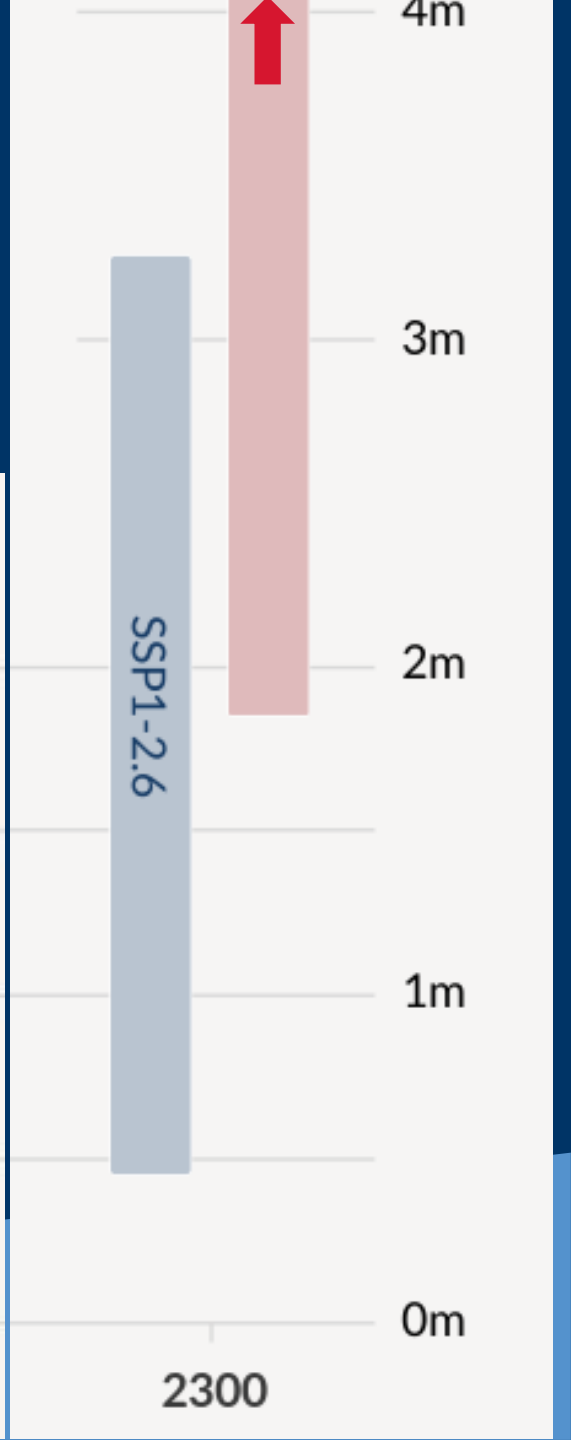


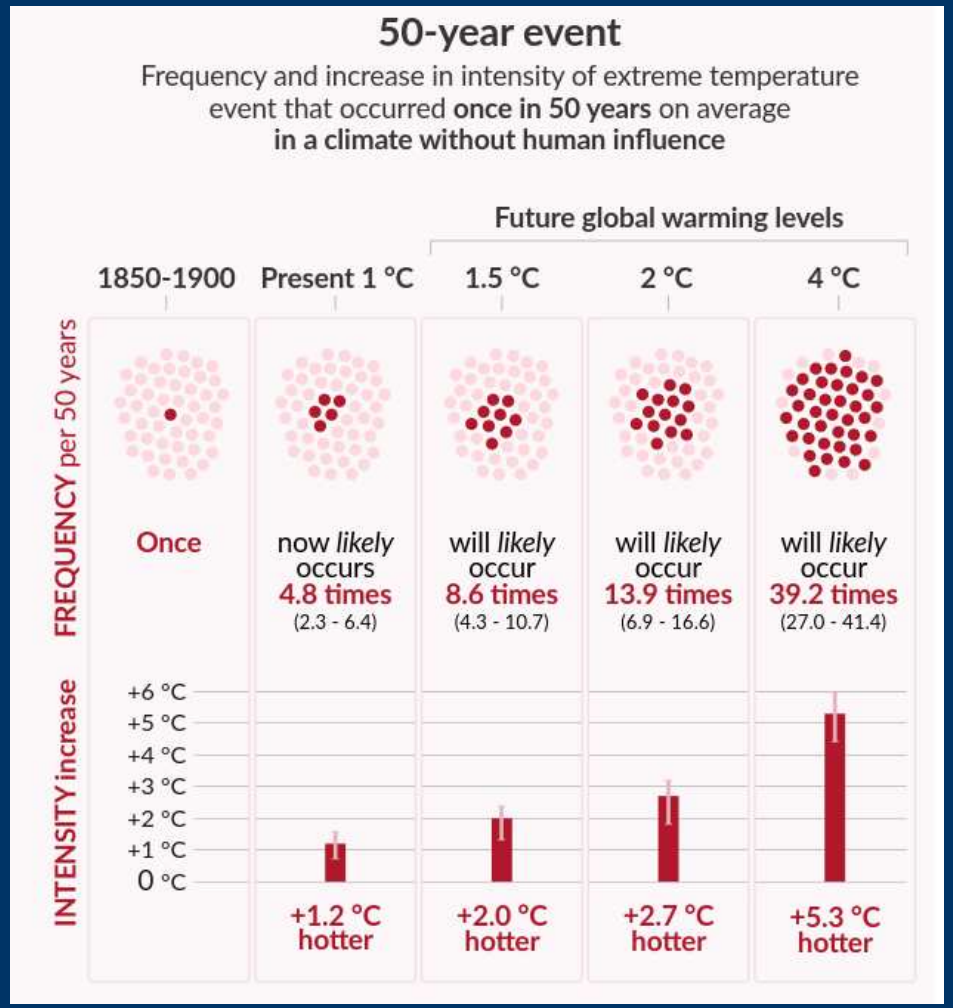
[IPCC WGI Figures SPM.4 and SPM.8]

“Many changes due to greenhouse gas emissions are **irreversible** for centuries to millennia, especially changes in the ocean, ice sheets and global sea level.



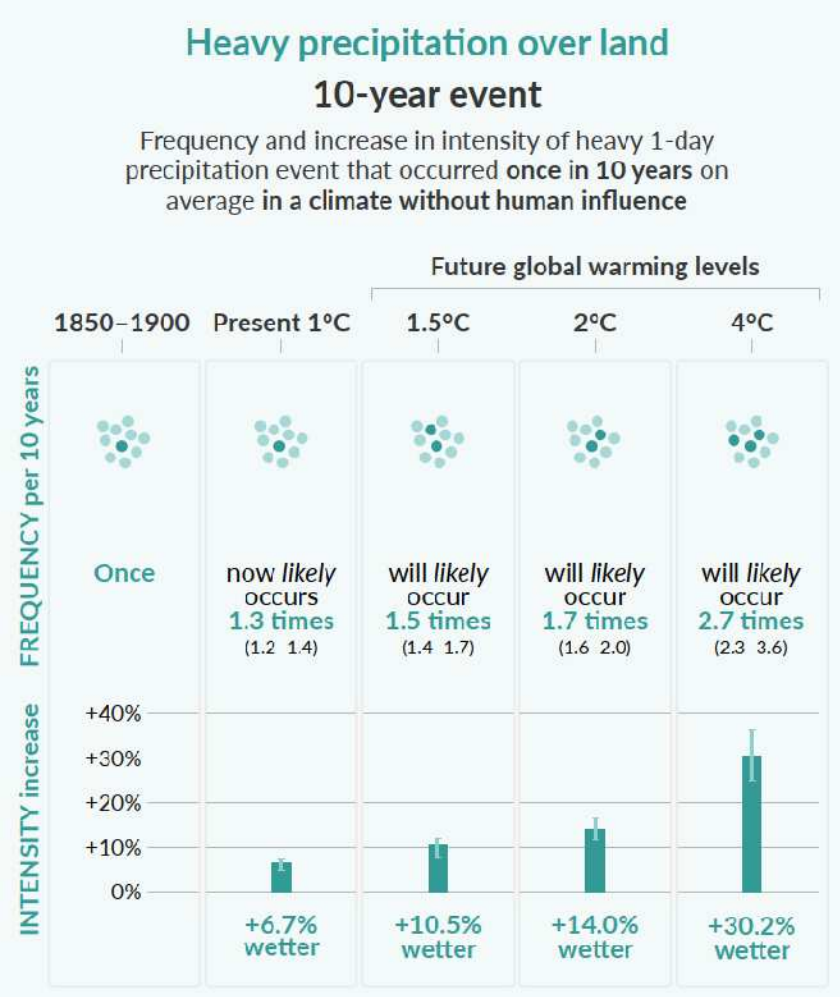
[IPCC WGI Figure SPM.8]





[IPCC WGI Figure SPM.6]

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

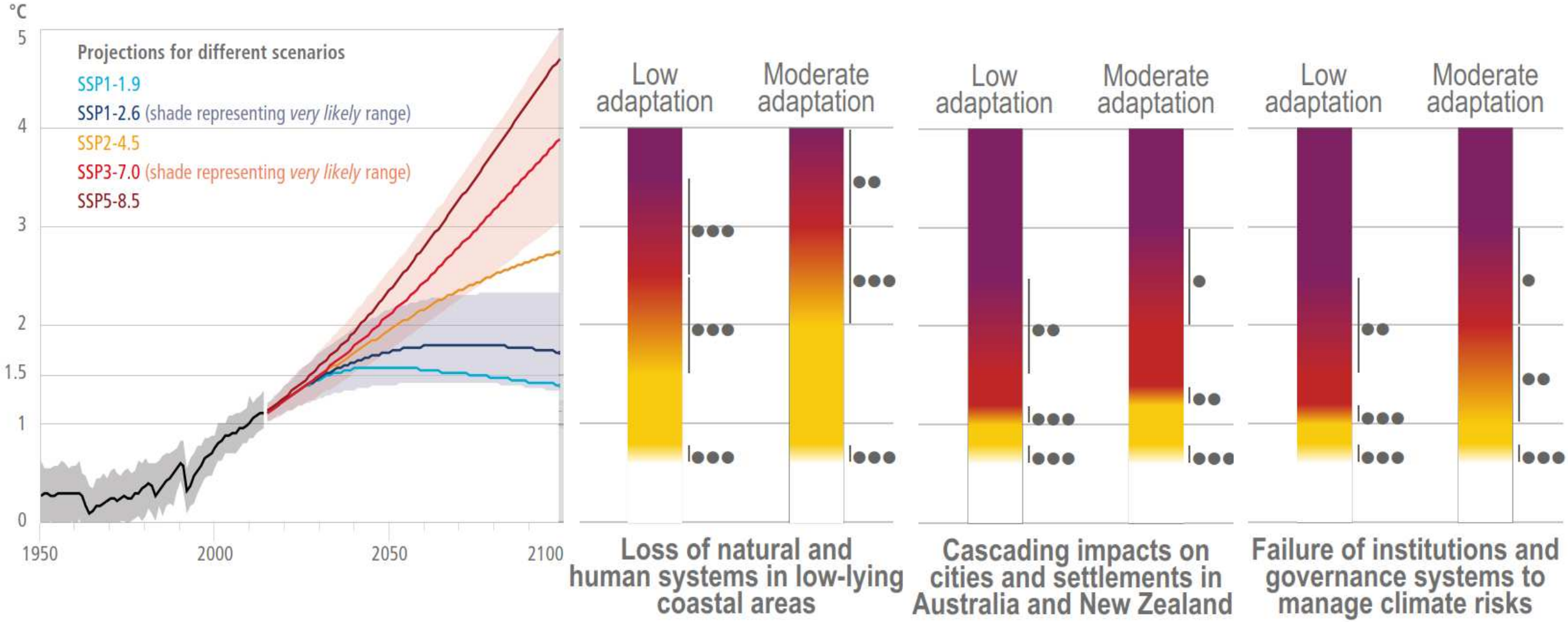


[IPCC WGI Figure SPM.6]

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

Key risks increase with every increment of warming

Selected key risks for New Zealand, from WGII Chapter 11, Australasia: Figure 11.6



“There are increasing gaps between adaptation action taken and what’s needed.

These gaps are largest among lower income populations.

They are expected to grow.

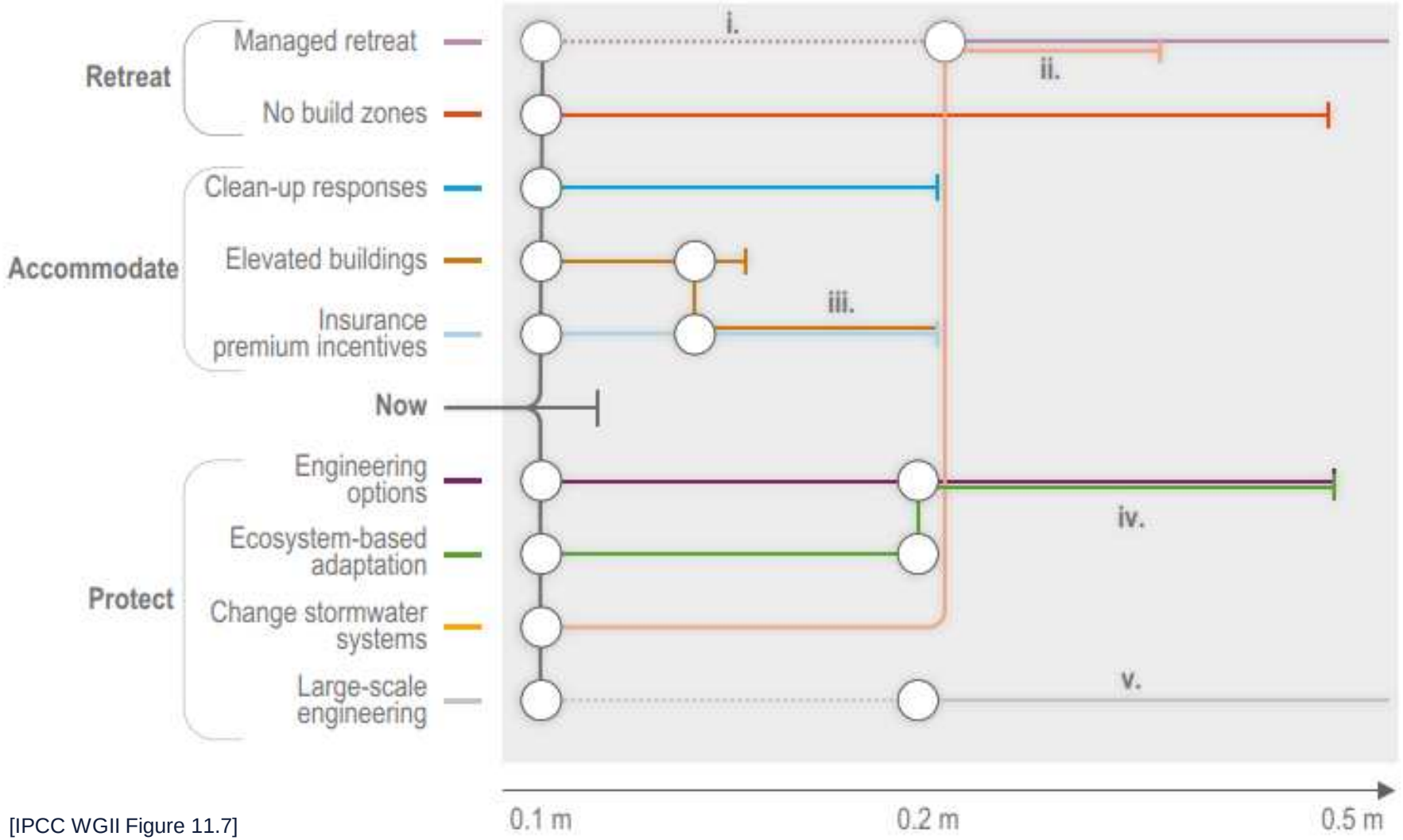
Climate change is a stress multiplier

Engineered solutions can increase the risk from catastrophic failure

Image sequence compiled by Nathanael Mehlia
@nathanaelmelia

19:30

Illustrative adaptation pathway for risk to natural and human systems in low-lying coastal areas due to sea level rise



= Decision trigger points

i. Long lead time to align with social goals.

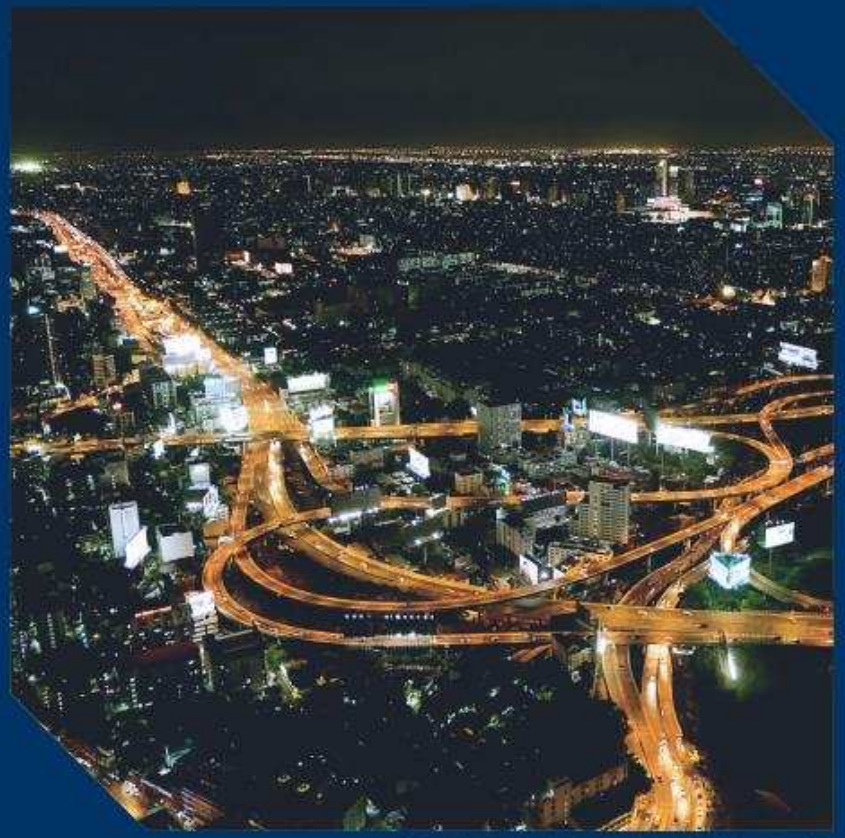
ii. Shifting from gravity to pumped stormwater and groundwater systems buys time before managed retreat becomes necessary.

iii. Elevated building costs can be reduced by insurance incentives.

iv. Ecosystem based adaptation is effective for initial sea level rise, but may need to combine with engineering options to be effective in the long term.

v. Large-scale engineering, e.g. tidal barrages, will be effective long term but only for large populations willing to pay the high cost.

[IPCC WGII Figure 11.7]



[Credit: Peter John Maridable | Unsplash]

"Unless there are immediate, rapid, and large-scale reductions in greenhouse gas emissions, limiting warming to 1.5°C will be beyond reach.

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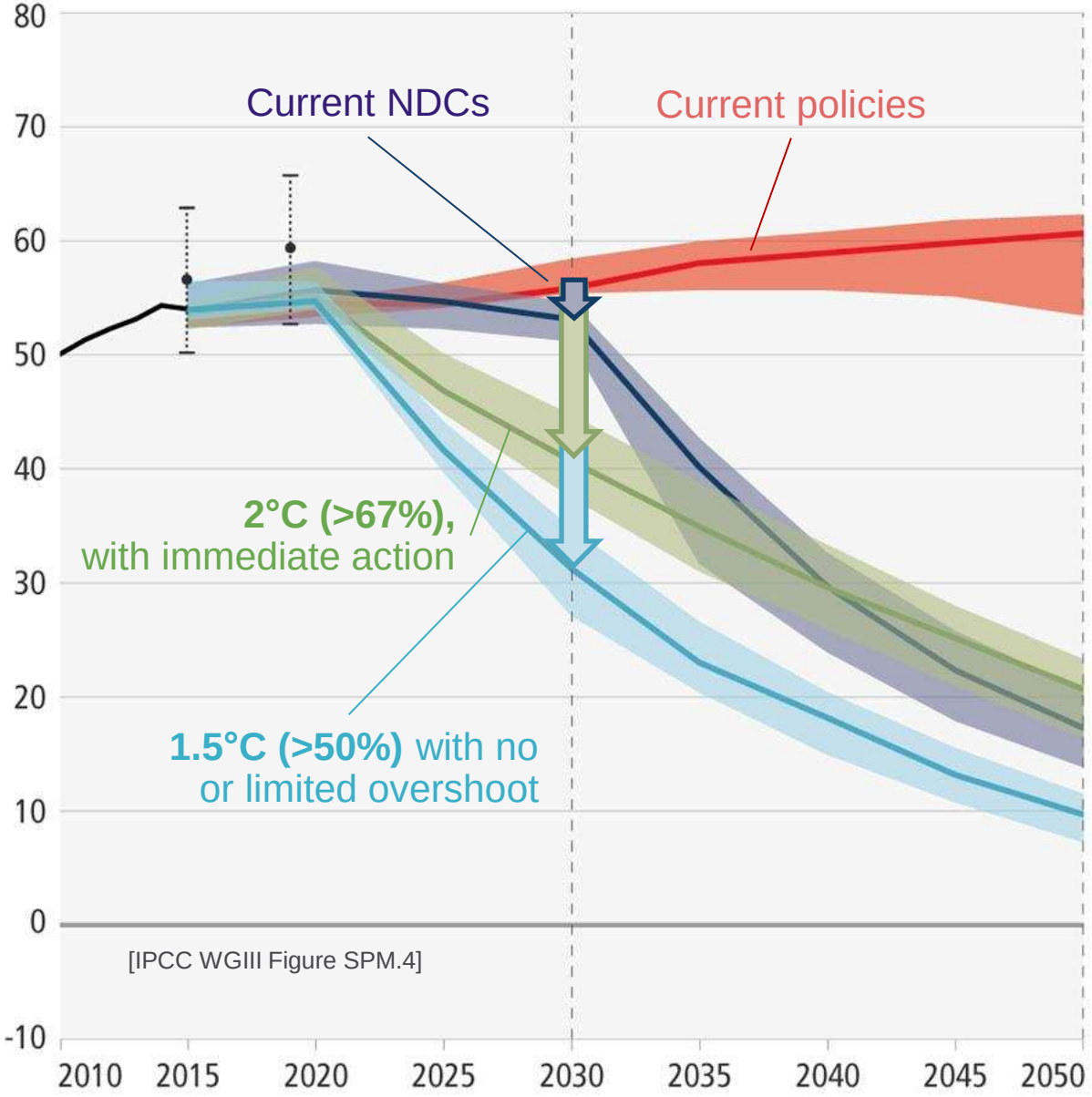


[IPCC WGIII Figure SPM.4]

Under current NDCs (Oct 2021)

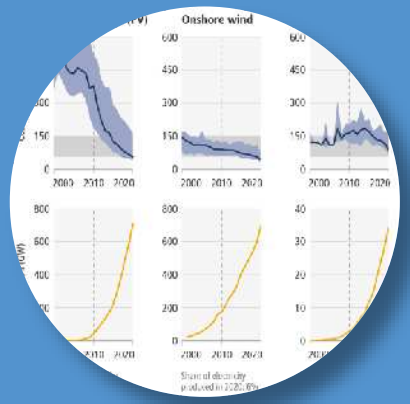
- Limiting warming 1.5°C no longer feasible (unlikely)
- Limiting warming to 2°C (>67%) not infeasible, but relies on rapid and challenging acceleration post-2030

	1.5°C	2°C (>67%)	
	immediate action	immediate action	NDCs
2030	43%	27%	5%
2035	60%	37%	30%

(median reduction on 2019 in IPCC-assessed scenarios)

“Limiting warming to 1.5°C or *likely* below 2°C involves reaching global net zero CO_2 emissions by the 2050s or 2070s, along with deep reductions of other GHGs.

There are signs of progress



Declining costs of some technologies

Especially solar, wind, battery storage
Rapidly increasing installed capacity

Increasing policy coverage

Framework legislation, net zero targets, policy packages, pricing schemes

Sustained reductions in some countries

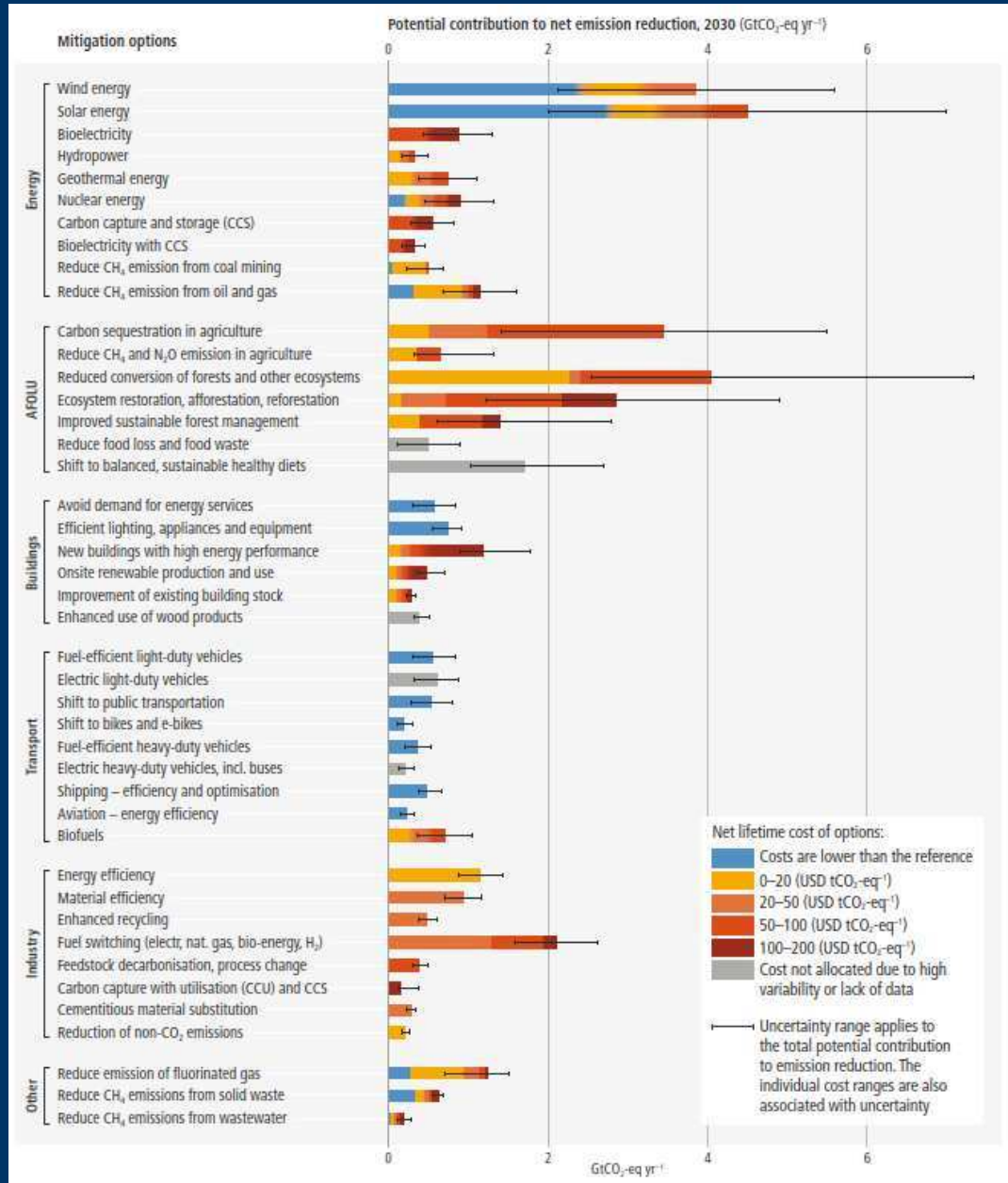
Reductions in >18 countries
Supply decarbonization, efficiency, demand

‘Business as usual’ no longer means > 4°C of warming

Climate policy works !

... but we’re starting from a low base, apply policy narrowly, inconsistently, and with insufficient ambition and finance

> **Mitigation options costing US$100/tCO$_2$-eq or less could reduce global GHG emissions by at least half the 2019 level by 2030.**



[IPCC WGIII Figure SPM.7]

Sixth Assessment Report

WORKING GROUP III – MITIGATION OF CLIMATE CHANGE

We know what to do.
We know how to do it.
It is up to us now.

[IPCC WGIII Figure SPM.7]

Thank you

https://www.ipcc.ch/report/ar6/wg1/
https://www.ipcc.ch/report/ar6/wg2/
https://www.ipcc.ch/report/ar6/wg3/

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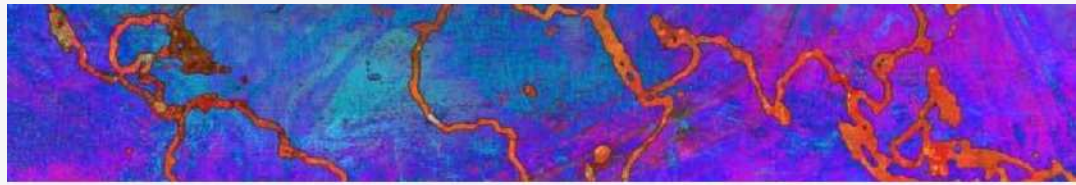

Climate Change 2021: The Physical Science Basis

The Working Group I contribution to the Sixth Assessment Report addresses the most up-to-date physical understanding of the climate system and climate change, bringing together the latest advances in climate science.

Climate Change 2022: Impacts, Adaptation and Vulnerability

The Working Group II contribution to the IPCC Sixth Assessment Report assesses the impacts of climate change, looking at ecosystems, biodiversity, and human communities at global and regional levels. It also reviews vulnerabilities and the capacities and limits of the natural world and human societies to adapt to climate change.

Climate Change 2022: Mitigation of Climate Change

The Working Group III report provides an updated global assessment of climate change mitigation progress and pledges, and examines the sources of global emissions. It explains developments in emission reduction and mitigation efforts, assessing the impact of national climate pledges in relation to long-term emissions goals.