

The Challenges and Opportunities of Climate Change

***An Overview Based on the IPCC
Fifth Assessment Report (AR5)***

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Why the IPCC ?

Established by WMO and UNEP in 1988

to provide **policy-makers** with an **objective source of information** about

- causes of climate change,
- potential environmental and socio-economic impacts,
- possible response options (adaptation & mitigation).

WMO=World Meteorological Organization
UNEP= United Nations Environment Programme



Strengths of the IPCC

- ✓ **Mobilisation of thousands of multi-disciplinary experts worldwide**
- ✓ **Policy-relevant findings (but not policy-prescriptive)**
- ✓ **Widely used methodological reports**
- ✓ **Assessments relying on peer reviewed literature**
- ✓ **Review process involving experts and Governments**
- ✓ **Media attention and outreach activities**

AR5 is the best ever

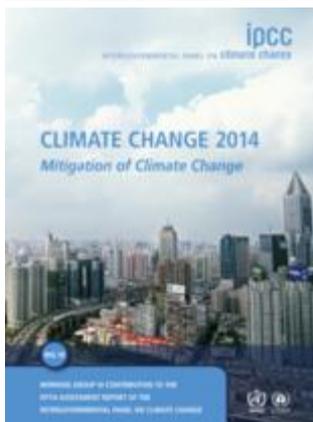
- **Better integration of Mitigation and Adaptation**
- **Improved risk-management approach**
- **Evolving away from the non-mitigation SRES scenarios** (SRES= Special Report on Emission Scenarios, 2000)
- **Special effort to provide regional information when available**
- **Sustainable development & equity aspects**
- **More comprehensive treatment of economic aspects, and of cross-cutting issues**
- **Emerging issues handled (acidification, ...)**
- **Better handling & communication of uncertainties**



What is happening in the climate system?



What are the risks?



What can be done?

Key messages from IPCC AR5

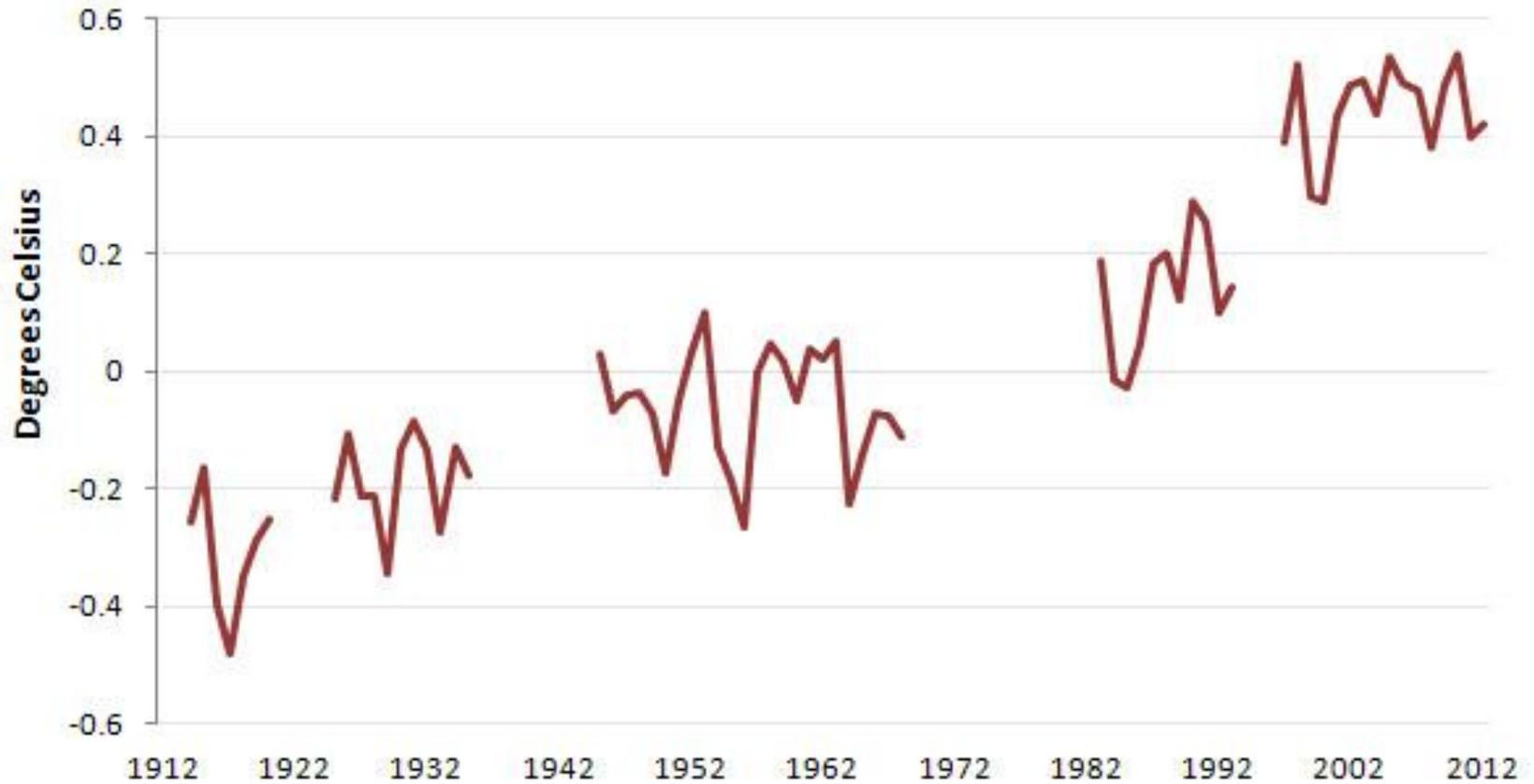
- **Human influence on the climate system is clear**
- **Continued emissions of greenhouse gases will increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems**
- **While climate change is a threat to sustainable development, there are many opportunities to integrate mitigation, adaptation, and the pursuit of other societal objectives**
- **Humanity has the means to limit climate change and build a more sustainable and resilient future**

Temperature Change From 1961-1990 Average



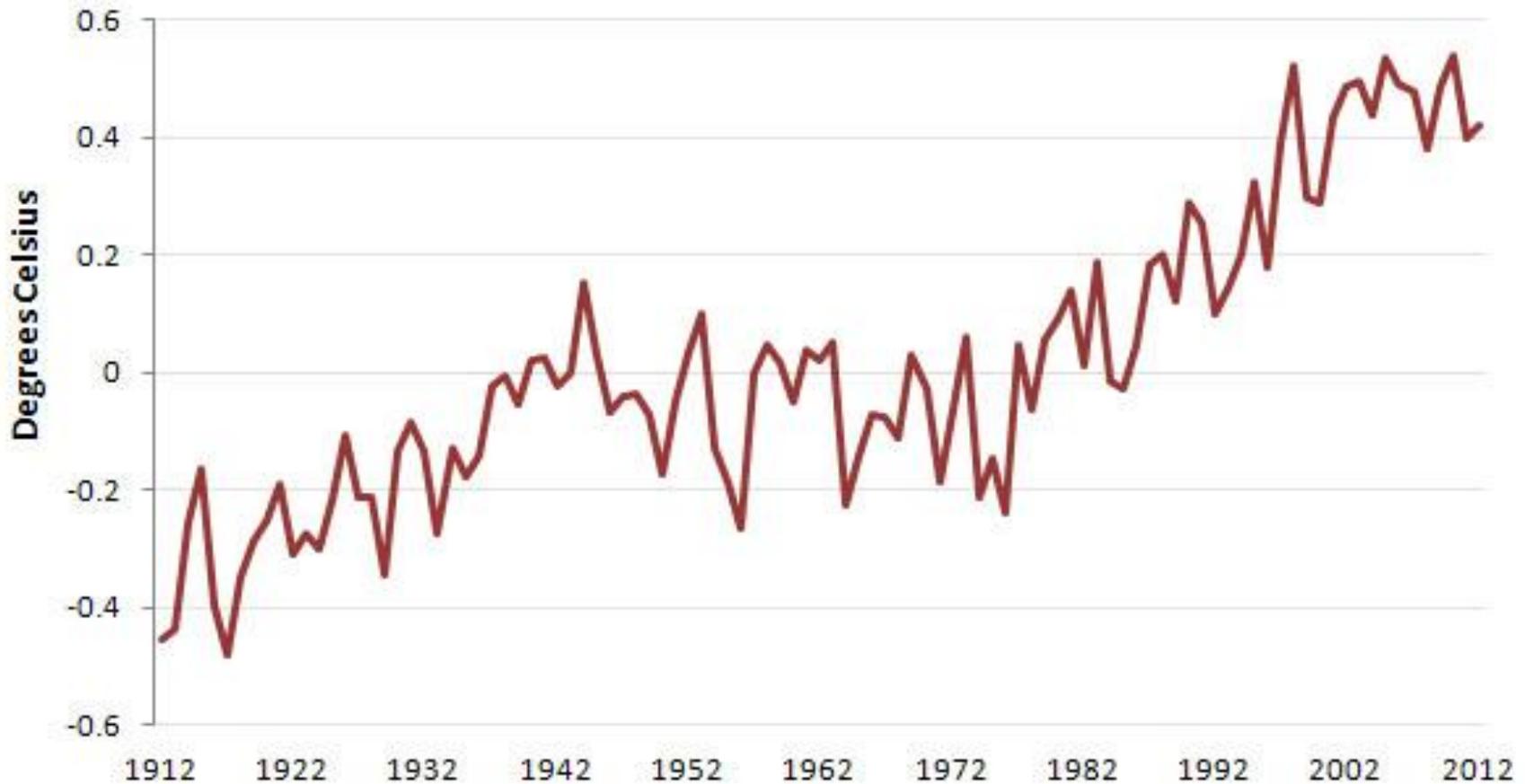
Lying With Statistics, Global Warming Edition

Temperature Plateaus — 1912-2012

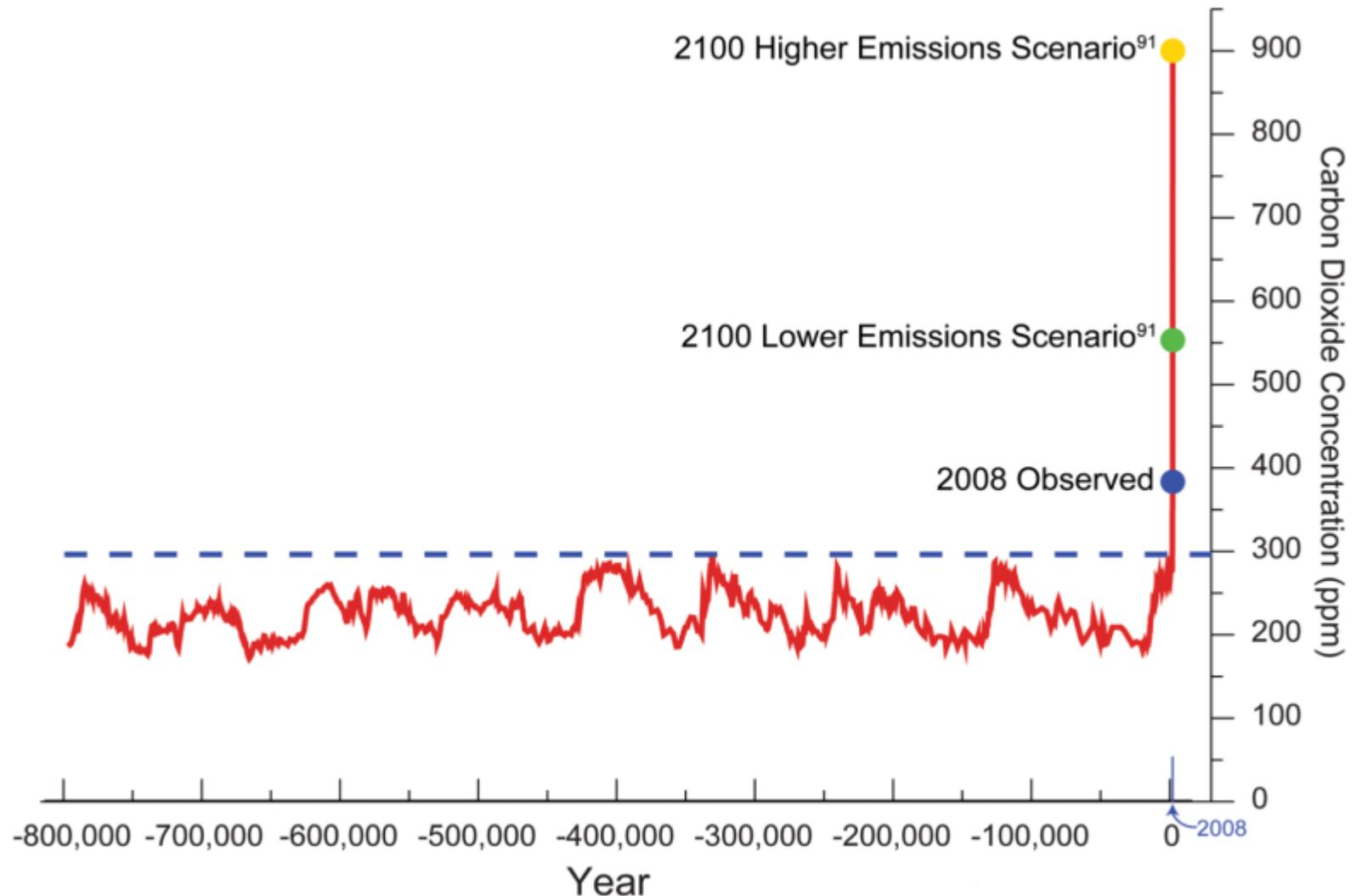


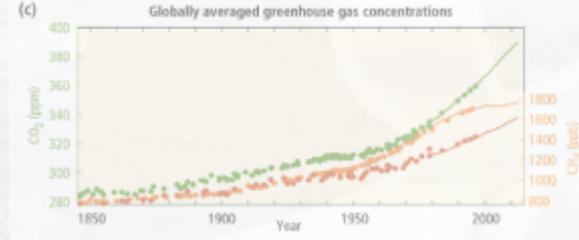
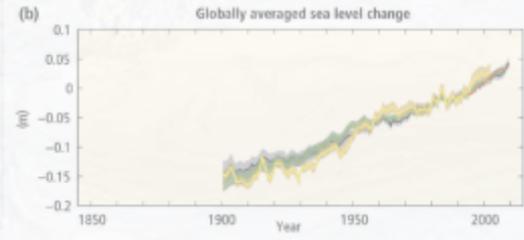
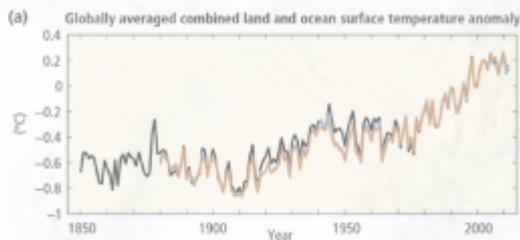
Lying With Statistics, Global Warming Edition

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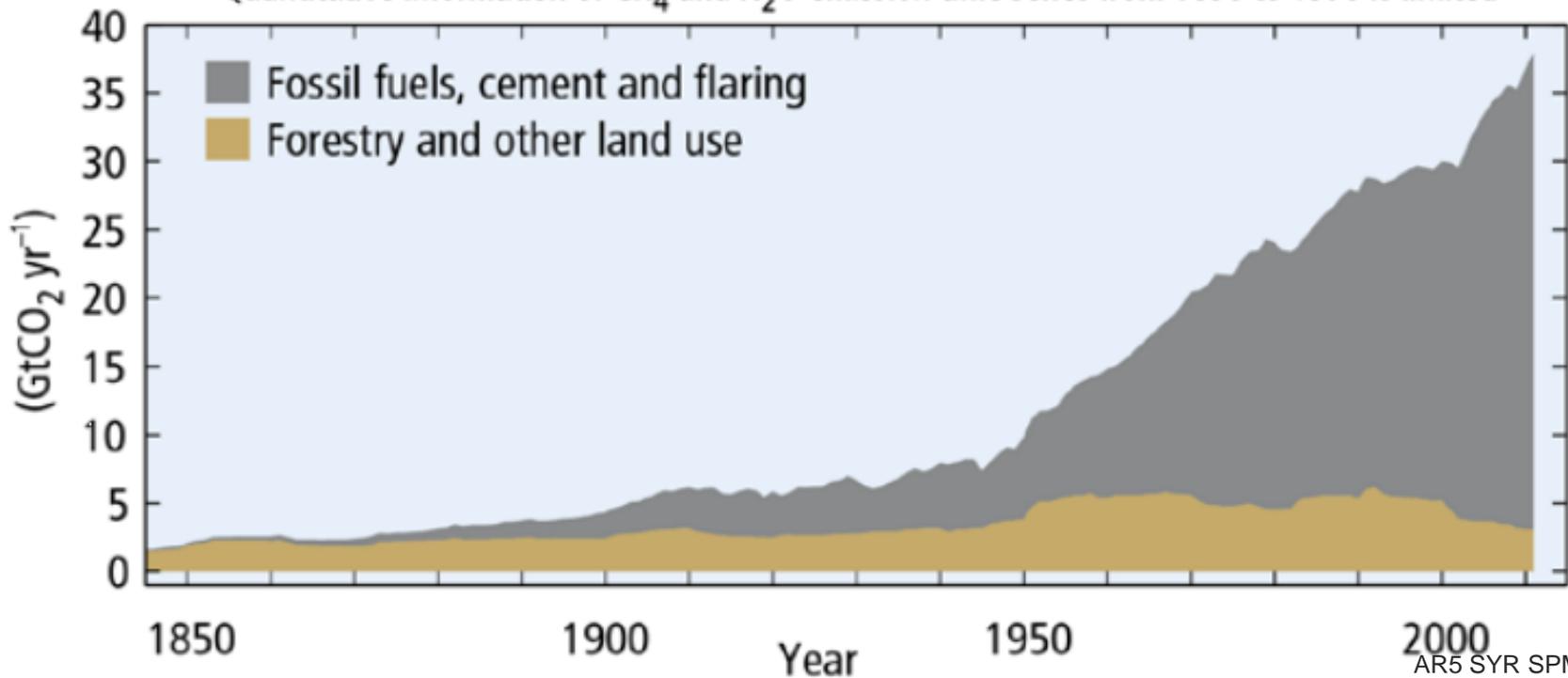


Atmospheric CO₂ over the last 800,000 years





(d) Global anthropogenic CO₂ emissions
 Quantitative information of CH₄ and N₂O emission time series from 1850 to 1970 is limited



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Sources of emissions

Energy production remains the primary driver of GHG emissions



2010 GHG emissions

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Since 1950, extreme hot days and heavy precipitation have become more common



There is evidence that anthropogenic influences, including increasing atmospheric greenhouse gas concentrations, have changed these extremes

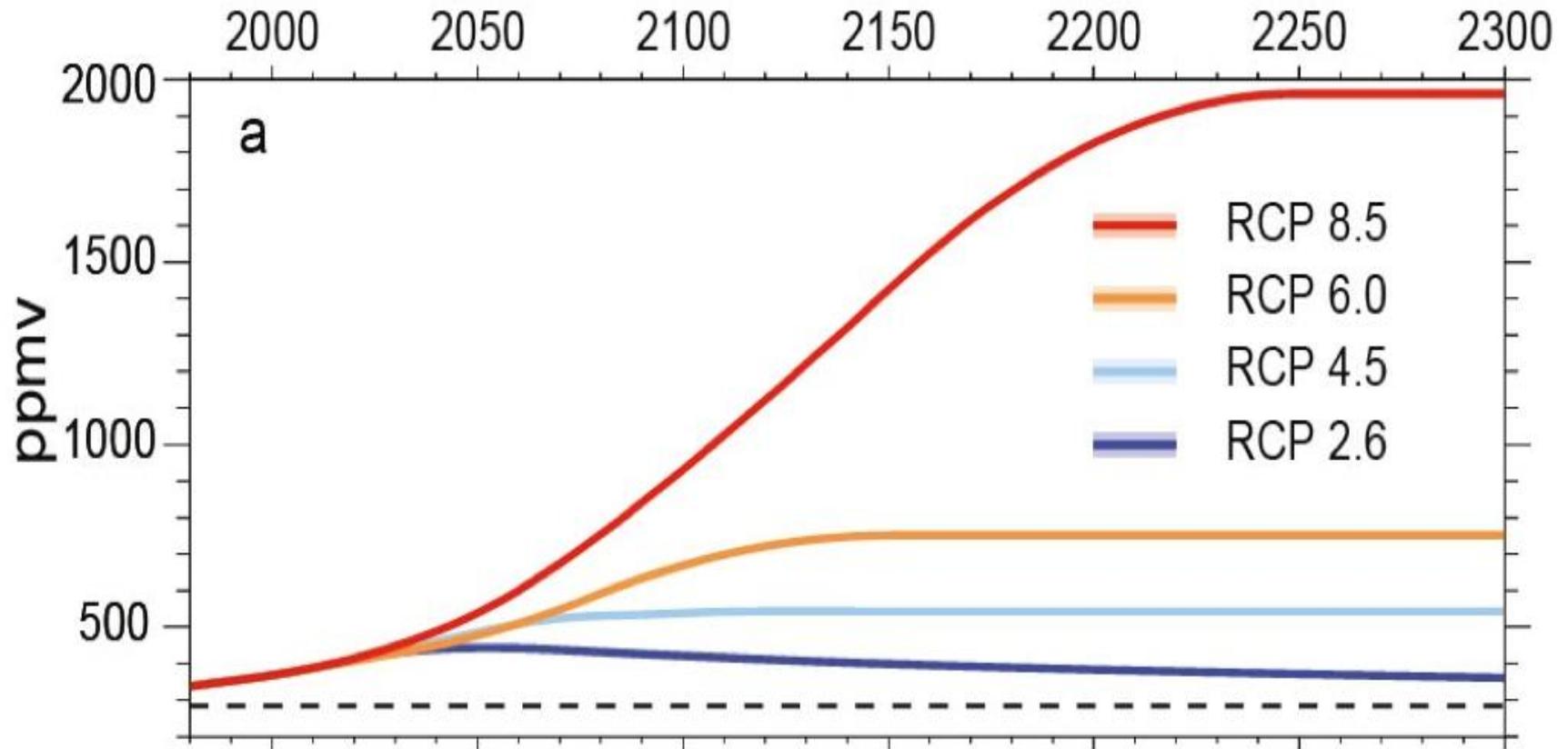
Impacts are already underway

- **Tropics to the poles**
- **On all continents and in the ocean**
- **Affecting rich and poor countries (but the poor are more vulnerable everywhere)**



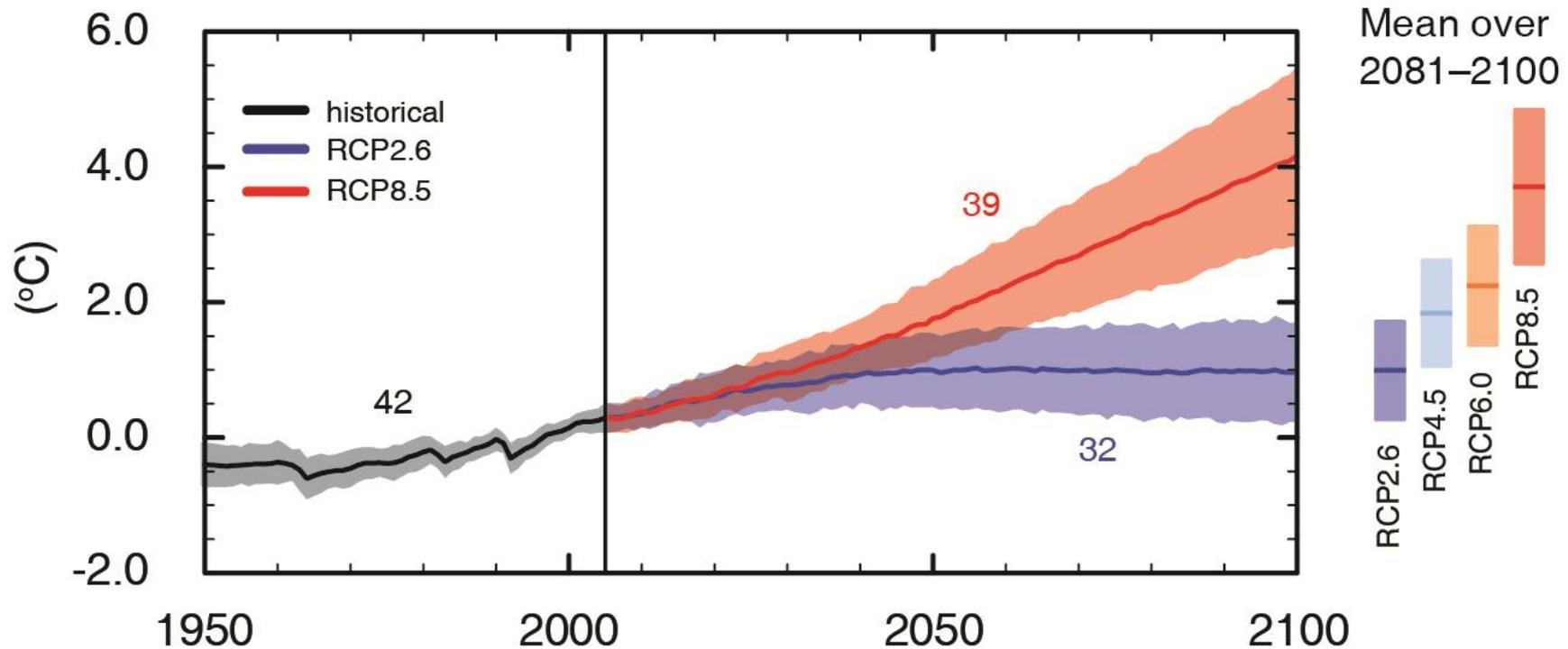
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RCP Scenarios: Atmospheric CO₂ concentration



Three stabilisation scenarios: RCP 2.6 to 6
One Business-as-usual scenario: RCP 8.5

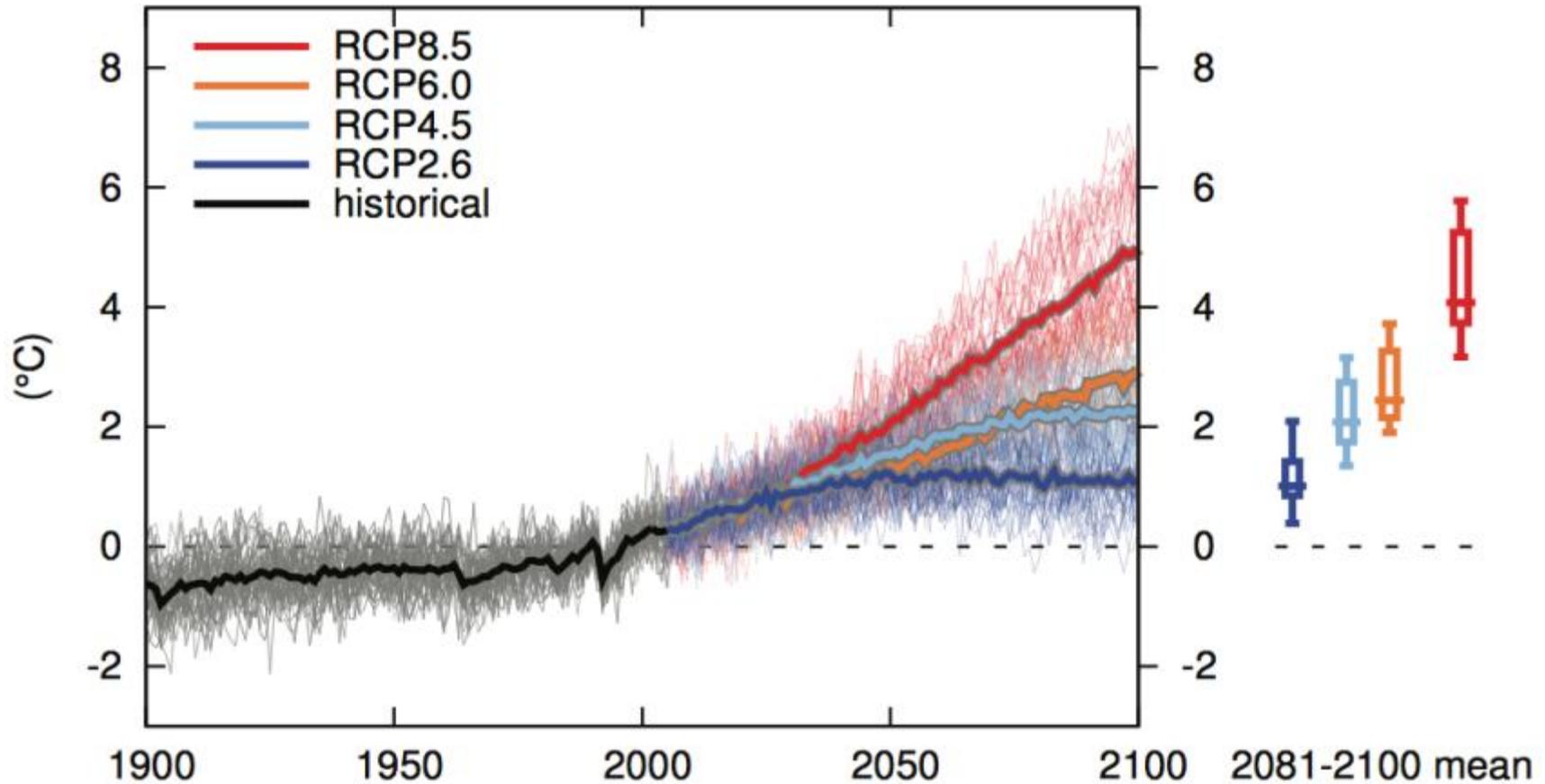
Global average surface temperature change



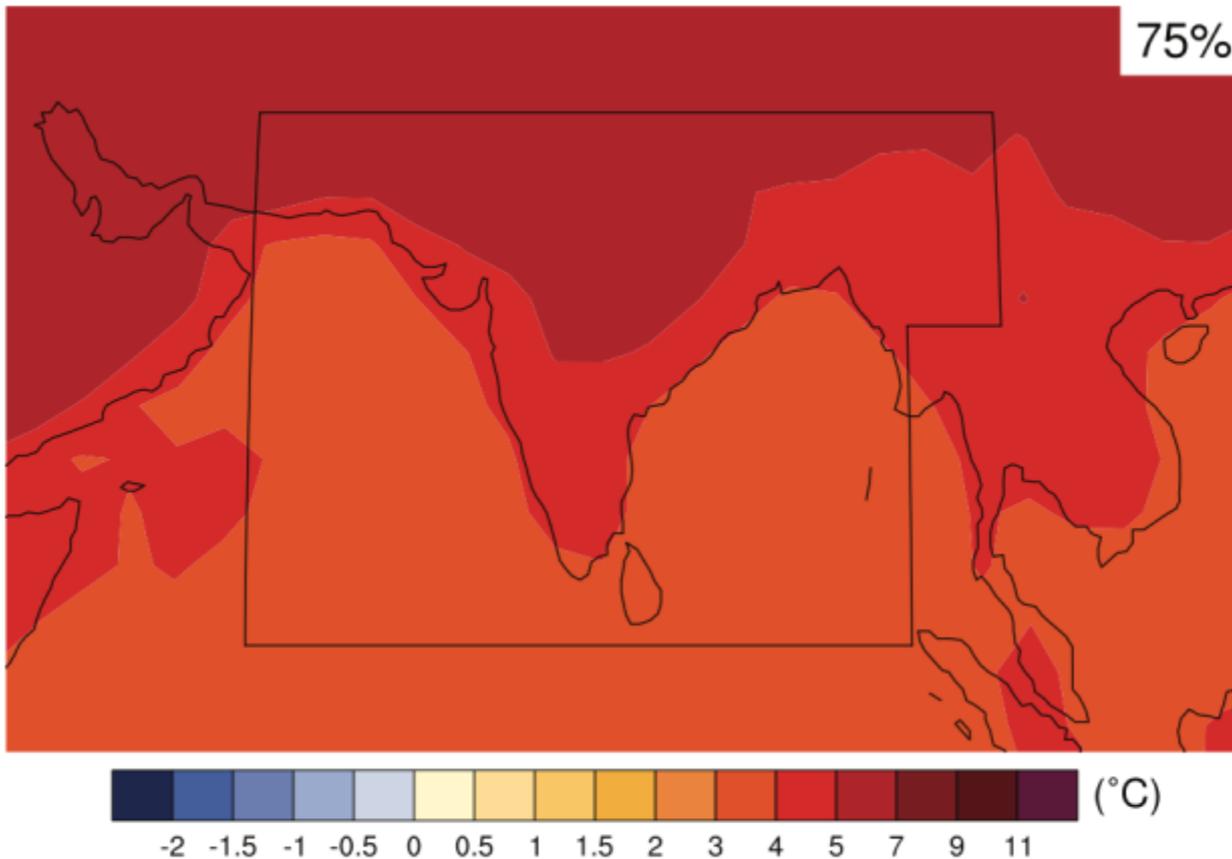
(IPCC 2013, Fig. SPM.7a)

Only the lowest (RCP2.6) scenario maintains the global surface temperature increase above the pre-industrial level to less than 2° C with at least 66% probability

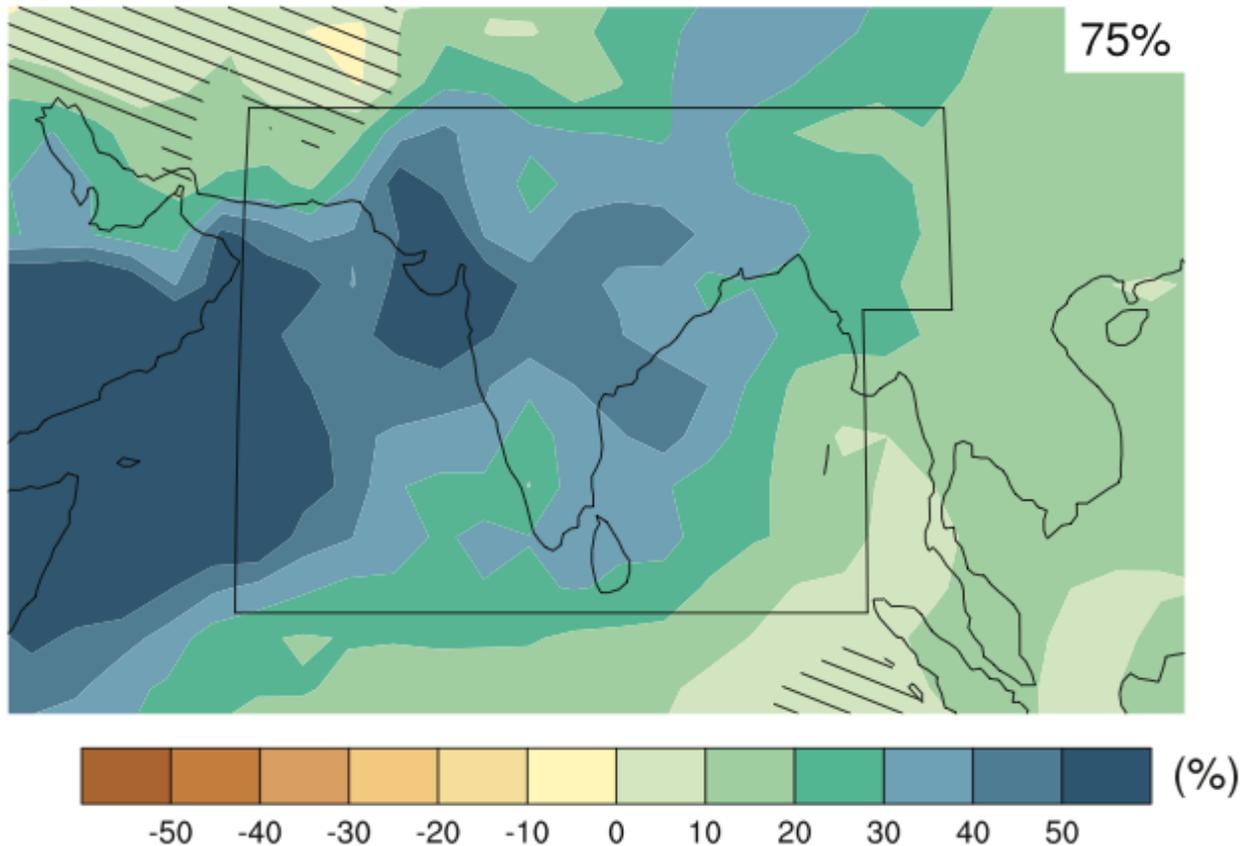
Temperature change South Asia annual



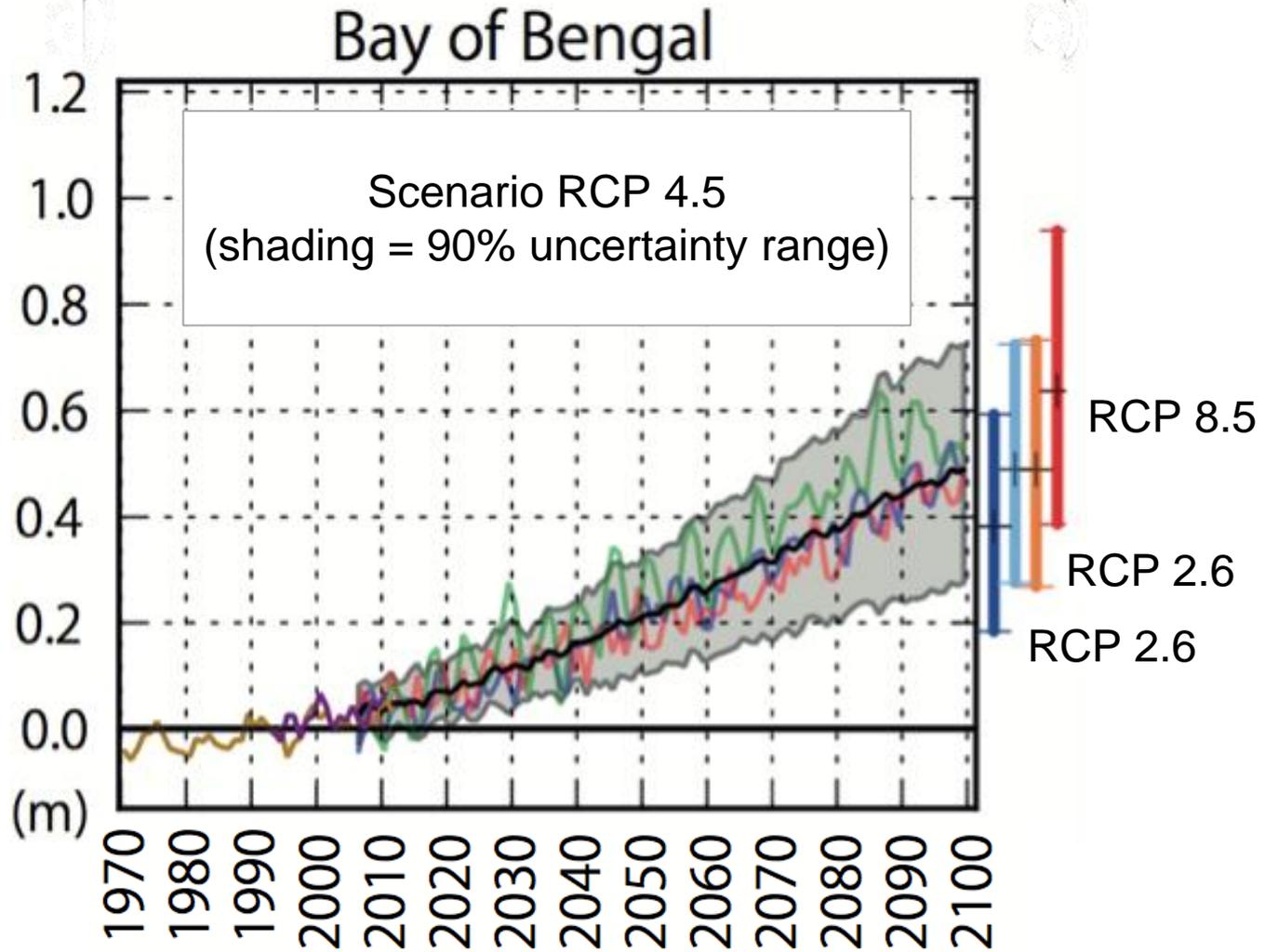
Maps of temperature changes in 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario



Maps of precipitation changes in 2081–2100, with respect to 1986–2005 in the RCP8.5 scenario



Regional sea-level rise



Specific climatic changes relevant to South Asia

- **Enhanced summer monsoon precipitation**
- **Increased rainfall extremes of landfall cyclones on the coasts of the Bay of Bengal and Arabian Sea**

both statements have *medium confidence* in IPCC AR5;

- **possible increase of climate variability (temperature and summer precipitation) related to El Niño oscillation (low confidence)**

Potential Impacts of Climate Change



Food and water shortages



Increased displacement of people



Increased poverty



Coastal flooding

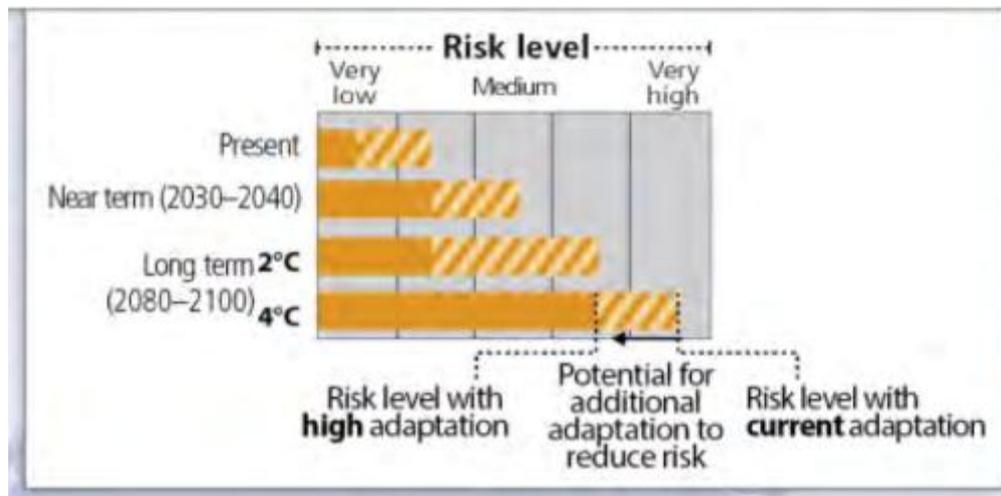
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ADAPTATION IS ALREADY OCCURRING

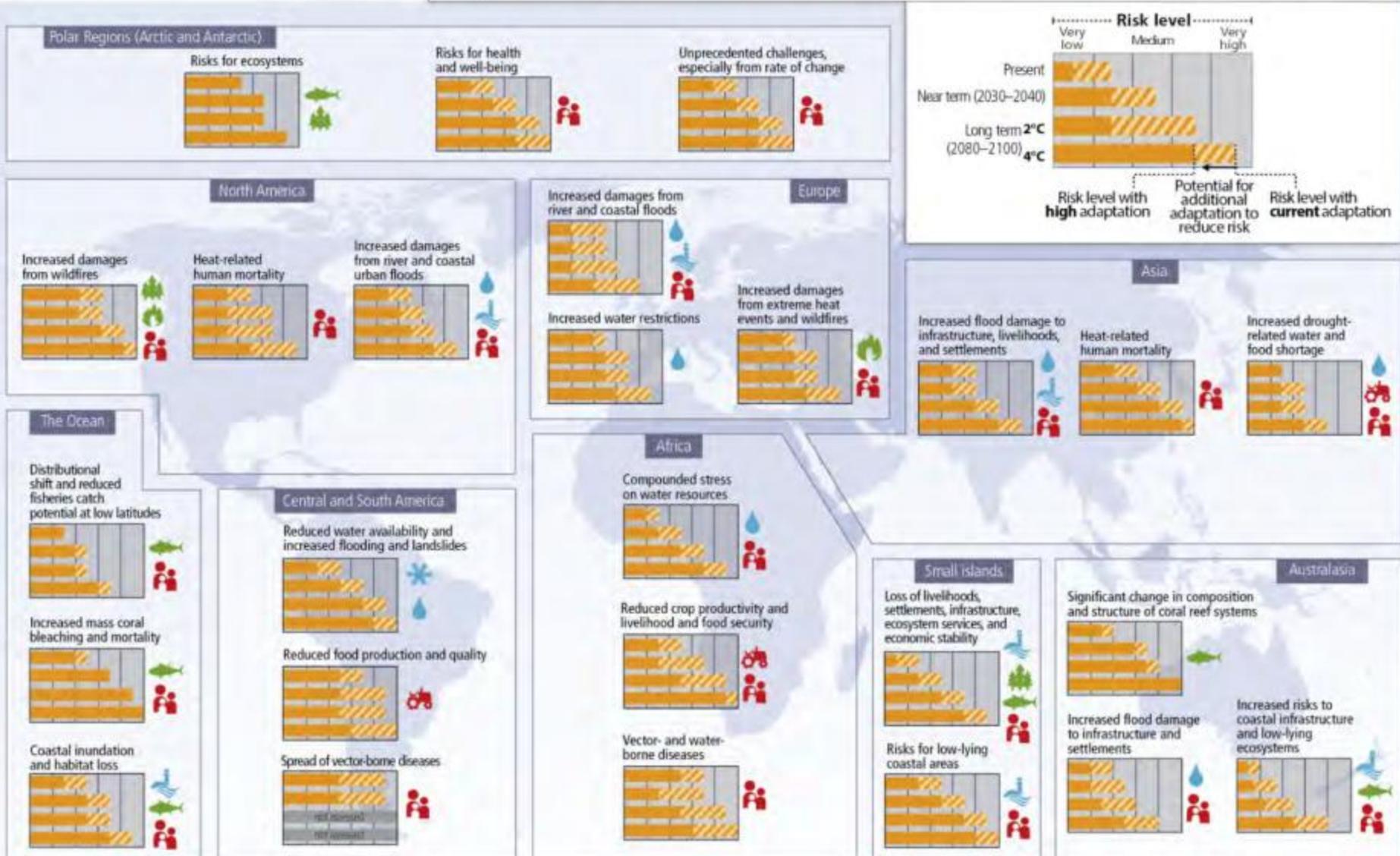
Regional key risks and potential for risk reduction through adaptation

Representative key risks for each region for



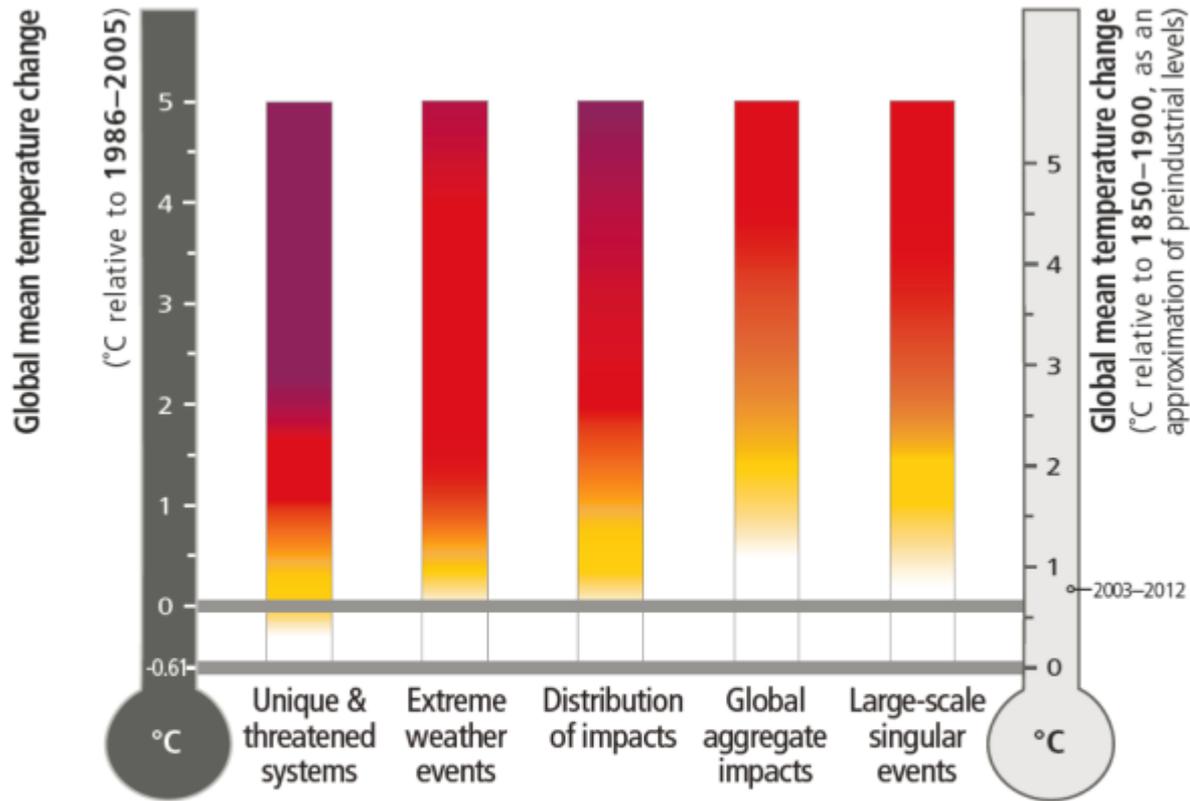
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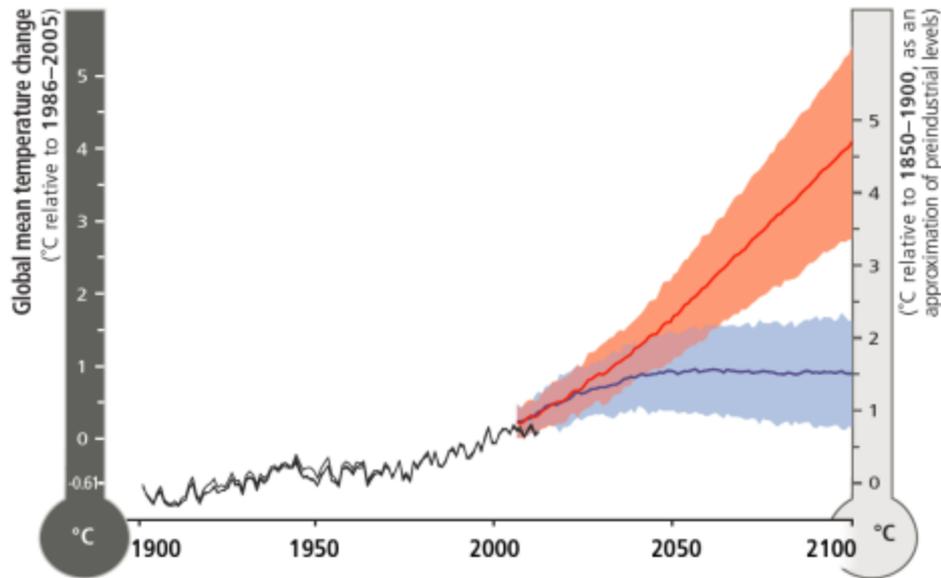
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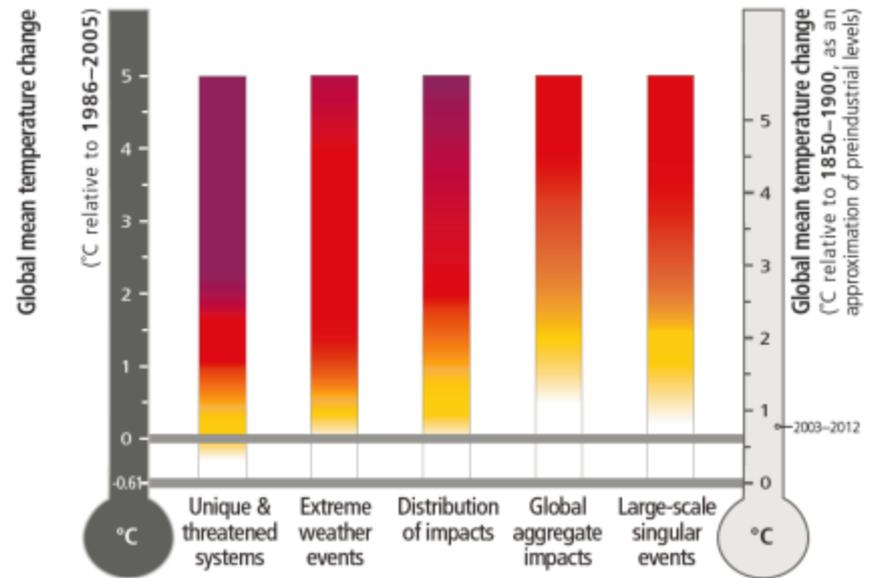


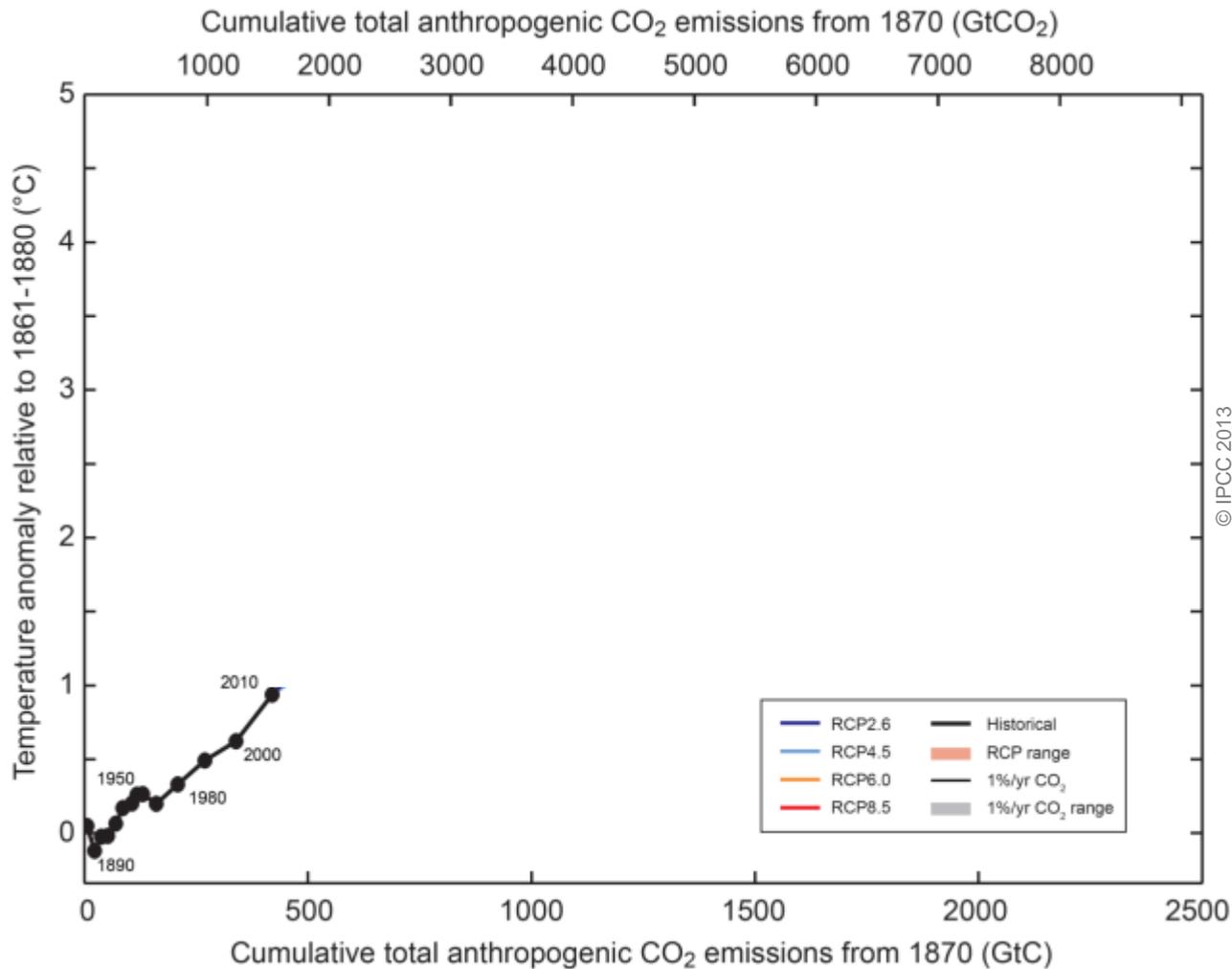
RISKS OF
CLIMATE CHANGE
INCREASE
WITH CONTINUED
HIGH EMISSIONS





- Observed
- RCP8.5 (a high-emission scenario)
- Overlap
- RCP2.6 (a low-emission mitigation scenario)

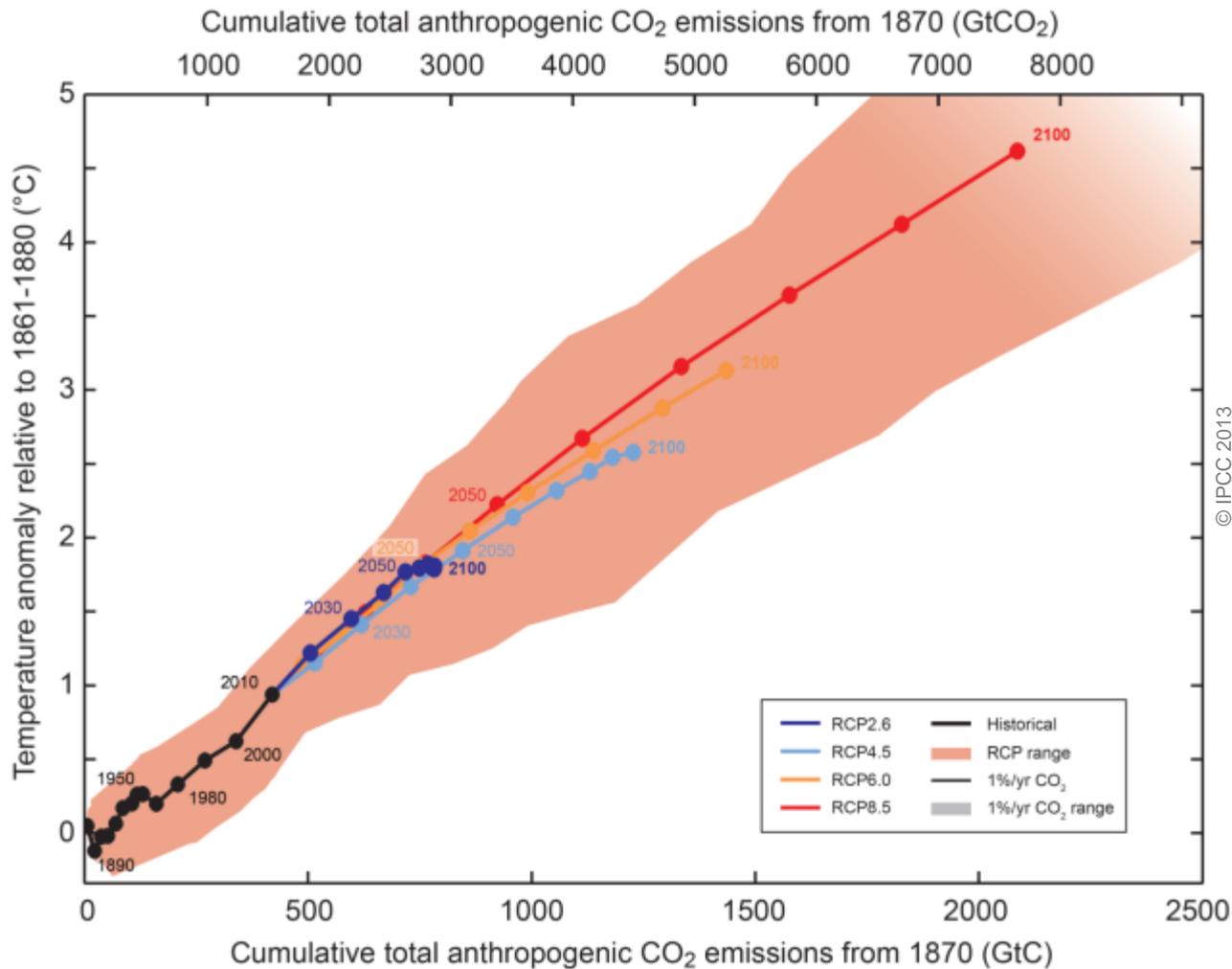




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Fig. SPM.10

Cumulative emissions of CO₂ largely determine global mean surface warming by the late 21st century and beyond.



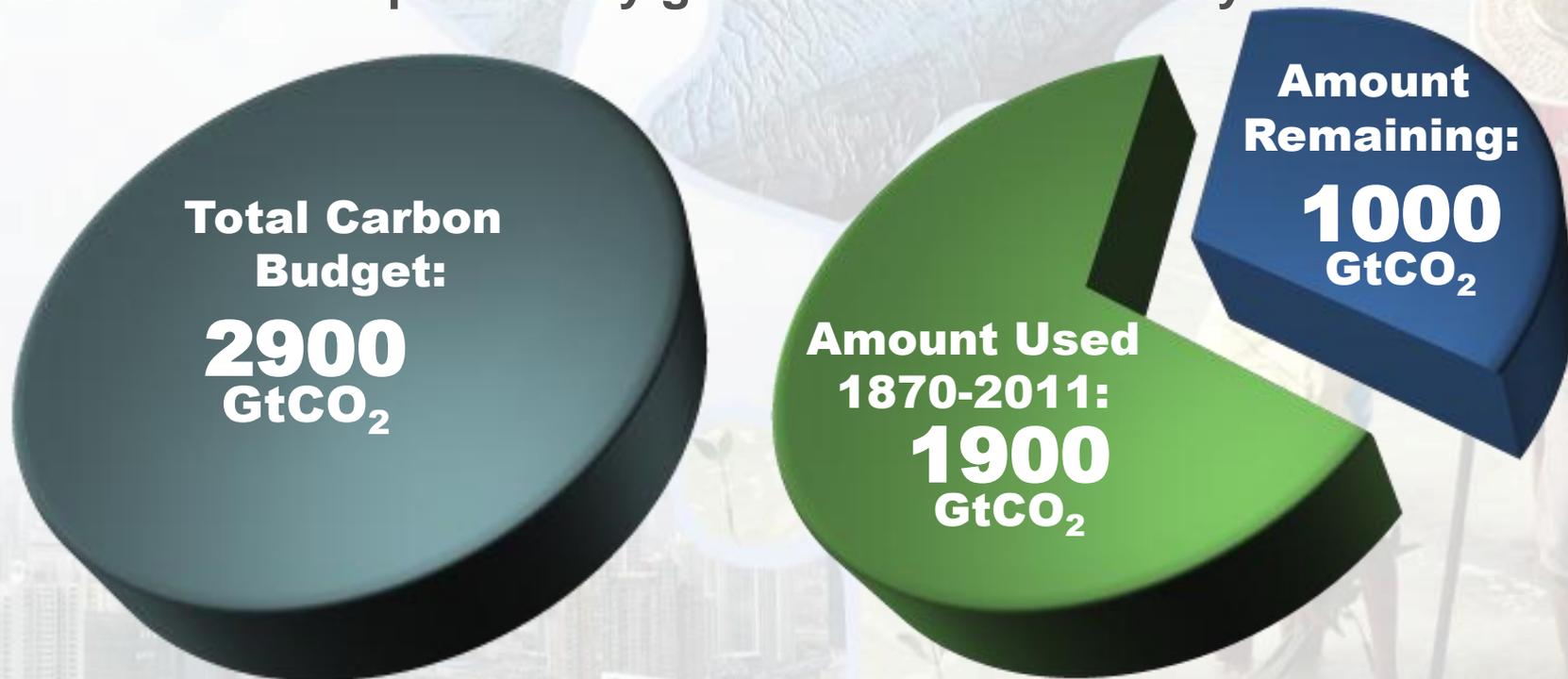
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Fig. SPM.10

Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.

The window for action is rapidly closing

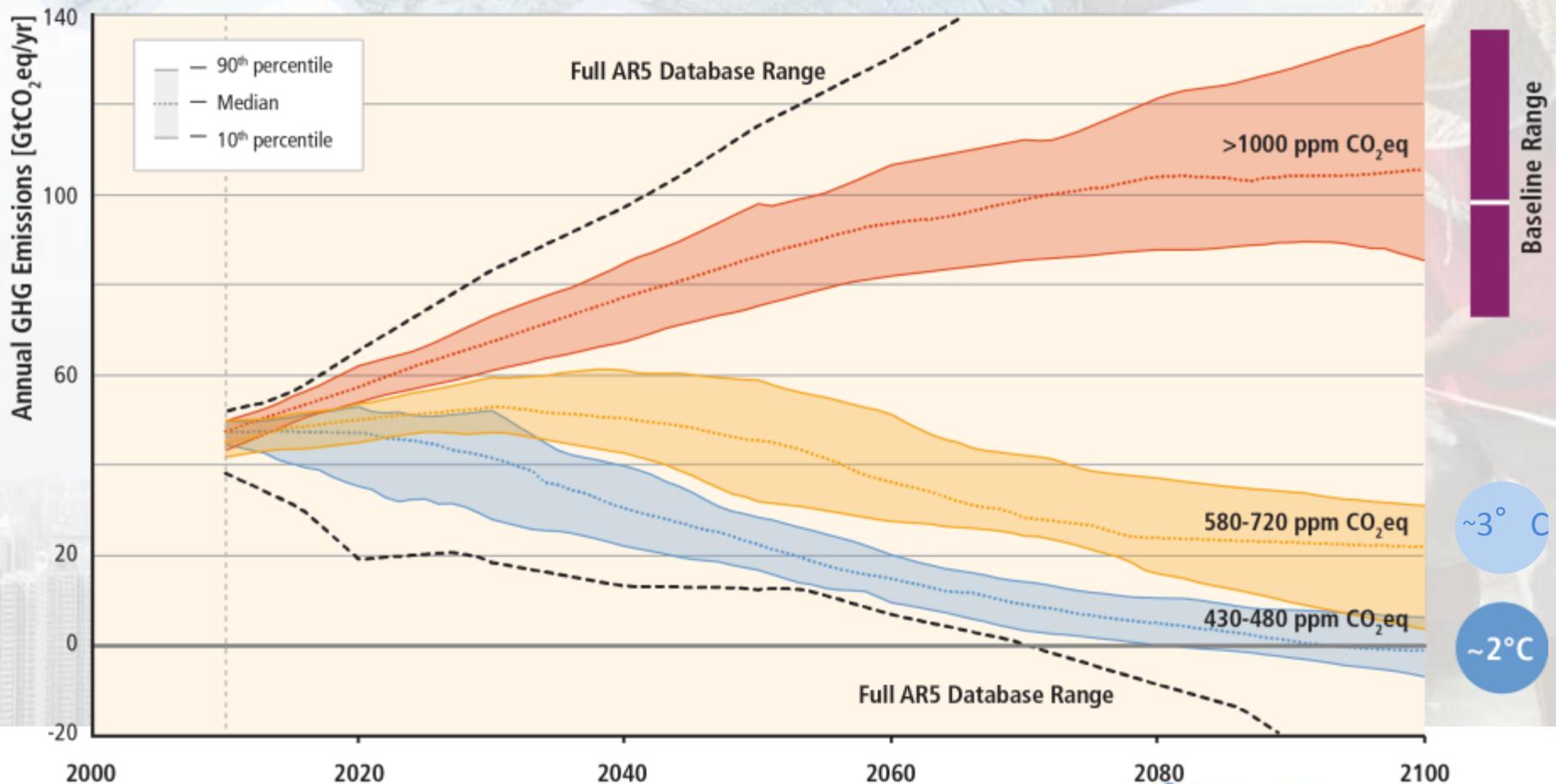
65% of the carbon budget compatible with a 2° C goal is already used
NB: this is with a probability greater than 66% to stay below 2° C



NB: Emissions in 2011: 38 GtCO₂/yr

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Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.



Based on Figure 6.7

Limiting Temperature Increase to 2°C



Measures exist to achieve the substantial emissions reductions required to limit likely warming to 2° C



A combination of adaptation and substantial, sustained reductions in greenhouse gas emissions can limit climate change risks



Implementing reductions in greenhouse gas emissions poses substantial technological, economic, social, and institutional challenges



But delaying mitigation will substantially increase the challenges associated with limiting warming to 2° C

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Mitigation Measures



More efficient use of energy



Greater use of low-carbon and no-carbon energy

- Many of these technologies exist today



Improved carbon sinks

- Reduced deforestation and improved forest management and planting of new forests
- Bio-energy with carbon capture and storage



Lifestyle and behavioural changes

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- **Many scenario studies confirm that it is technically and economically feasible to keep the warming below 2°C, with more than 66% probability (“likely chance”).** This would imply limiting atmospheric concentrations to 450 ppm CO₂-eq by 2100.
- **Such scenarios for an above 66% chance of staying below 2°C imply reducing by 40 to 70% global GHG emissions compared to 2010 by mid-century, and reach zero or negative emissions by 2100.**

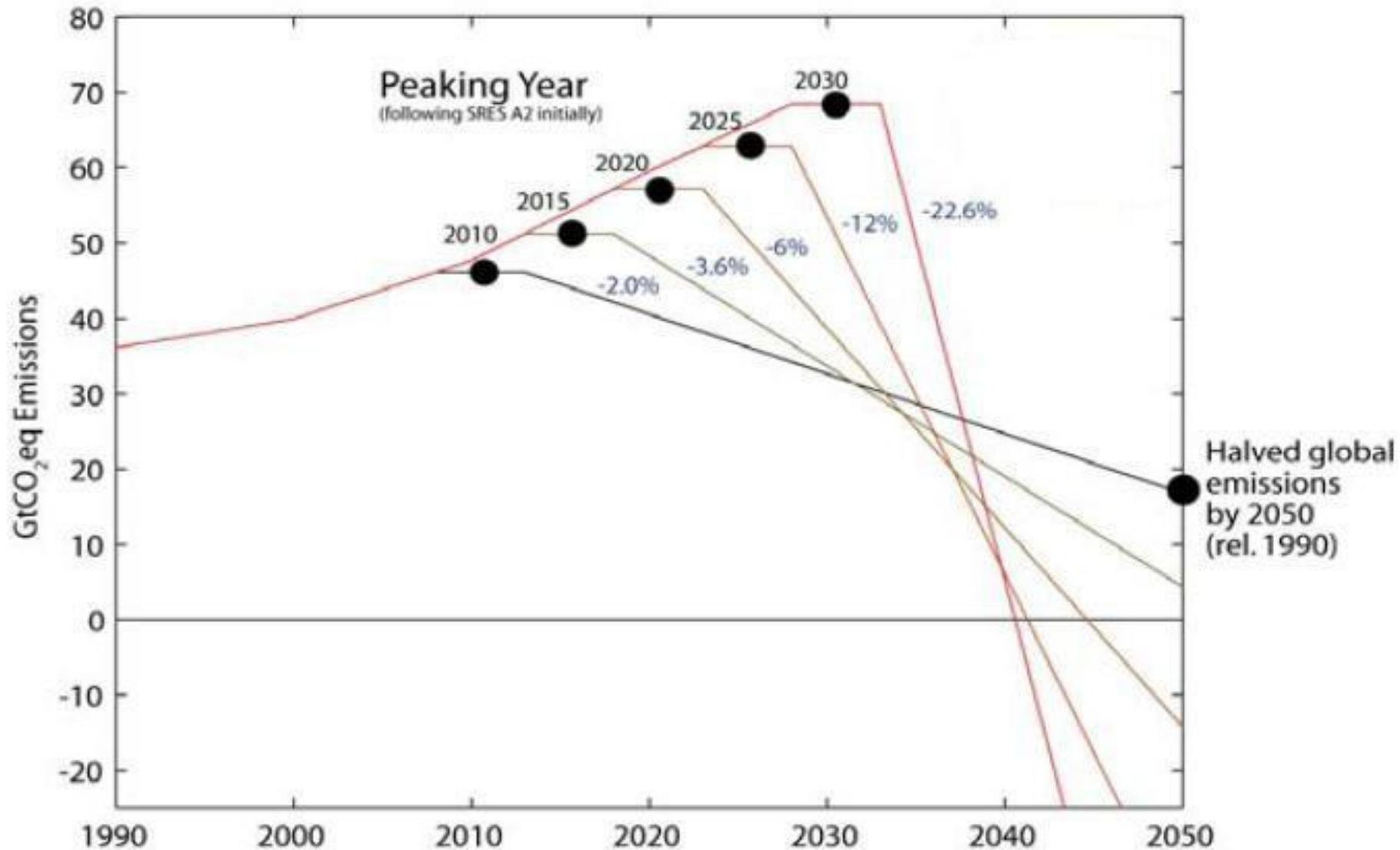
- **These scenarios are characterized by rapid improvements of energy efficiency and a near quadrupling of the share of low-carbon energy supply (renewables, nuclear, fossil and bioenergy with CCS), so that it reaches 60% by 2050.**
- **Keeping global temperature increase below 1.5°C would require even lower atmospheric concentrations (<430 ppm CO₂eq) to have a little more than 50% chance.** There are not many scenario studies available that can deliver such results, **requiring even faster reductions** in the medium term, **indicating how difficult this is.**

Ambitious Mitigation Is Affordable

- **Economic growth reduced by ~ 0.06% (BAU growth 1.6 - 3%)**
- **This translates into delayed and not forgone growth**
- **Estimated cost does not account for the benefits of reduced climate change**
- **Unmitigated climate change would create increasing risks to economic growth and efforts to eradicate poverty**

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The more we wait, the more difficult it will be



Source: Meinshausen et al. - Nature, 30th April 2009

- **Sustainable development and equity provide a basis for assessing climate policies and highlight the need for addressing the risks of climate change**
- **Issues of equity, justice, and fairness arise with respect to mitigation and adaptation**

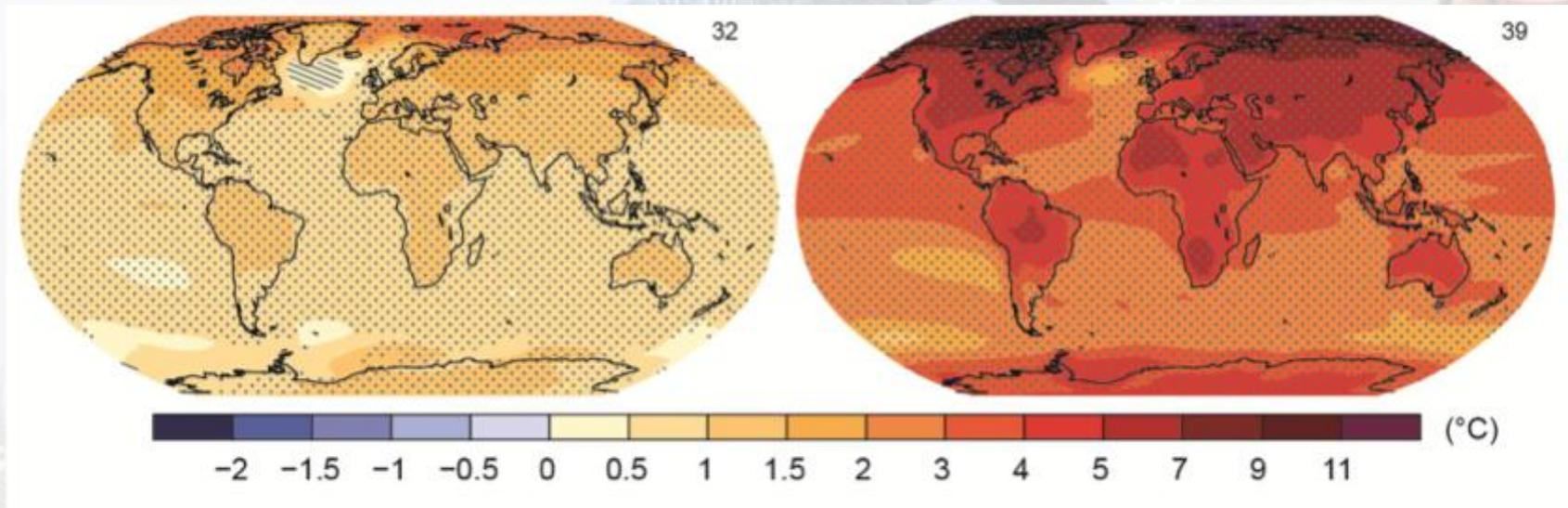
Equity is an integral dimension of Sustainable development (*high confidence*)

- Intergenerational equity underlies the concept of sustainability;
- Intra-generational equity is also often considered an intrinsic component of SD.
- In the particular context of international climate policy discussions, several arguments support giving equity an important role:
 - a moral justification that draws upon ethical principles;
 - a legal justification that appeals to existing treaty commitments ...;
 - and an effectiveness justification that argues that a fair arrangement is more likely to be agreed internationally ...

The Choices We Make Will Create Different Outcomes (and increase prospects for effective adaptation)

**With substantial
mitigation**

**Without
additional
mitigation**



Change in average surface temperature (1986–2005 to 2081–2100)

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Useful links:



- z www.ipcc.ch : IPCC (reports and videos)
- z www.climate.be/vanyp : my slides and other documents
- z www.skepticalscience.com: excellent responses to contrarians arguments
- z **On Twitter: @JPvanYpersele
and @IPCC_CH**