



# The challenges of Climate Change and the COP21: ambition and aims

Minh Ha-Duong

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CLIMATE CHANGE FORUM:

Favouring a green economy and sustainable urban development

Colombo, Wednesday 10th June



PARIS2015  
UN CLIMATE CHANGE CONFERENCE  
COP21-CMP11

# **The challenges of Climate Change and the COP21: ambition and aims**

**Dr Minh Ha Duong**

Senior Researcher, lead author of the IPCC and founder of the Clean Energy and Sustainable Development lab at the University of Science and Technology Hanoi, Vietnam

# Clean Energy and Sustainable Development Laboratory

Mission

Facilities

Team

Publications

News

Seminar

## Mission

The Clean Energy and Sustainable Development (CleanED) lab is an international and interdisciplinary research team contributing to the green growth of the energy sector in Vietnam. Established in December 2014 with support from USTH and French Embassy, the CleanED lab hosts today four researchers from France and Vietnam, three doctoral fellows and two internationally qualified staff under the direction of Dr. Minh Ha-Duong.

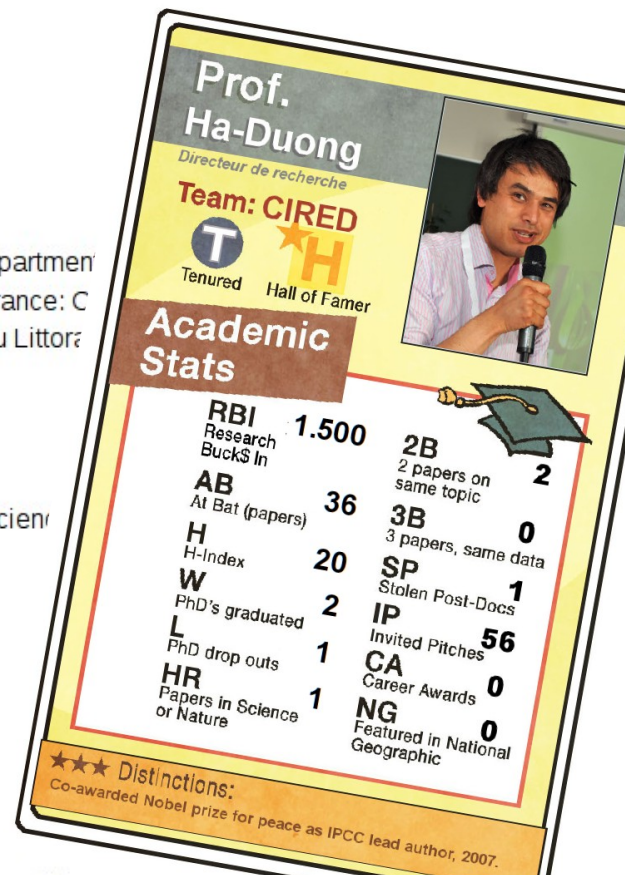
Our expertise ranges from engineering to public policy on:

- Natural resources characterization and management
- Biomass and waste to energy conversion process technologies
- Energy systems optimization from smart grid to national plans

The CleanED lab is a working place for researchers, doctoral fellows and students from USTH's Energy department welcome Bachelor and Master level interns. Most are coming from or going to our partner laboratories in France: C BioWooEB/CIRAD, LAGEP/Université de Lyon, LABEX ARBRE/Université de Lorraine, LOG/Université du Littoral; other USTH consortium members, and our partner institute in Vietnam: IES/VAST.

## Facilities

The CleanED lab office and experimental room are both located on the Campus of Vietnam Academy of Science Hoang Quoc Viet, Cau Giay, Hanoi.



# Minh Ha-Duong's Publication List

Energy, climate, society economics & uncertainty

## Articles in peer-reviewed journals

36. Nguyen Trinh Hoang Anh and Minh Ha-Duong. **Perspective of CO<sub>2</sub> capture & storage (CCS) development in Vietnam: Results from expert interviews.** *International Journal of Greenhouse Gas Control*, 37:220-227, June 2015.
35. Jeff M. Bielicki, Guillaume Calas, Richard S. Middleton, and Minh Ha-Duong. **National corridors for climate change mitigation: Managing industrial CO<sub>2</sub> emissions in France.** *Greenhouse gases: science and technology*, 3 (4):262-277, June 2014.
34. Minh Ha-Duong and Venance Journé. **Calculating nuclear accident probabilities from empirical frequencies.** *Environment Systems and Decisions*, 34 (2):249-258, May 2014.
33. Olivier Boucher, Piers M. Forster, Nicolas Gruber, Minh Ha-Duong, Mark G. Lawrence, Timothy M. Lenton, Achim Maas, and Naomi E. Vaughan. **Rethinking climate engineering categorization in the context of climate change mitigation and adaptation.** *WIREs Clim Change*, 5 (1):23-25, 2014.
32. Patrice Dumas and Minh Ha-Duong. **Optimal growth with adaptation to climate change.** *Climatic Change*, 117 (4):691-710, April 2013.
31. Marta Benito-Garzón, Minh Ha-Duong, Nathalie Frascaria-Lacoste, and Juan Fernández-Manjarrés. **Extreme climate variability should be considered in forestry-assisted migration.** *BioScience*, 63 (5):317, 2013.
30. Marta Benito-Garzón, Minh Ha-Duong, Nathalie Frascaria-Lacoste, and Juan Fernández-Manjarrés. **Habitat restoration and climate change: dealing with climate variability, incomplete data and management decisions with tree translocations.** *Restoration Ecology*, 21 (5):530-536, 2013.
29. Minh Ha-Duong and Rodica Loisel. **Actuarial risk assessment of expected fatalities attributable to carbon capture and storage in 2050.** *International Journal of Greenhouse Gas Control*, 5:1346-1358, 2011.
28. Nhan Thanh Nguyen, Minh Ha-Duong, Thanh C. Tran, Ram M. Shrestha, and Franck Nadaud. **Barriers to the adoption of cleaner and energy efficient technologies in Vietnam.** *GMSARN International Journal*, 4 (2):89-104, June 2010.
27. Nhan Thanh Nguyen, Minh Ha-Duong, Sandra Greiner, and Michael Mehling. **Improving the clean development mechanism post-2012: A developing country perspective.** *Carbon and Climate Law Review*, 1 (4):76-85, 2010.
26. Minh Ha-Duong, Alain Nadaï, and Ana Sofia Campos. **A survey on the public perception of CCS in France.** *International Journal of Greenhouse Gas Control*, 3 (5):633-640, September 2009.
25. Minh Ha-Duong. **What is the price of carbon? Five definitions.** *Survey and Perspectives Integrating Environment & Society*, 2 (1), June 2009.

## About me

My research is on energy, climate change, society, economics and uncertainty. I am interested in imprecise probabilities, especially using **possibility theory** for scenario-making and the **Transferable Belief Model** for expert opinion fusion, with applications to environmental and energy economics issues such as climatic change and carbon capture and storage...

I also work on the social and economic aspects of carbon capture and storage. My CCS blog in French is at [CaptageStockageCO2.eu](#). I also commit prose at my [homepage on CIRED website](#).

Here is the formal [CV](#), there is the [informal summary](#) (thanks [PhD comics](#)!), the [LinkedIn](#) and the [bibliometric link](#).



# Transition to low carbon world

*Renewable energy technologies set new installation records as their contribution to the global energy mix continued to climb in 2013.*

*Renewable power capacity jumped more than 8 percent in 2013, accounting for over 56 percent of net additions*

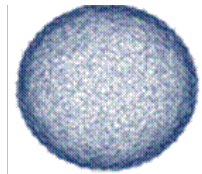
*It now has the potential to account for over a fifth of world electricity generation.*

# Climate negotiations since 1992



**1992**

**UNFCCC  
Rio**



**COP15  
COPENHAGEN**

**2009**

**COP 15  
Copenhag.**

**2010**

**COP 16  
Cancun**

**2011**

**COP 17  
Durban**

**2012**

**COP 18  
Doha**

**2013**

**COP 19  
Varsovie**

**2014**

**COP 20  
Lima**



**PARIS2015**  
UN CLIMATE CHANGE CONFERENCE  
COP21-CMP11

**2015**

**COP 21  
Paris**

**2007**

**COP 13  
Bali**

**1997  
Protocol  
Kyoto**

Starts 2005  
No USA  
27% of GHG  
emissions.  
39 countries  
- 5,2% over  
2008-2012  
relative to  
1990

**Bali process**

**Bali  
roadmap**  
Towards a  
post-2012  
agreement  
in 2009

**Copenhaguen  
fiasco**

**Cancun  
agreement**

Engagements de  
financement et de  
limitation des  
émissions à 2020,  
mise en place  
d'instance sur le  
financement,  
d'adaptation et le  
transfert de  
techno.

**Bali  
roadmap  
end**

**Décision :**  
Accord de principe sur une  
2<sup>ème</sup> période d'engagement  
du PK et création de la  
plateforme de Durban  
pour un accord en 2015

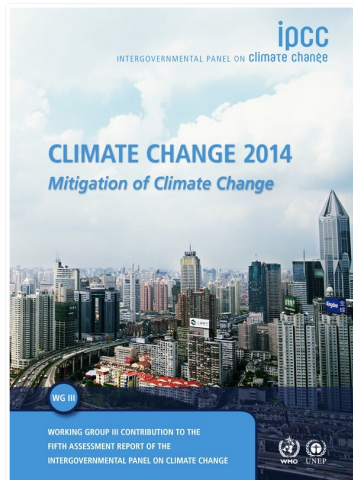
**Durban platform**

# UNFCCC

## United Nations Framework Convention on Climate Change

### IPCC

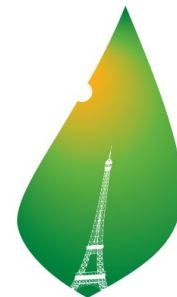
Intergovernmental Panel  
on Climate Change



Science

### COP

Conferences of Parties



Policy

PARIS2015  
UN CLIMATE CHANGE CONFERENCE  
COP21•CMP11



# IPCC Fifth Assessment Report Synthesis Report

IPCC AR5 Synthesis Report

**ipcc**  
INTERGOVERNMENTAL PANEL ON climate change





# The IPCC Synthesis Report

→ Integration of three Working Group Reports of the 5<sup>th</sup> Assessment, 2013-2014

- WG I : The Physical Science Basis

- WGII: Impacts, Adaptation and Vulnerability

- WG III: Mitigation of Climate Change



# The IPCC Synthesis Report

- Written by 60 authors from Working Group reports
- Chaired by the IPCC Chair R.K. Pachauri
- Member governments approved the SPM on 1<sup>st</sup> November 2014 (total membership of IPCC is 195 governments)



# Key Messages

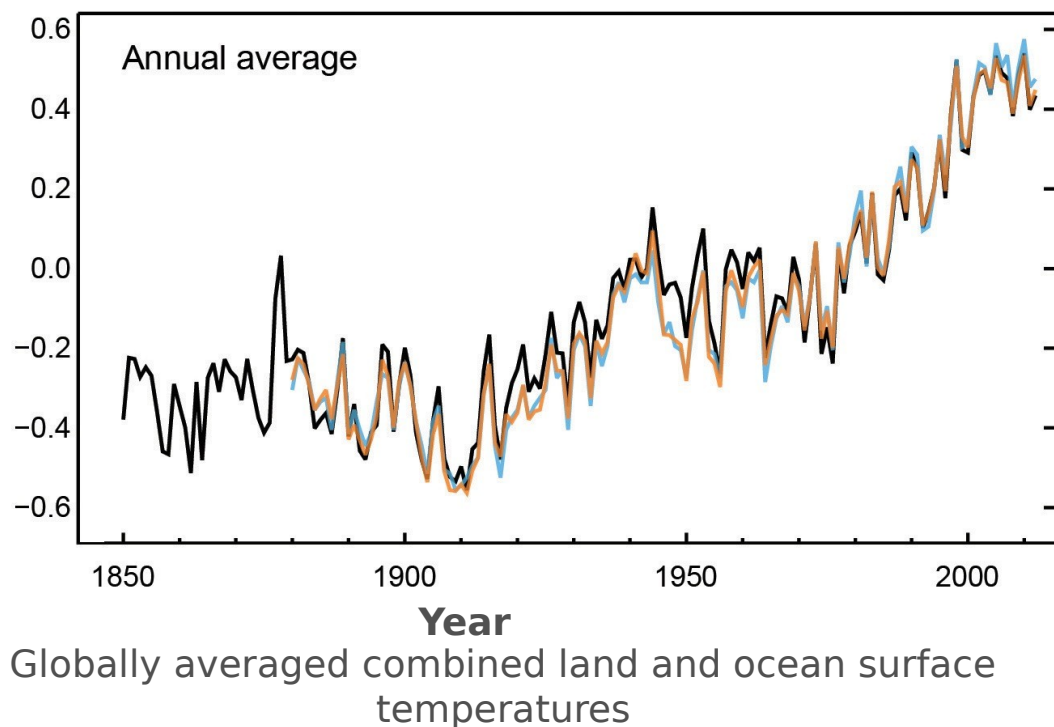
- Human influence on the climate system is clear
- The more we disrupt our climate, the more we risk severe, pervasive and irreversible impacts
- We have the means to limit climate change and build a more prosperous, sustainable future

AR5 WGI SPM, AR5 WGI SPM, AR5 WGI SPM



# Humans are changing the climate

It is extremely likely that we are the dominant cause of warming since the mid-20th century

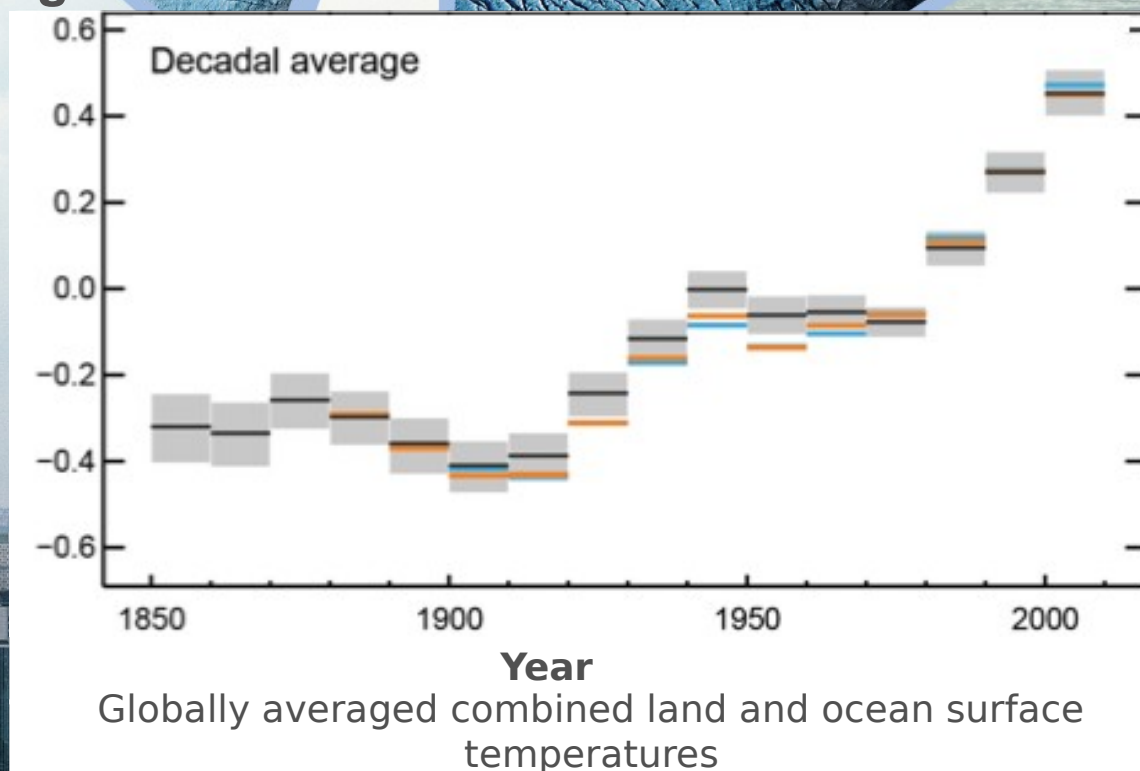


AR5 WGI SPM



# Temperatures continue to rise

Each of the past 3 decades has been successively warmer than the preceding decades since 1850

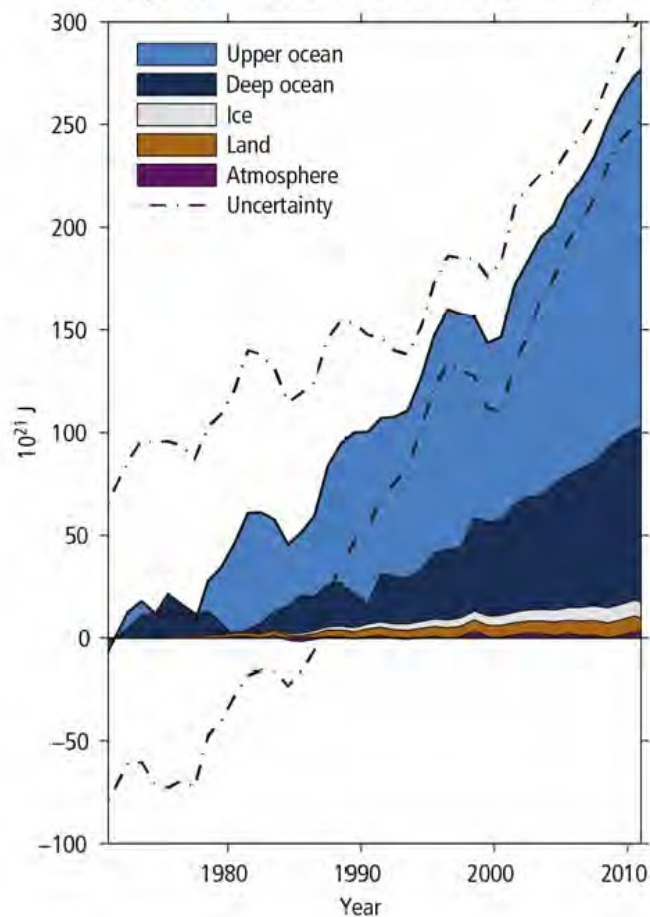


AR5 WGI SPM



# Oceans absorb most of the heat

Energy accumulation within the Earth's climate system

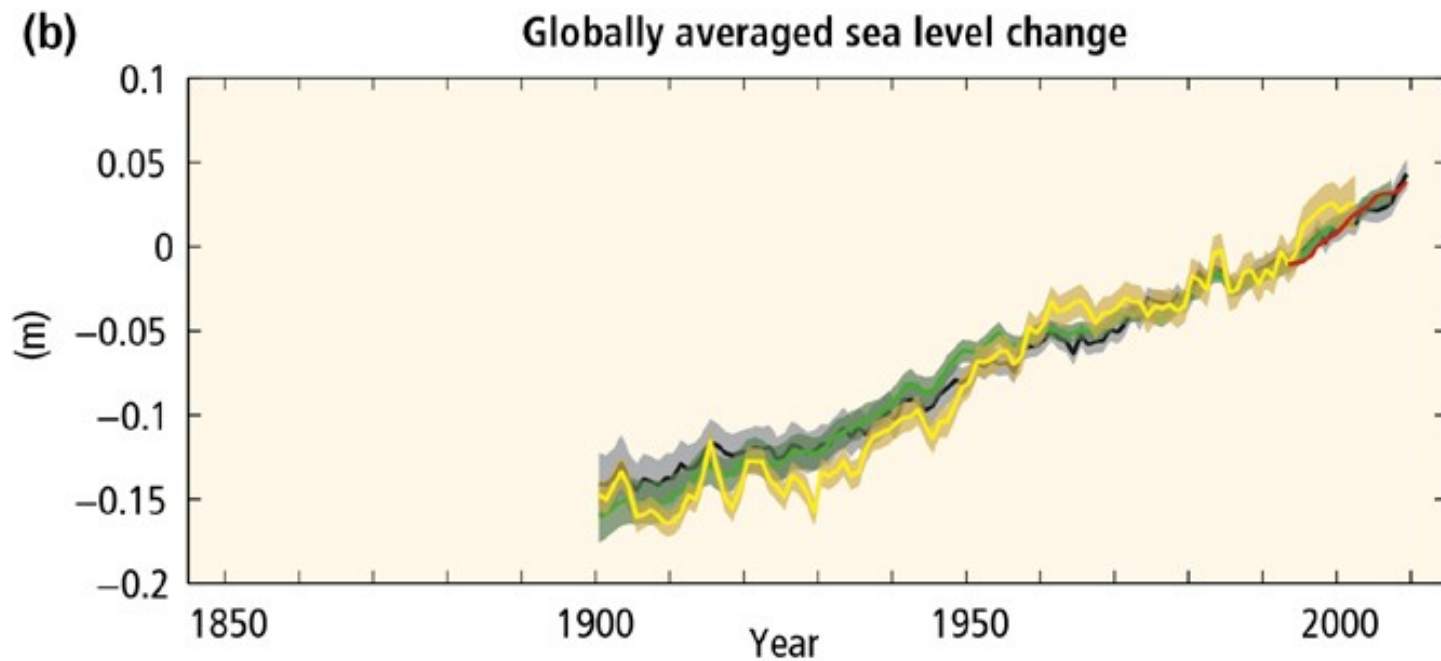
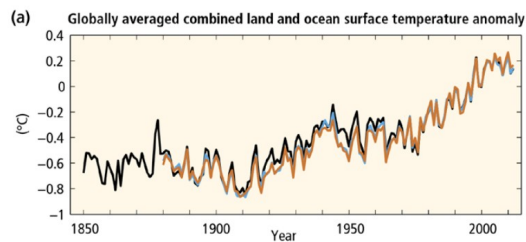


→ More than 90% of the energy accumulating in the climate system between 1971 and 2010 has accumulated in the ocean

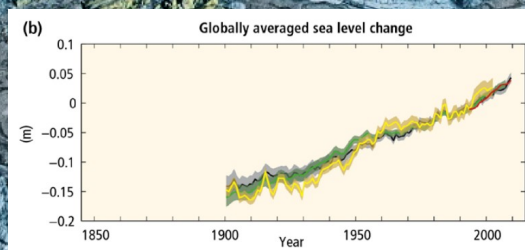
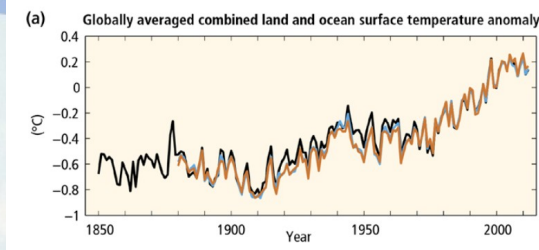
→ Land temperatures remain at historic highs while ocean temperatures continue to climb

AR5 SYR

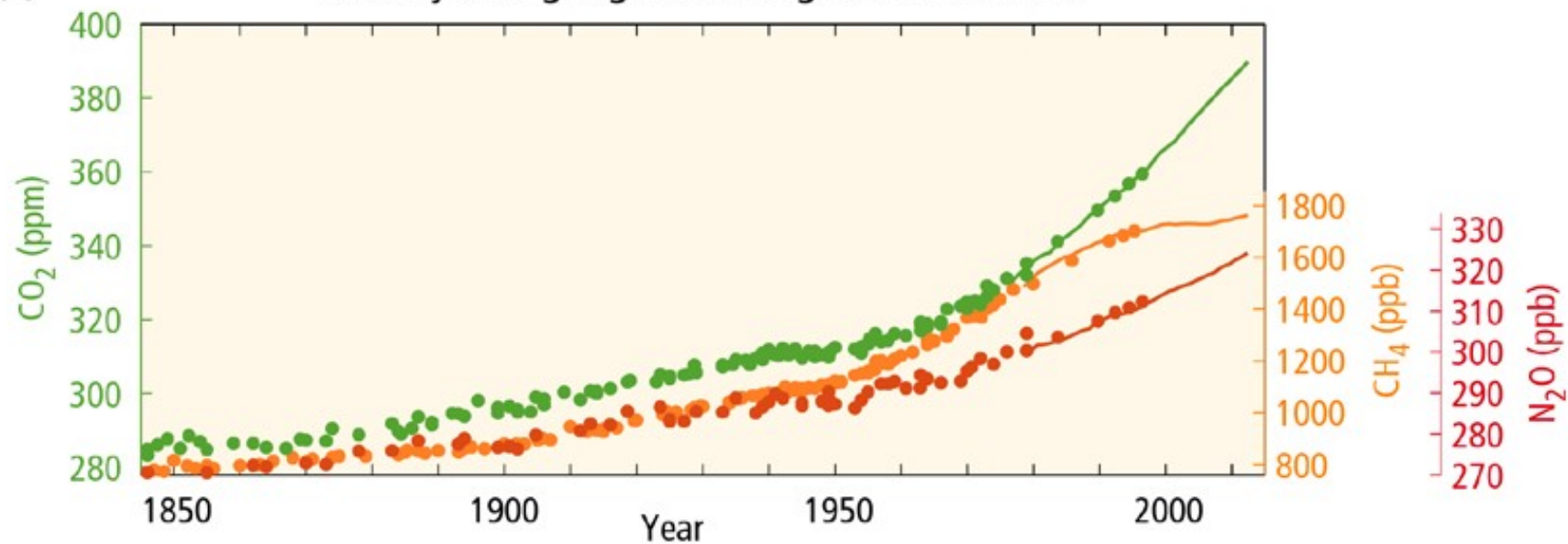




AR5 SYR SPM

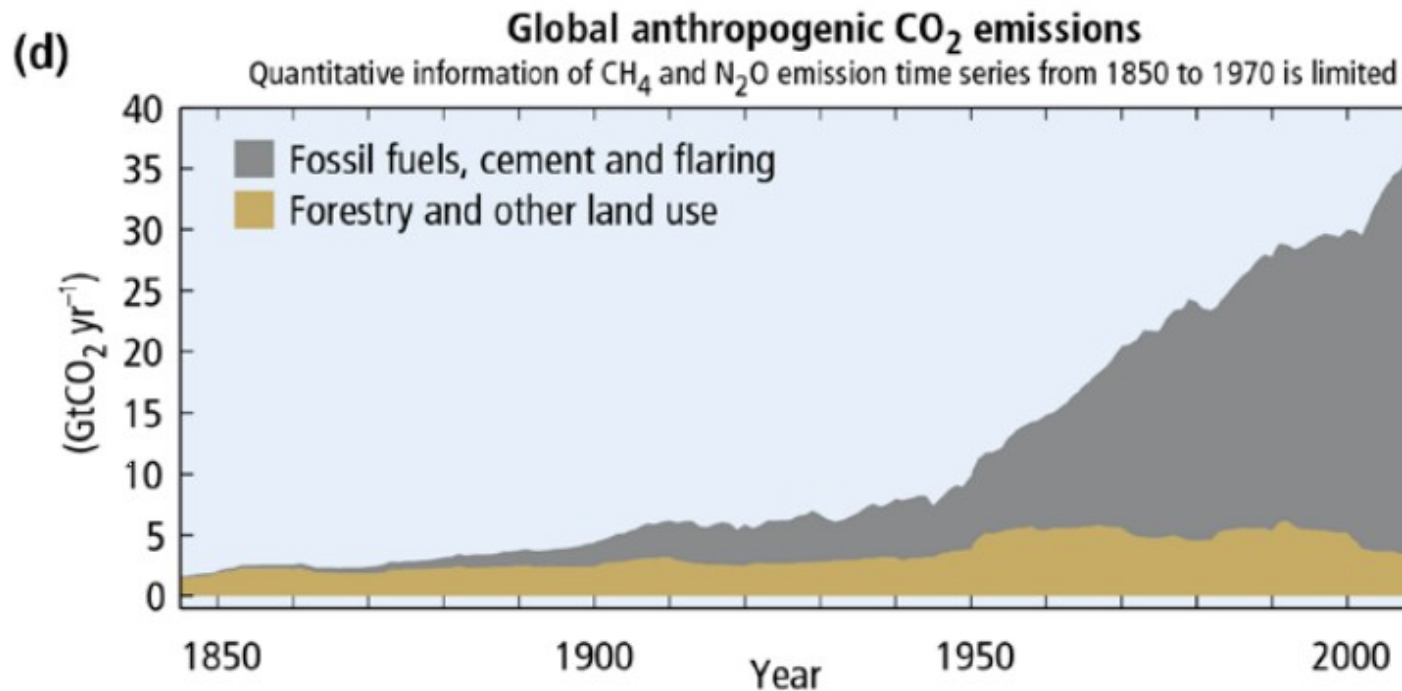
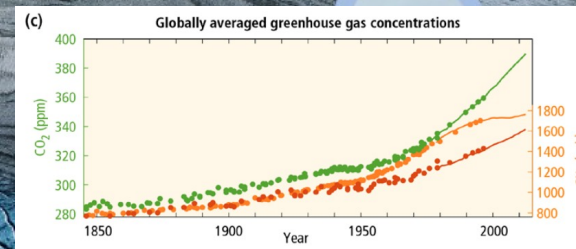
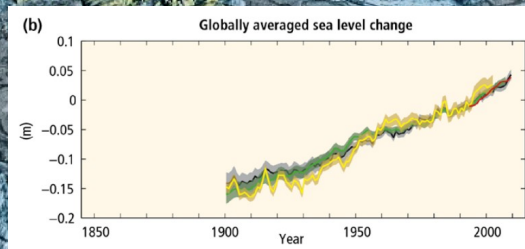
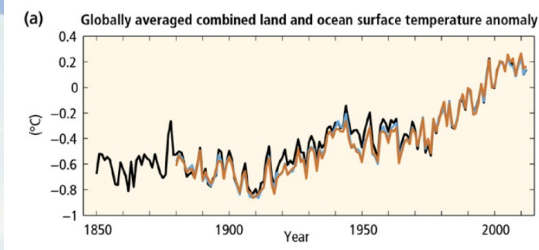


(c) Globally averaged greenhouse gas concentrations



AR5 SYR SPM

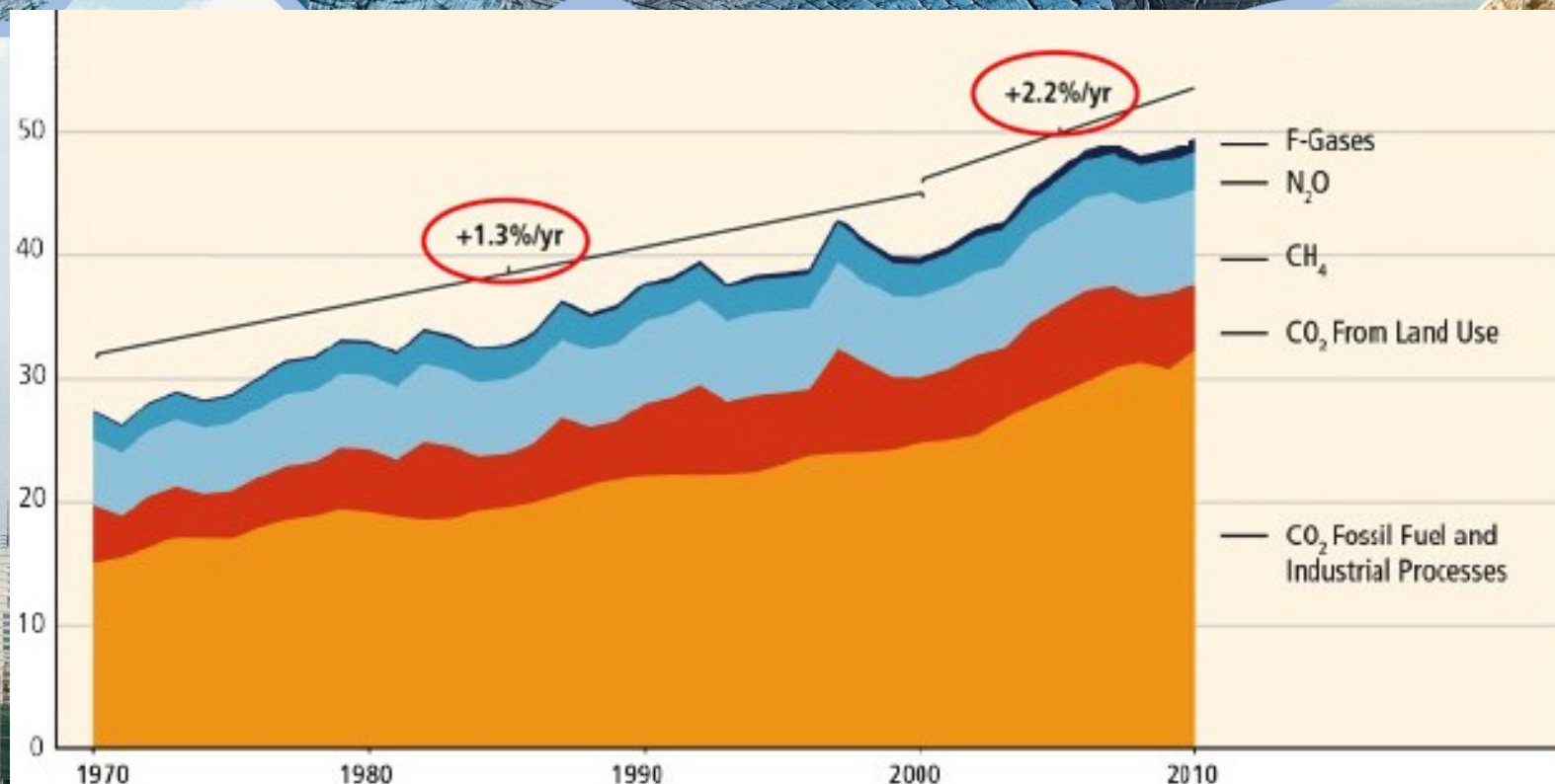




AR5 SYR SPM

# GHG emissions growth between 2000 and 2010 has been larger than in the previous three decades

GHG Emissions [GtCO<sub>2</sub> eq/yr]

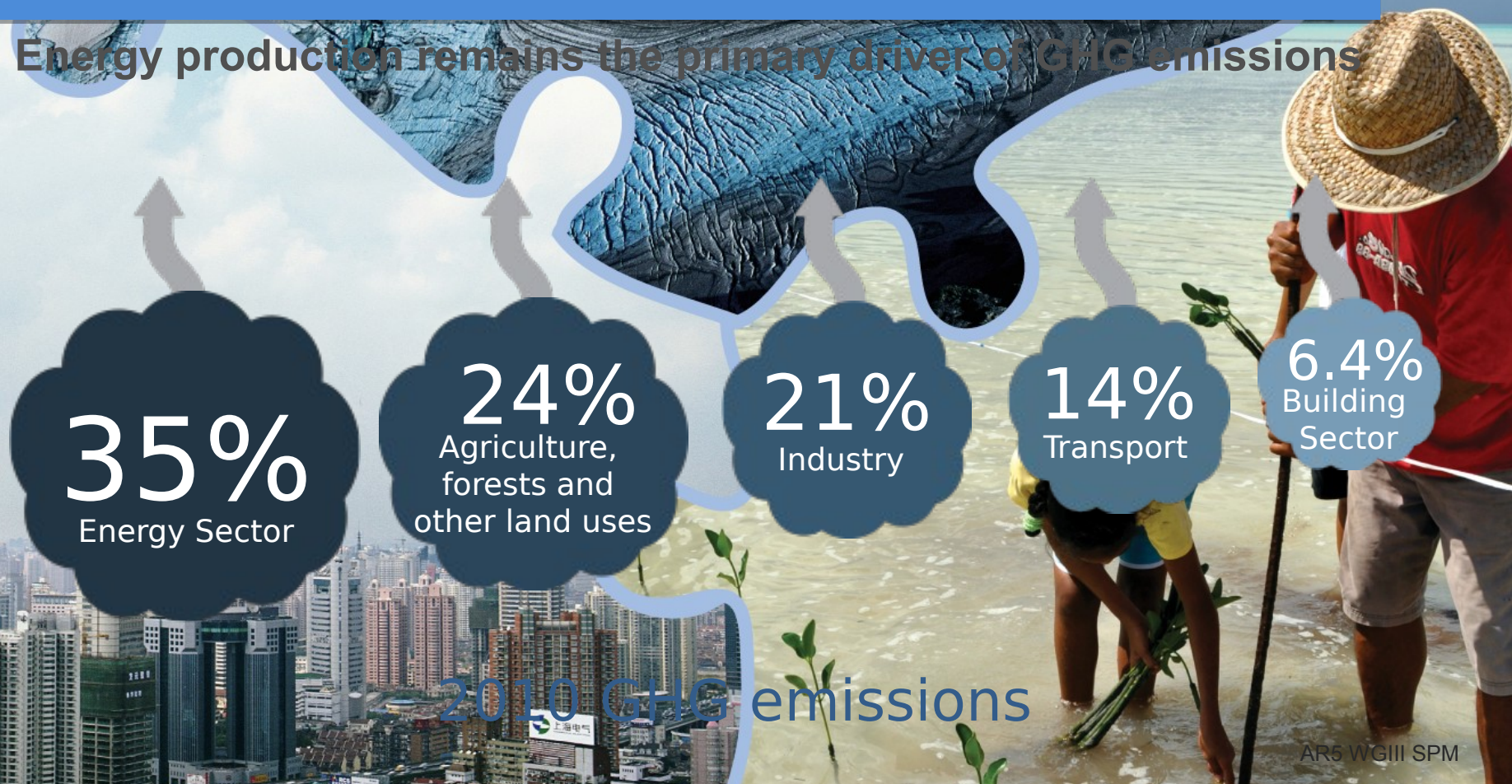


AR5 WGIII SPM



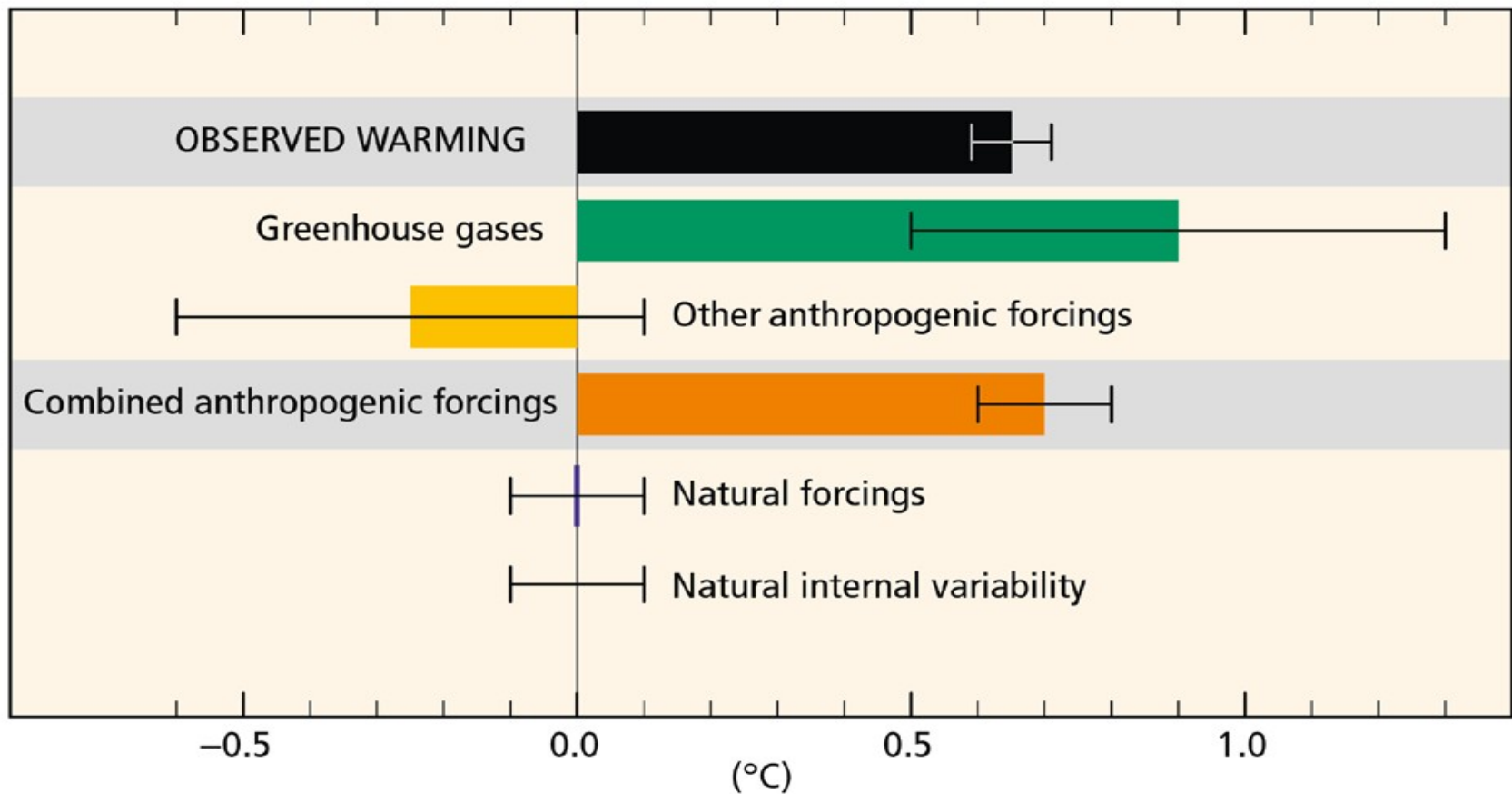
# Sources of emissions

Energy production remains the primary driver of GHG emissions



# Antropogenic forcings are *extremely likely* the cause of warming

Contributions to observed surface temperature change over the period 1951-2010





Some of the changes in extreme weather and climate events observed since about 1950 have been linked to human influence



AR5 WGI SPM



# Impacts are already underway

- Tropics to the poles
- On all continents and in the ocean
- Affecting rich and poor countries



AR5 WGII SPM



# Projected climate changes

Continued emissions of greenhouse gases will cause further warming and changes in the climate system



Oceans will continue to warm during the 21st century



Global mean sea level will continue to rise during the 21st century



It is very likely that the Arctic sea ice cover will continue to shrink and thin as global mean surface temperature rises



Global glacier volume will further decrease

AR5 WGI SPM



# Potential Impacts of Climate Change



Food and water shortages



Increased displacement of people



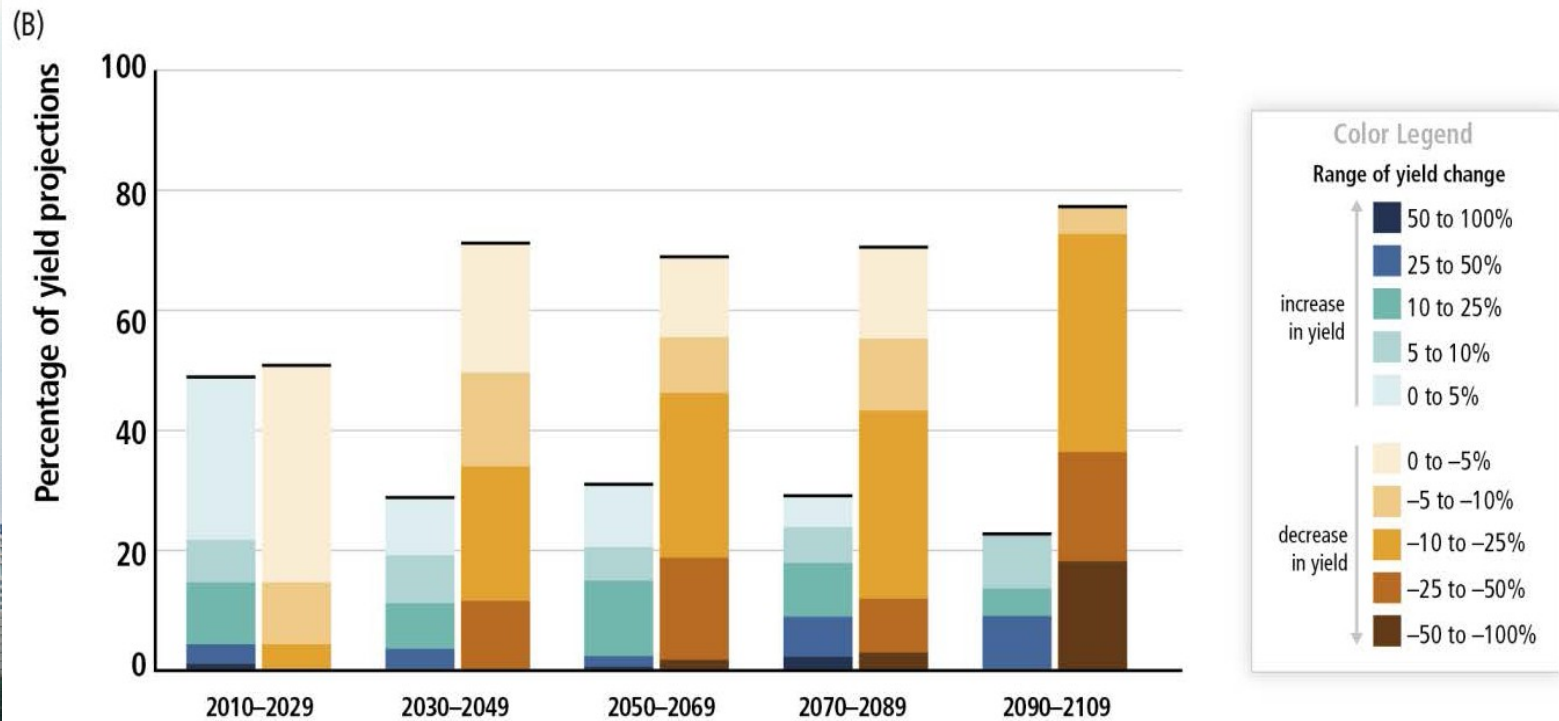
Increased poverty



Coastal flooding

AR5 WGII SPM

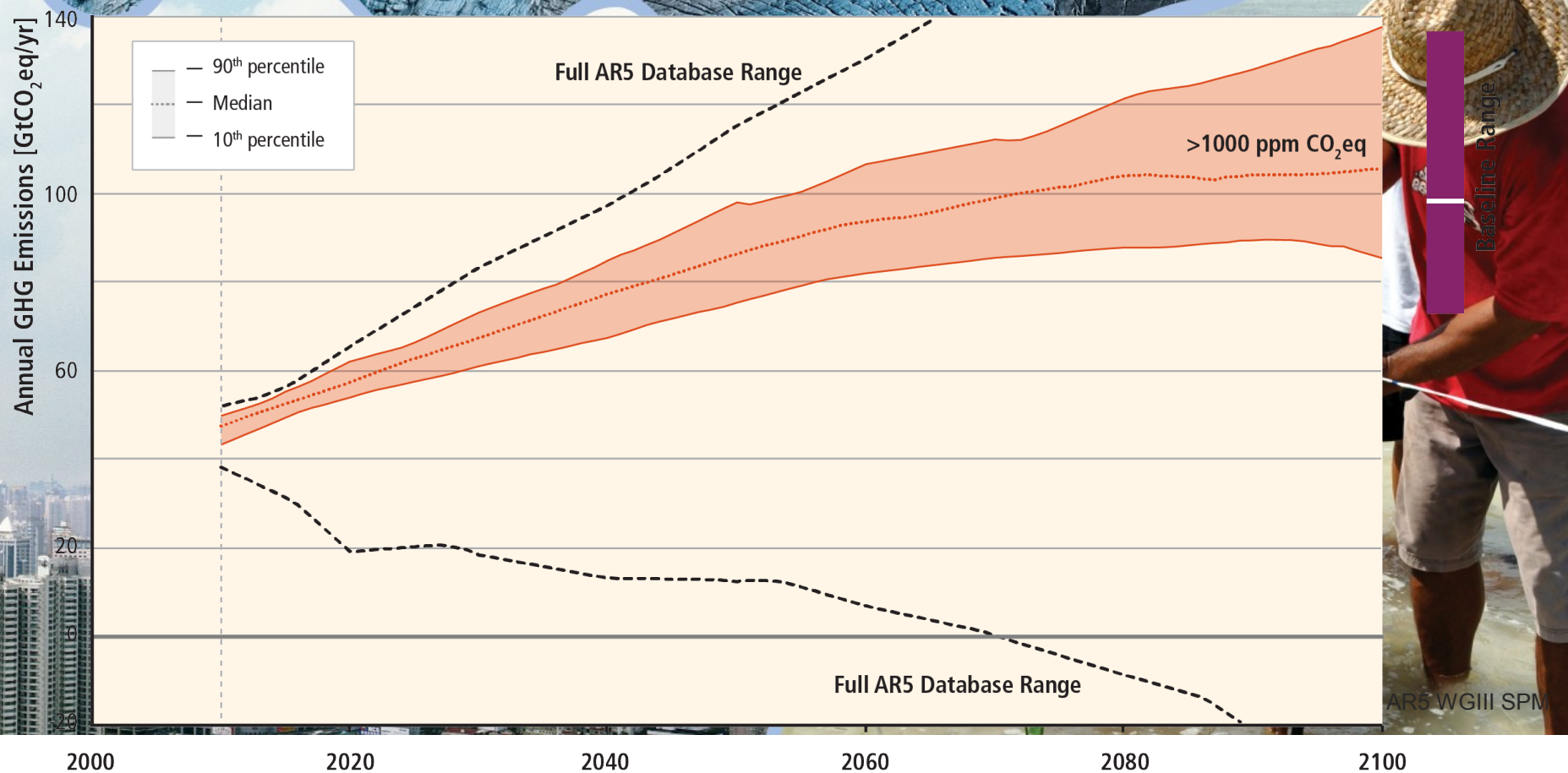
# Climate Change Poses Risk for Food Production



AR5 SYR SPM

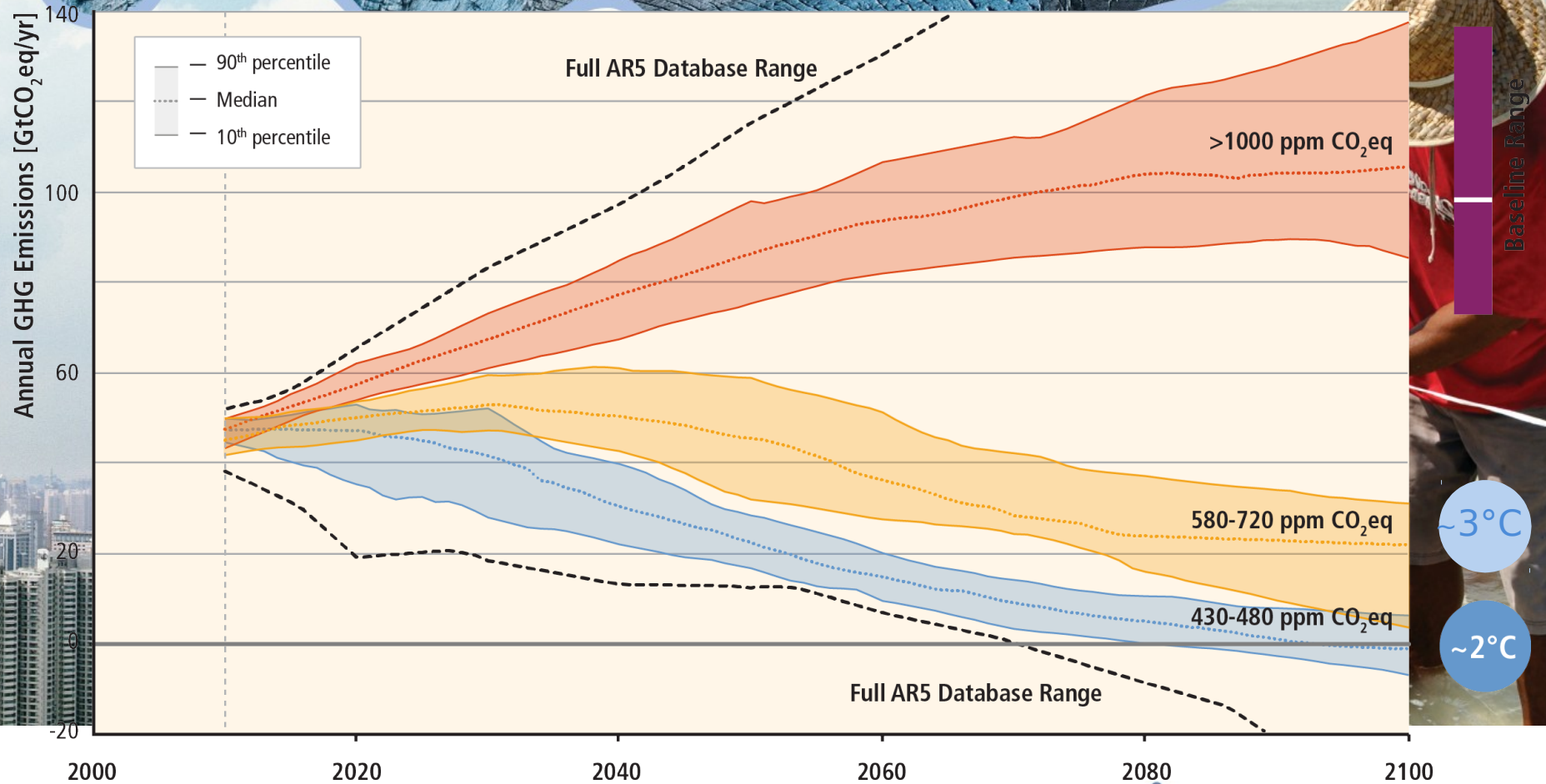


# Stabilization of atmospheric concentrations requires moving away from the baseline - regardless of the mitigation goal.



Based on Figure 6.7

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



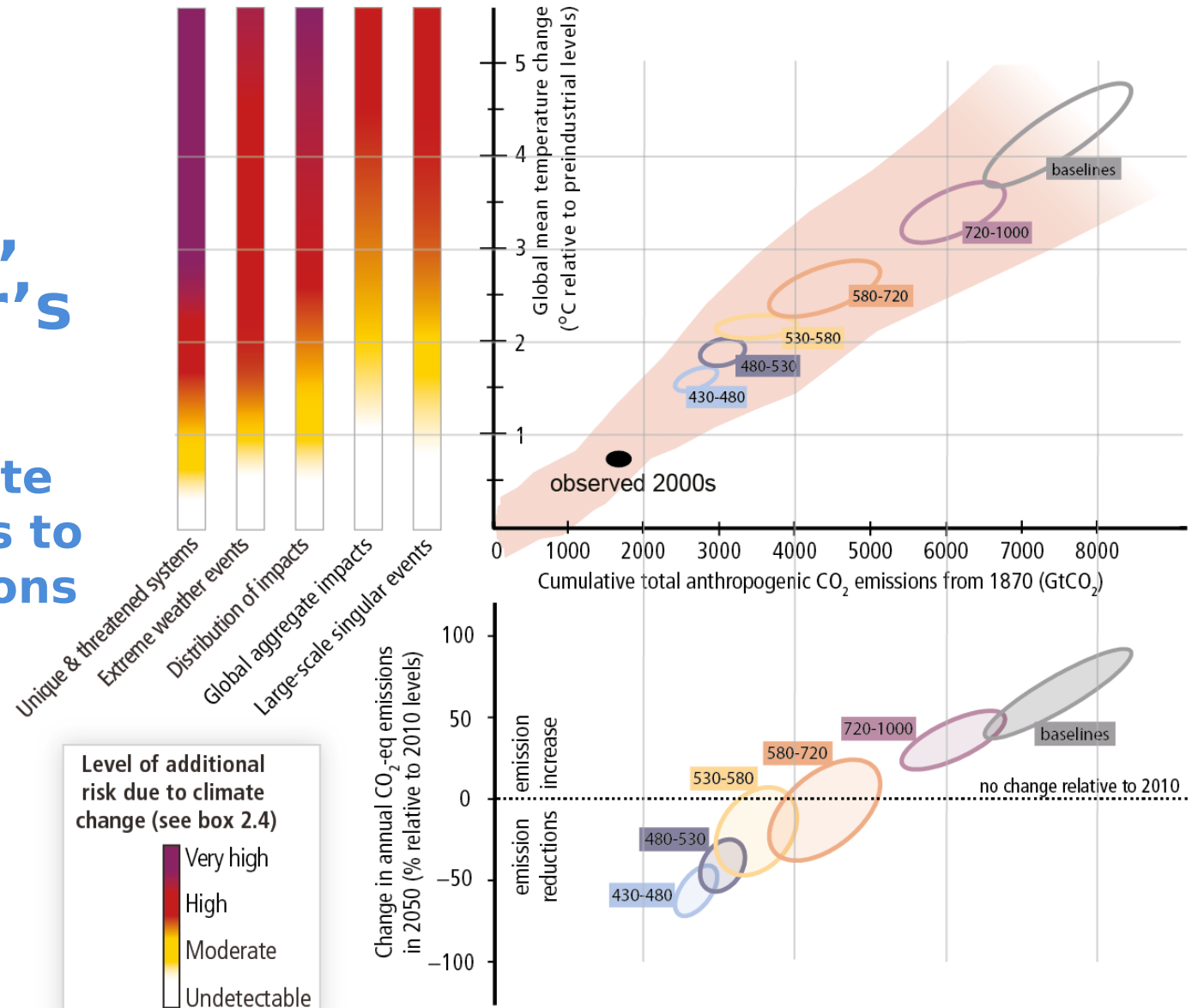
Based on Figure 6.7



(A) Risks from climate change... (B) ...depend on cumulative CO<sub>2</sub> emissions...

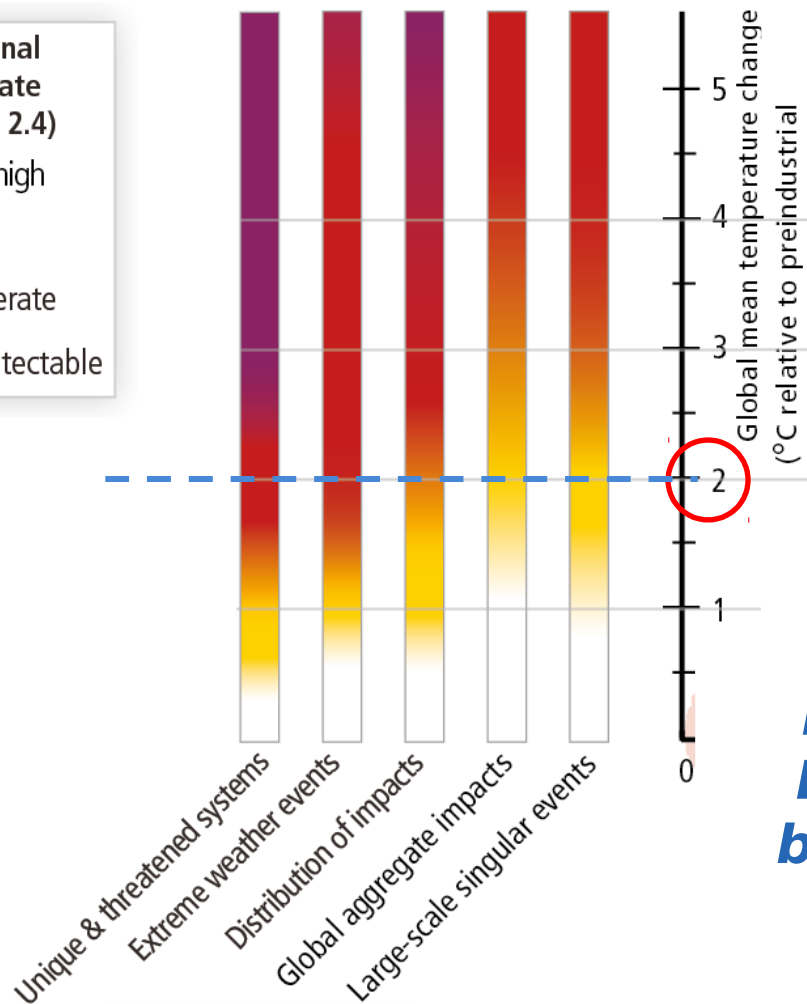
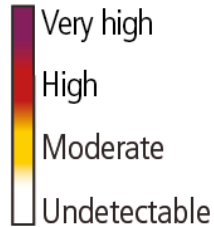
# Figure SPM.10, A reader's guide

## From climate change risks to GHG emissions



(C) ...which in turn depend on annual emissions over the next decades

Level of additional risk due to climate change (see box 2.4)



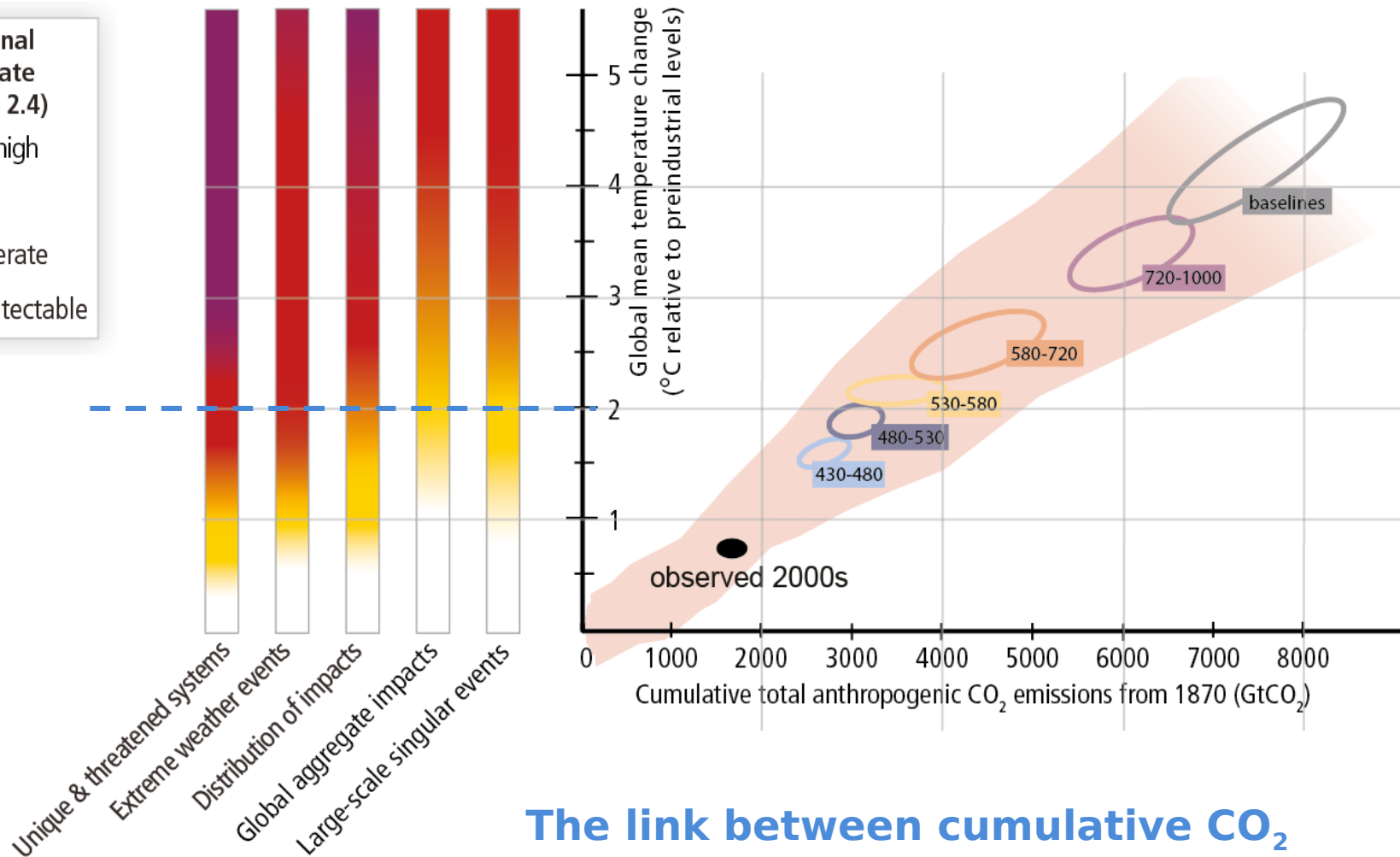
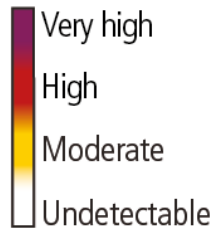
**The risks from climate change, assessed by the WGII of the IPCC AR5, and aggregated in five “Reasons for Concern”**

***Levels of risk across the Reasons for Concern can be associated with a level of global temperature change.***

***Here shown for a warming by 2°C***



Level of additional risk due to climate change (see box 2.4)

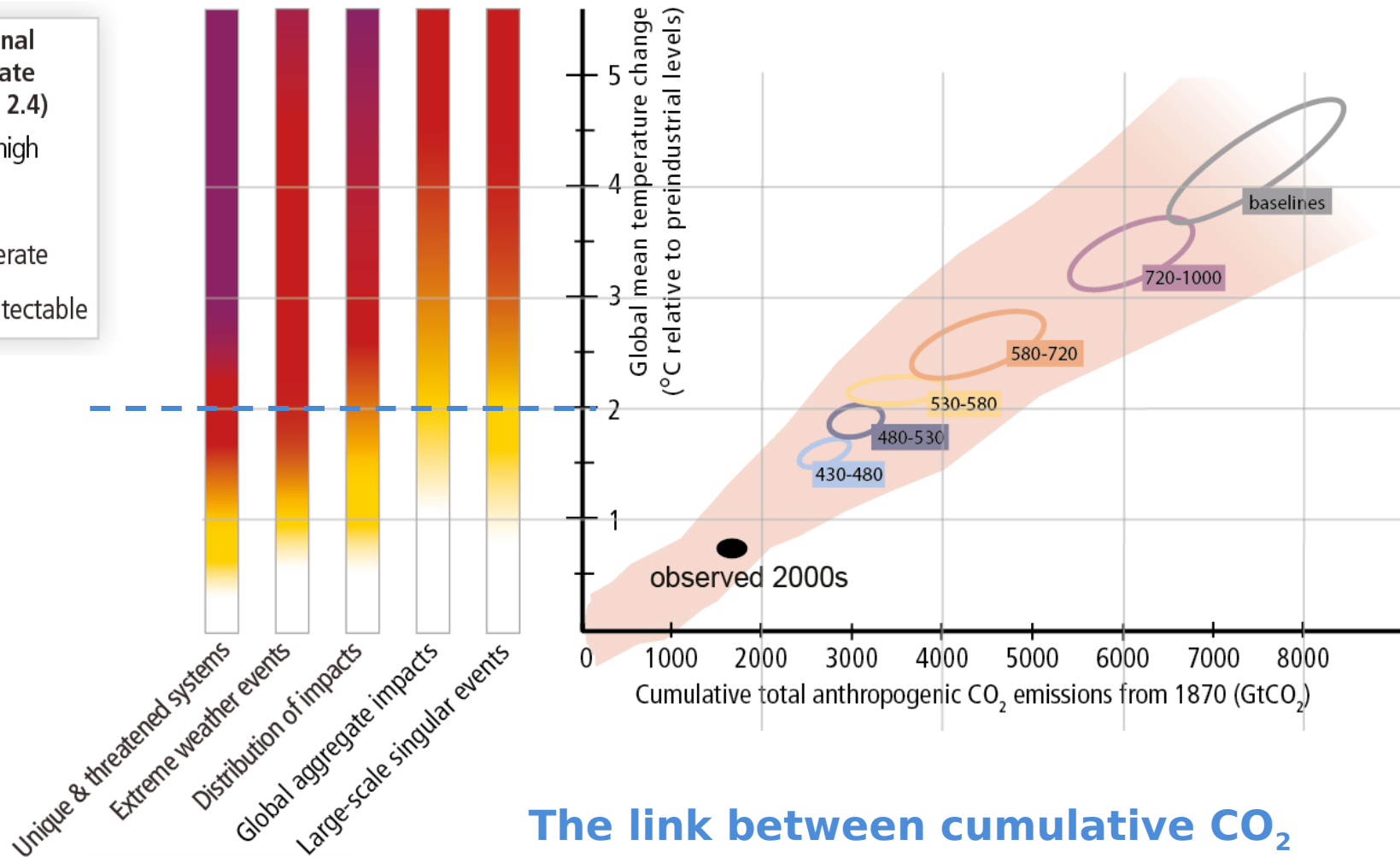
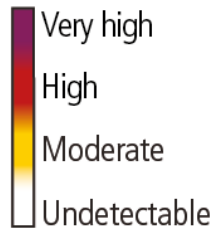


**The link between cumulative CO<sub>2</sub> emissions and global mean temperature**

**The pink plume is from WGI complex models.**

**It includes the uncertainty from non-CO<sub>2</sub> gases and climate and carbon cycle**

Level of additional risk due to climate change (see box 2.4)

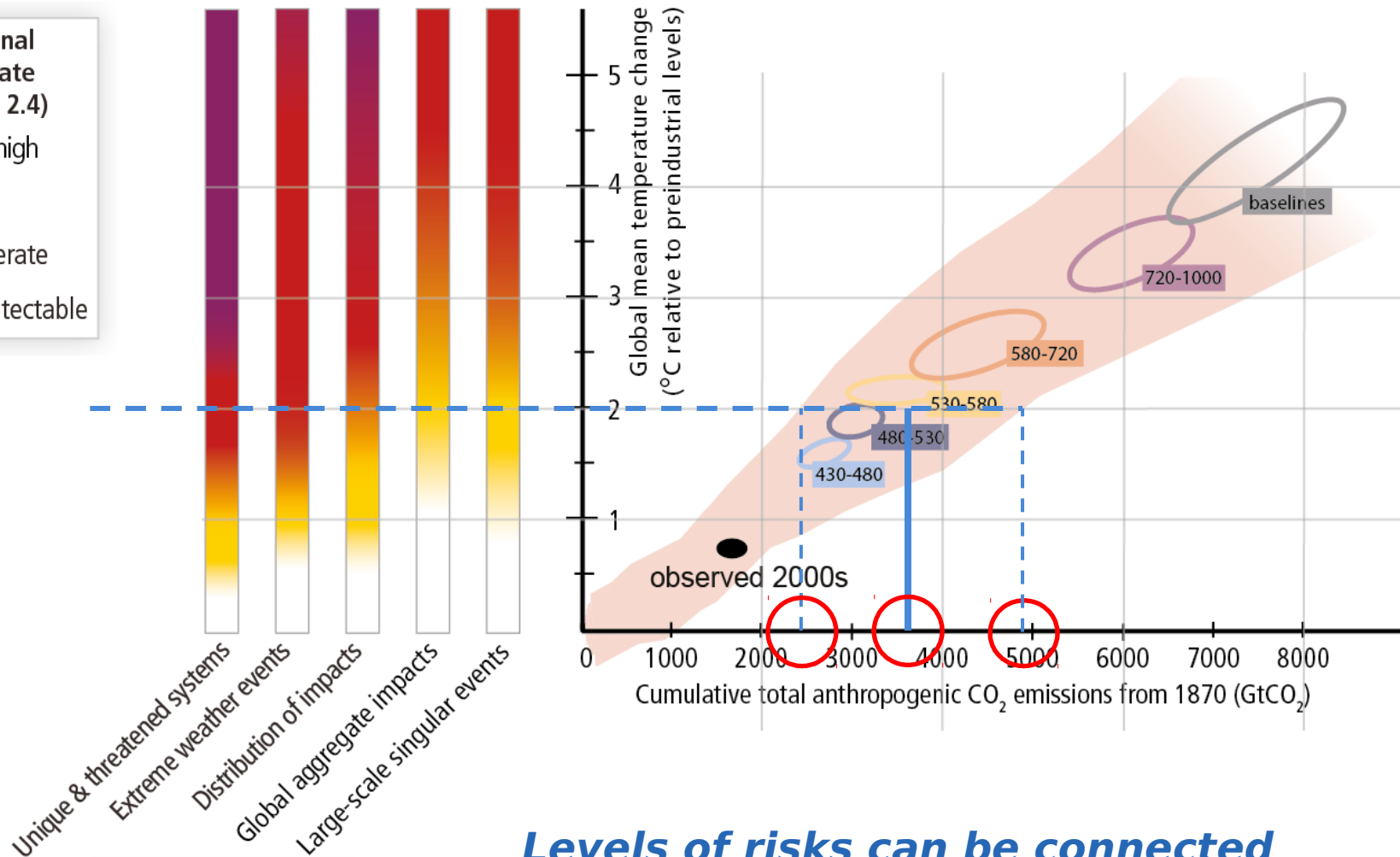
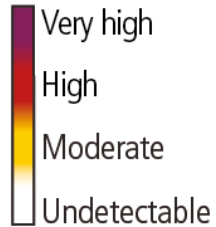


## The link between cumulative CO<sub>2</sub> emissions and global mean temperature

The ellipses show results from the WGIII models, using a simple climate model. It does not include climate and carbon cycle uncertainty, but explores more



Level of additional risk due to climate change (see box 2.4)

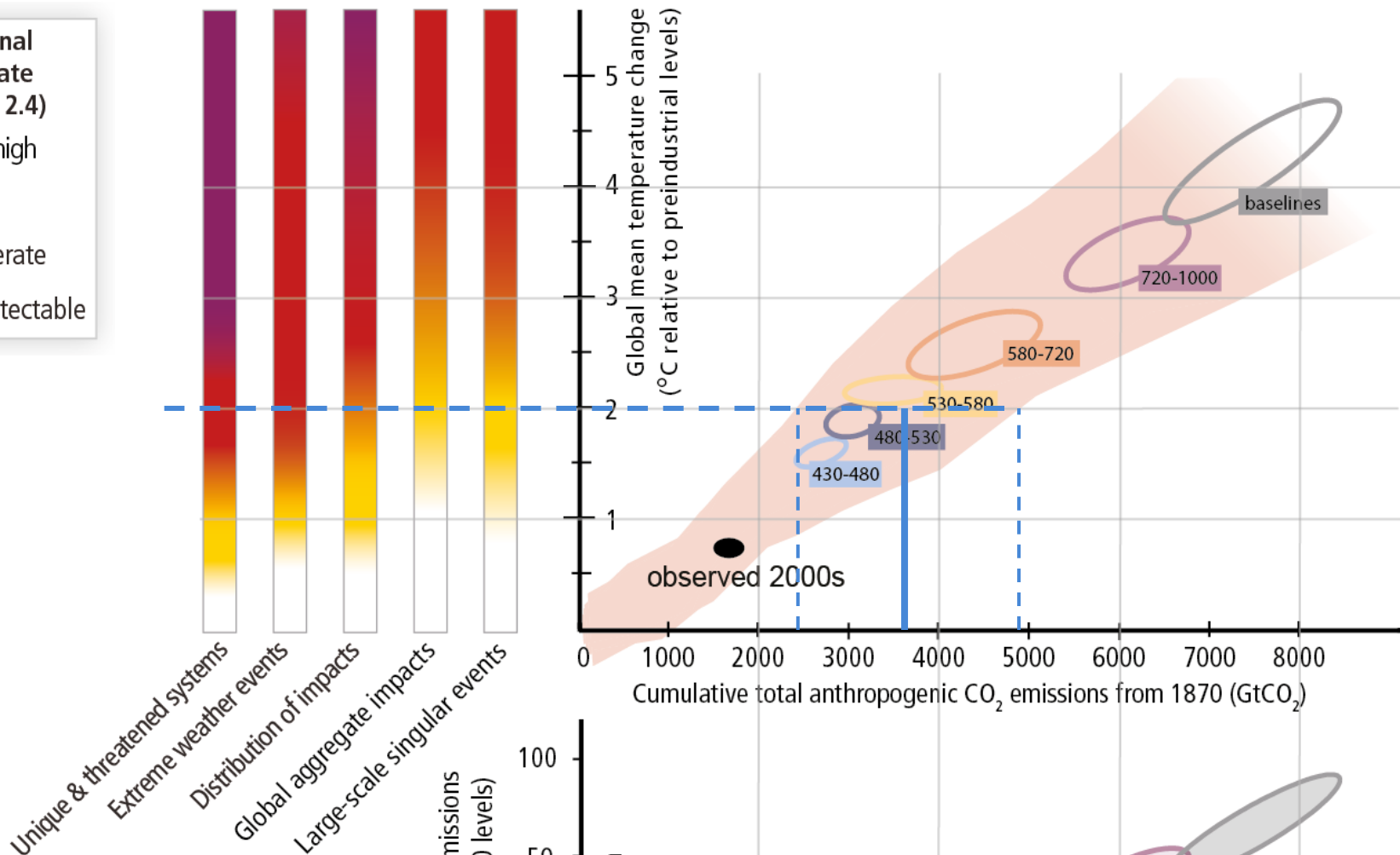
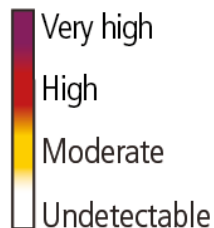


**Levels of risks can be connected to cumulative CO<sub>2</sub> emission levels, for the i**

**cu**

**y (higher cumulative emissions)**

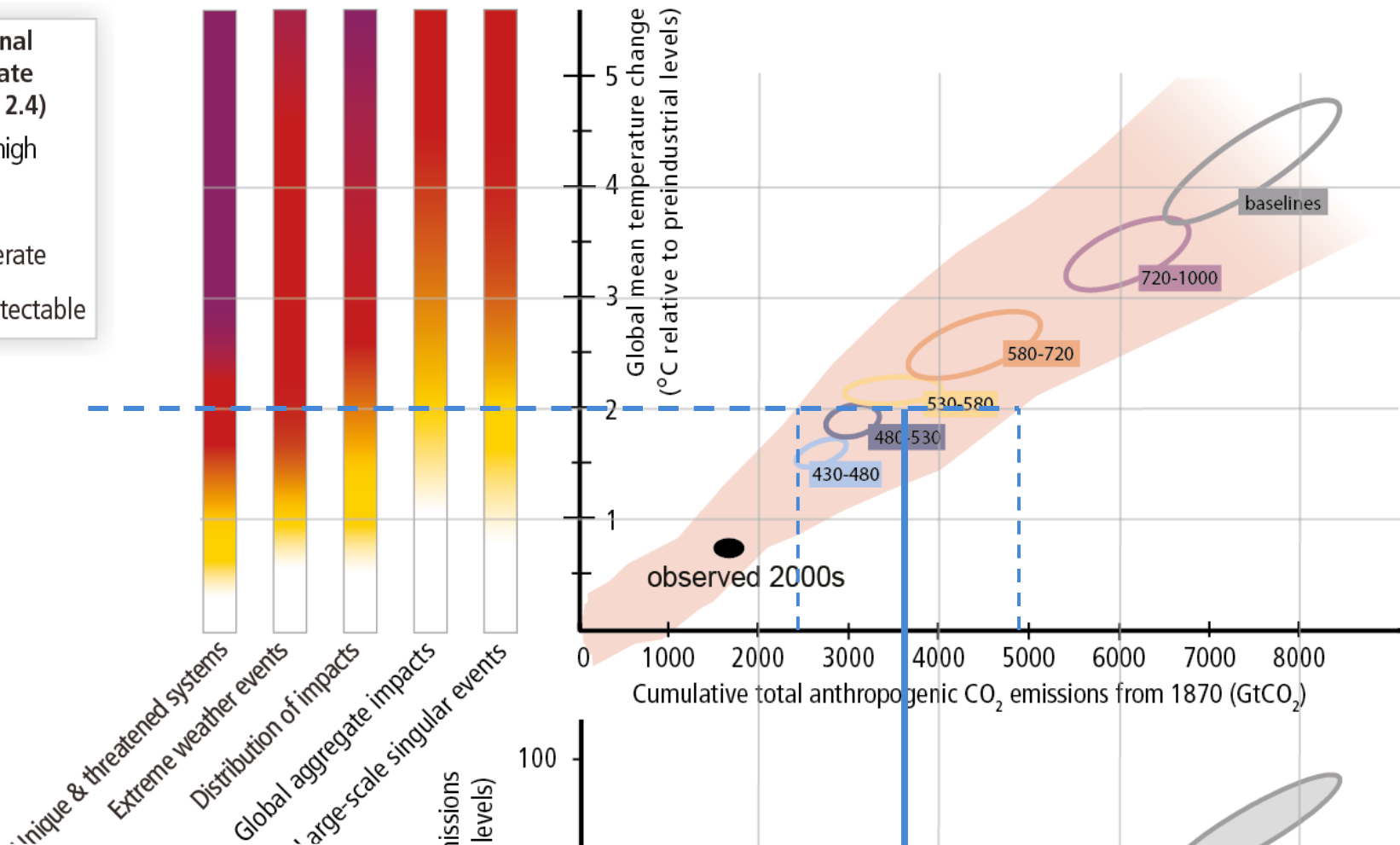
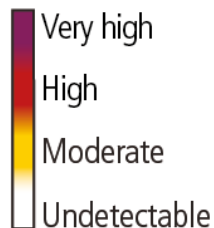
Level of additional risk due to climate change (see box 2.4)



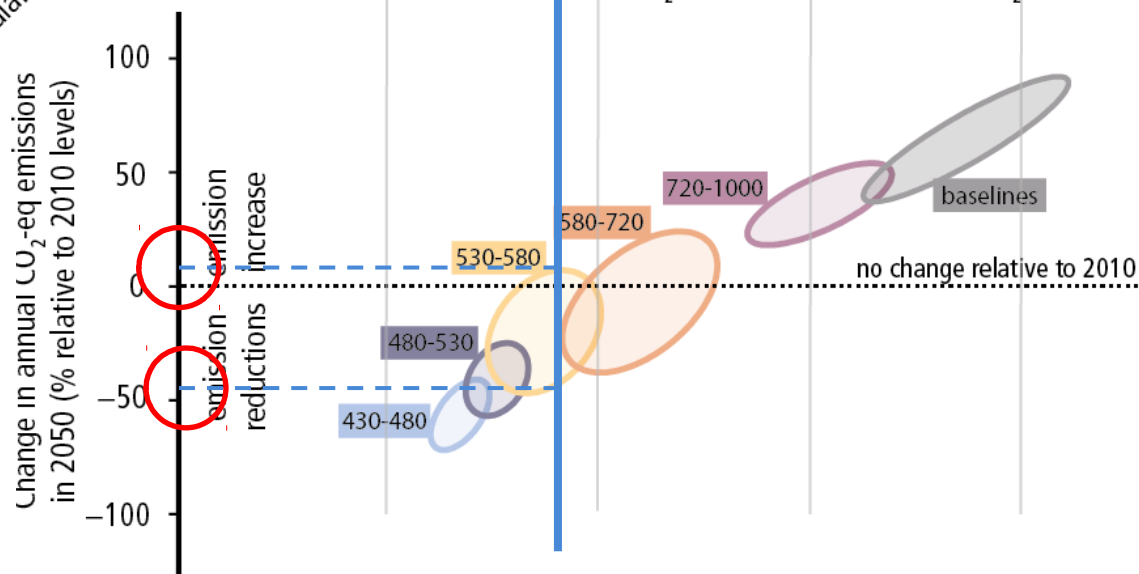
**The link between changes in annual GHG emissions by 2050 and the cumulative CO<sub>2</sub> emissions of the WGIII scenarios categories**



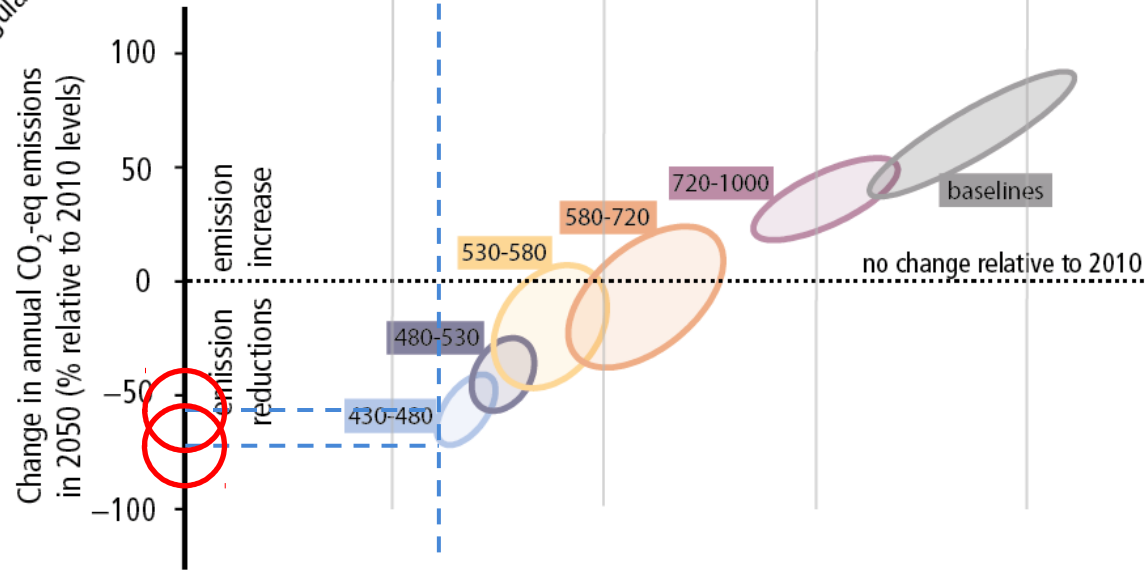
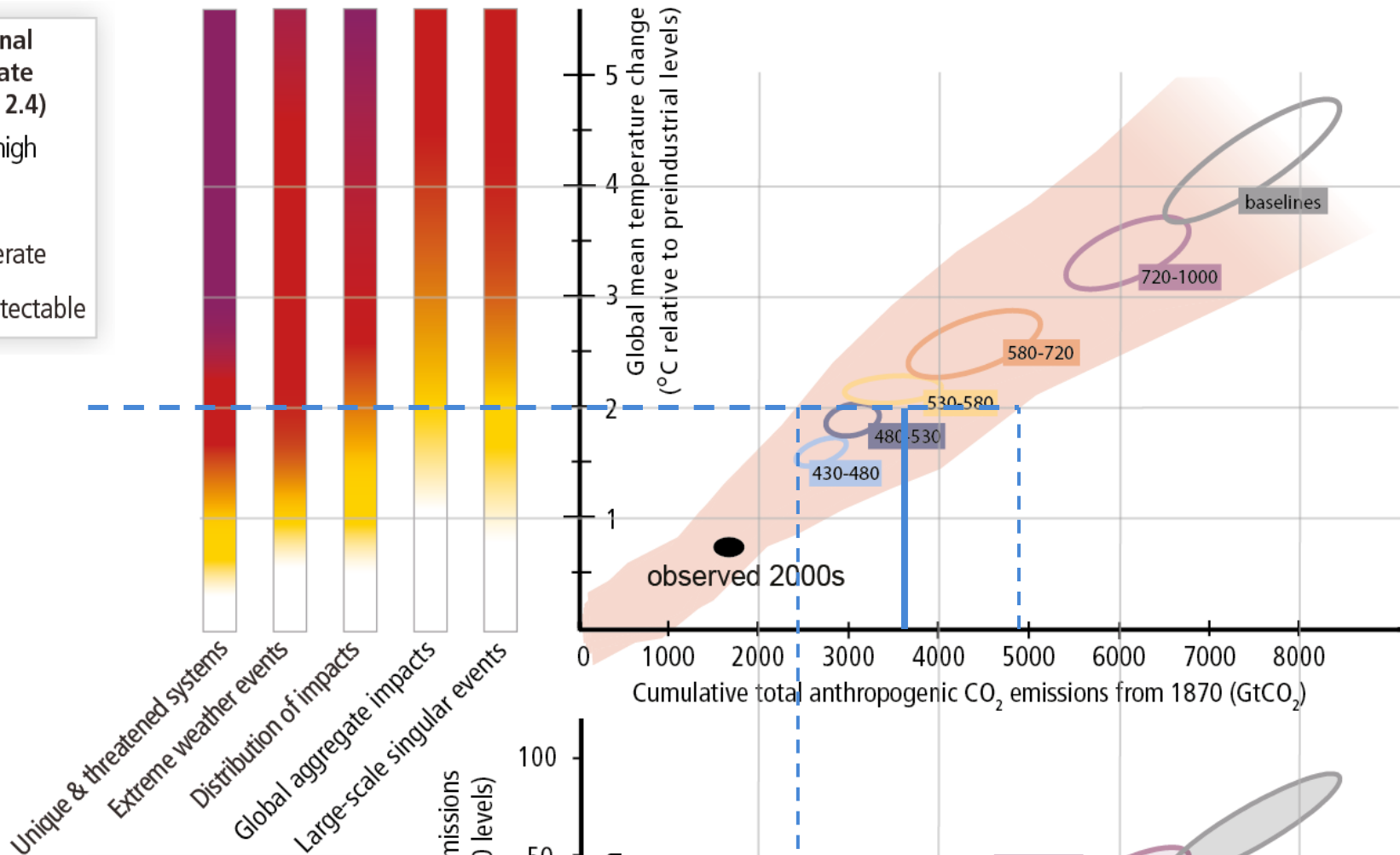
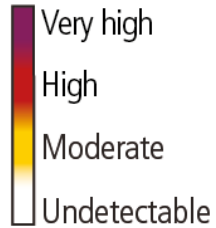
Level of additional risk due to climate change (see box 2.4)



**Levels of risks can now be connected to GHG emission changes by 2050. Added uncertainty arises from action on non-CO<sub>2</sub> gases, timing of pre-2050 action, and ambition**



Level of additional risk due to climate change (see box 2.4)

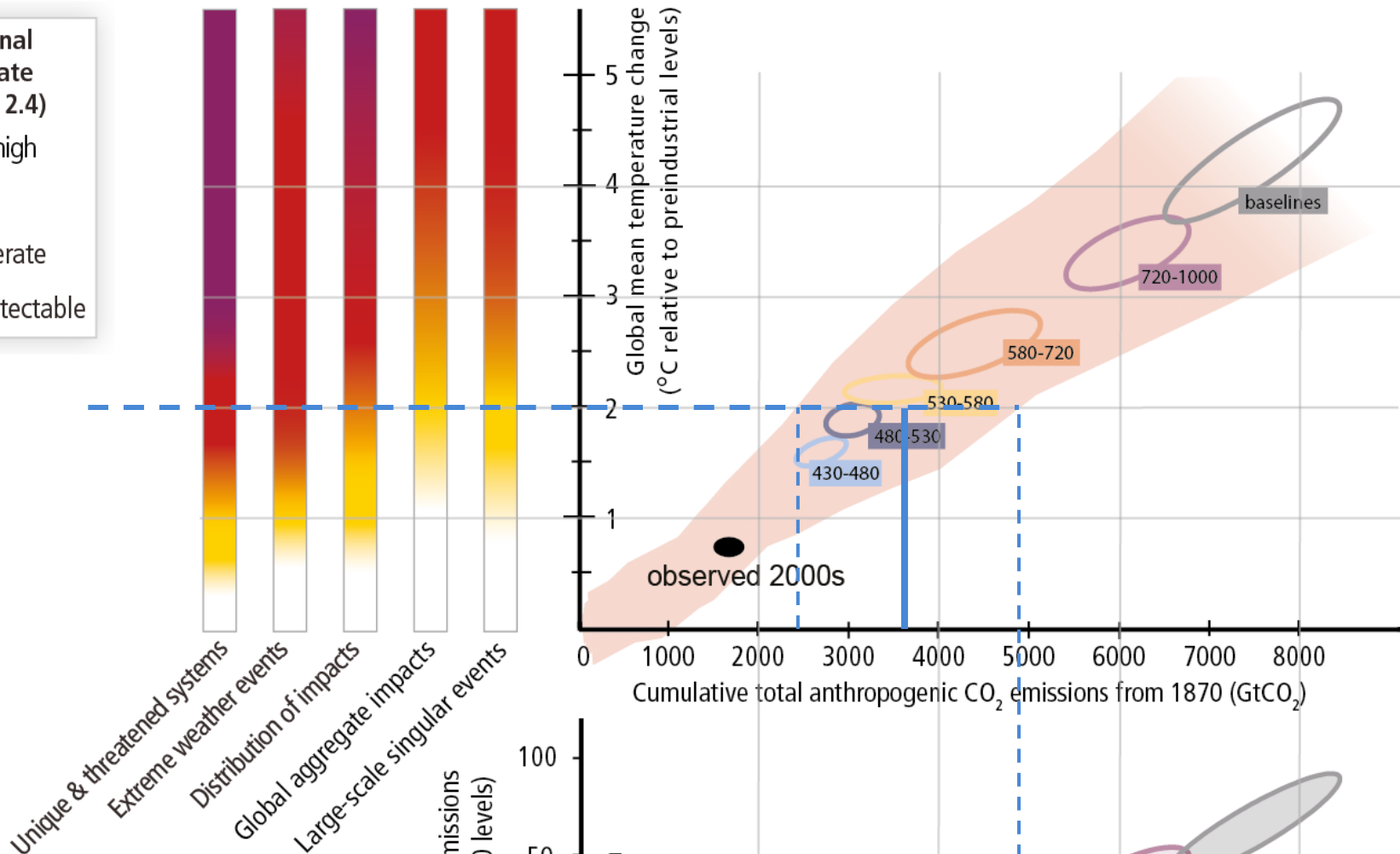
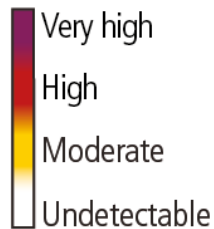


**The constraint on changes in GHG emissions by 2050 depends on the sensitivity of the climate response.**

**Here, with large climate sensitivity,**

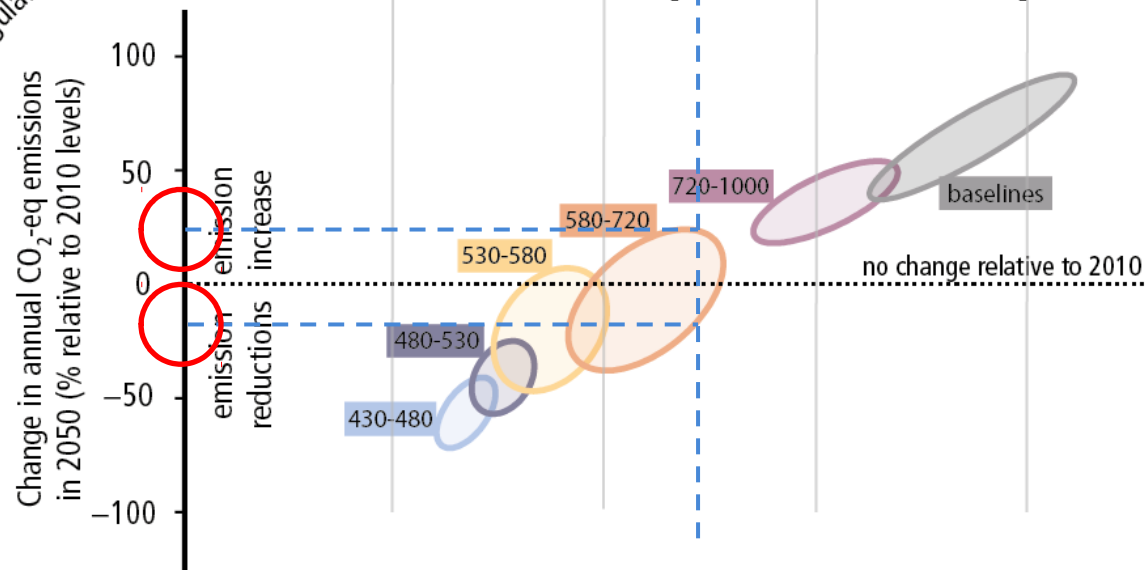


Level of additional risk due to climate change (see box 2.4)



**The constraint on changes in GHG emissions by 2050 depends on the sensitivity of the climate response.**

**Here, with low climate sensitivity,**



# Limiting Temperature Increase to 2°C



Measures exist to achieve the substantial emissions reductions required to limit likely warming to 2°C (40-70% reduction in GHGs globally by 2050 and near zero GHGs in 2100)



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

AR5 WGI SPM, AR5 WGII SPM, AR5 WGIII SPM



# 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



# Ambitious Mitigation Is Affordable

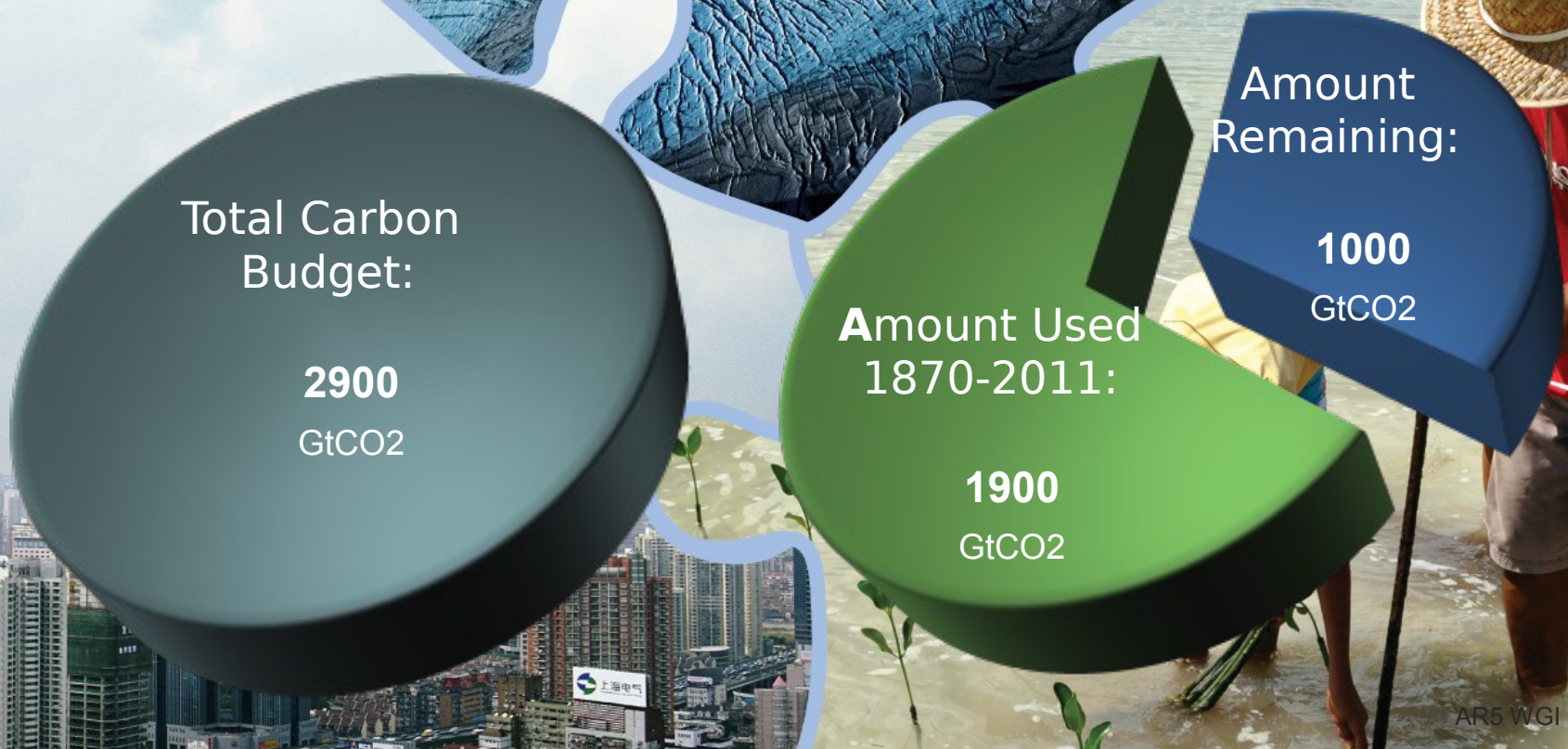
- Economic growth reduced by  $\sim 0.06\%$   
(BAU growth 1.6 - 3%)
- This translates into delayed and not forgone growth
- Estimated cost does not account for the benefits of reduced climate change
- Unmitigated climate change would create increasing risks to economic growth

AR5 WGI SPM, AR5 WGII SPM



# The window for action is rapidly closing

65% of our carbon budget compatible with a 2°C goal already used



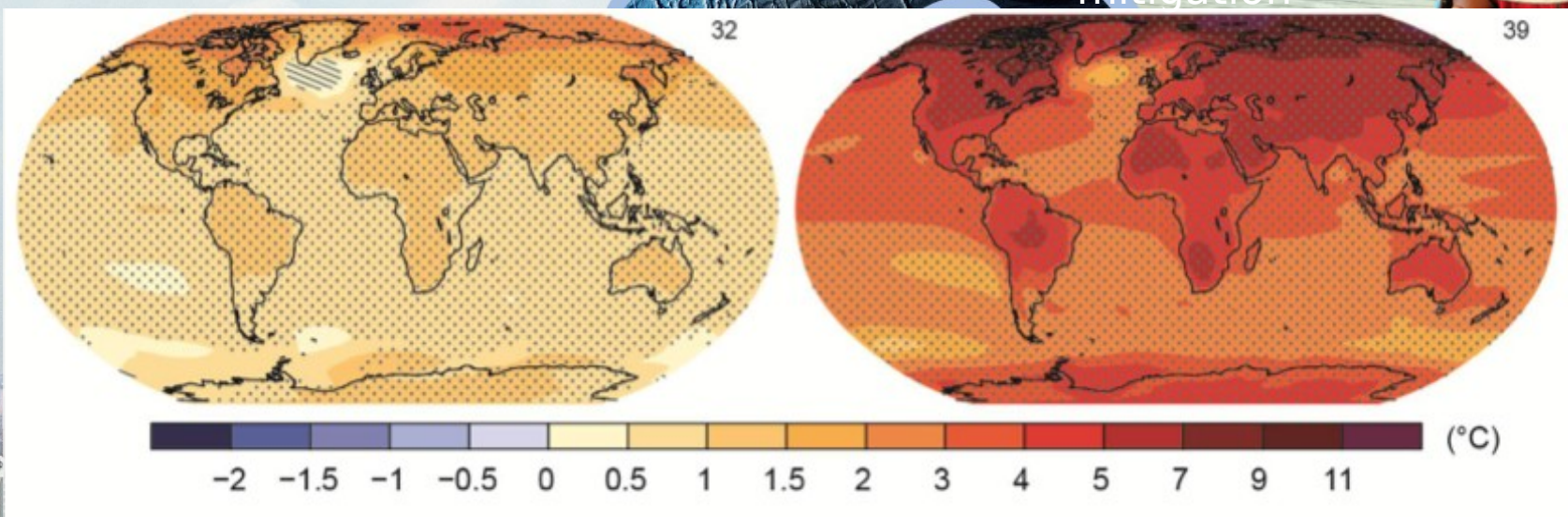
AR5 WGI SPM



# The Choices We Make Will Create Different Outcomes

With substantial  
mitigation

Without  
additional  
mitigation



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

AR5 WGI SPM





# IPCC Fifth Assessment Report

## Synthesis Report