The Challenges and Opportunities Of Climate Change

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

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Why the IPCC ?

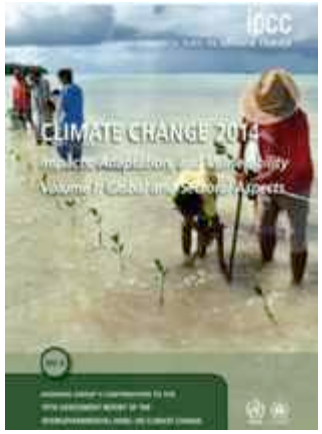
Established by WMO and UNEP in 1988

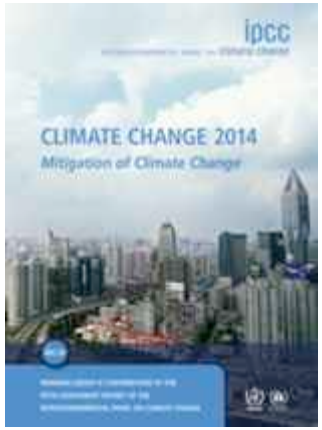
to provide **policy-makers** with an **objective source of information** about

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

WMO=World Meteorological Organizatior

UNEP= United Nations Environment Programme





What is happening in the climate system?

What are the risks?

What can be done?

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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

Plateau Glacier (1961)
(Alaska)

http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

Plateau Glacier (2003) (Alaska)

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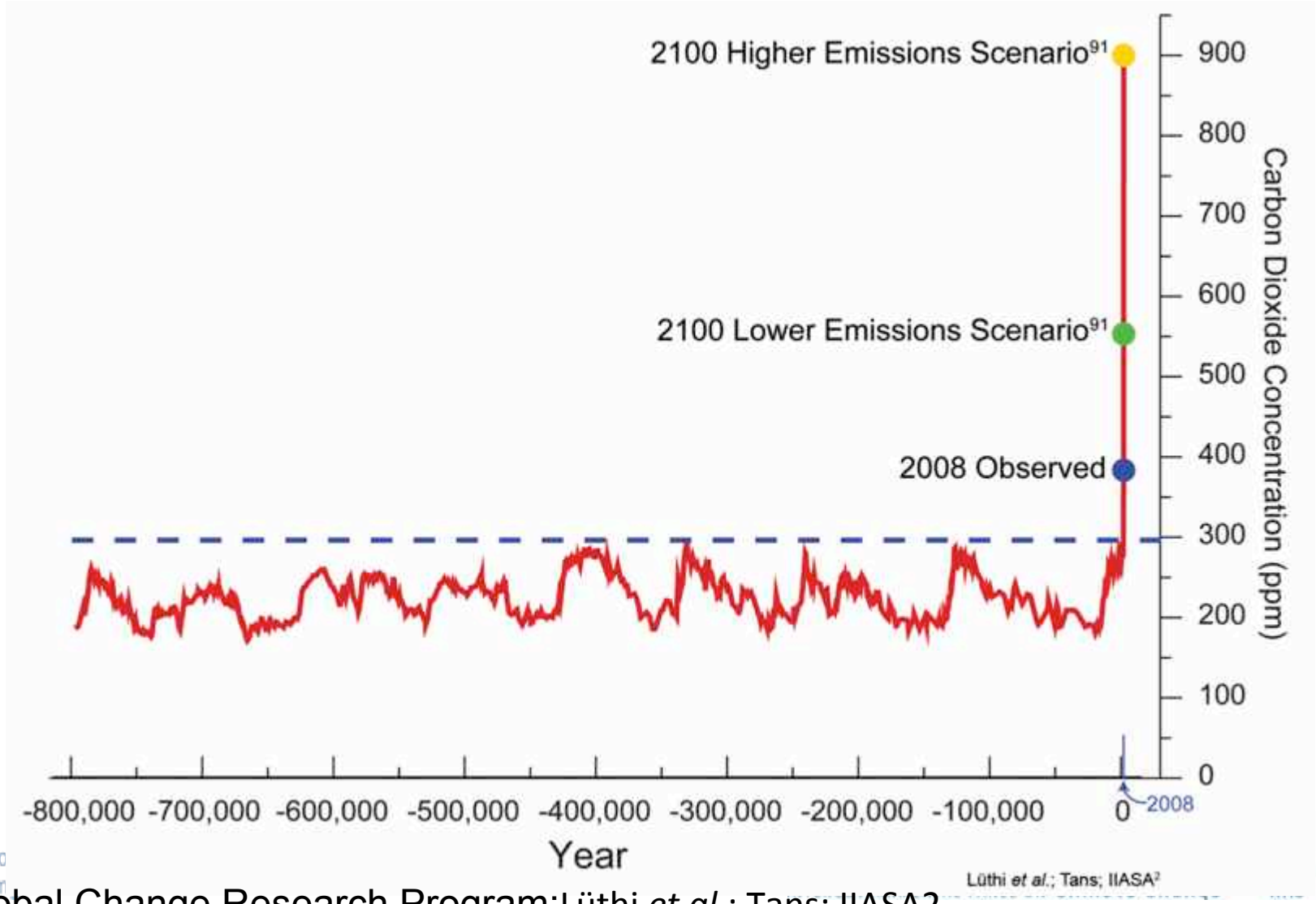
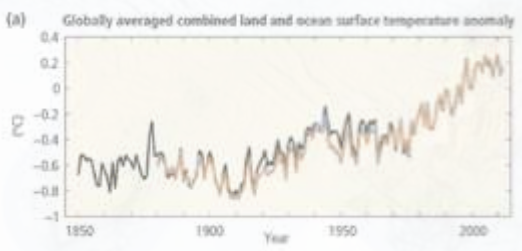
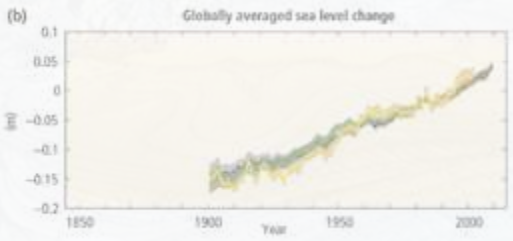
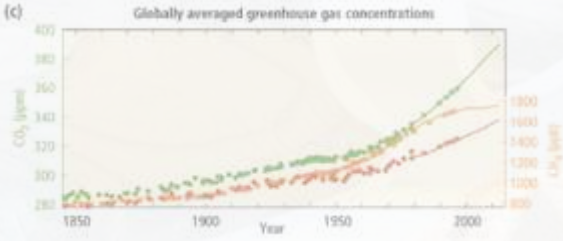
Atmospheric CO_2 over the last 800000 years

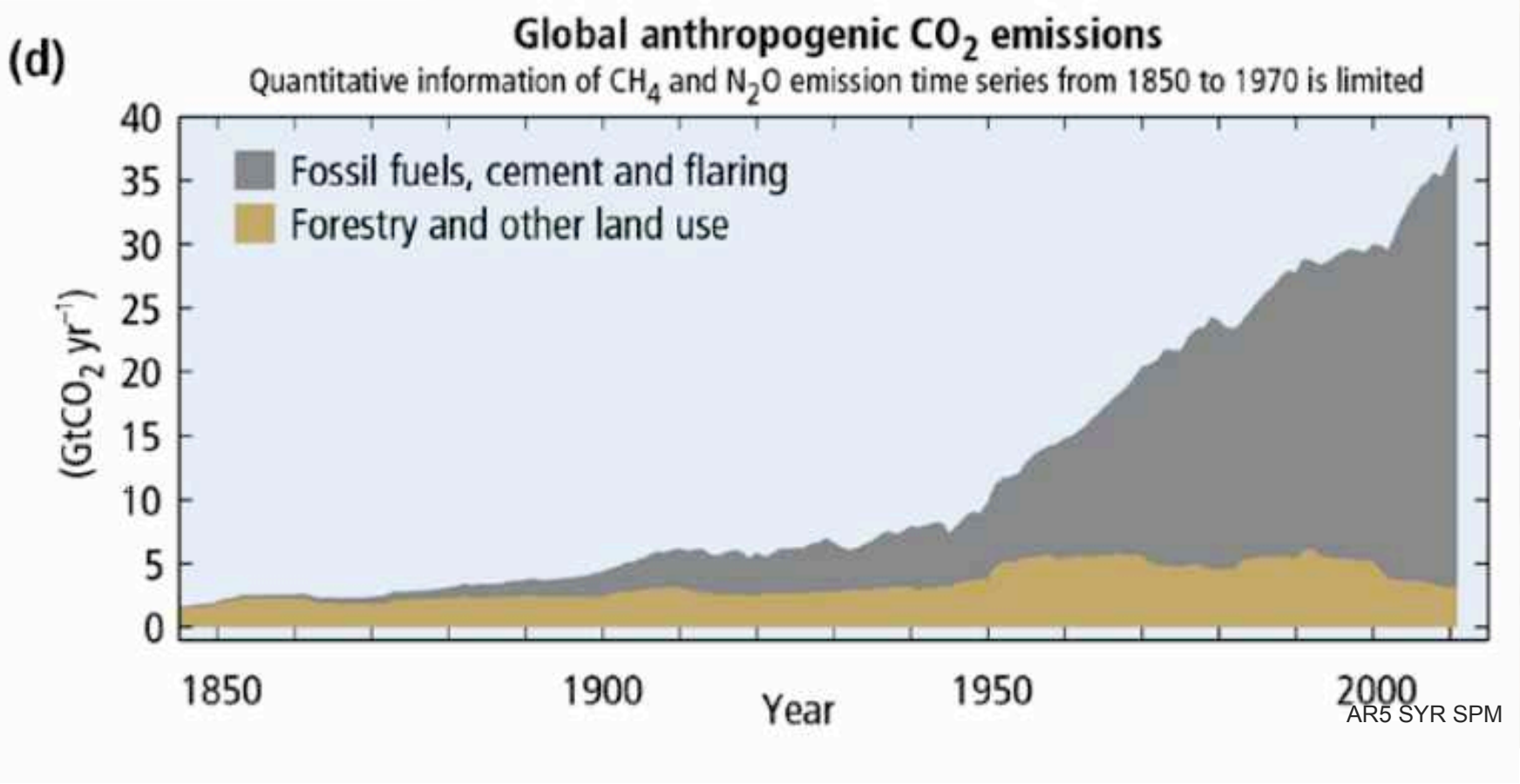


U.S. Global Change Research Program:Lüthi *et al.*; Tans; IIASA2


(a)
Globally averaged combined land and ocean surface temperature anomaly
Year


(b)
Globally averaged sea level change
Year


(c)
Globally averaged greenhouse gas concentrations
Year


(d)
Global anthropogenic CO_2 emissions
Quantitative information of CH_4 and N_2O emission time series from 1850 to 1970 is limited
Fossil fuels, cement and flaring
Forestry and other land use
$(GtCO_2\ yr^{-1})$
40
35
30
25
20
15
10
5
0
1850
1900
1950
2000
Year

AR5 SYR SPM

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

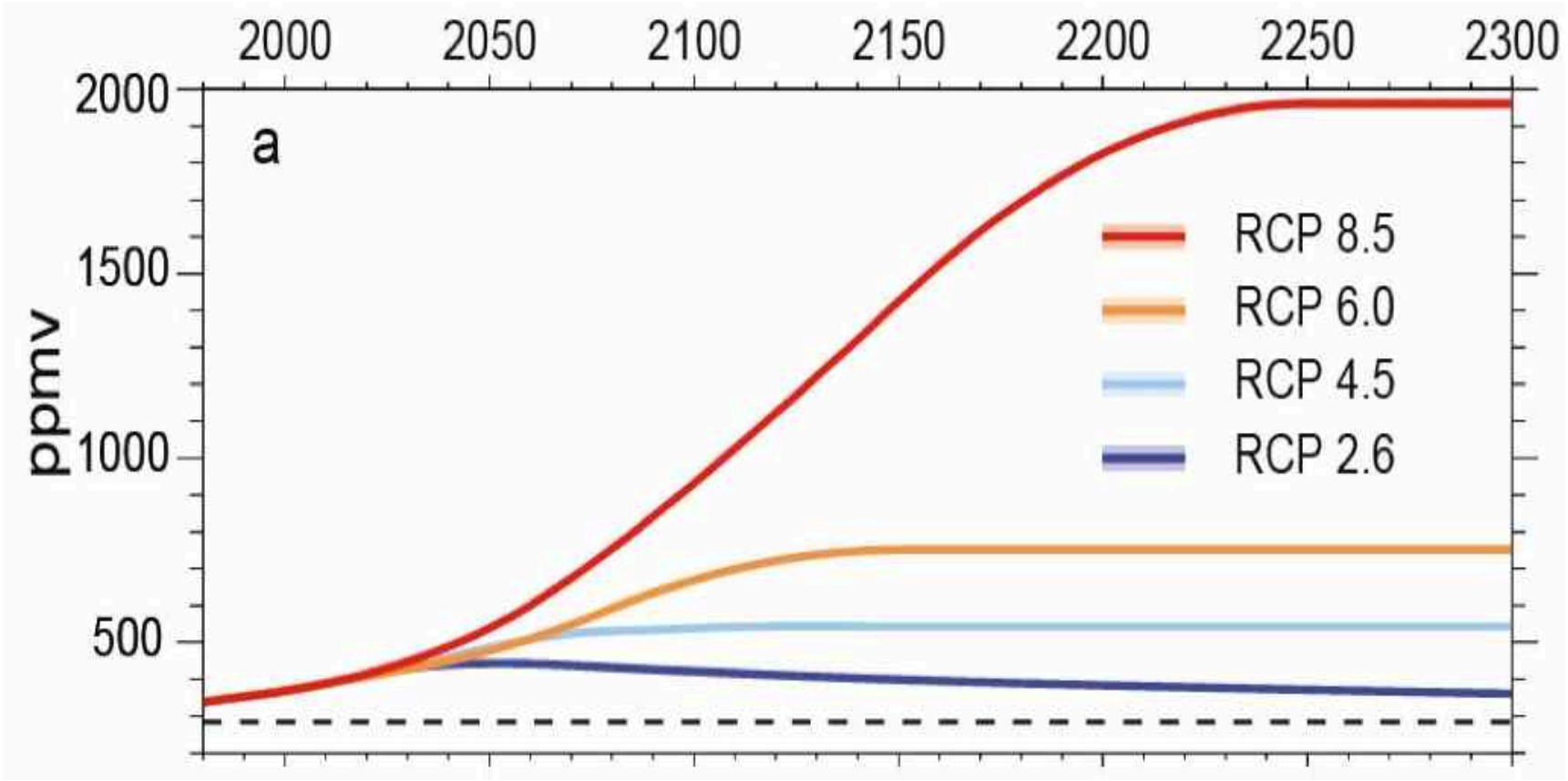
Impacts are already underway

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



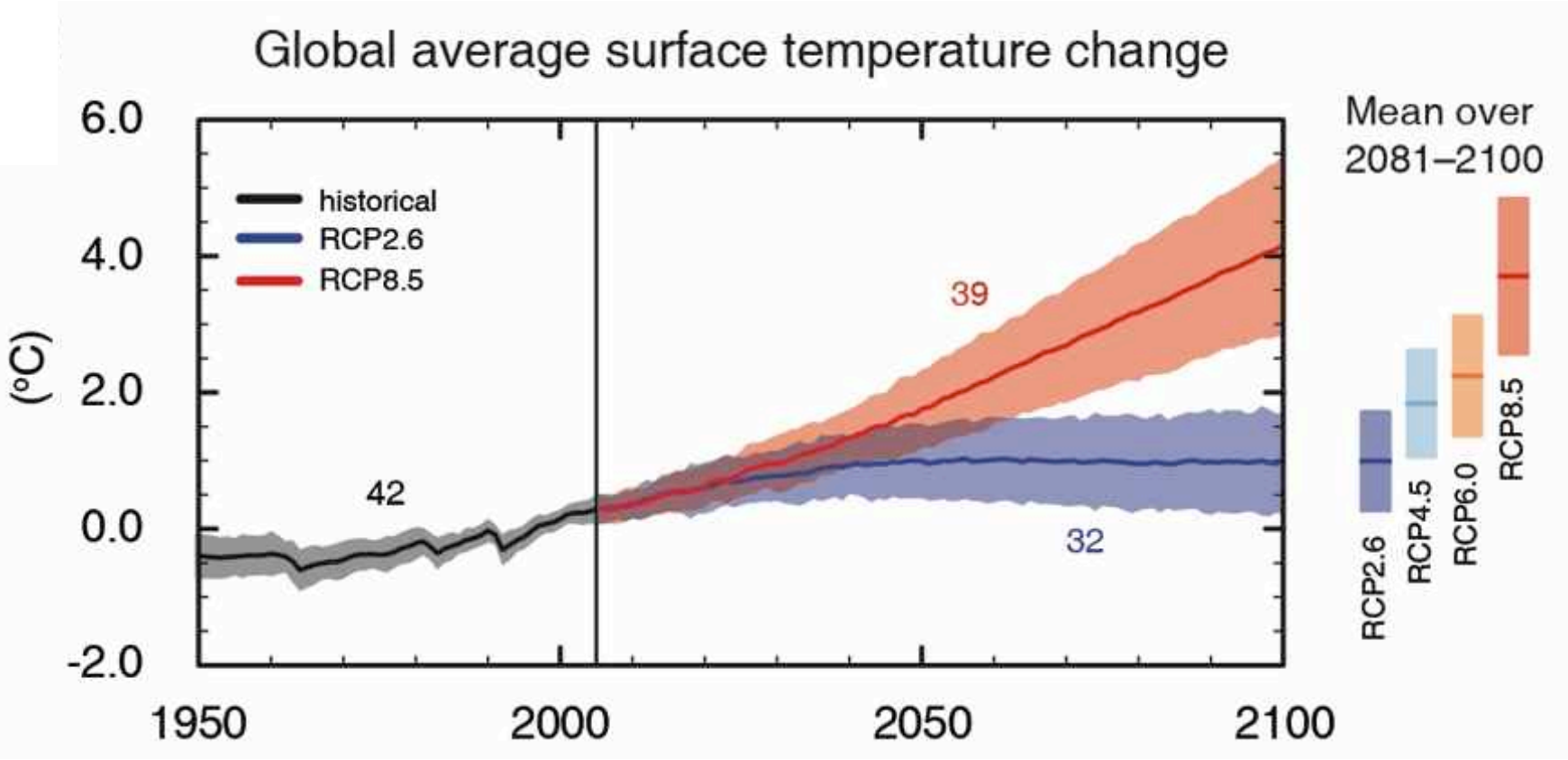

AR5 WGII SPM

RCP Scenarios: Atmospheric CO_2 concentration



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

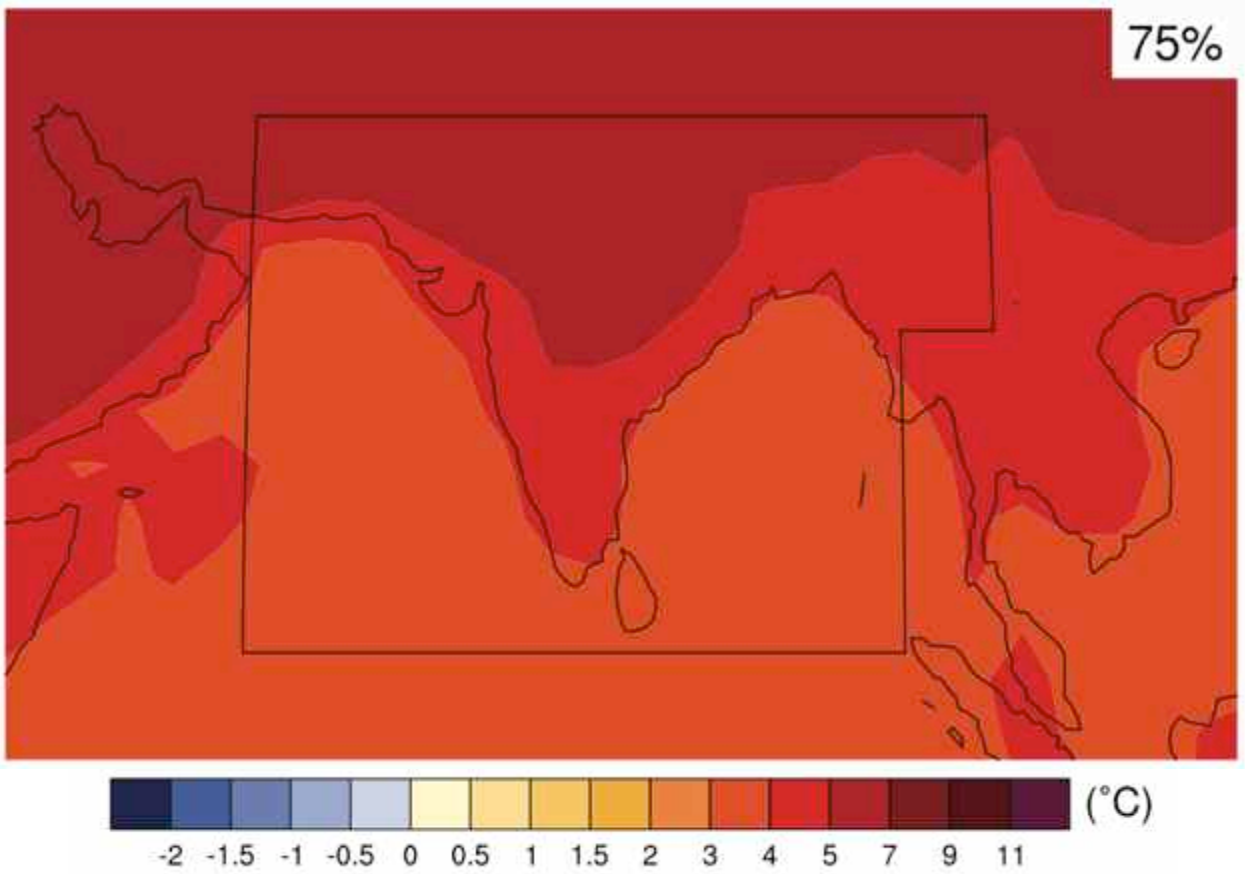
AR5, chapter 12. WGI- Adopted version / subject to final copyedit



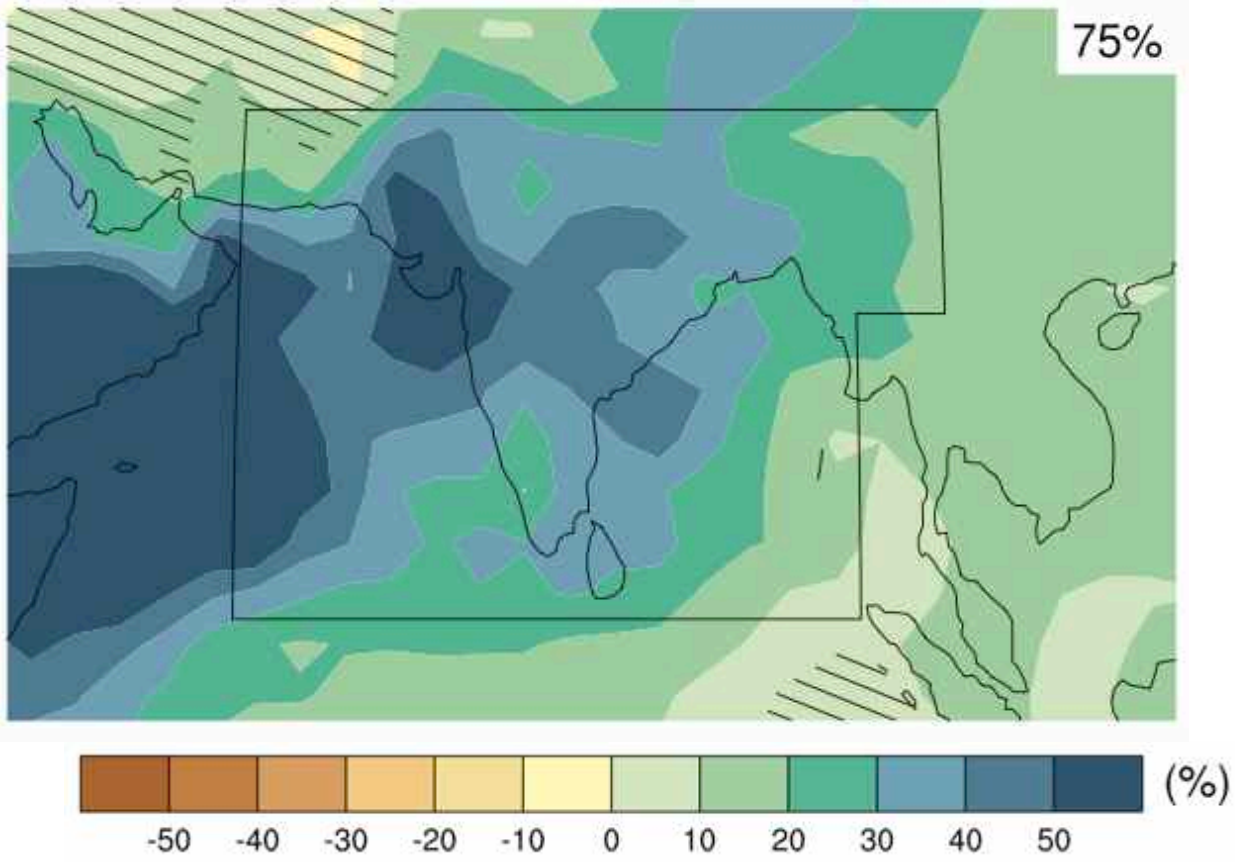
(IPCC 2013, Fig. SPM.7a)

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

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



Future Regional Climate Change

Changes in the **summer monsoon dominate annual rainfall**. The **CMIP3** multi-model ensemble shows an **increase in summer precipitation** *(Kumar et al., 2011a; May, 2011; Sabade et al., 2011)*, although there are **wide variations among model projections** *(Annam- alai et al., 2007; Kripalani et al., 2007b)*.

Spatially, the **rainfall increase** is stronger over northern parts of South Asia, Bangladesh and Sri Lanka, **with a weak decrease over Pakistan** *(Turner and Annamalai, 2012)*.

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IPCC, AR5, WG I, Chap. 24, p. 1289

Future Regional Climate Change

In **RCP6.0 and RCP8.5 scenarios**, frequency of **extreme precipitation days** shows consistent **increasing trends in 2060 and beyond** *(Chaturvedi et al., 2012; Figure AI.63)*.

In six **CMIP3 models**, **precipitation anomalies** during **Indian summer monsoon** breaks strengthen in a **warmer climate**, but changes in the timing and duration of active/break spells are variable among models *(Mandke et al., 2007)*.

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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 Nino oscillation (low confidence)**

Source: IPCC AR5, WGI Table TS.2 and table 14.3

Potential Impacts of Climate Change

Food and water shortages

Increased displacement of people

Increased poverty

Coastal flooding

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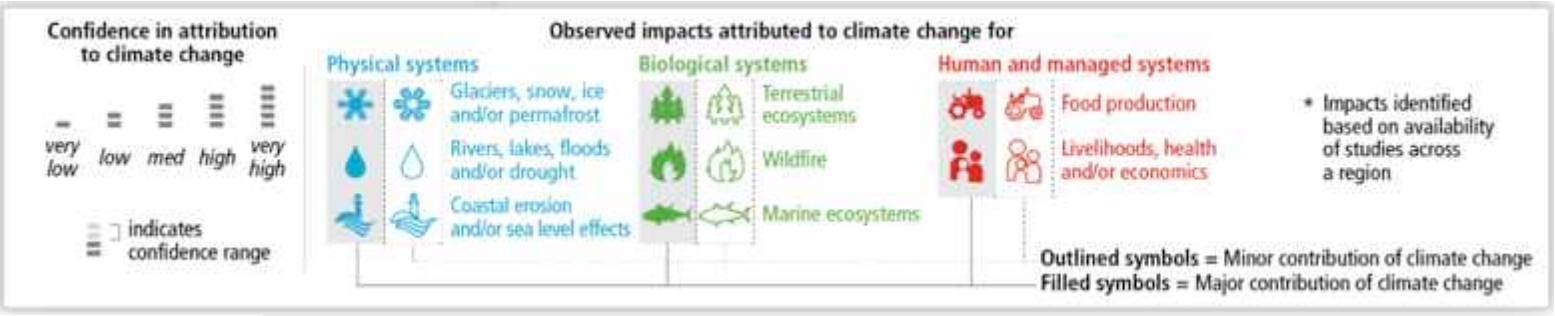
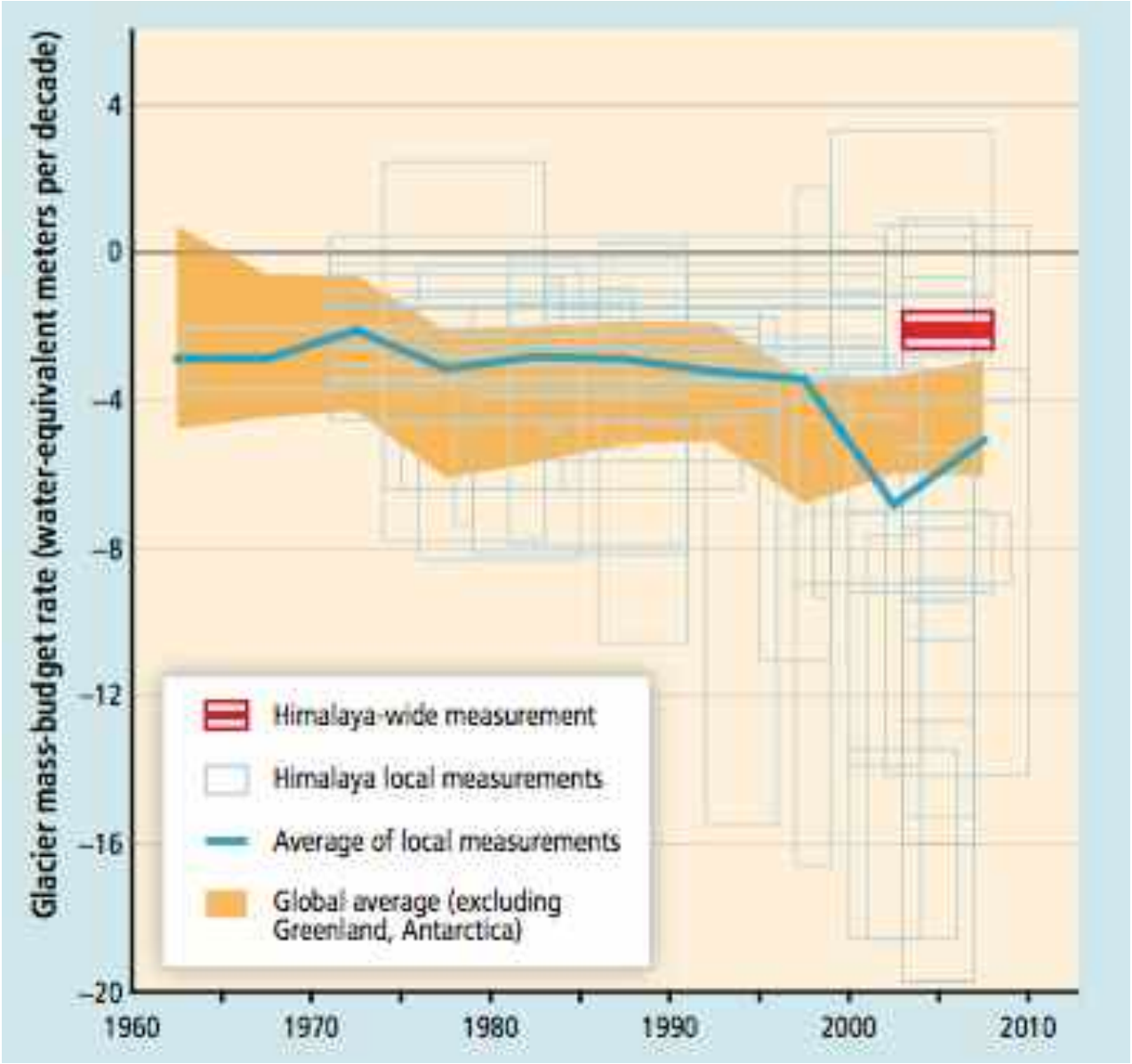
Widespread impacts attributed to climate change based on the available scientific literature since literature since the AR4: Asia (IPCC, AR5, SYR, SPM 4)



Himalayan Glaciers



IPCC, AR5, WG II, Chap. 3, p. 242

Himalayan Glaciers

The total **freshwater resource** in the **Himalayan glaciers** of Bhutan, China, India, Nepal, and **Pakistan** is known only roughly; estimates range from 2100 to 5800 Gt *(Bolch et al., 2012)*. Their mass budgets have been negative on average for the past 5 decades. The **loss rate** may have become **greater after about 1995**, but it has not been greater in the Himalaya than elsewhere. A recent large-scale measurement, highlighted in the Figure, is the first well-resolved, region-wide measurement of any component of the Himalayan water balance. It suggests strongly that the conventional measurements, mostly on small, accessible glaciers, are not regionally representative.

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ADAPTATION IS
ALREADY OCCURRING
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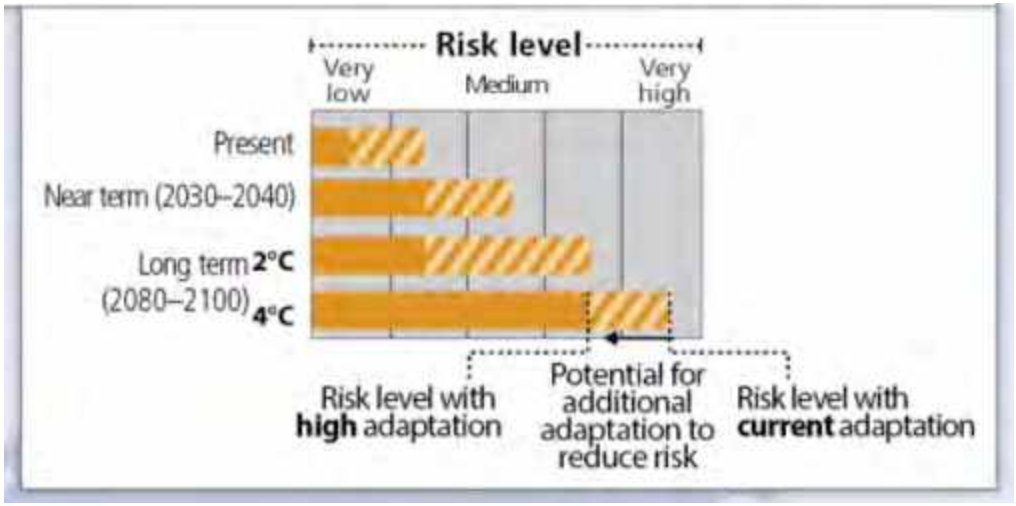
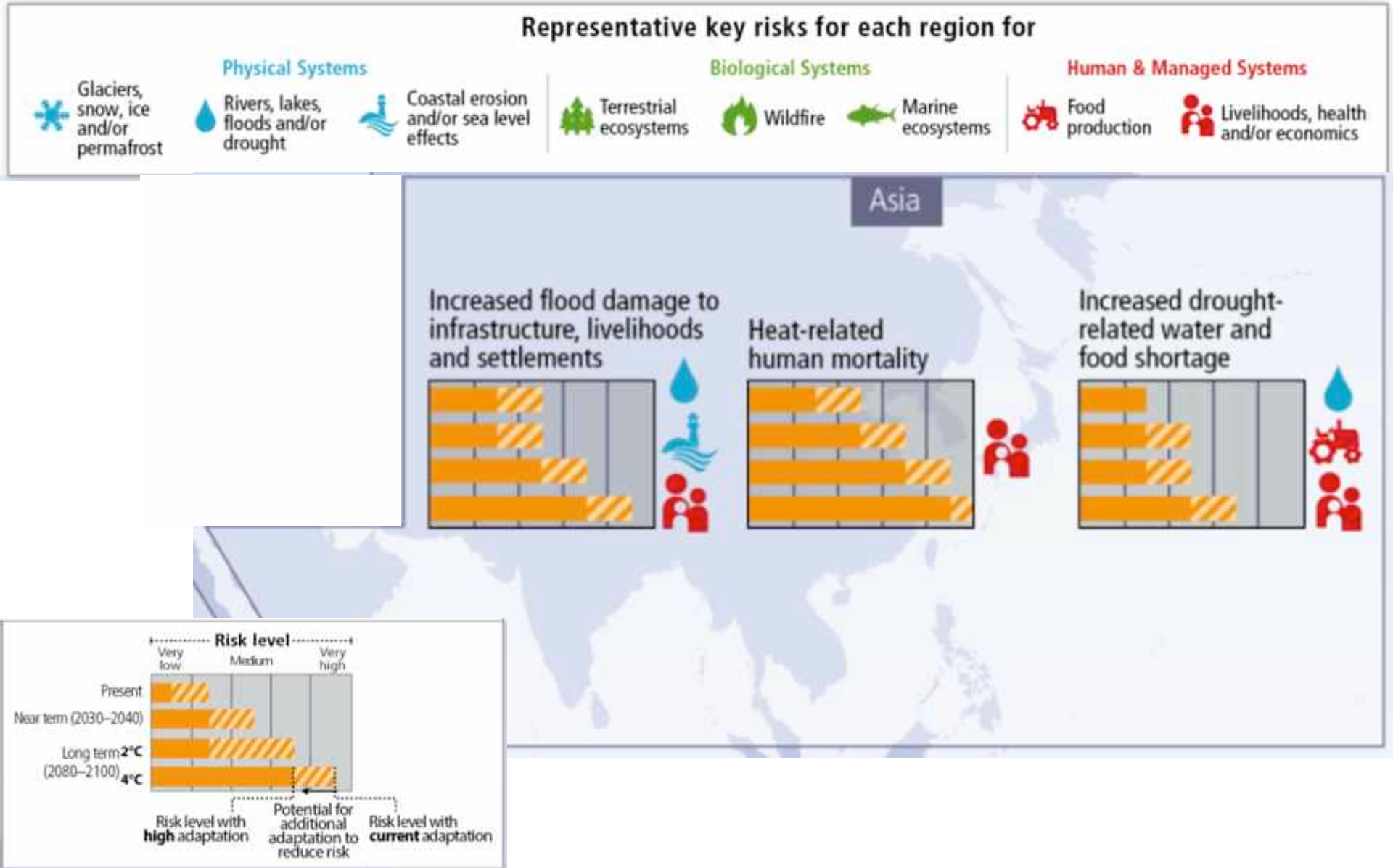
Regional key risks and potential for risk reduction through adaptation



IPCC, AR5, SPM, Figure SPM.8

Regional key risks and potential for risk reduction: Asia (IPCC, AR5, SPM, Figure SPM.8)




RISKS OF
CLIMATE CHANGE
INCREASE
WITH CONTINUED
HIGH EMISSIONS
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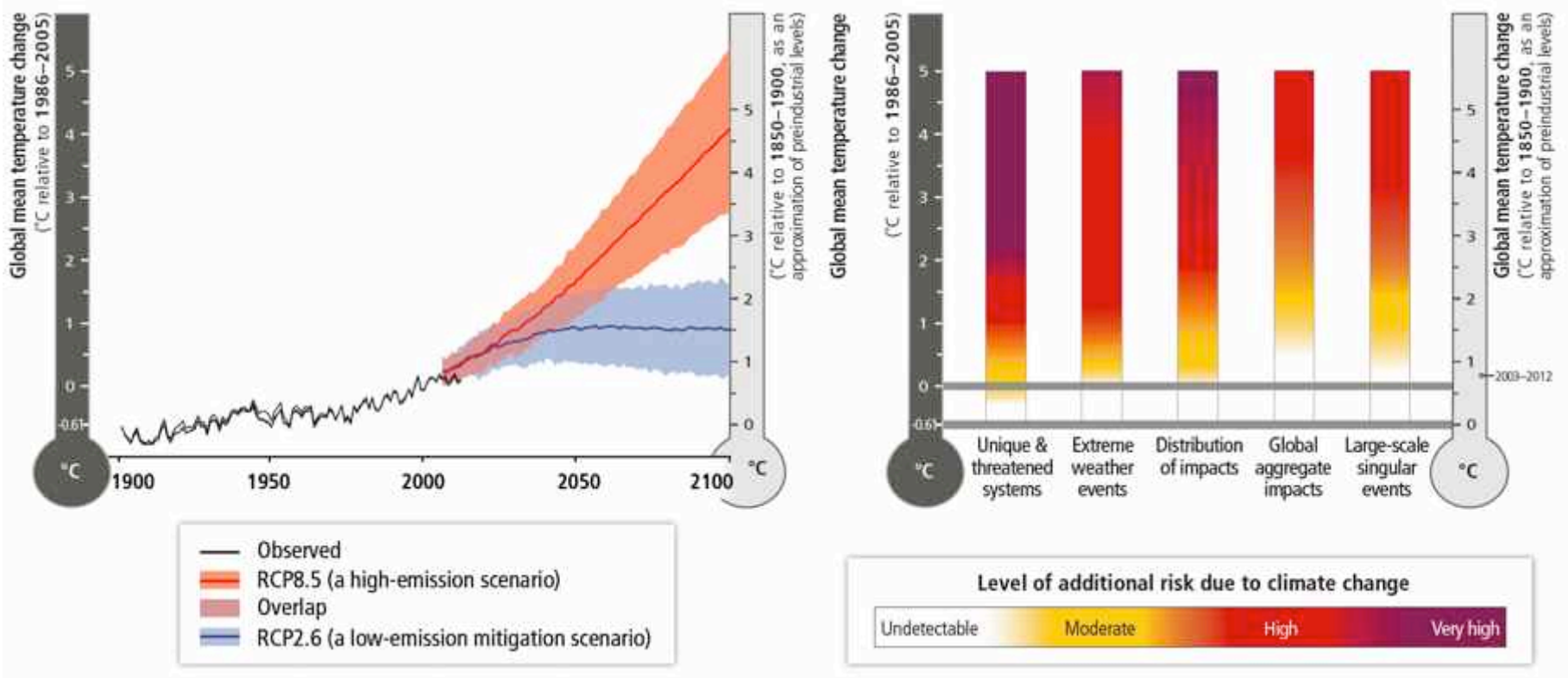

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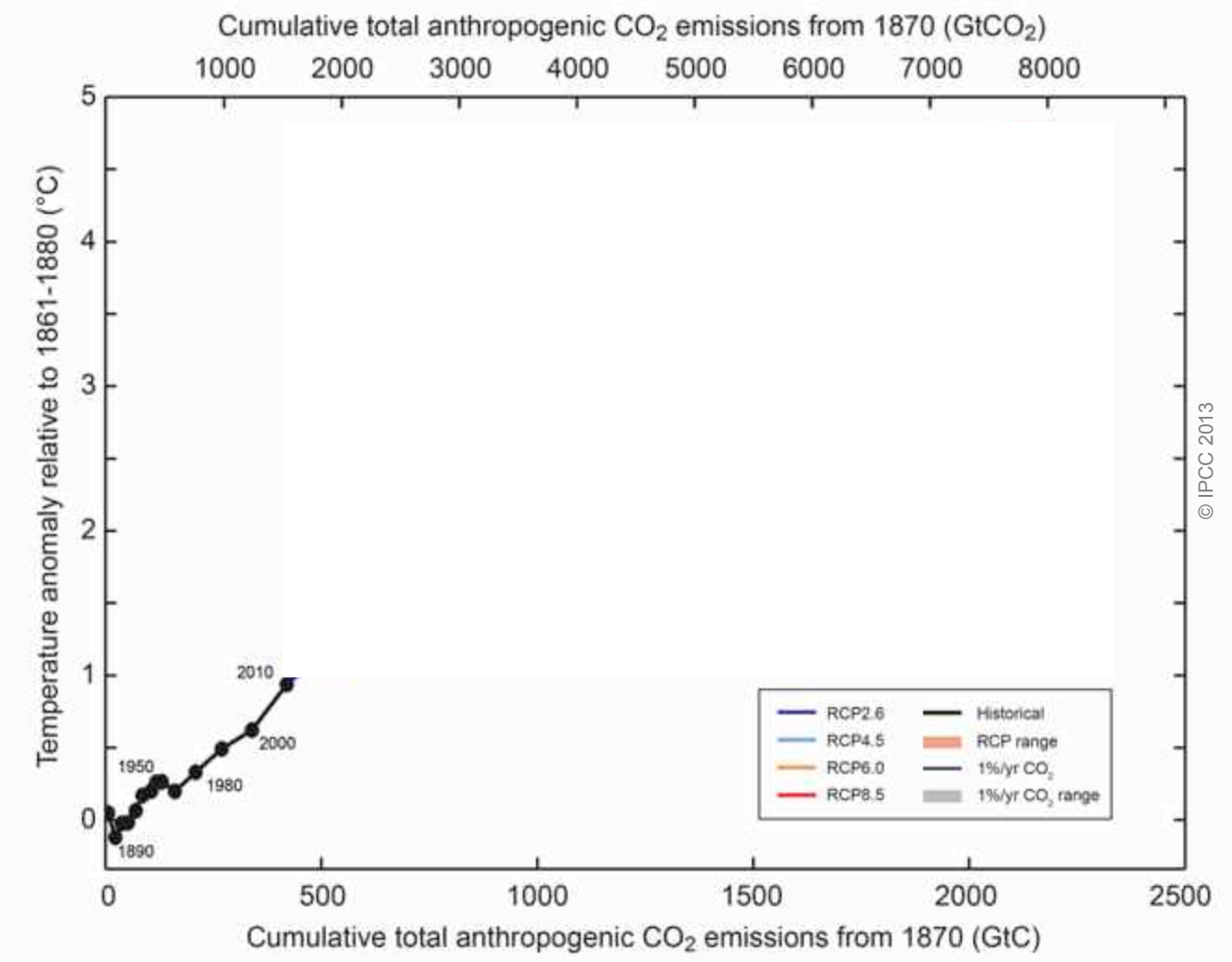


Fig. SPM.10

Cumulative emissions of CO_2 largely determine global mean surface warming by the late 21st century and beyond.

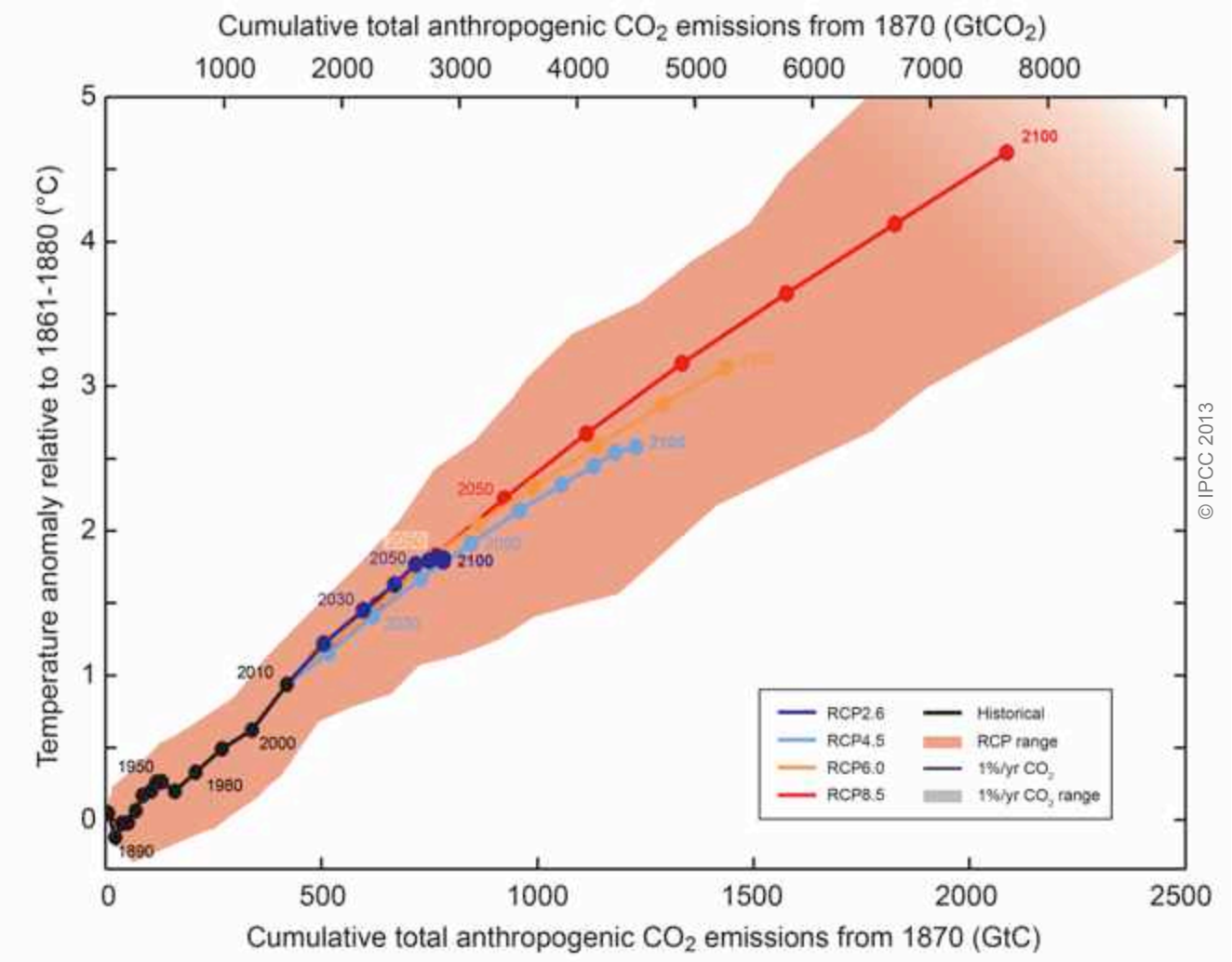
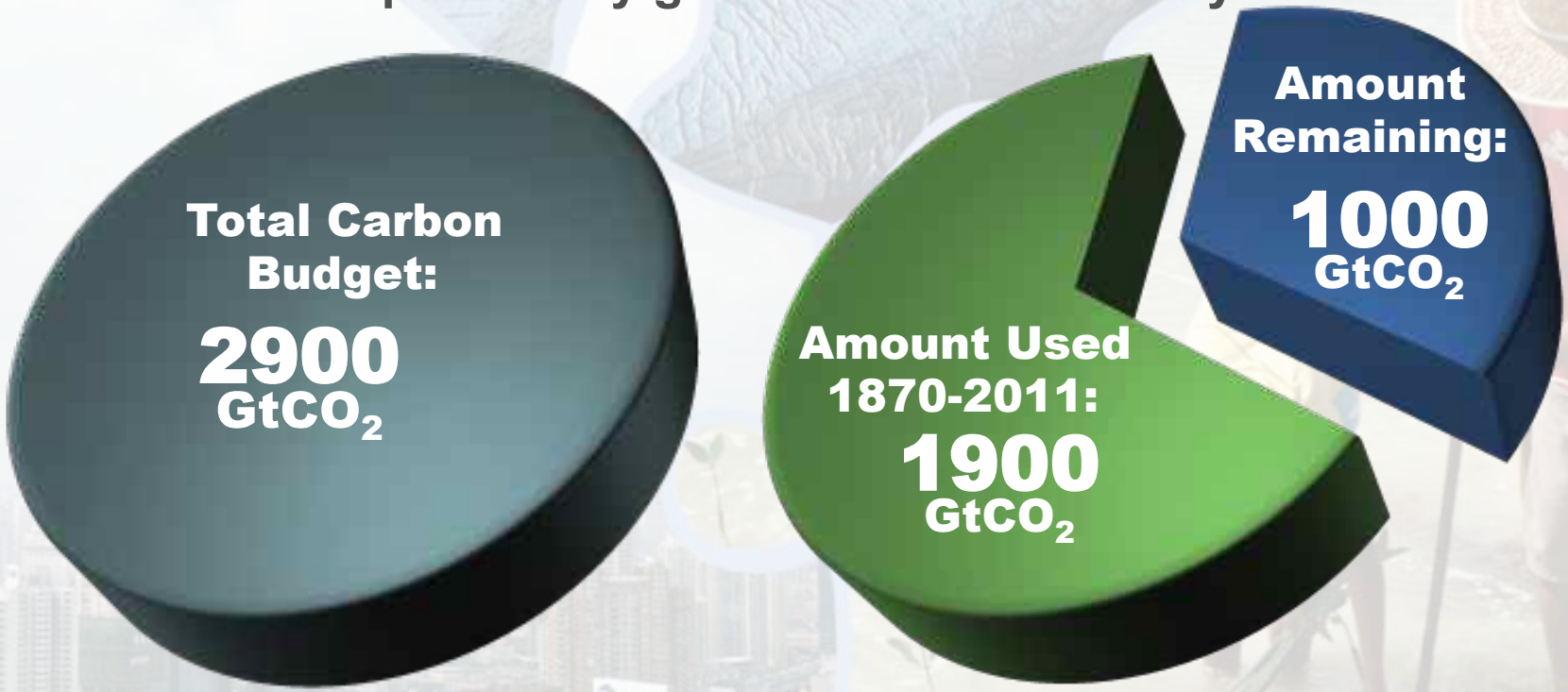


Fig. SPM.10

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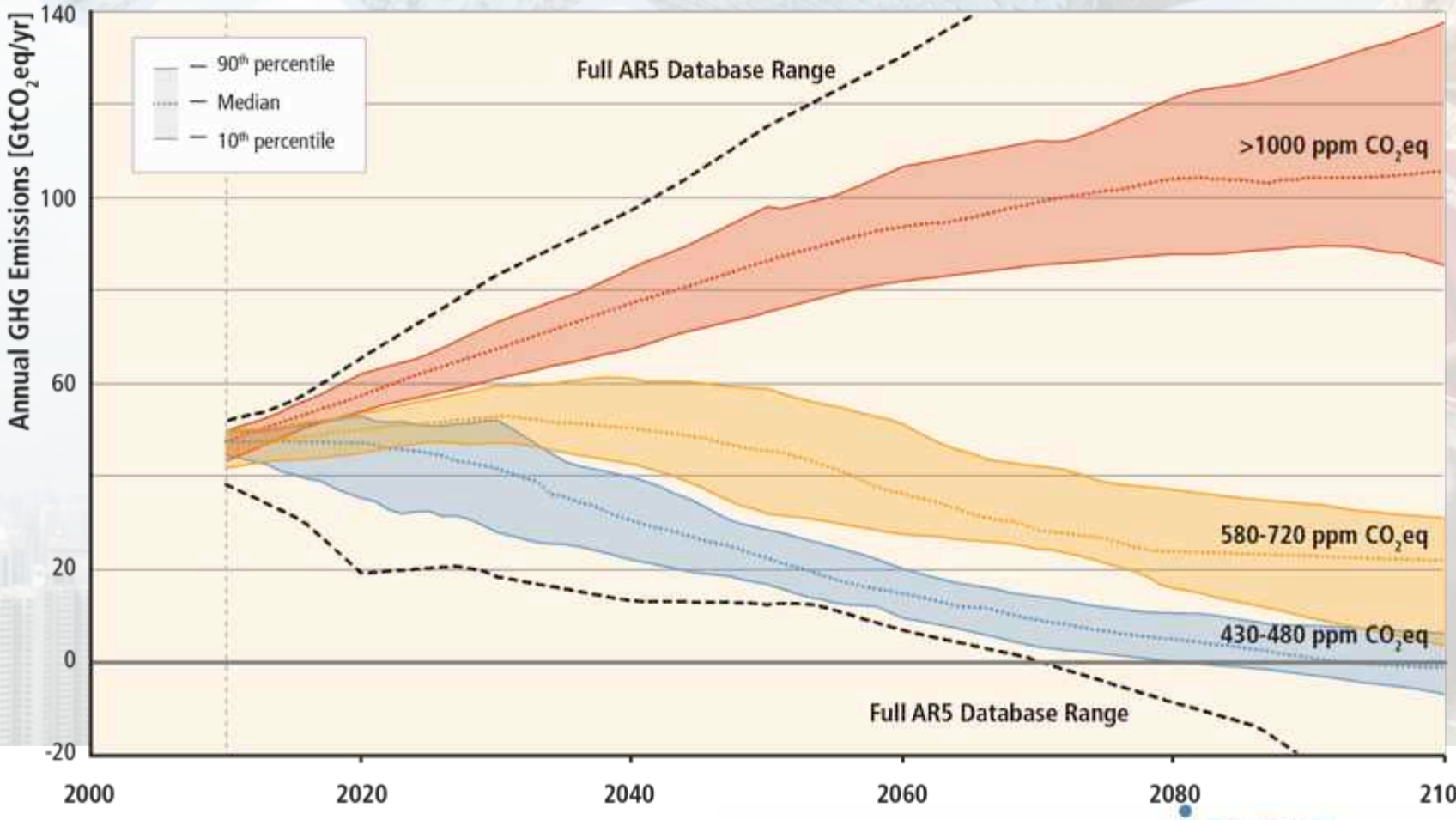
Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.



Based on Figure 6.7

AR5 WGIII SPM

IPCC AR5 Synthesis Report

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Mitigation Measures

More efficient use of energy

Greater use of low-carbon and no-carbon energy

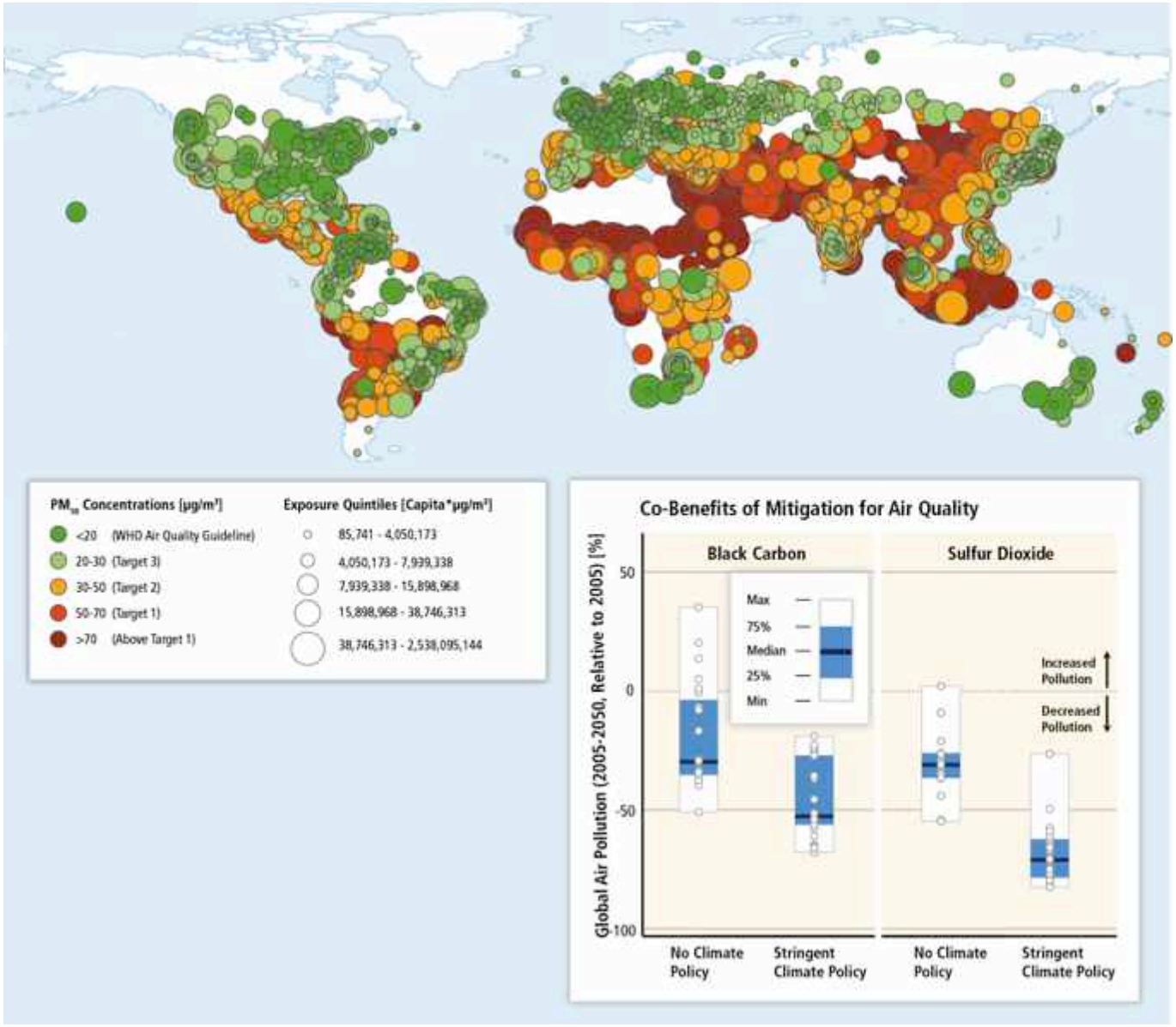
- Many of these technologies exist today

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

AR5 WGIII SPM



Mitigation can result in large co-benefits for human health and other societal goals.

- **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*)

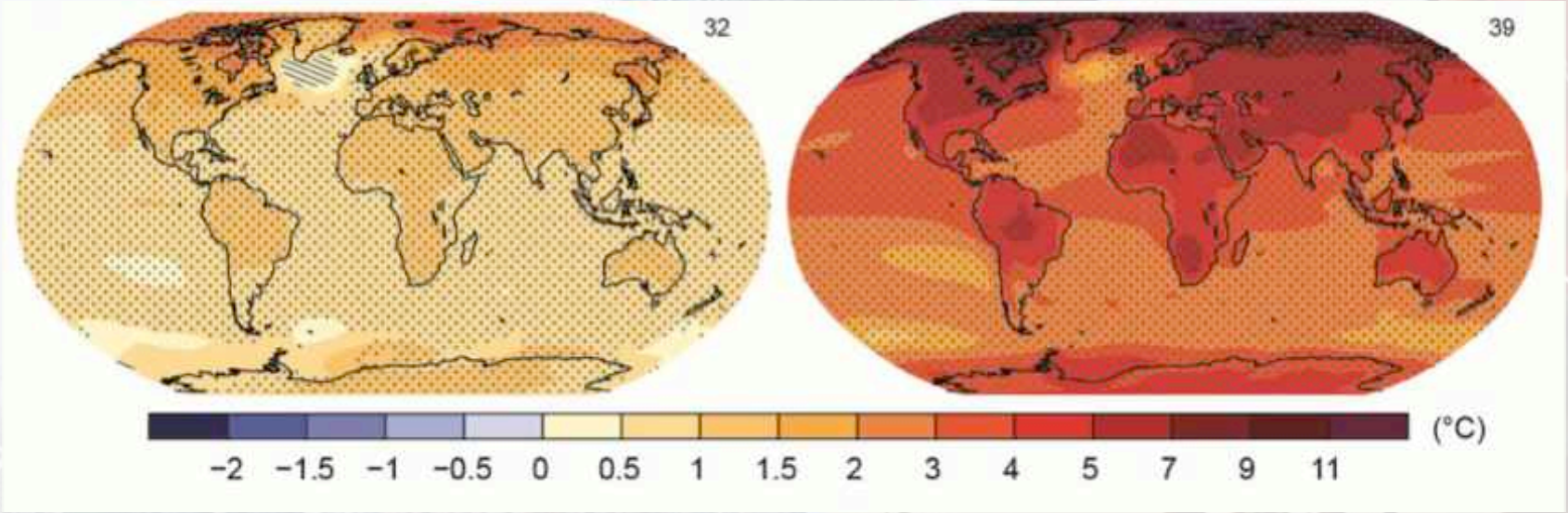
- Intergenerational equity underlies the concept of sustainability;
- Intra-generational equity is also often considered an intrinsic component of SD.
- In the particular context of international climate policy discussions, several arguments support giving equity an important role:
  - a moral justification 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 ...

AR5, WGIII, Ch.4, p.4

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)

AR5 WGI SPM

A few words about my platform as a candidate IPCC Chair

See details at:

www.climate.be/vanyp (« IPCC » page)

See also my long interview on:

www.carbonbrief.org (search « Ypersele »)

Keep the IPCC mandate

"When manoeuvering a vehicle in limited space, one **must be very well informed** about both the surrounding **risks and the available options**. This is what the IPCC must do, and continue to do, in a scientifically rigorous, but policy-neutral, way: assess the risks, the options and the processes for reaching decisions."

@JPvanYpersele for The Guardian, 16 March 2015

Inclusiveness & Team Spirit

"But the IPCC must do so in a manner even **more inclusive** than in the past, **involving more scientists from developing countries** in particular. It must encourage all authors to **work better across disciplinary boundaries.** The next assessment by the IPCC must ensure the best **team spirit**, with a **sense of accountability and ownership** that is shared by all."

@JPvanYpersele for The Guardian, 16 March 2015

Improve Communication

For the IPCC to be relevant, it must also continue to improve its communication with policymakers and with the public. The IPCC products need to be **more accessible, more readable**,…

… reach out to **different audiences**, seek greater **transparency** in how it works and show more responsiveness on **social media**.

@JPvanYpersele for The Guardian, 16 March 2015

Full Time IPCC Chair needed

"To make sure all of this happens during the next assessment cycle, the IPCC needs a strong **leader**, a **team builder**, who dedicates herself or himself **full time** as IPCC Chair."

@JPvanYpersele for The Guardian, 16 March 2015

Useful links:

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