Climate Change Projections for 2050/2100 and their Potential Impacts in the Middle East

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Thanks to the Belgian Federal Science Policy Office (BELSPO) and Ministry of Foreign Affairs, and to my team at the Université catholique de Louvain for their support

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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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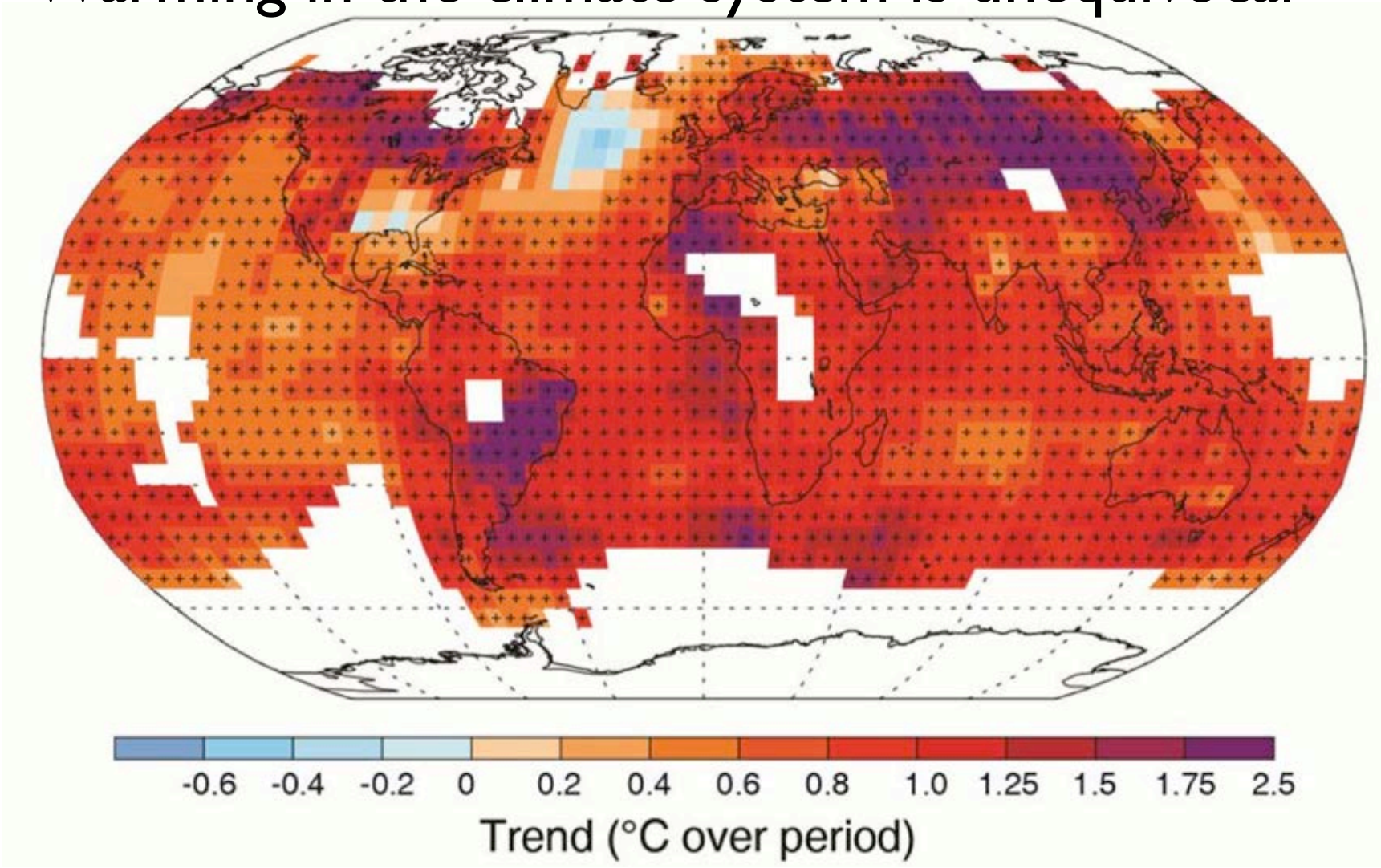
Key messages from IPCC AR5

- 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

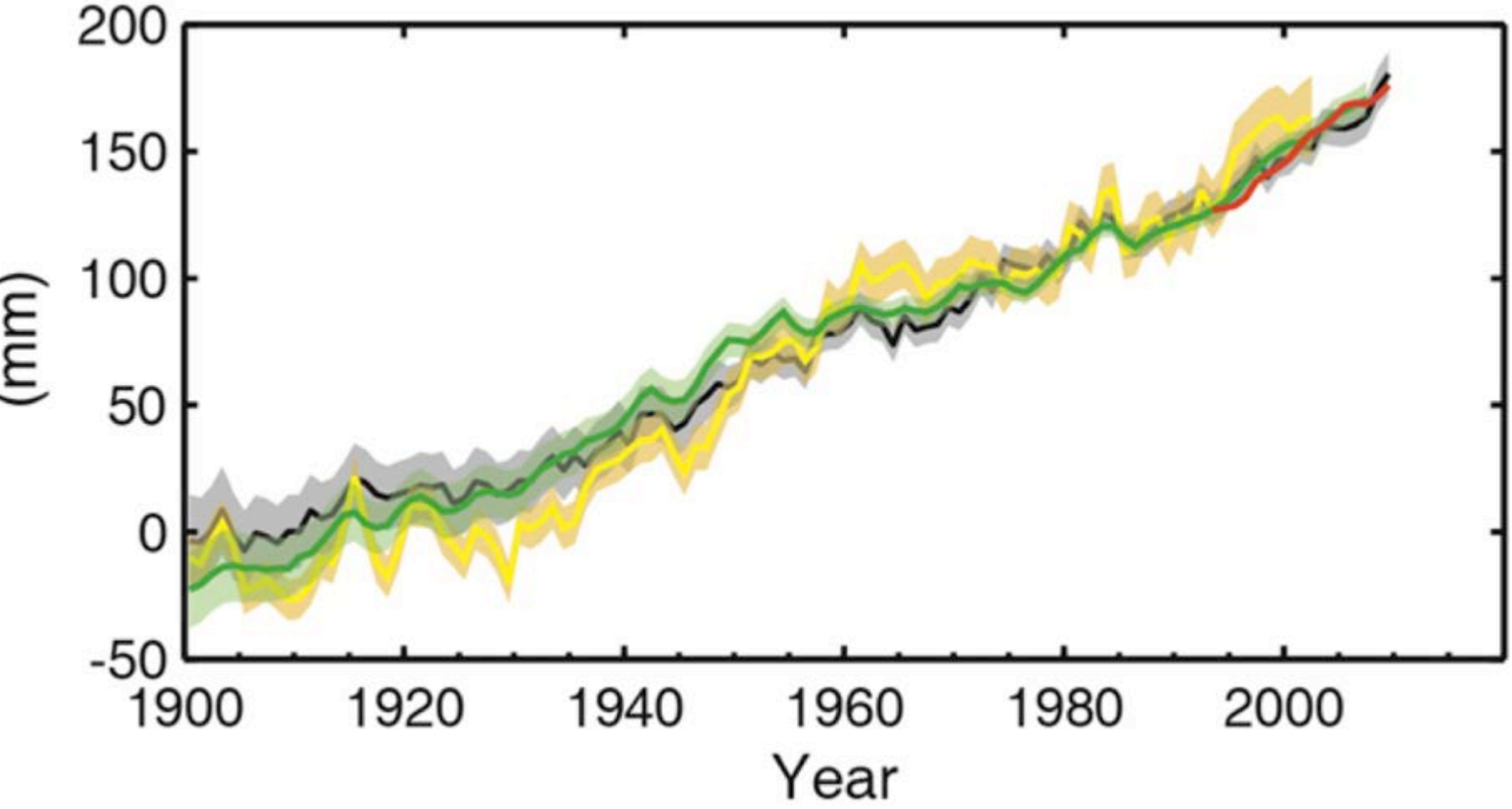
Change in average surface temperature 1901-2012

Warming in the climate system is unequivocal



AR5 WGI SPM - Approved version / subject to final copyedit

Change in average sea-level change



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Sources of emissions

Energy production remains the primary driver of GHG emissions

2010 GHG emissions

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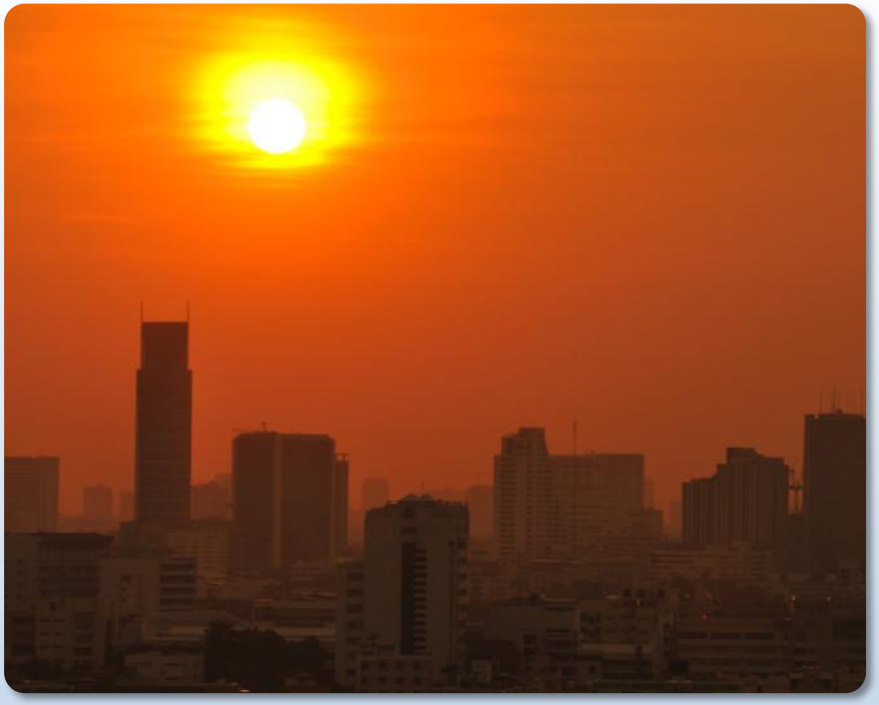
Since 1950, extreme hot days and heavy precipitation have become more common



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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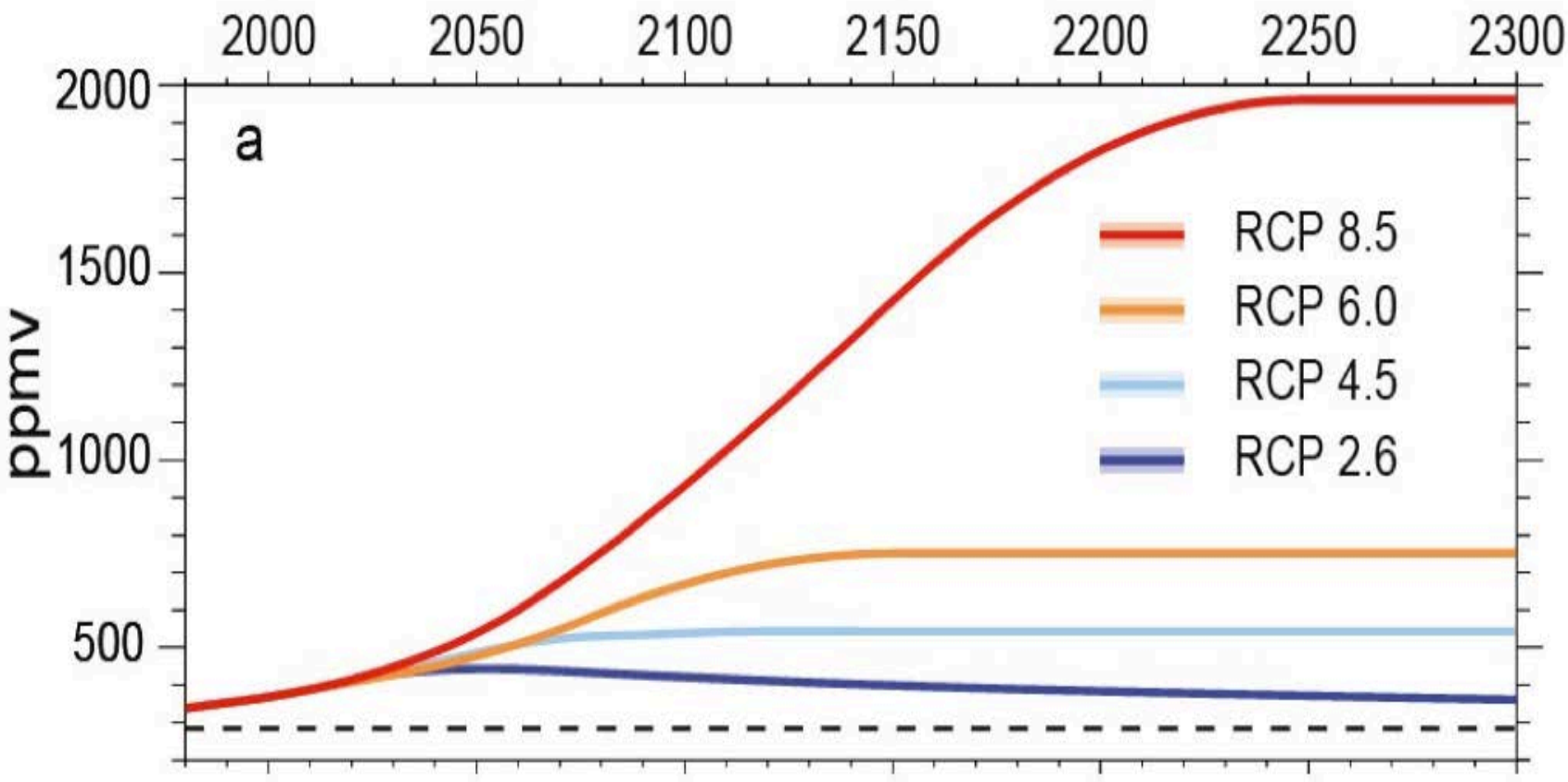
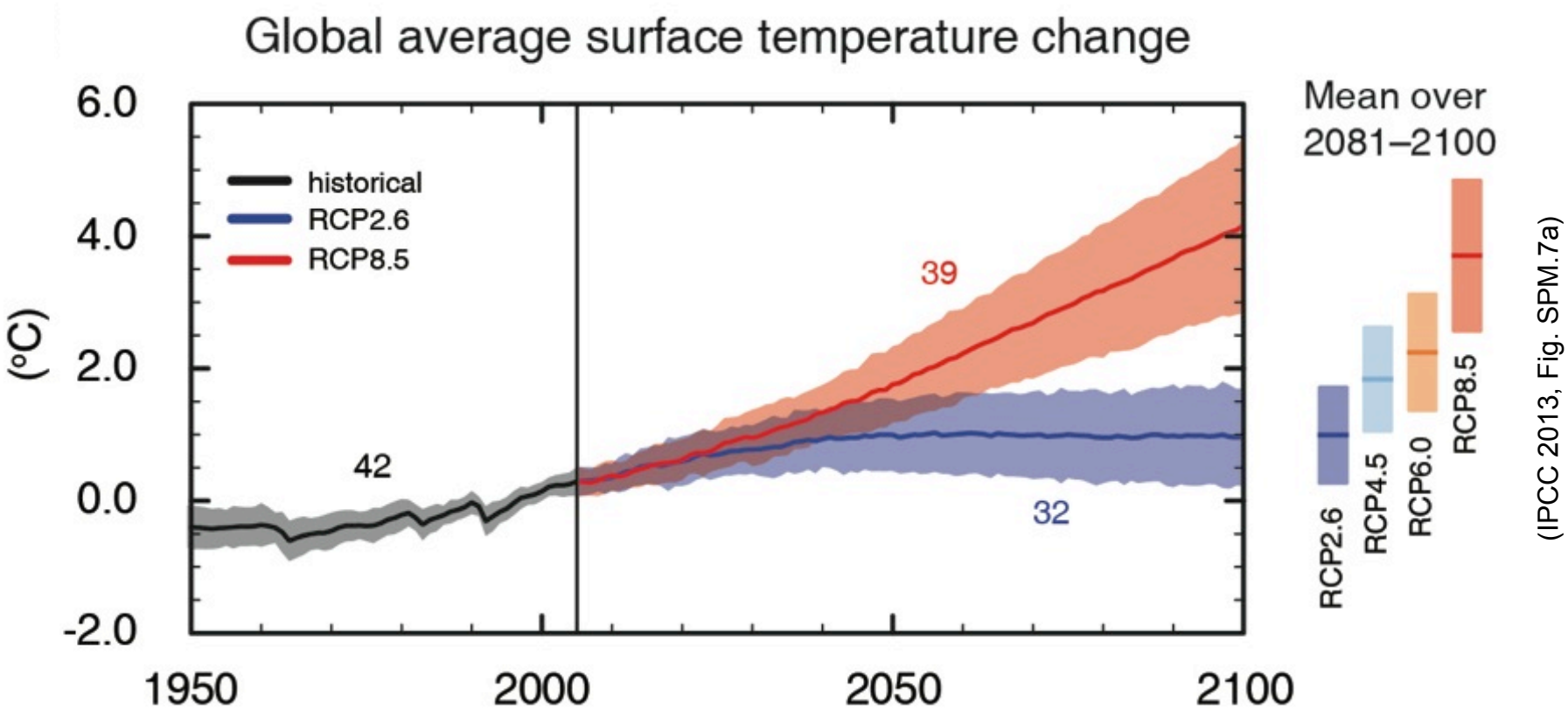
RCP Scenarios: Atmospheric CO_2 concentration



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

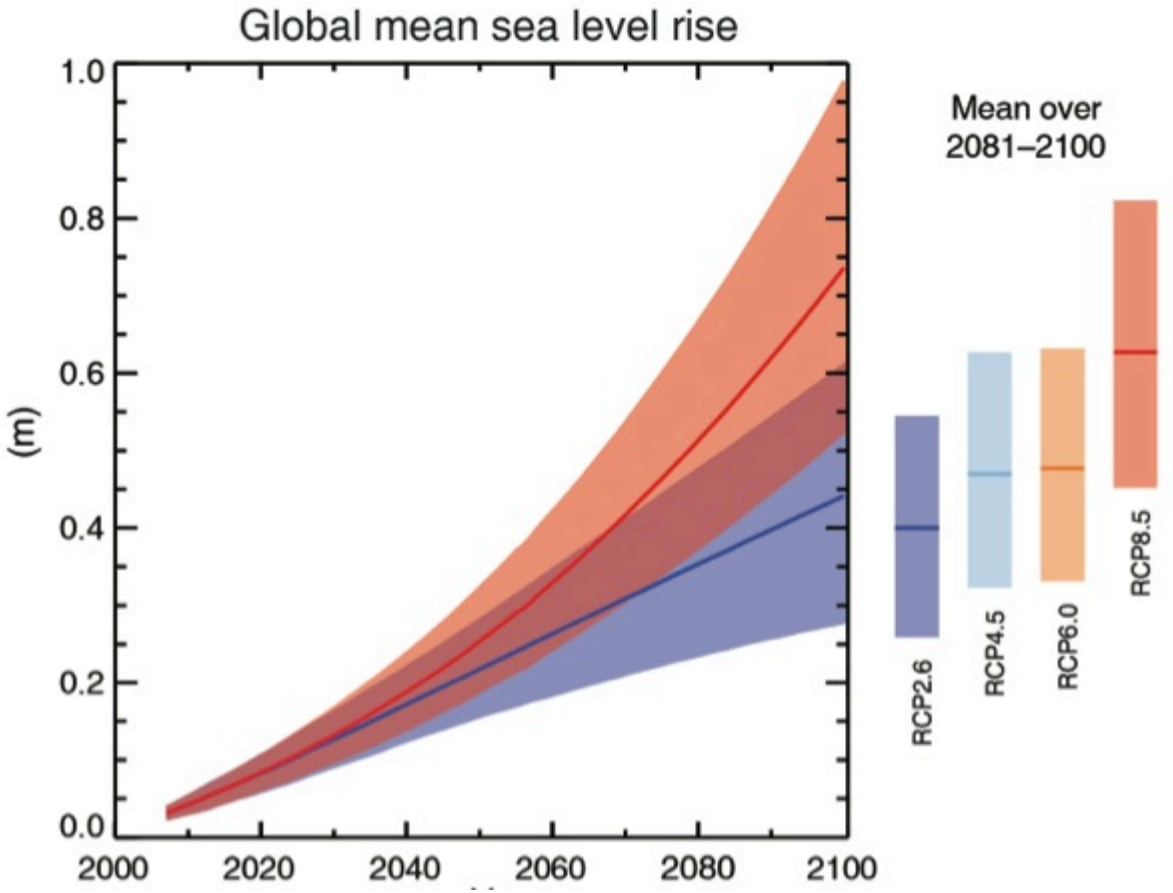


Fig. SPM.9

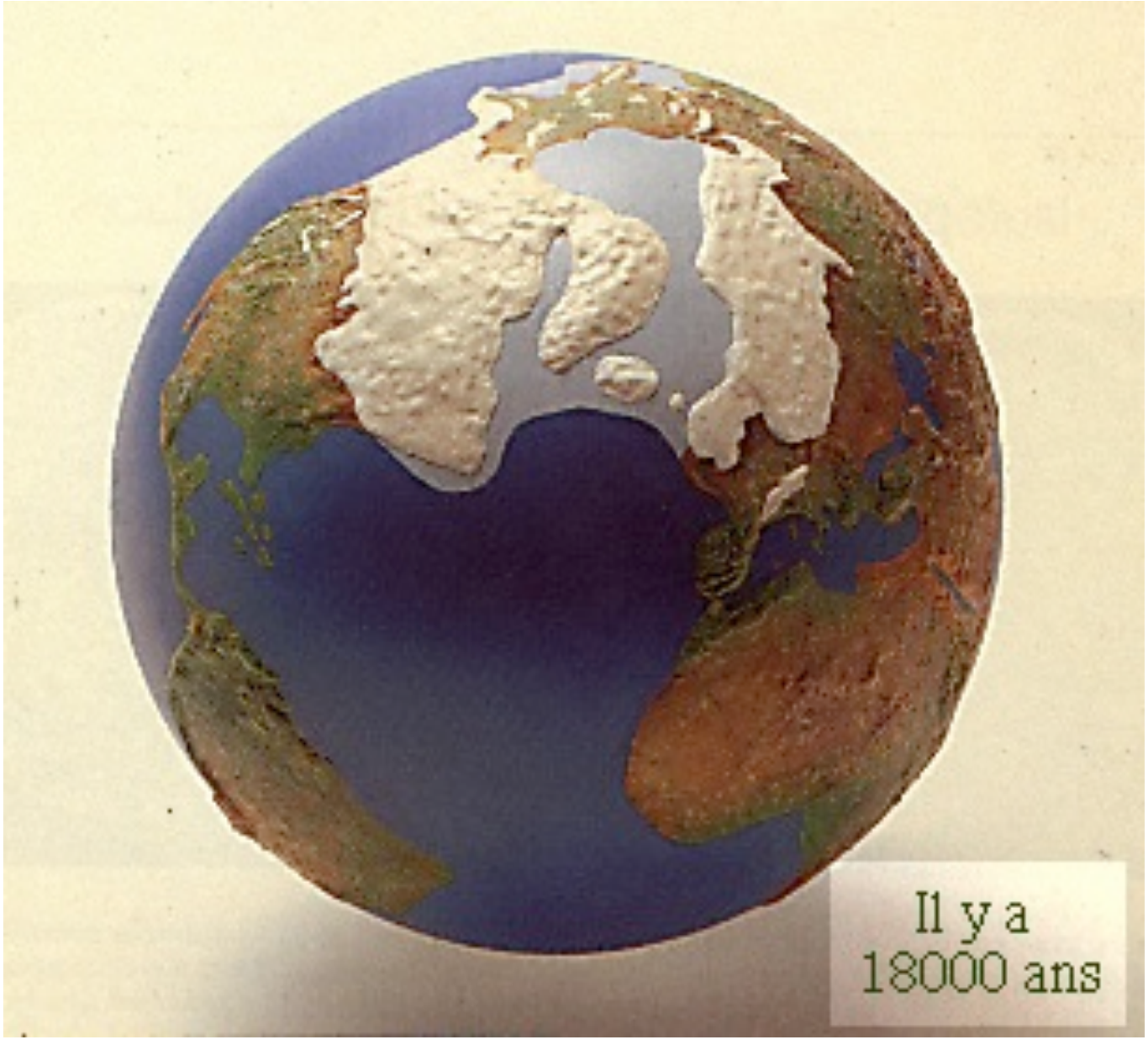
RCP2.6 (2081-2100), *likely* range: **26 to 55 cm**

RCP8.5 (in 2100), *likely* range: **52 to 98 cm**

(Reference level: 1986-2005)

18-20000 years ago (Last Glacial Maximum)

With permission from Dr. S. Joussaume, in « Climat d'hier à demain », CNRS éditions.



Today, with +4-5°C globally

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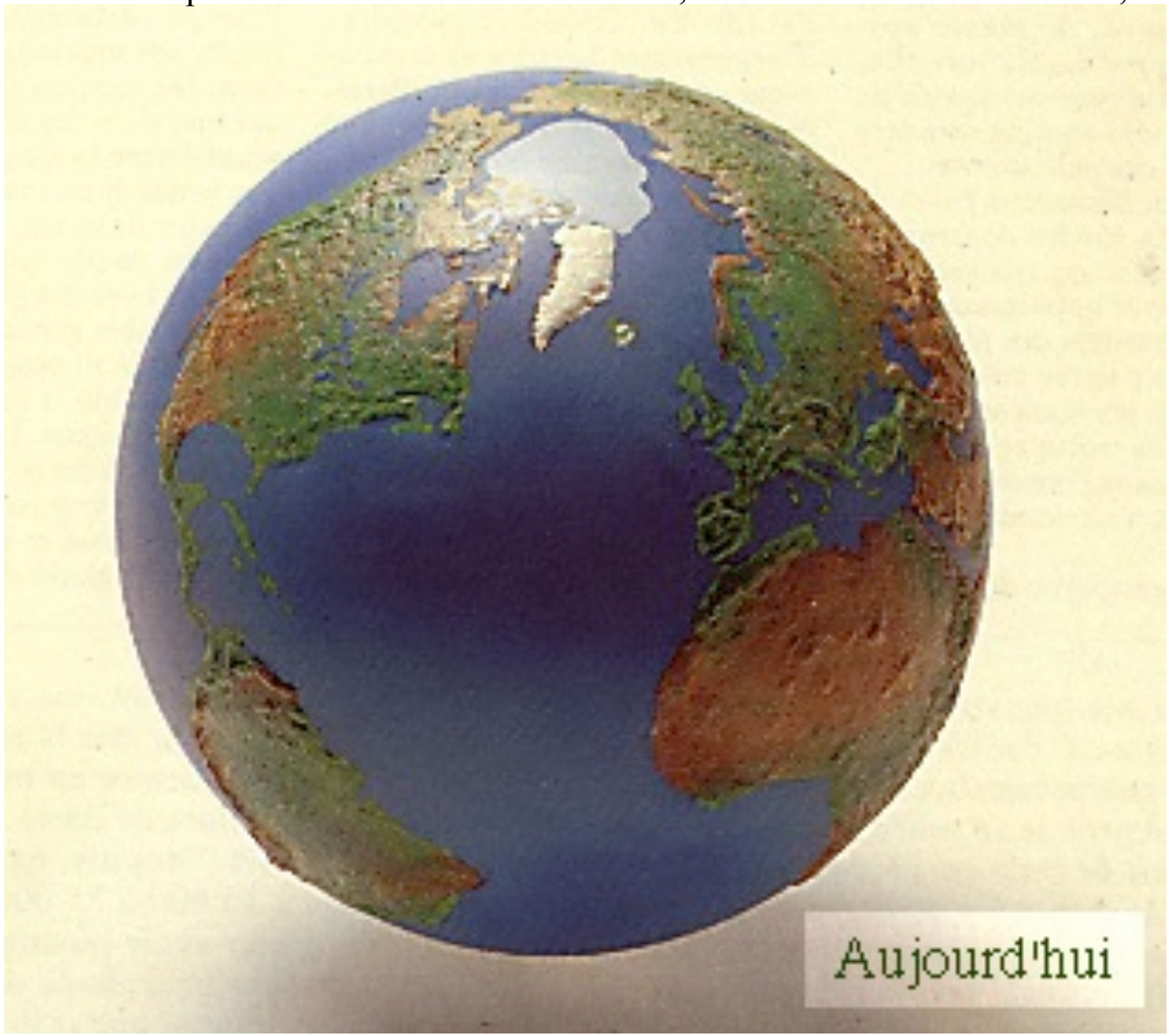
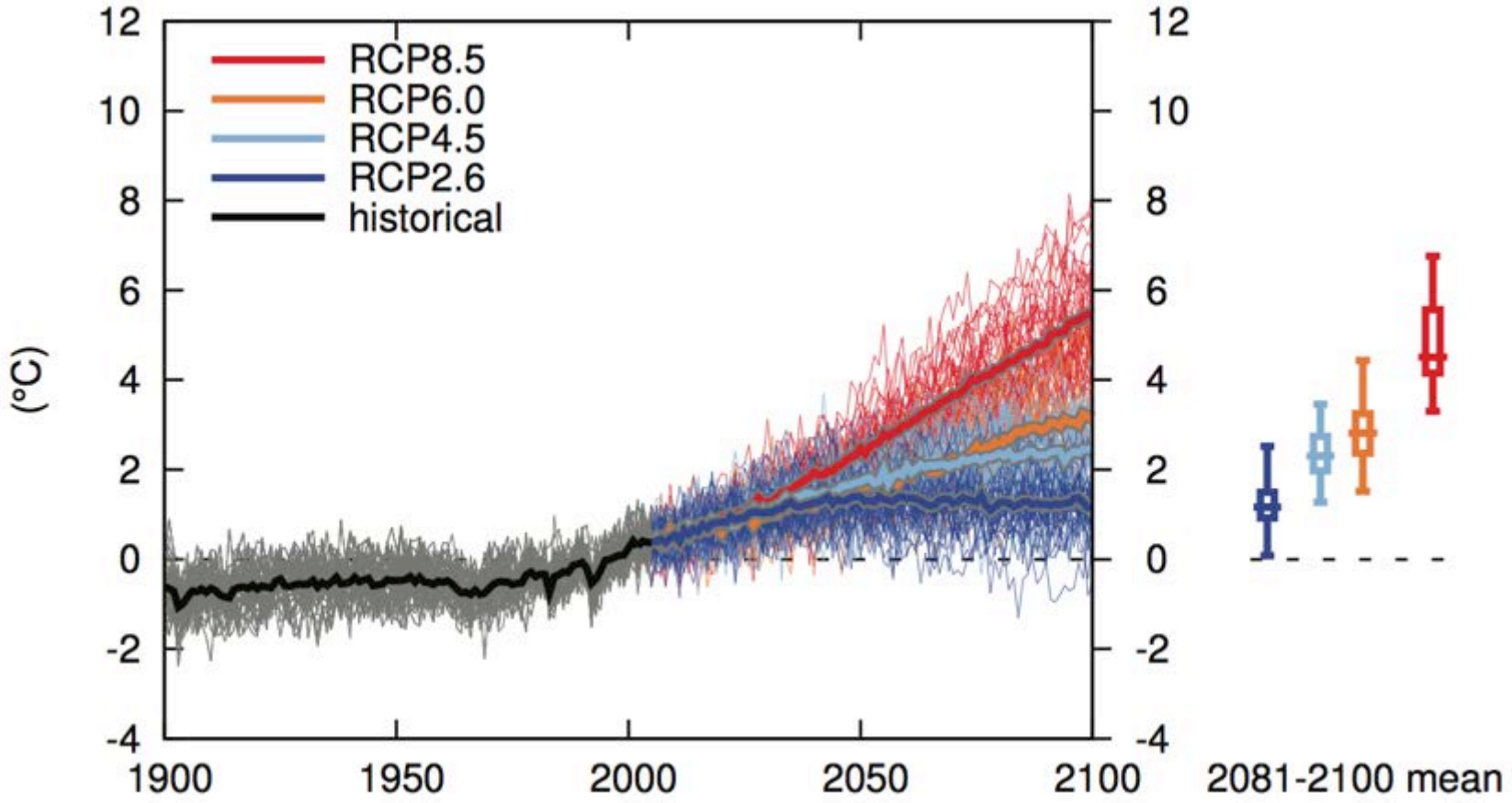
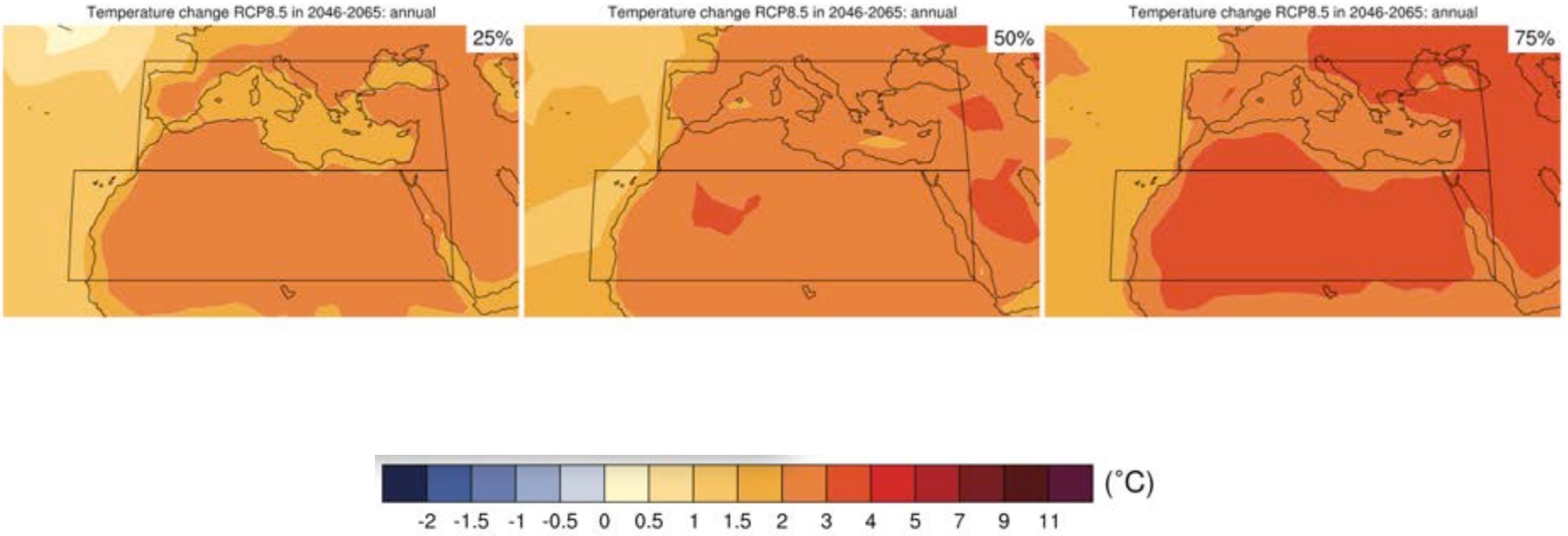


Temperature change South Europe/Mediterranean annual



IPCC, AR5, WGI, Annex I: Atlas of Global and Regional Climate Projections Supplementary Material RCP8.5

Maps of temperature changes in 2046 – 2065 with respect to 1986–2005 in the RCP8.5 scenario



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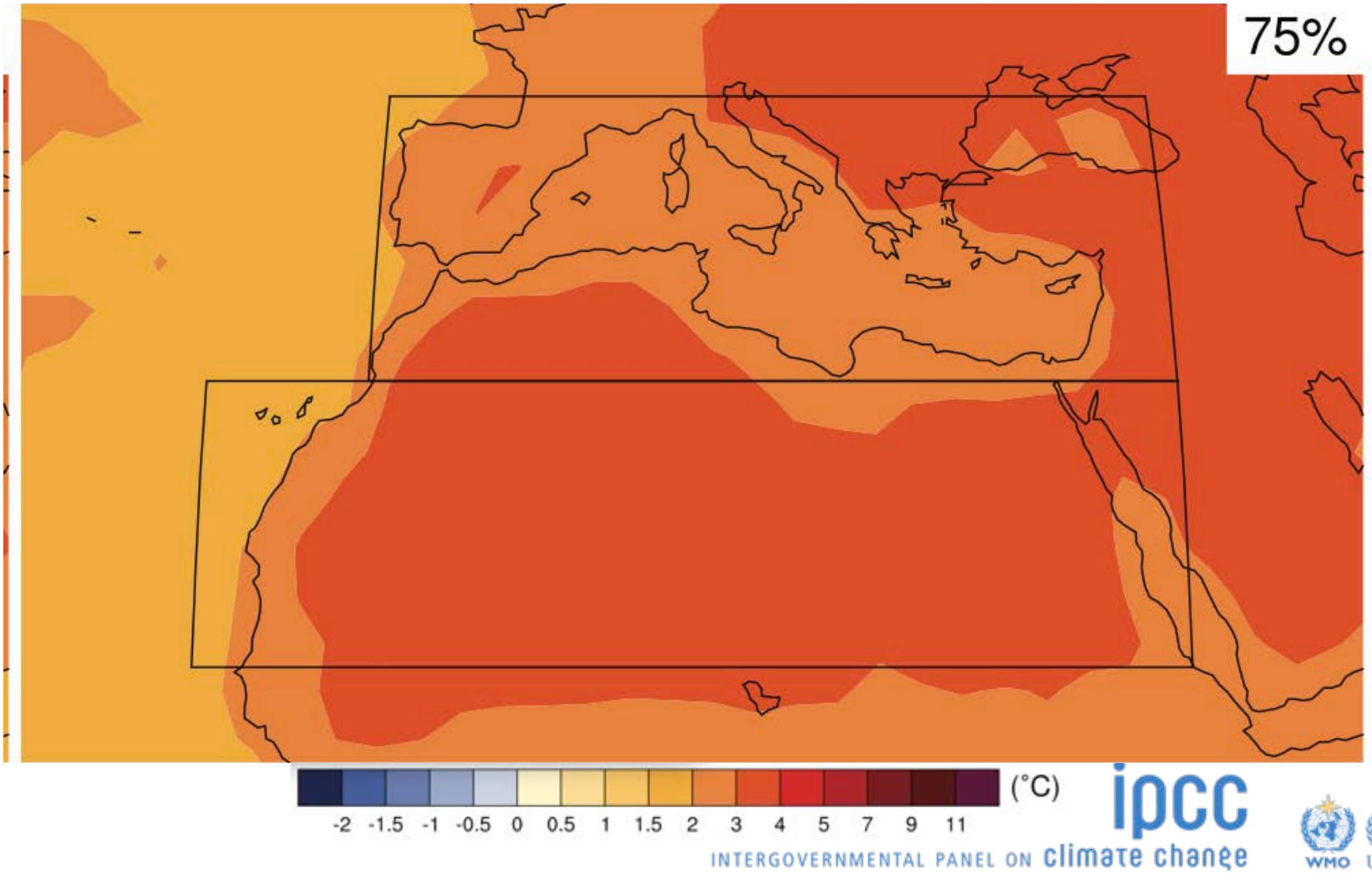

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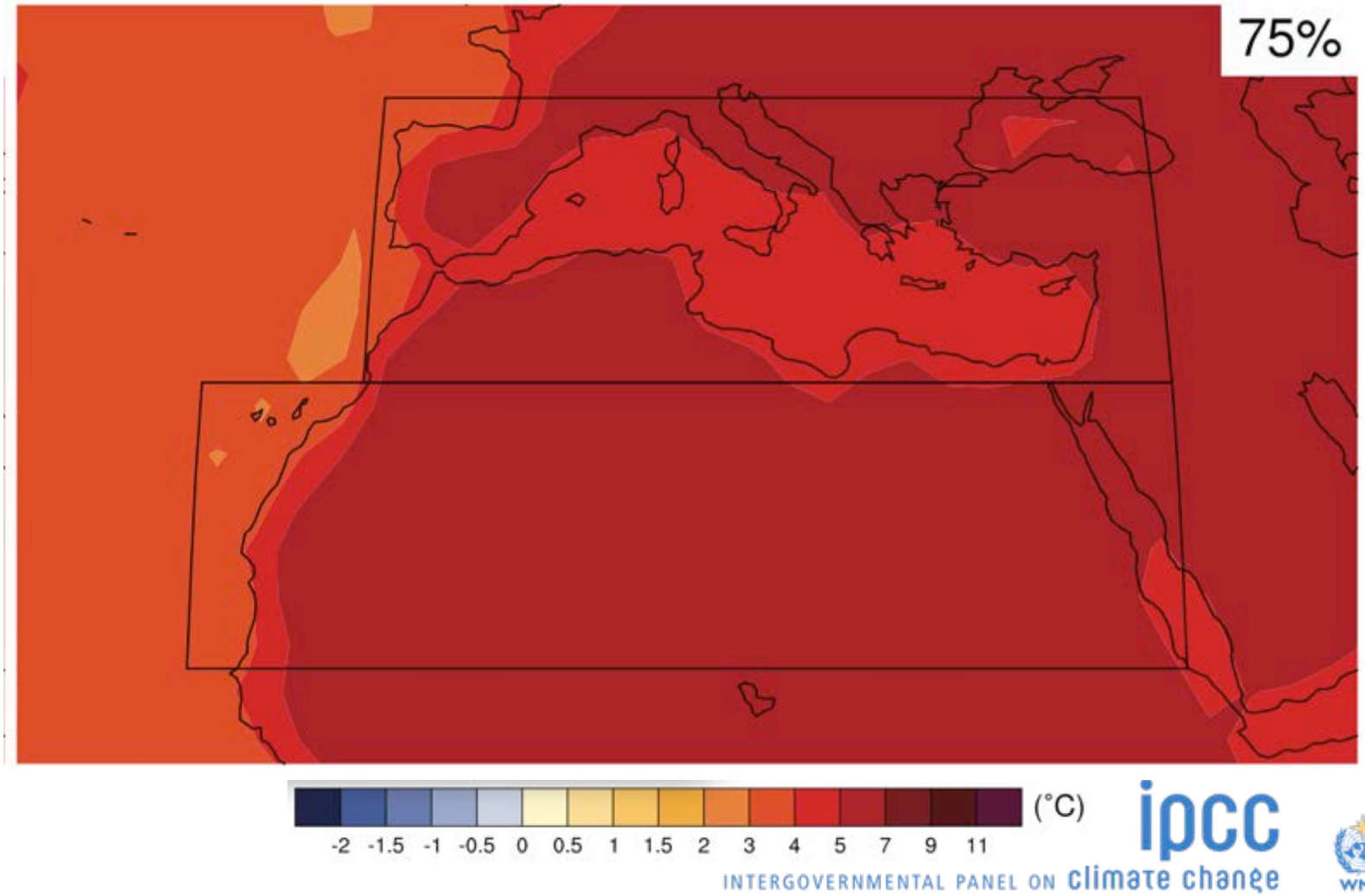

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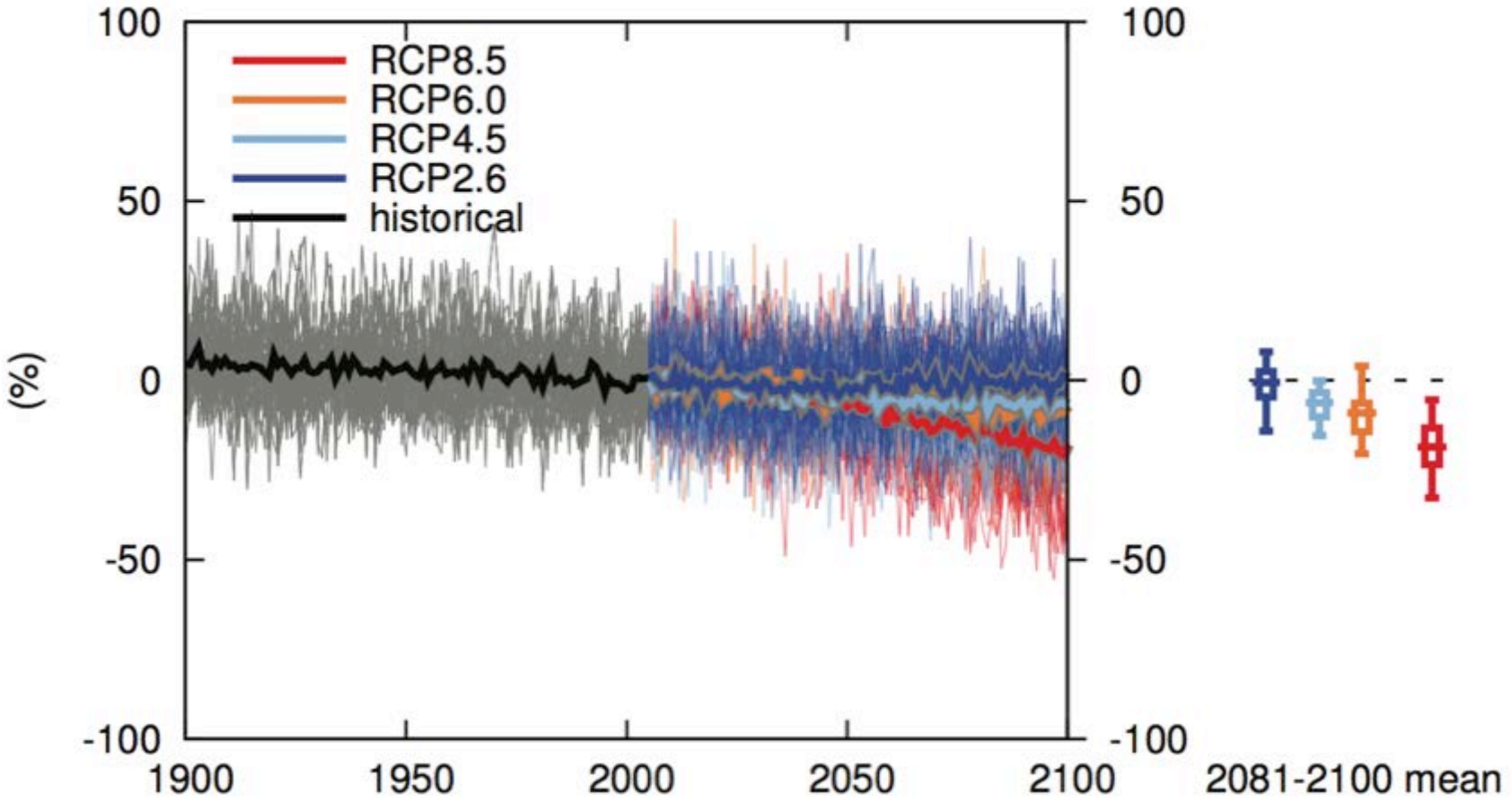
Precipitation change South Europe/ Mediterranean annual



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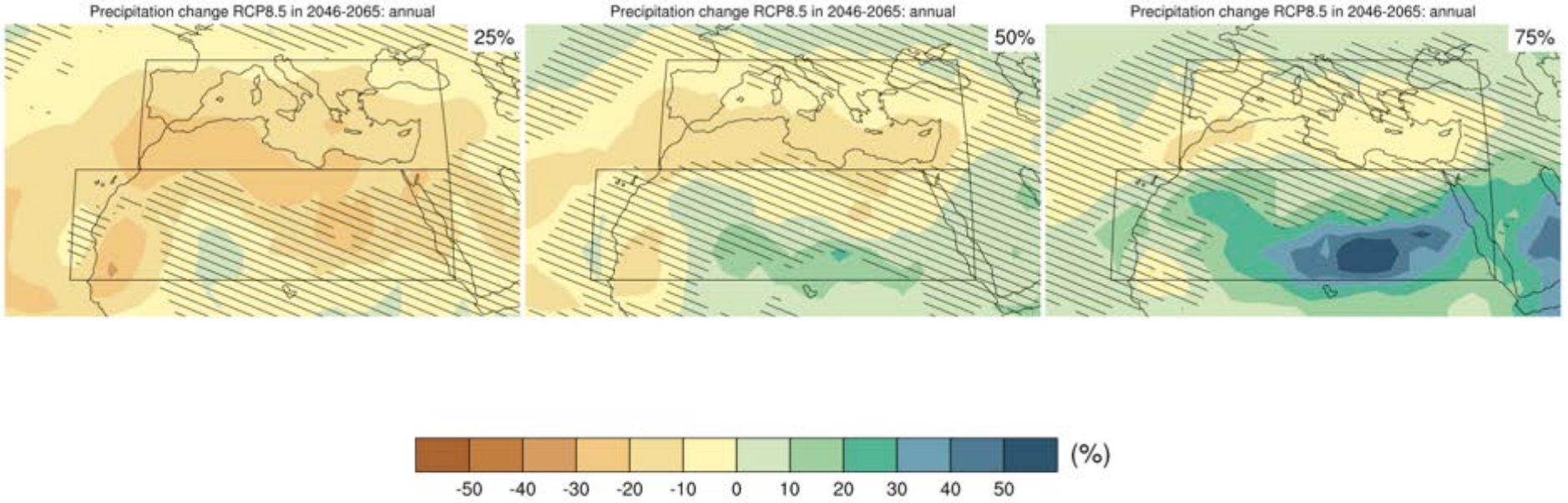
Map of precipitation changes in 2046–2065 with respect to 1986–2005 in the RCP8.5 scenario



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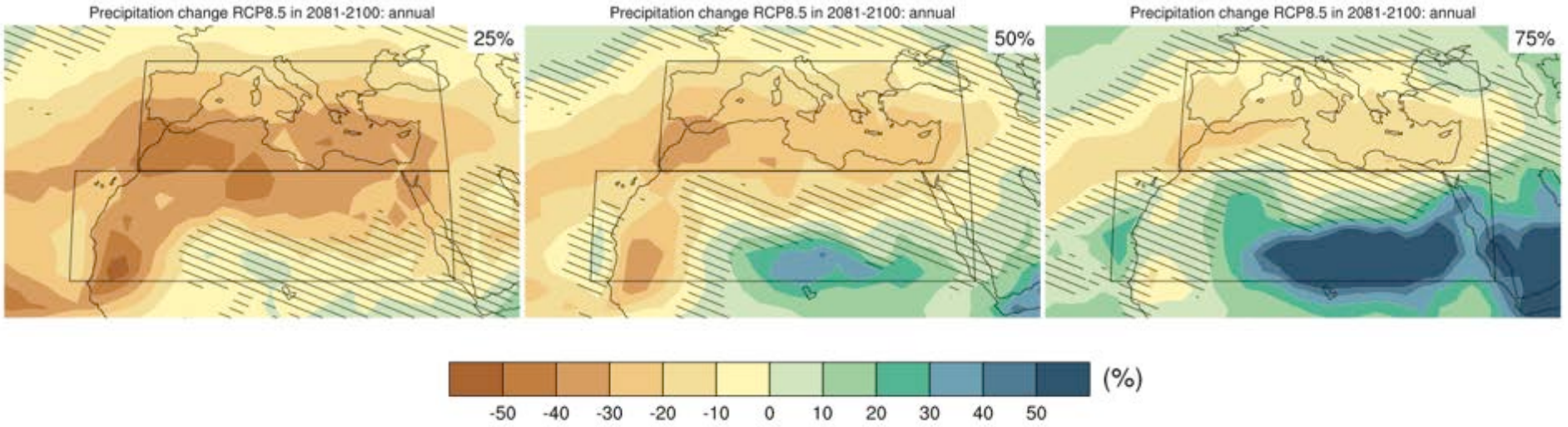
Map of precipitation changes in 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario



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Risk = Hazard x Vulnerability x Exposure (Katrina flood victim)

AP Photo - Lisa Krantz (http://lisakrantz.com/hurricane-katrina/zspbn1k4cn17phidupe4f9x5t1mzdr)

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
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CLIMATE CHANGE

REDUCING AND MANAGING RISKS

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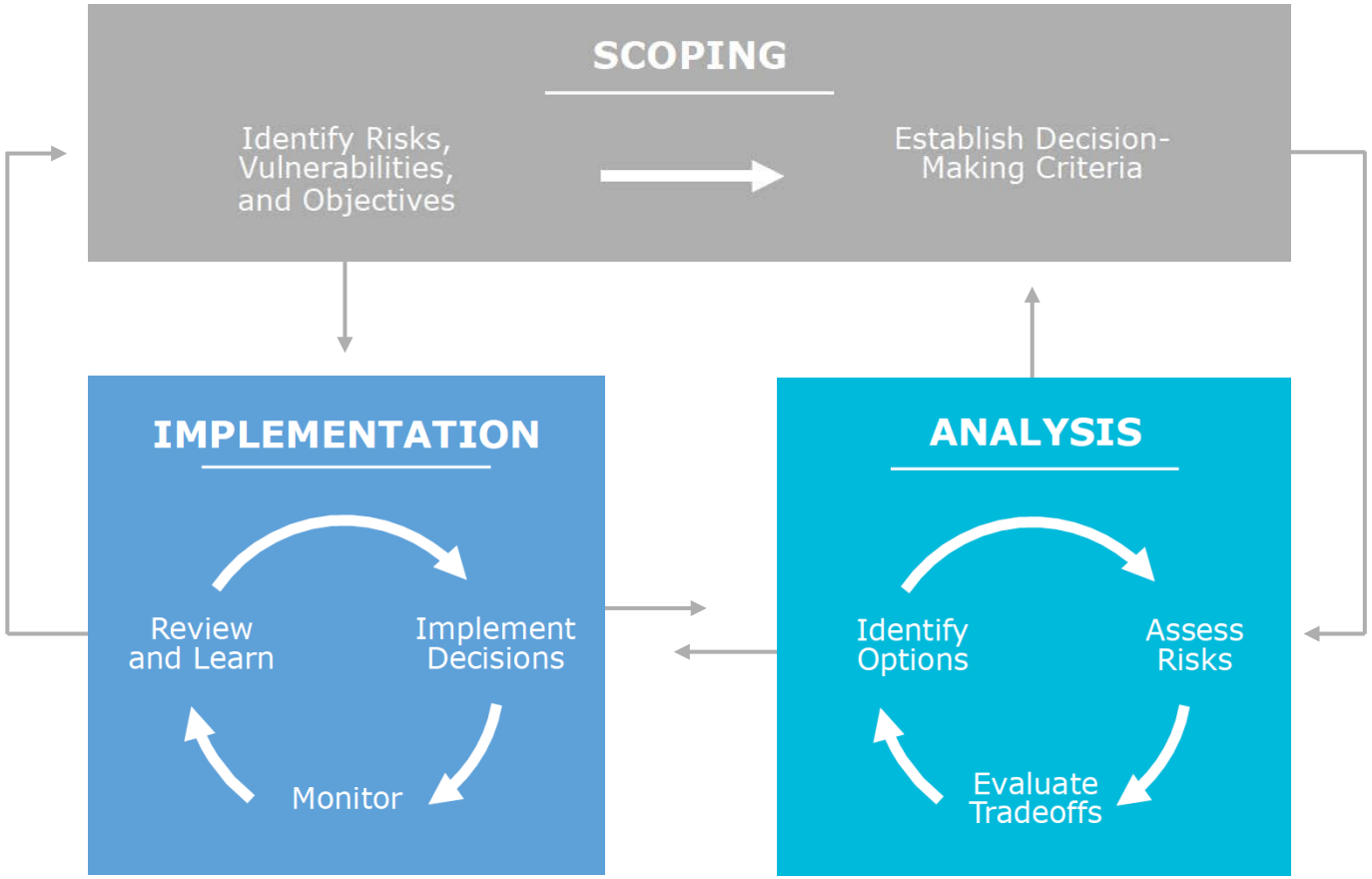
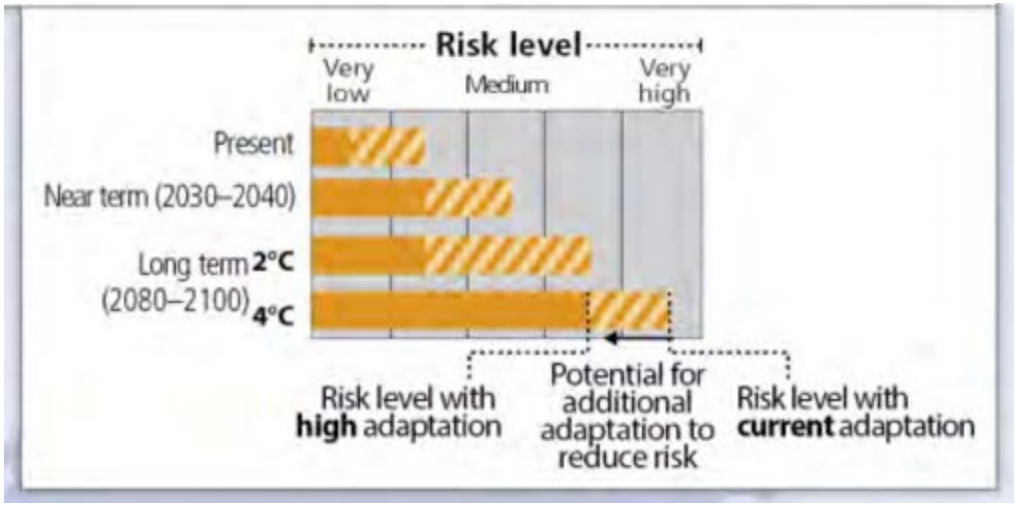
Climate risk management

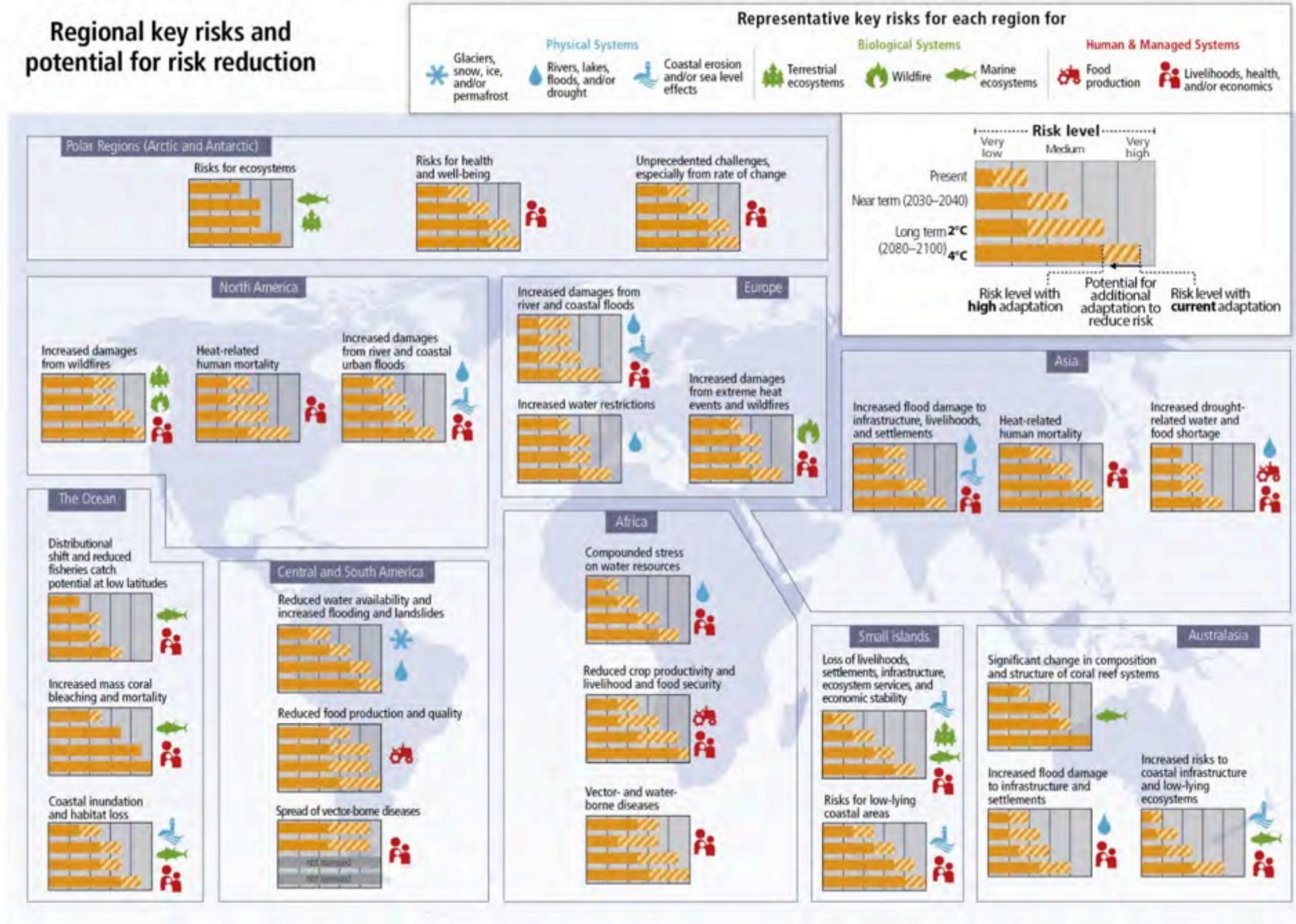


Regional key risks and potential for risk reduction through adaptation



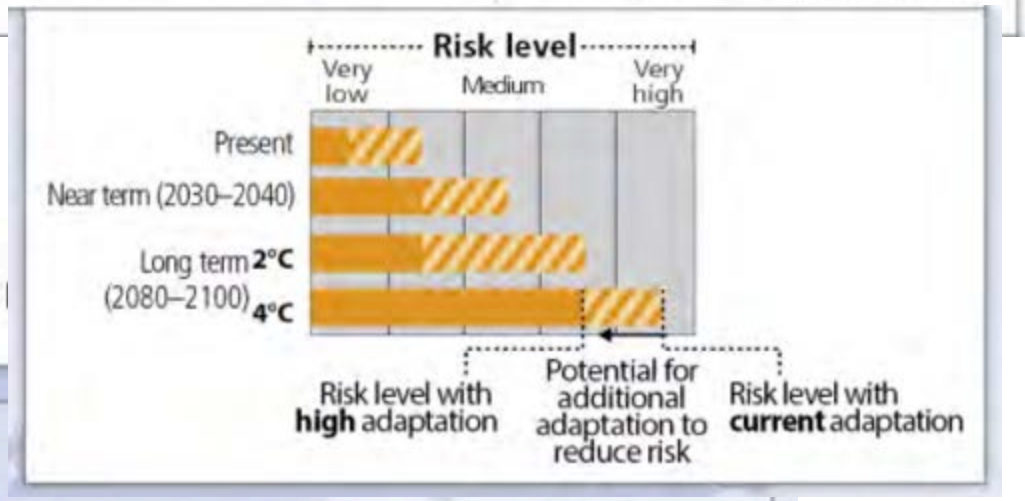
IPCC, AR5, SPM, Figure SPM.8

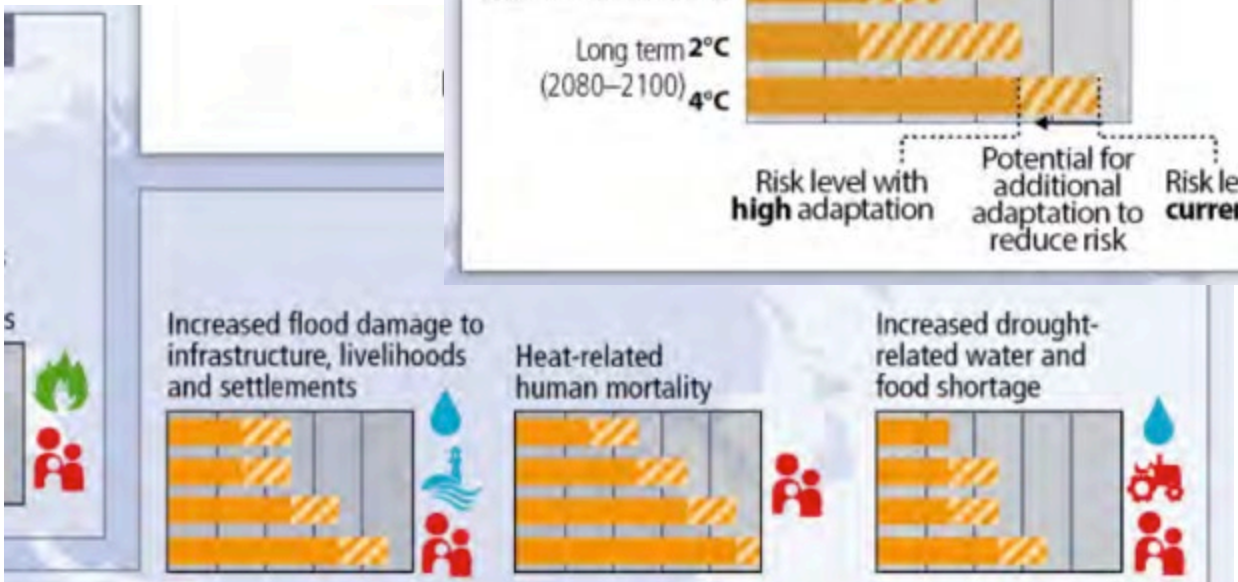
Regional key risks and potential for risk reduction



IPCC, AR5, SPM, Figure SPM.8

Regional key risks and potential for risk reduction through adaptation





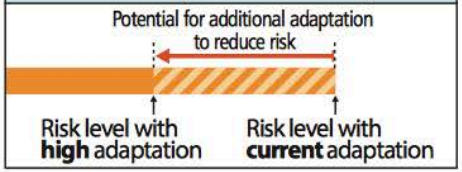
Floods Heat stress Droughts

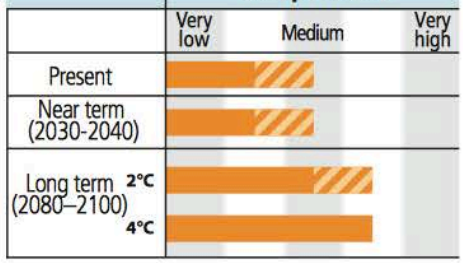
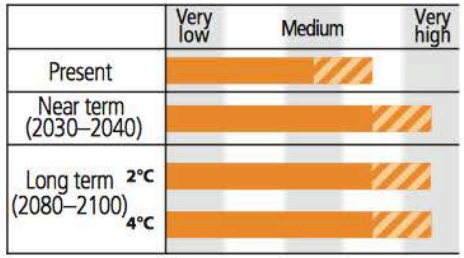
IPCC, AR5, SYR, SPM, Fi

Key risks from climate change and the potential for risk reduction through mitigation and adaptation in Asia

Climate-related drivers of impacts

Level of risk & potential for adaptation

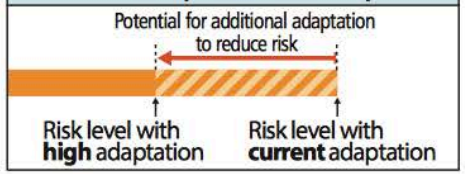


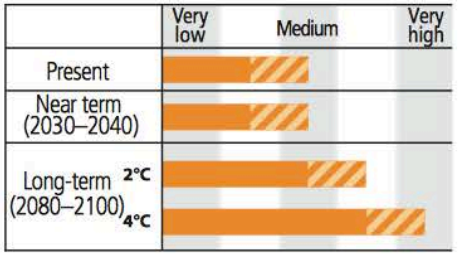
Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Increased risk of crop failure and lower crop production could lead to food insecurity in Asia (*medium confidence*) [24.4.4]	Autonomous adaptation of farmers on-going in many parts of Asia.			
Water shortage in arid areas of Asia (*medium confidence*) [24.4.1.3, 24.4.1.4]	Limited capacity for water resource adaptation; options include developing water saving technology, changing drought-resilient crops, building more water reservoirs.			

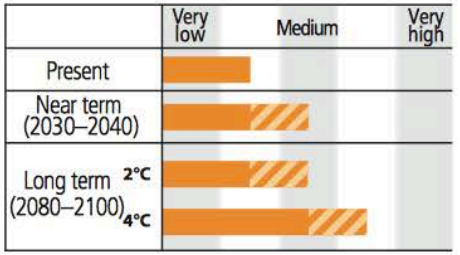
IPCC, AR5, WGII, Chap 24, Table 24.1

Key risks from climate change and the potential for risk reduction through mitigation and adaptation in Asia

Climate-related drivers of impacts							Level of risk & potential for adaptation		
Warming trend	Extreme temperature	Extreme precipitation	Drying trend	Damaging cyclone	Sea level	Ocean acidification			
Increased riverine, coastal, and urban flooding leading to widespread damage to infrastructure, livelihoods, and settlements in Asia (*medium confidence*) [24.4]	• Exposure reduction via structural and non-structural measures, effective land-use planning, and selective relocation • Reduction in the vulnerability of lifeline infrastructure and services (e.g., water, energy, waste management, food, biomass, mobility, local ecosystems, telecommunications) • Construction of monitoring and early warning systems; Measures to identify exposed areas, assist vulnerable areas and households, and diversify livelihoods • Economic diversification								
Increased risk of flood-related deaths, injuries, infectious diseases and mental disorders (*medium confidence*) [24.4.6.2, 24.4.6.3, 24.4.6.5]	Disaster preparedness including early-warning systems and local coping strategies.								







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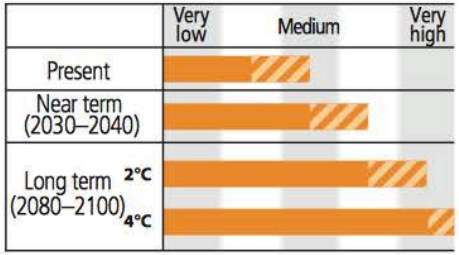
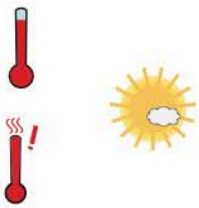
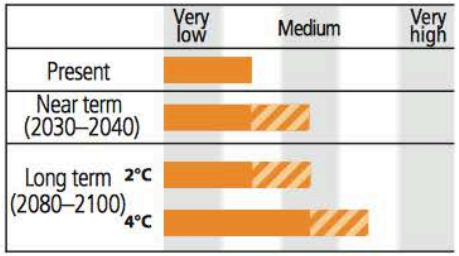
IPCC, AR5, WGII, Chap 24, Table 24.1

Key risks from climate change and the potential for risk reduction through mitigation and adaptation in Asia

Climate-related drivers of impacts							Level of risk & potential for adaptation
Warming trend	Extreme temperature	Extreme precipitation	Drying trend	Damaging cyclone	Sea level	Ocean acidification	Potential for additional adaptation to reduce risk; Risk level with **high** adaptation; Risk level with **current** adaptation

Increased risk of heat-related mortality (*high confidence*) [24.4]	• Heat health warning systems • Urban planning to reduce heat islands; Improvement of the built environment; Development of sustainable cities • New work practices to avoid heat stress among outdoor workers		
Increased risk of drought-related water and food shortage causing malnutrition (*high confidence*) [24.4]	• Disaster preparedness including early-warning systems and local coping strategies • Adaptive/integrated water resource management • Water infrastructure and reservoir development • Diversification of water sources including water re-use • More efficient use of water (e.g., improved agricultural practices, irrigation management, and resilient agriculture)		

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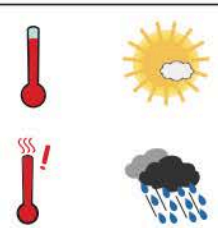
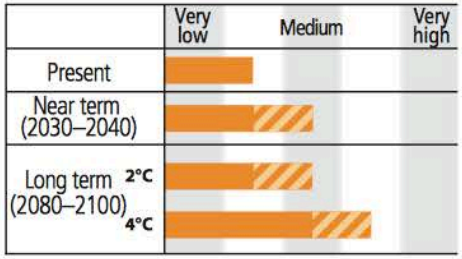
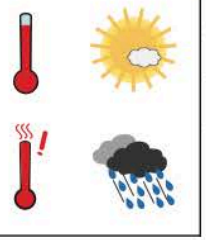
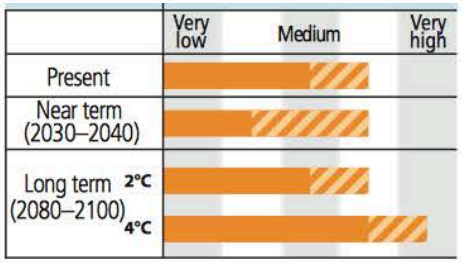
Increased risk of water and vector-borne diseases (*medium confidence*) [24.4.6.2, 24.4.6.3, 24.4.6.5]	Early-warning systems, vector control programs, water management and sanitation programs.		
Exacerbated poverty, inequalities and new vulnerabilities (*high confidence*) [24.4.5, 24.4.6]	Insufficient emphasis and limited understanding on urban poverty, interaction between livelihoods, poverty and climate change.		

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IPCC, AR5, WGII, Chap 24, Table 24.1


RISKS OF
CLIMATE CHANGE
INCREASE
WITH CONTINUED
HIGH EMISSIONS
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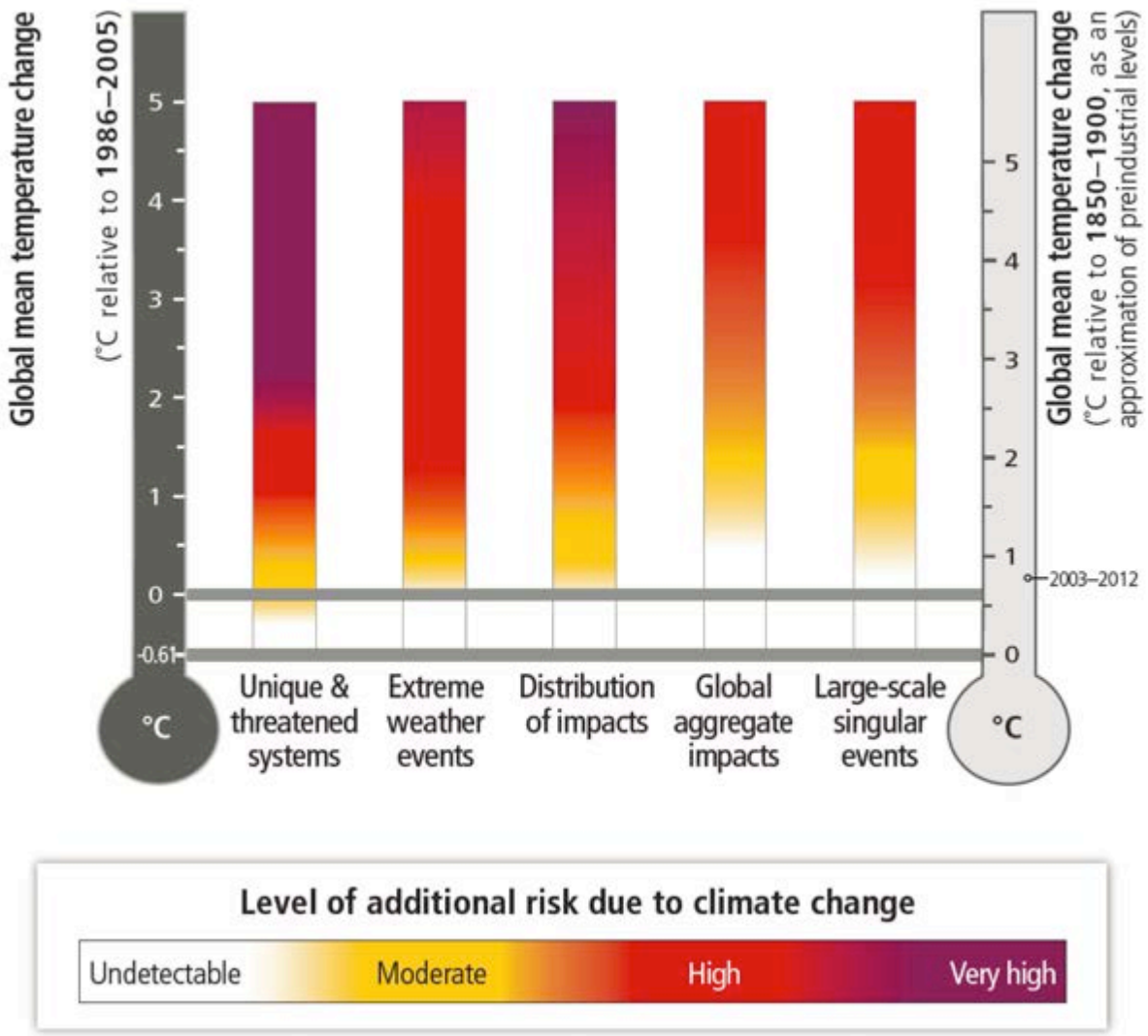
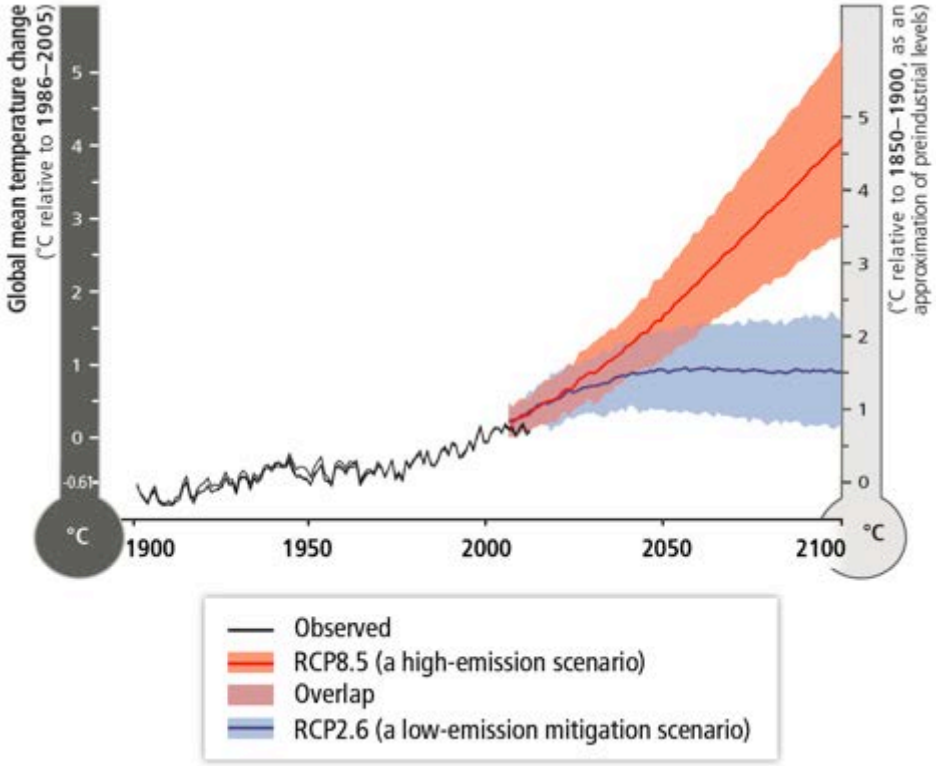
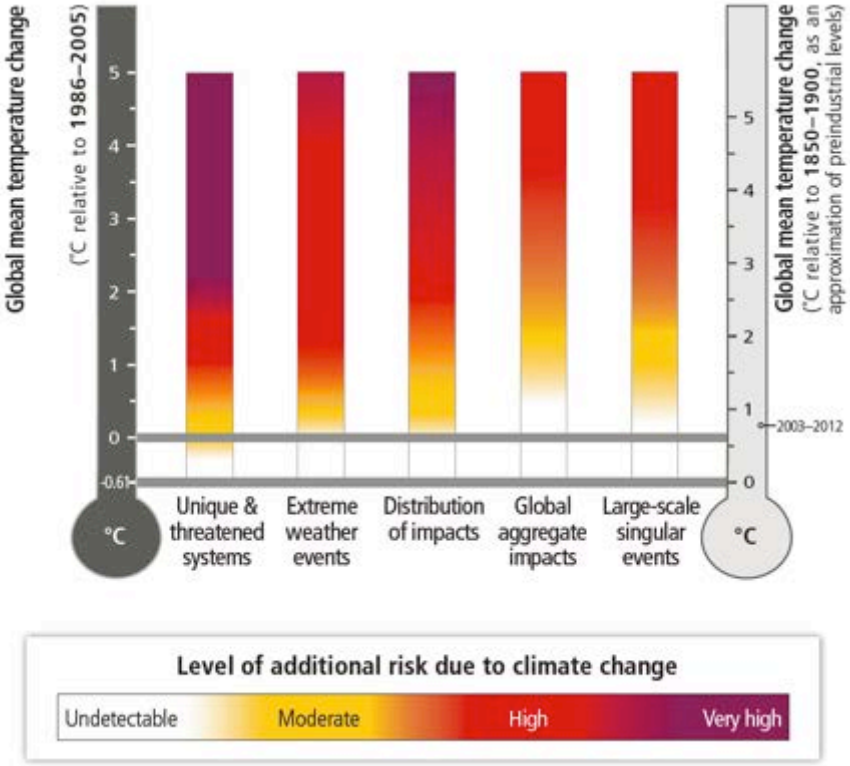


AR5, WGII, Box SPM.1 Figure 1





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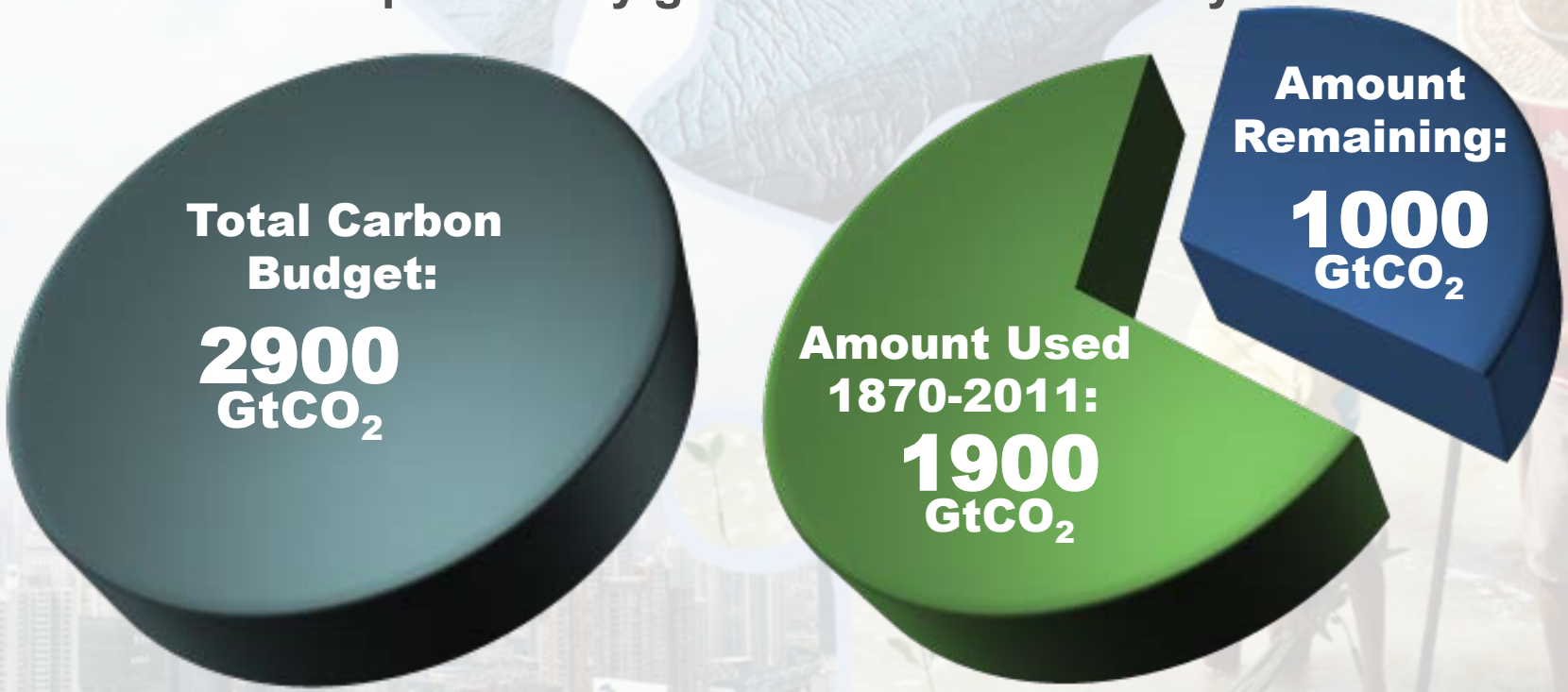
The window for action is rapidly closing

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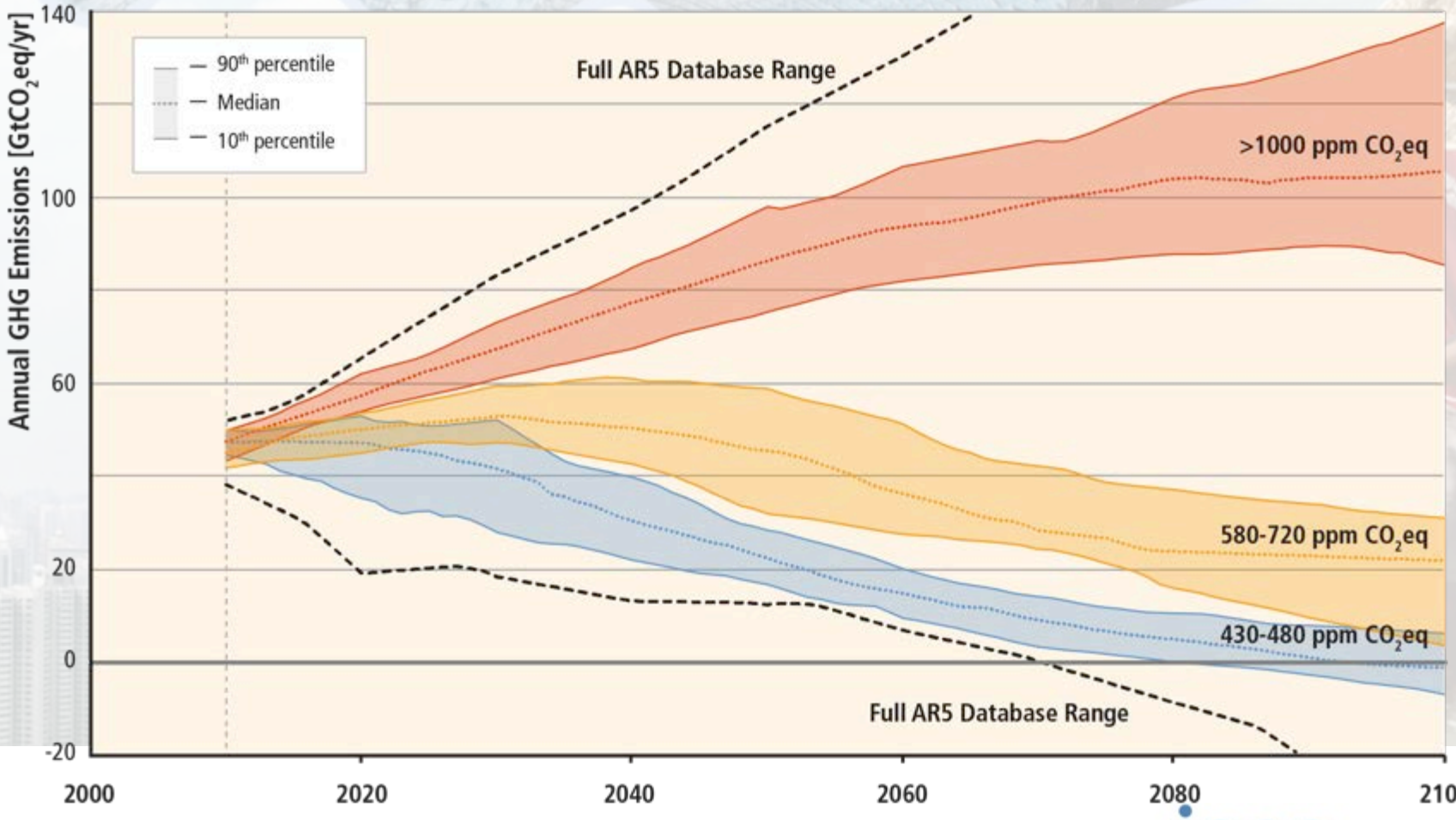
Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.



Based on Figure 6.7

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IPCC AR5 Synthesis Report

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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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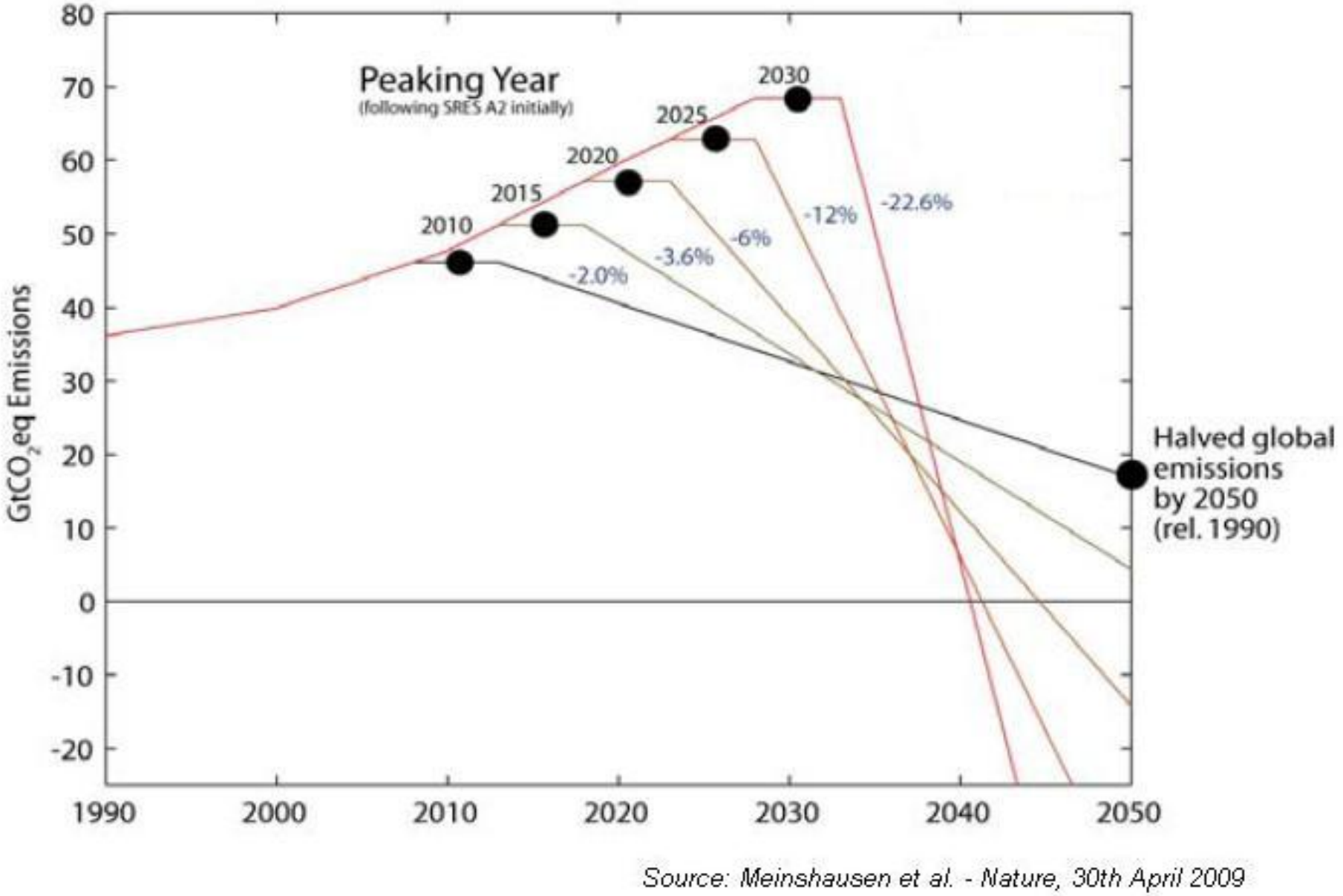
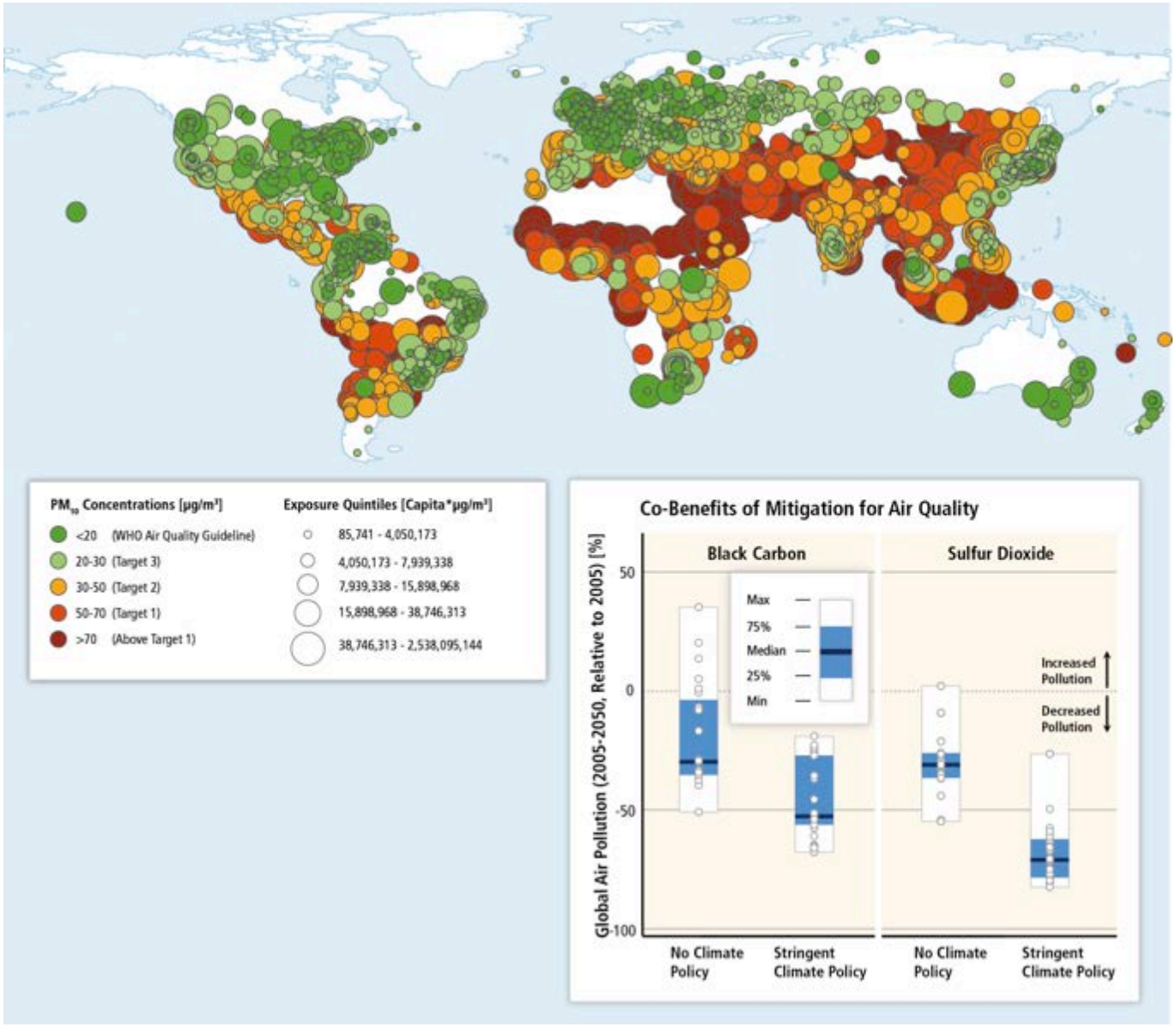
The more we wait, the more difficult it will be



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



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**

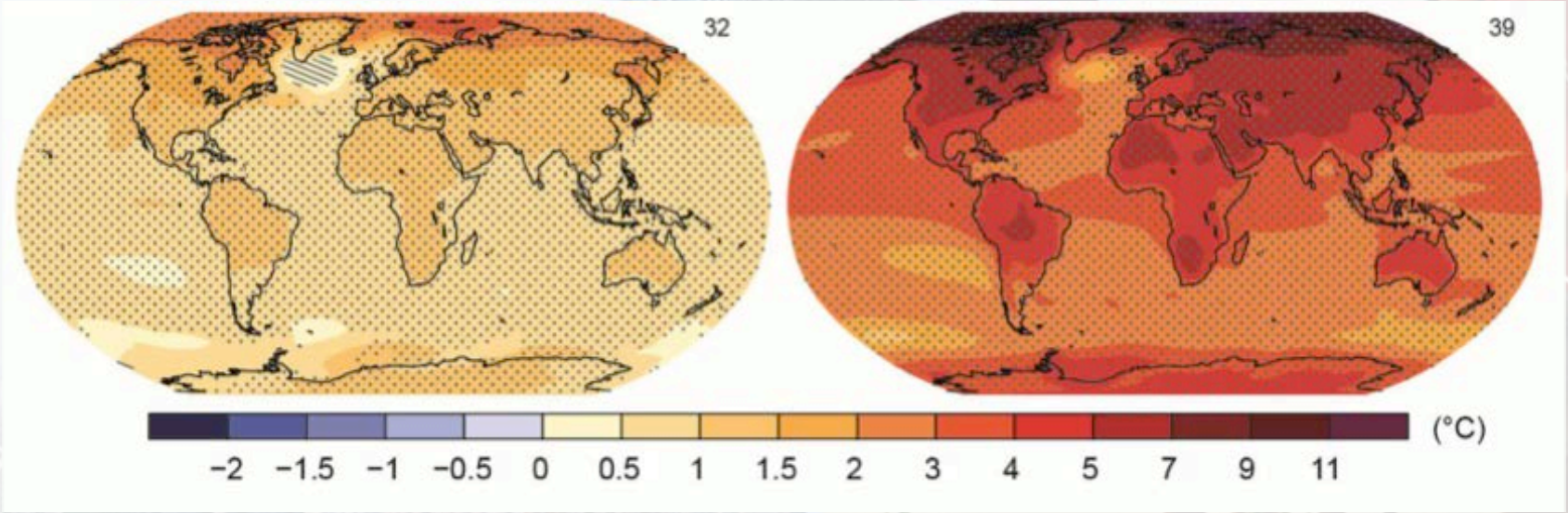
Equity is an integral dimension of Sustainable development (*high confidence*)

- 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 ...

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

ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

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**