



Findings of the IPCC Fifth Assessment: what they mean for energy

Jim Skea

BIEE Seminar

Grantham Institute, Imperial College

5 February 2015

IPCC AR5 Synthesis Report

ipcc

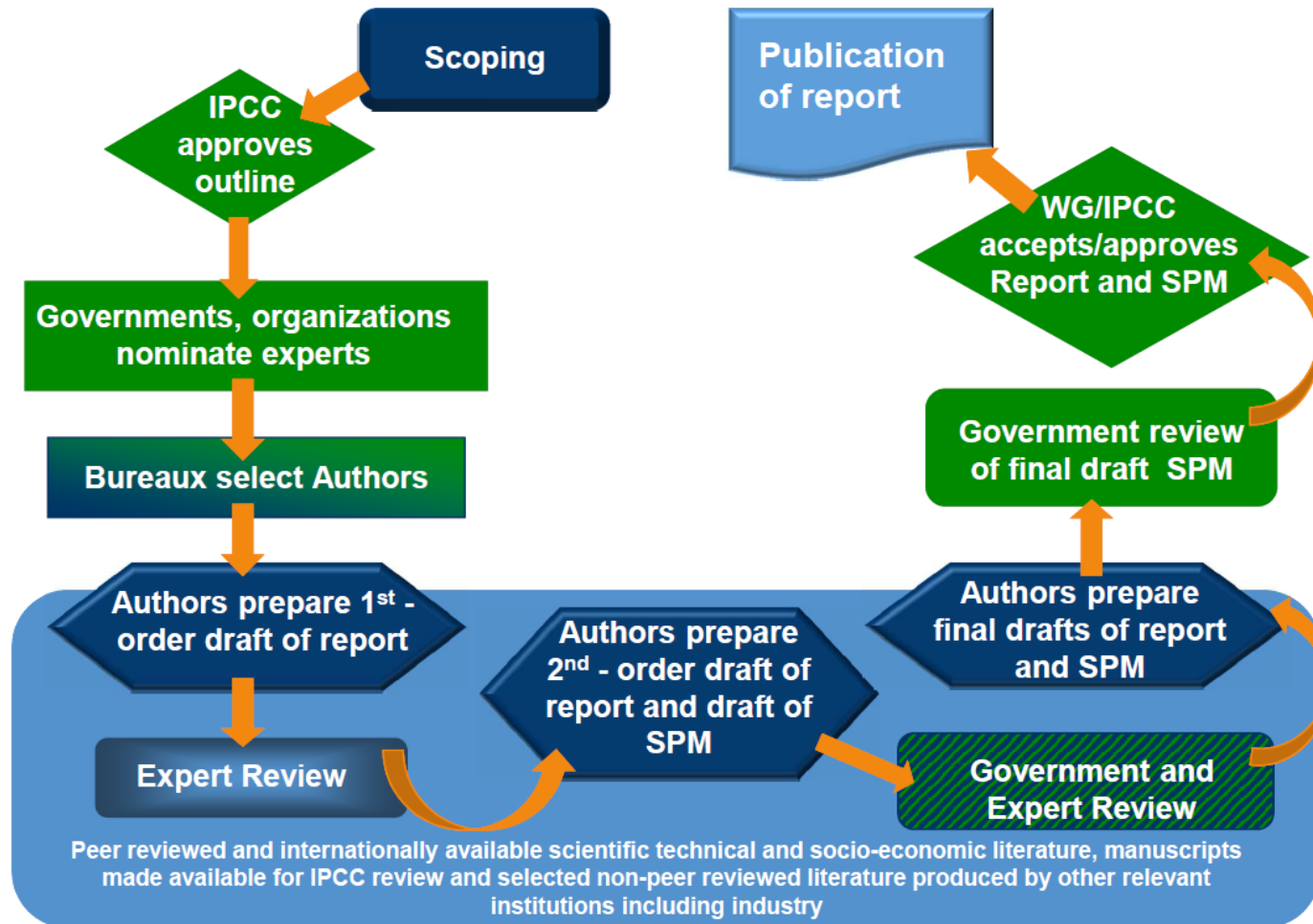
INTERGOVERNMENTAL PANEL ON climate change



Synthesis Report – the parameters

- **“Synthesis Reports” synthesise and integrate materials contained within the Assessment Reports and Special Reports**
- **Produced within ~ 1 year of the production of the underlying Working Group reports**
- **Are written in a non-technical style suitable for policymakers**
- **Address a broad-range of policy-relevant but policy-neutral questions**

How IPCC Works



Plenary approval



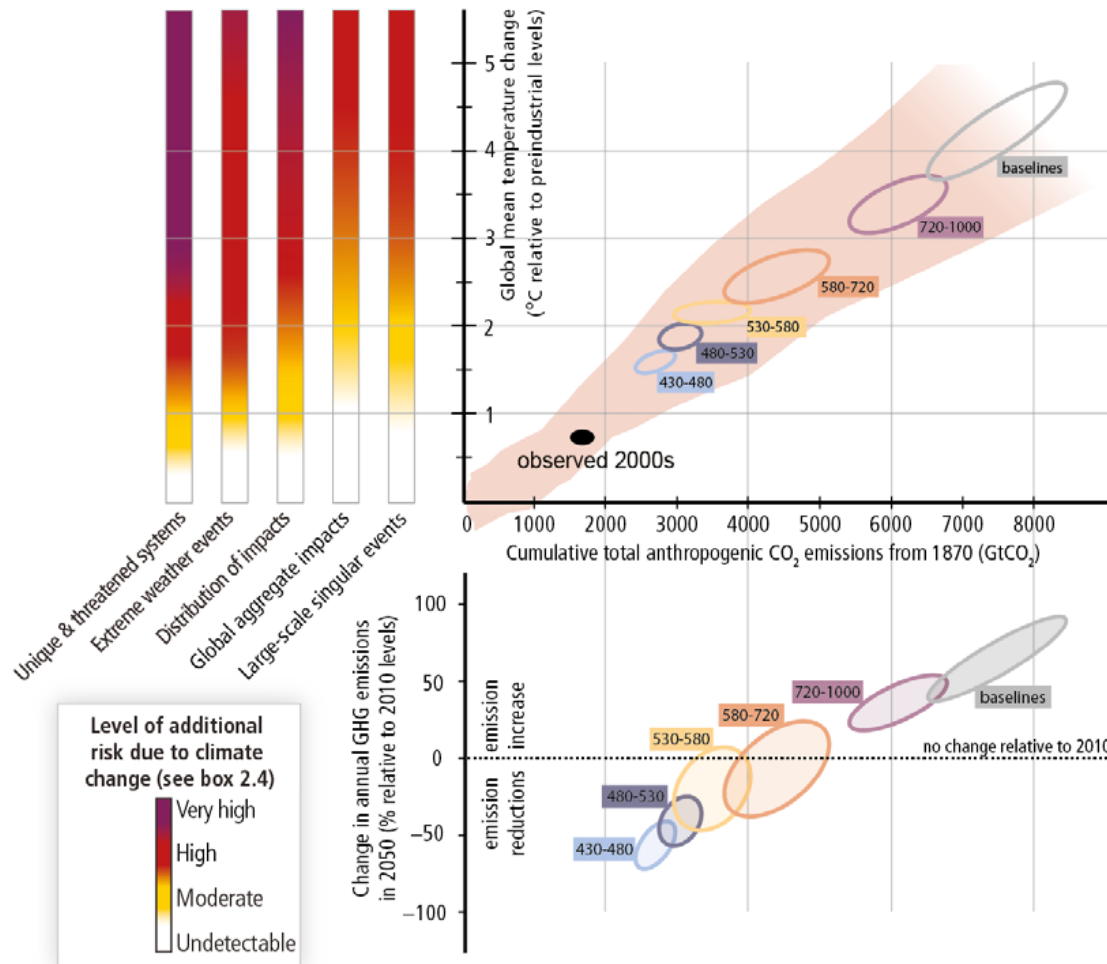
Key Messages

- **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 WGII SPM, AR5 WGIII SPM

Linking the evidence across scientific domains

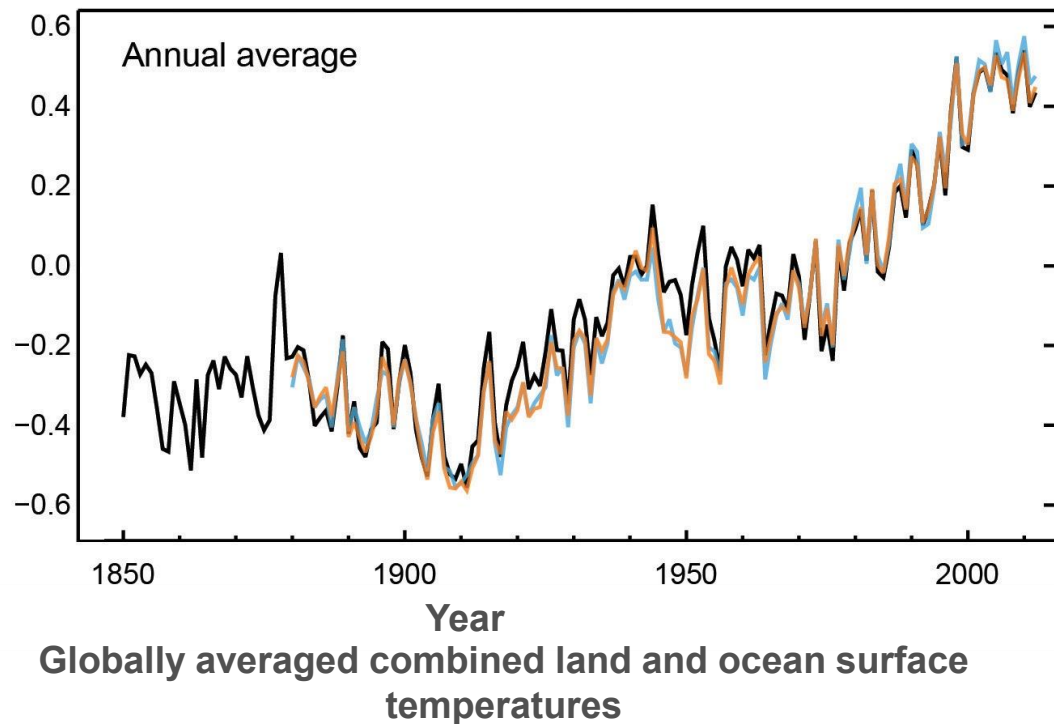
(A) Risks from climate change... (B) ...depend on cumulative CO₂ emissions...



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

Humans are changing the climate

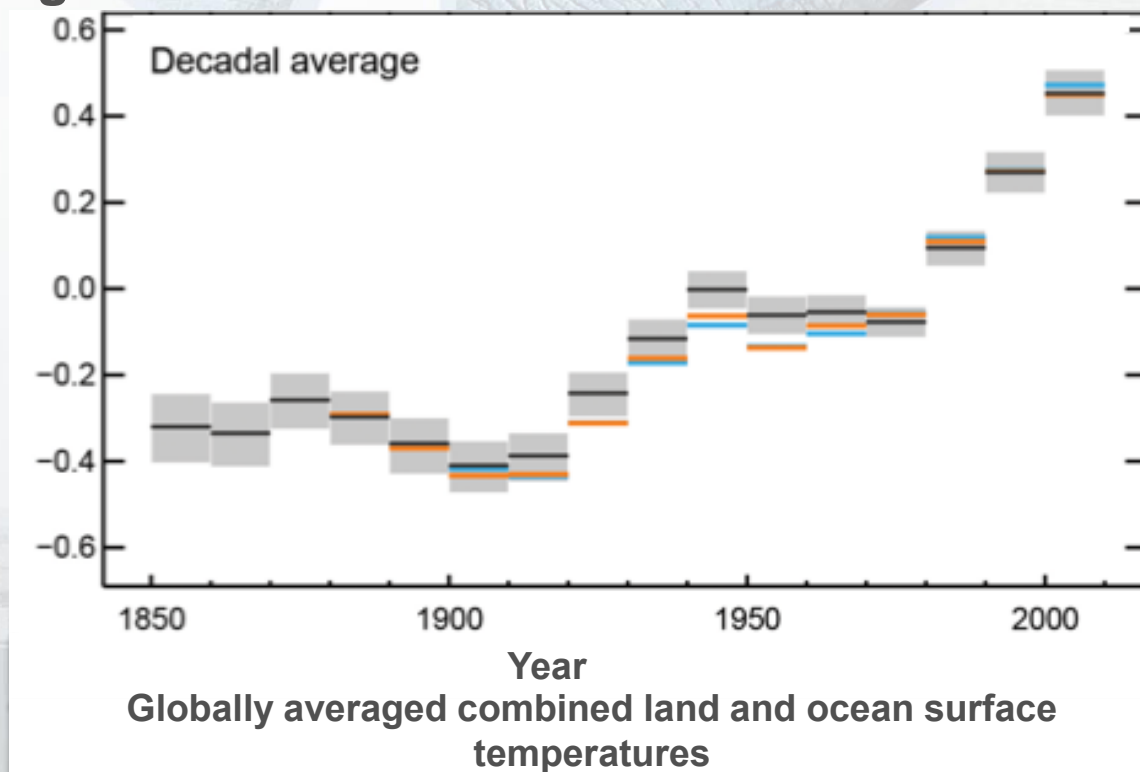
It is extremely likely that we are the dominant cause of warming since the mid-20th century



AR5 WGI SPM

Temperatures continue to rise

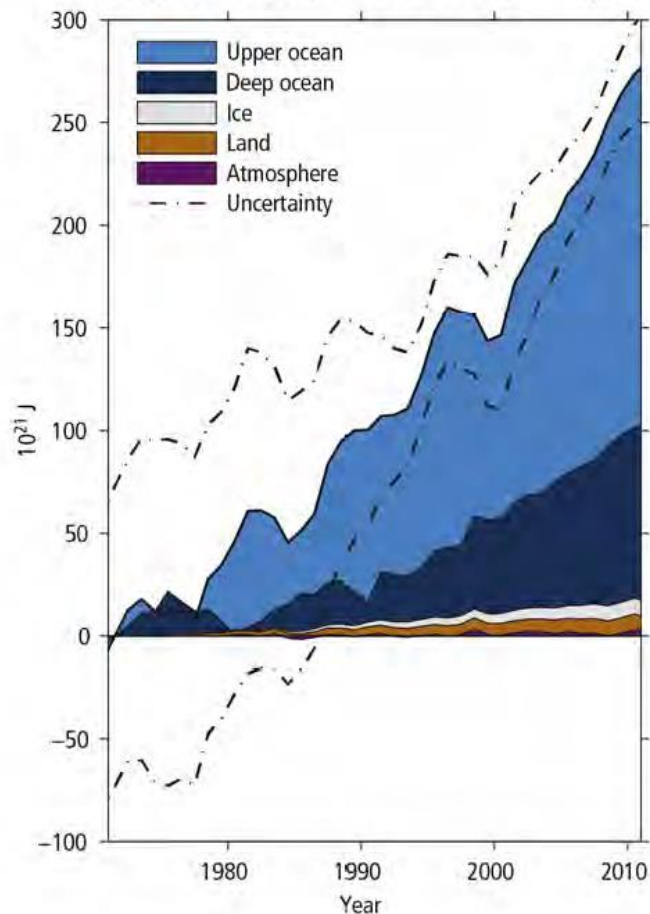
Each of the past 3 decades has been successively warmer than the preceding decades since 1850



AR5 WGI SPM

Oceans absorb most of the heat

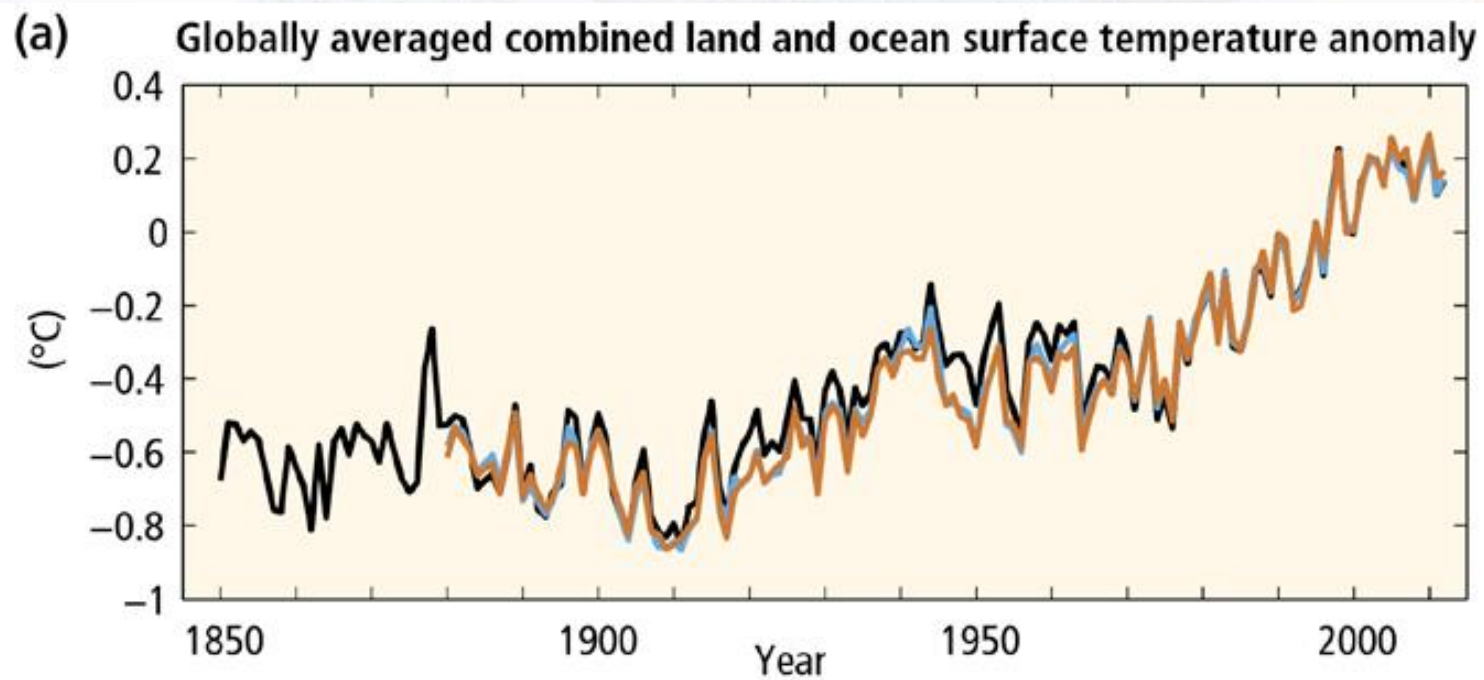
Energy accumulation within the Earth's climate system



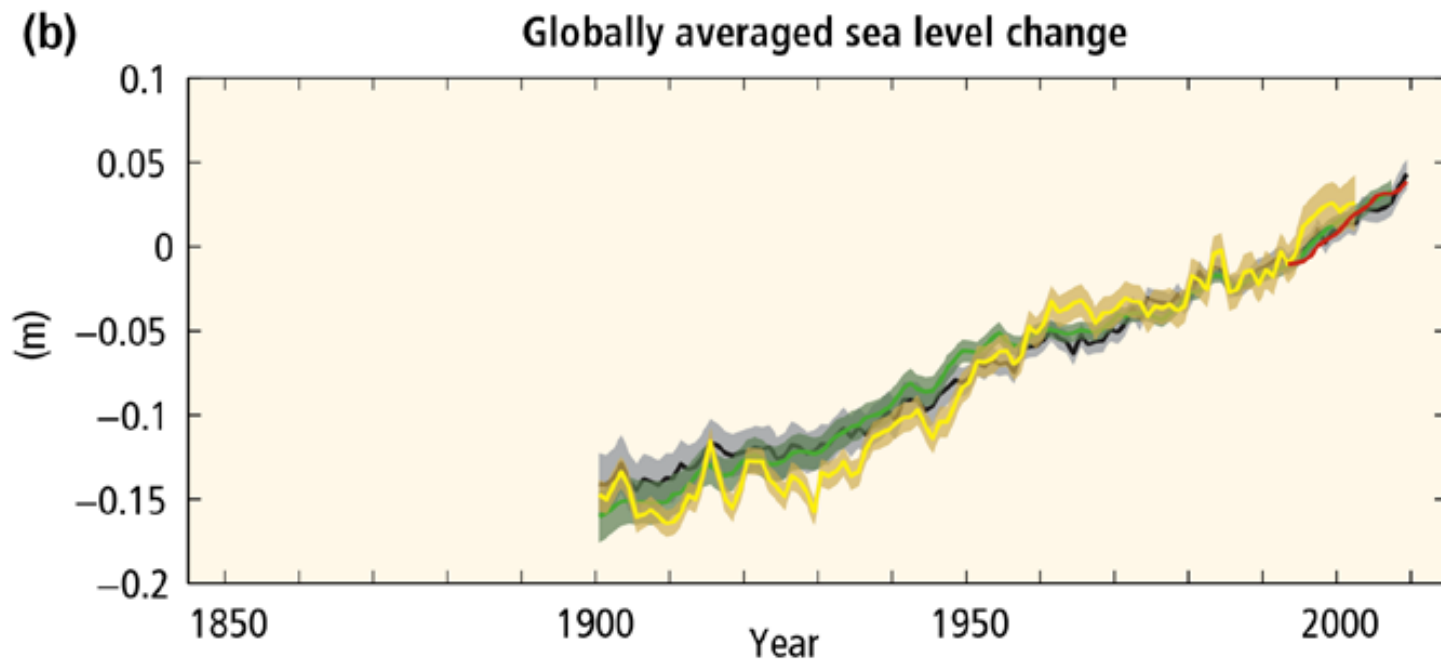
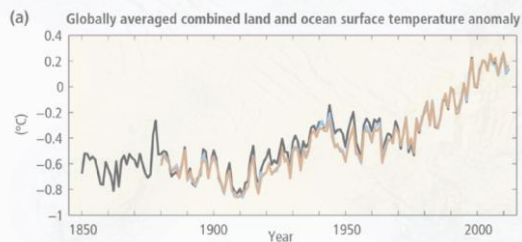
→ More than 90% of the energy accumulating in the climate system between 1971 and 2010 has accumulated in the ocean

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

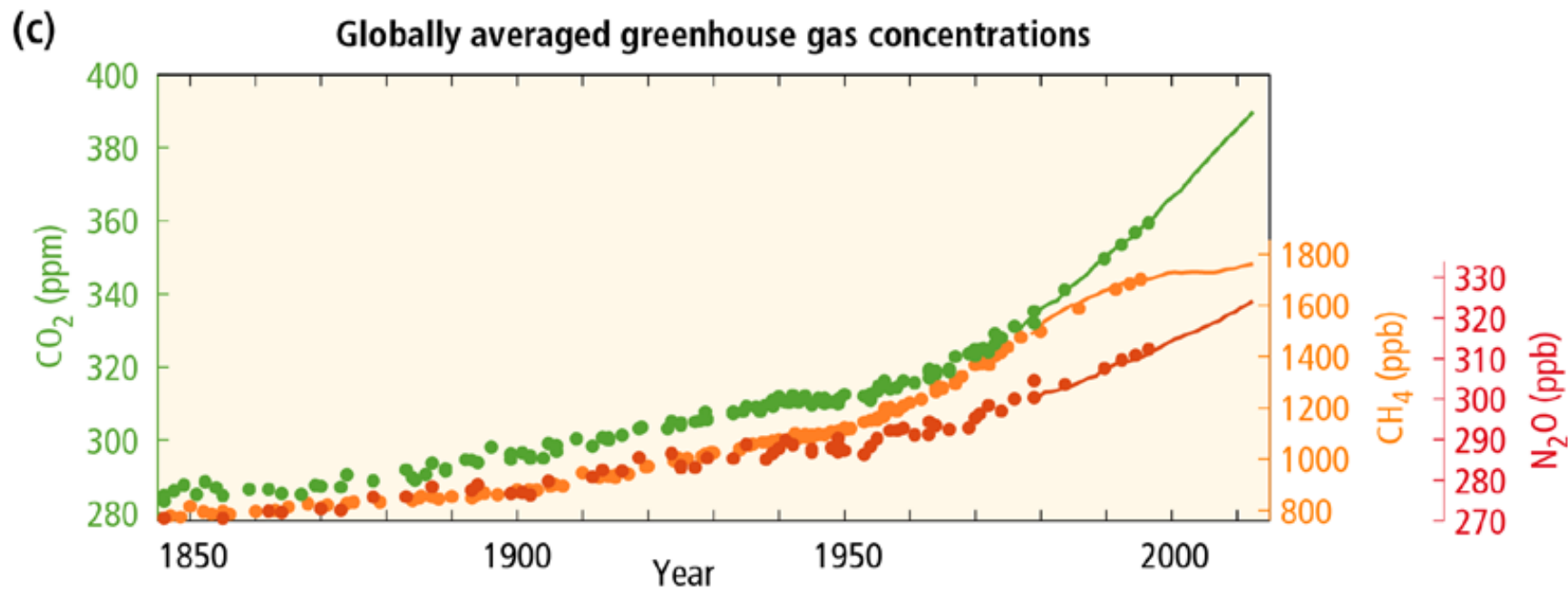
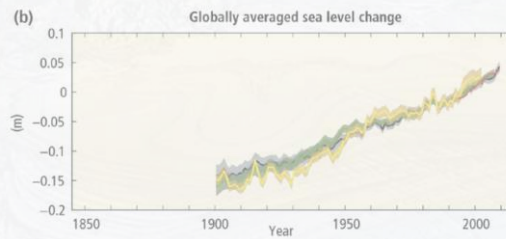
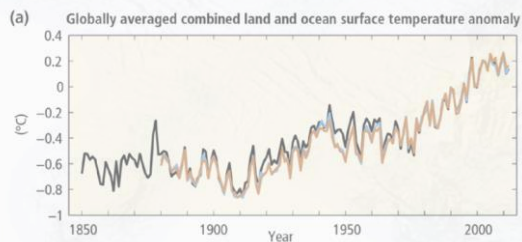
AR5 SYR



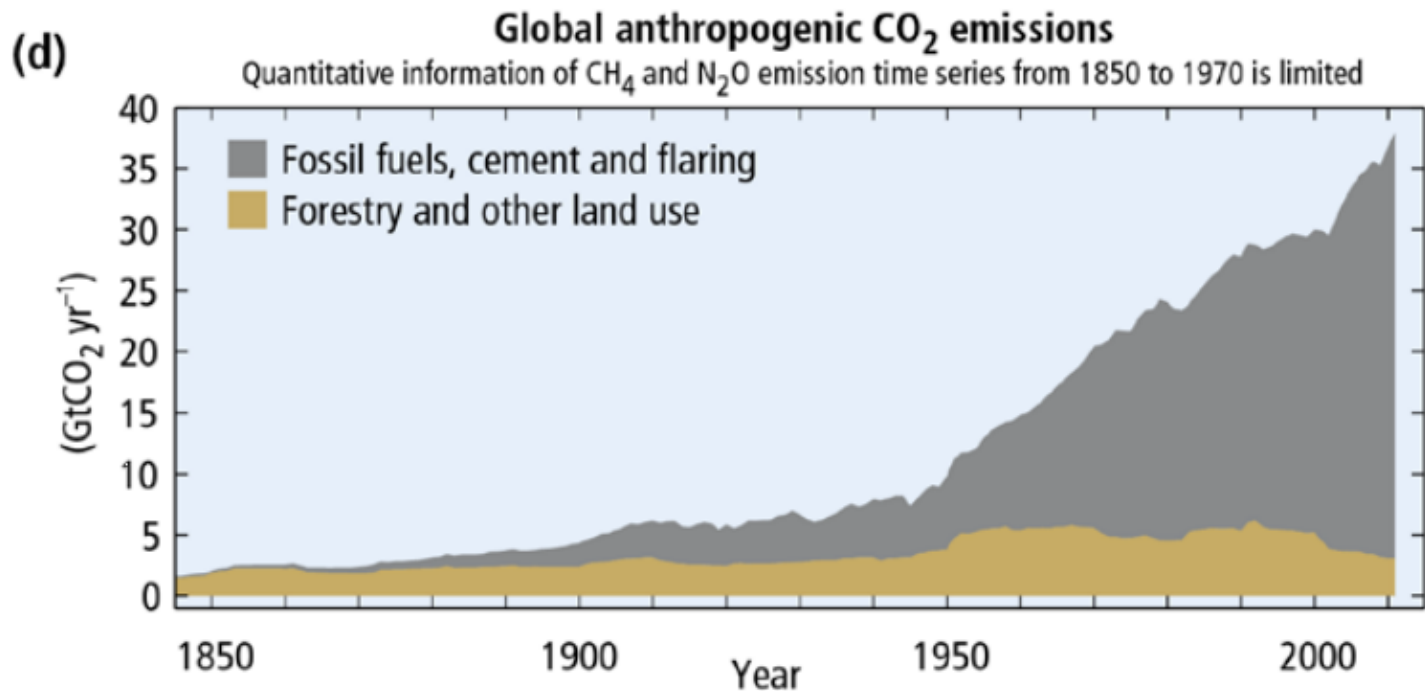
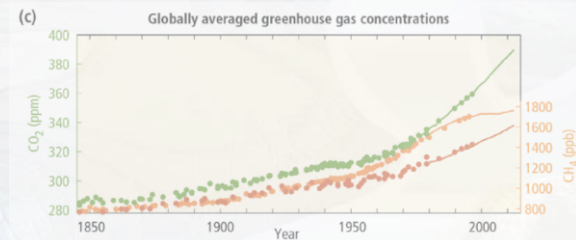
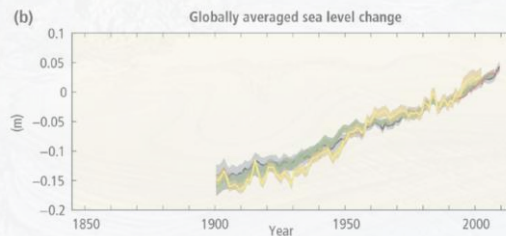
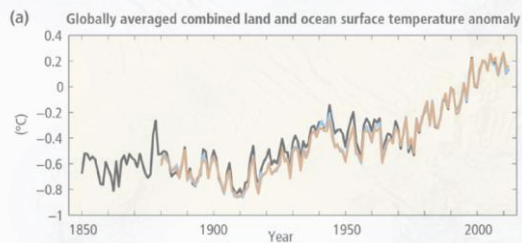
AR5 SYR SPM



AR5 SYR SPM

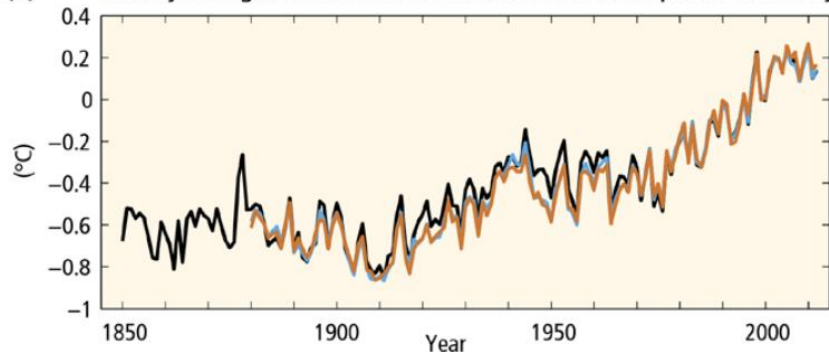


AR5 SYR SPM

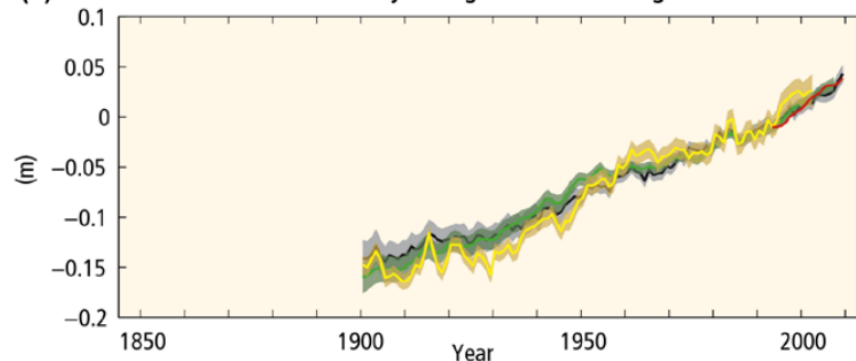


AR5 SYR SPM

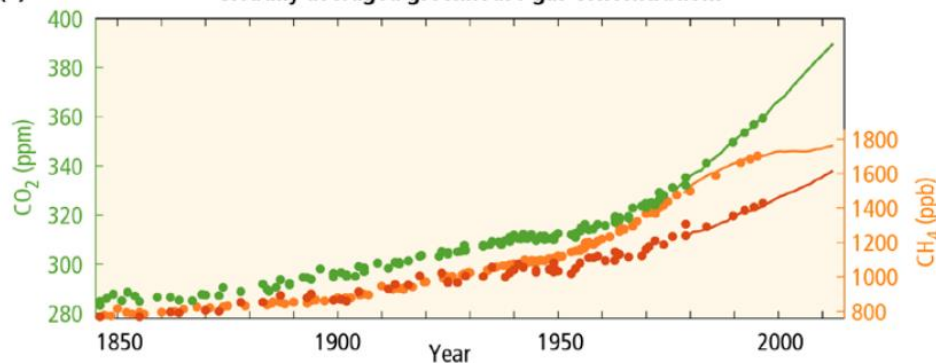
(a) Globally averaged combined land and ocean surface temperature anomaly



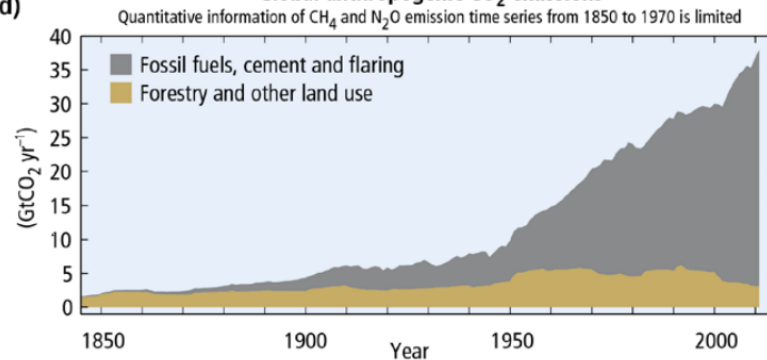
(b) Globally averaged sea level change



(c) Globally averaged greenhouse gas concentrations



(d) Global anthropogenic CO₂ emissions



AR5 SYR SPM

Sources of emissions

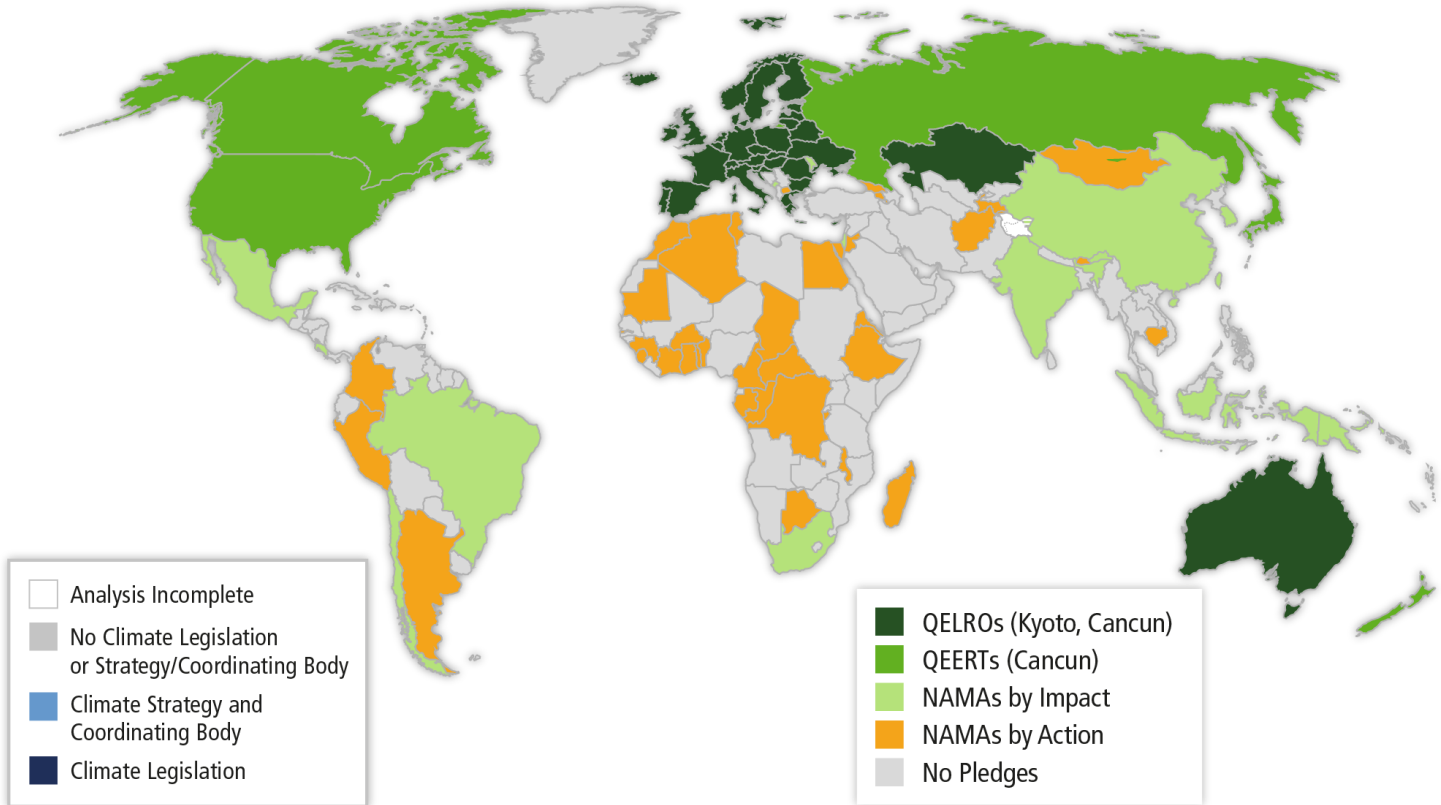
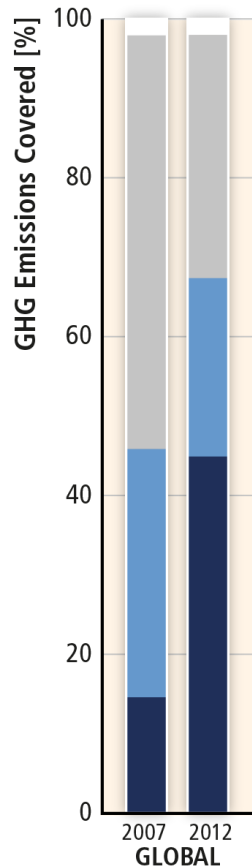
Energy production remains the primary driver of GHG emissions



2010 GHG emissions

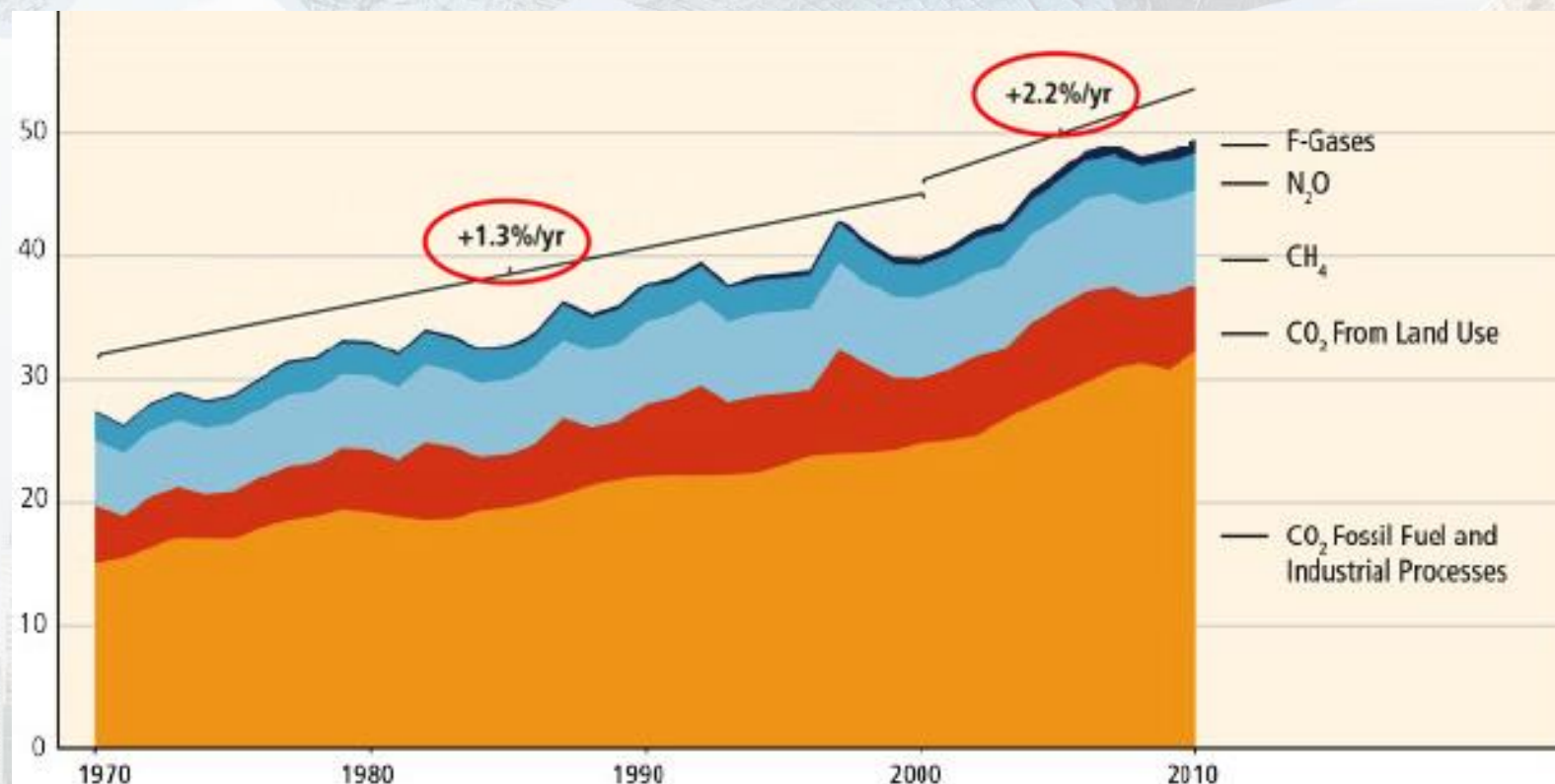
AR5 WGIII SPM

Plans and strategies have expanded since 2007



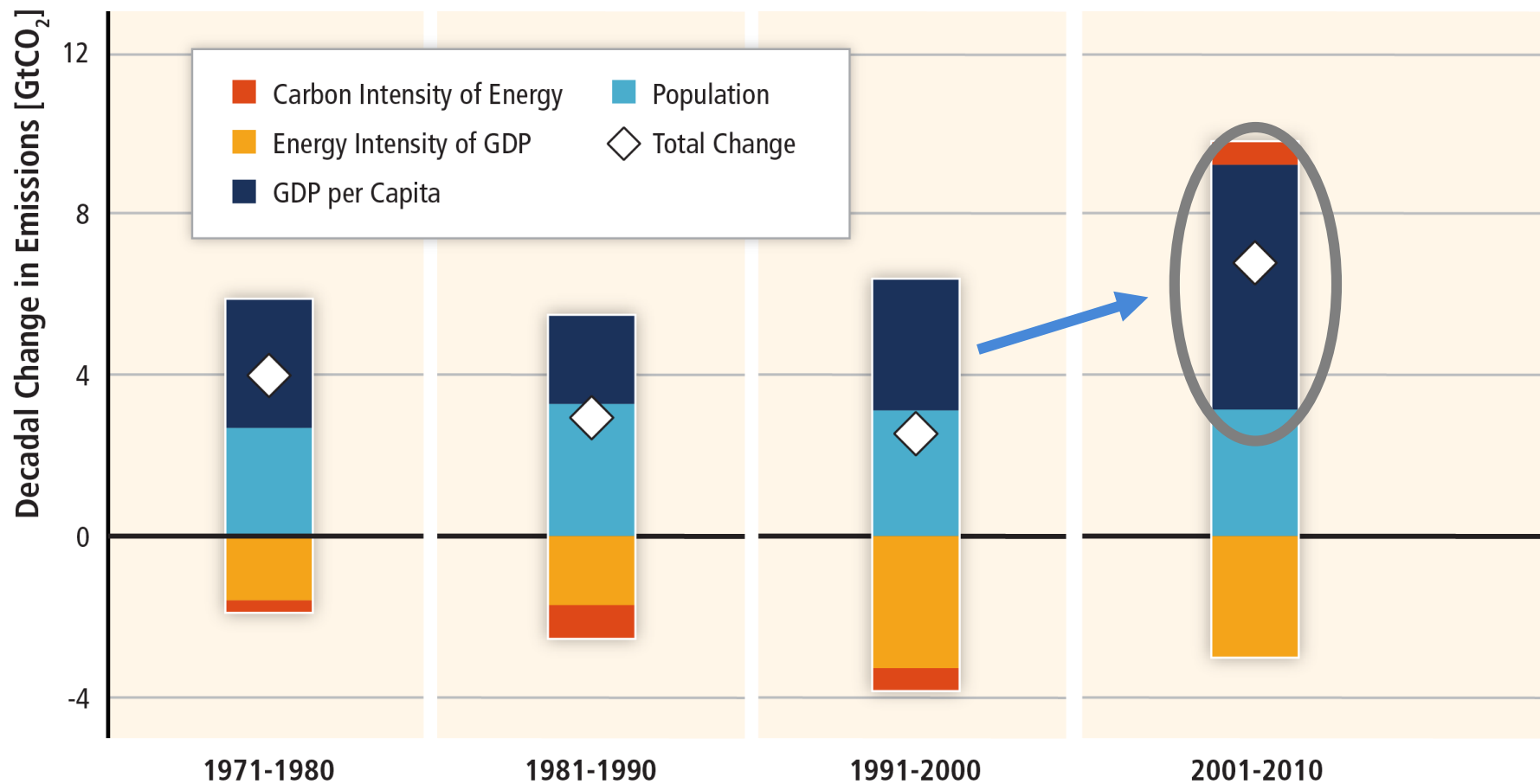
GHG emissions growth between 2000 and 2010 has been larger than in the previous three decades

GHG Emissions [GtCO₂ eq/yr]

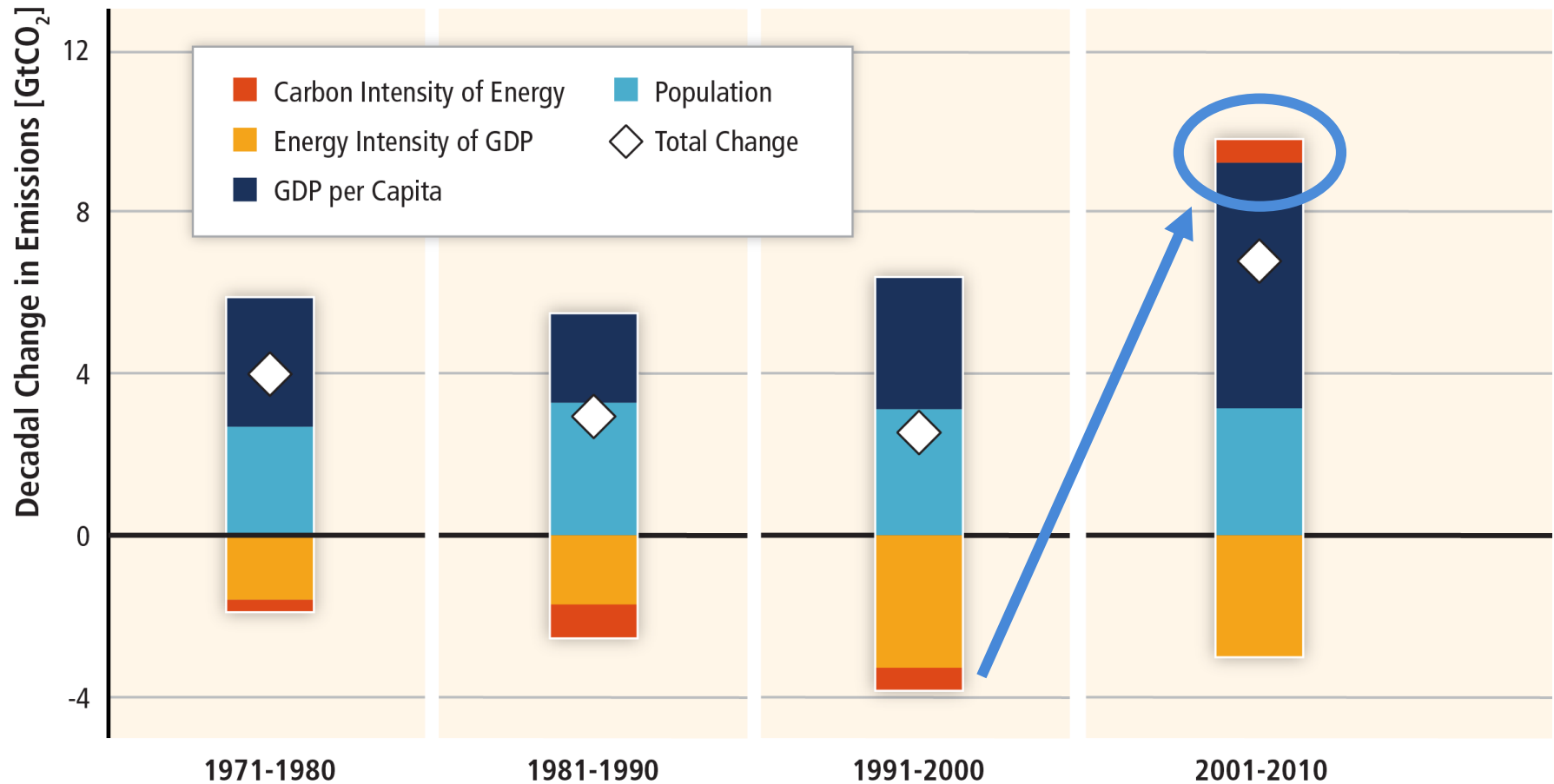


AR5 WGIII SPM

GHG emissions rise with income and population - but are moderated by energy efficiency



GHG emissions rise with income and population - but long-term energy decarbonisation has been reversed.



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

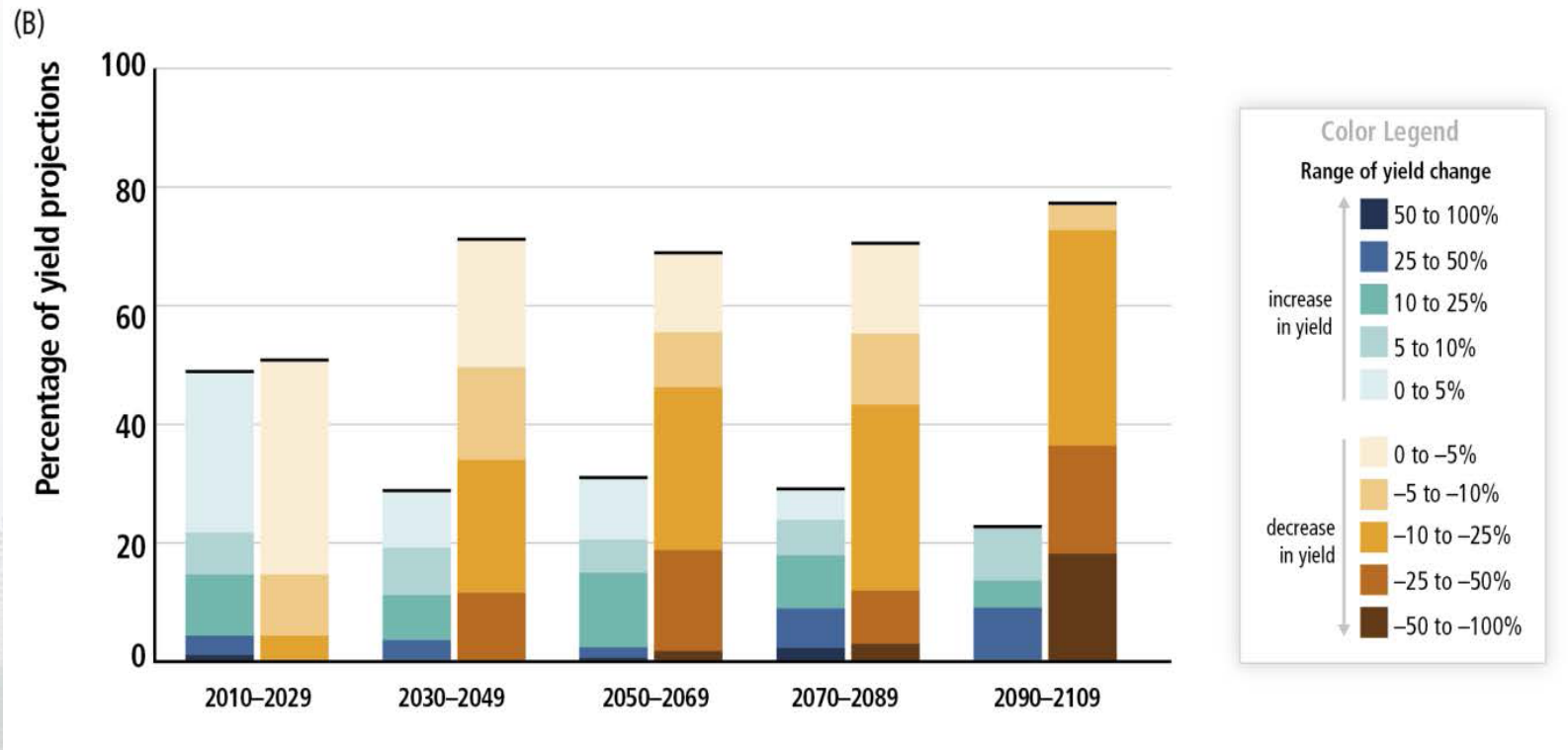


Coastal flooding

AR5 WGII SPM

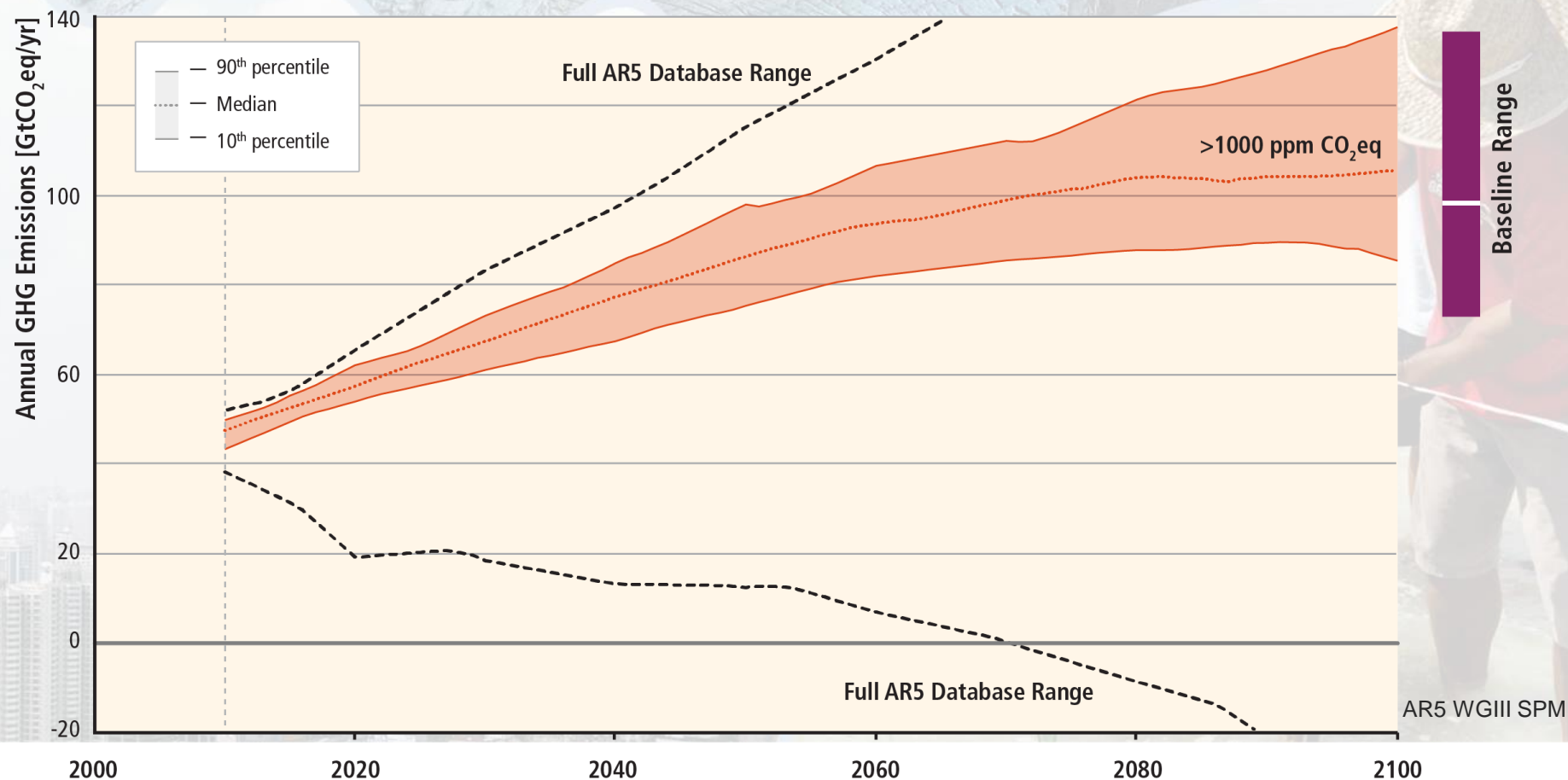
Climate Change Poses Risk for Food Production

Percentage of yield projections



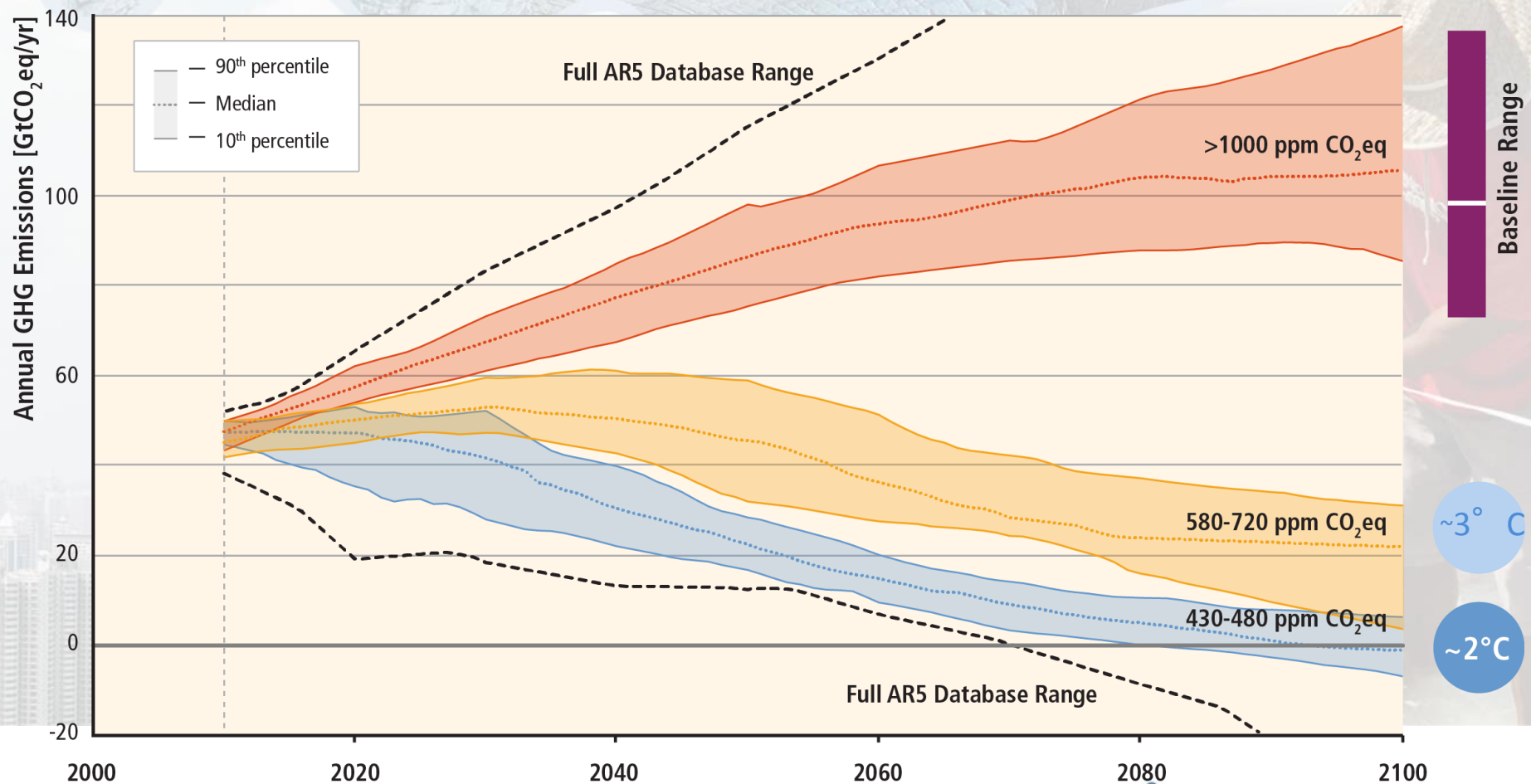
AR5 SYR SPM

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.

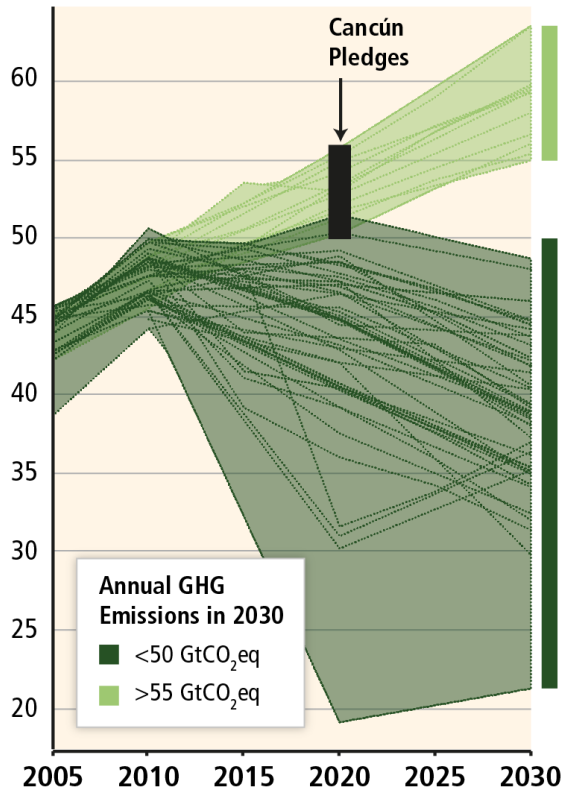


Based on Figure 6.7

Delaying mitigation until 2030 increases the difficulty and narrows the options for limiting warming to 2° C.

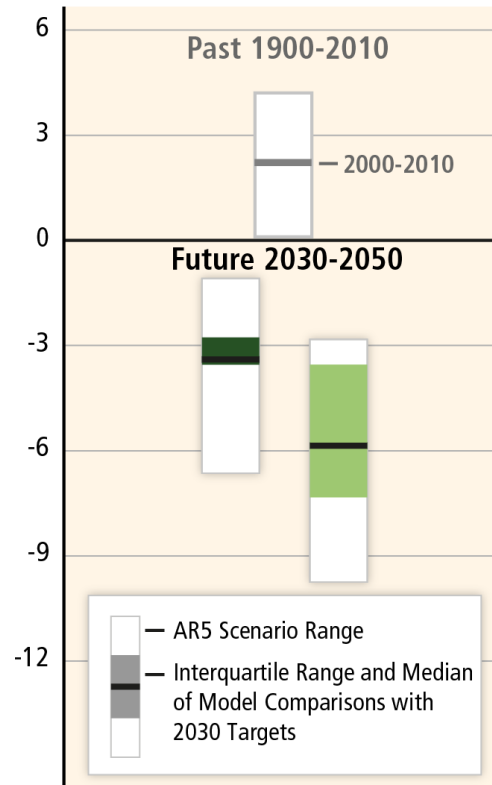
Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]

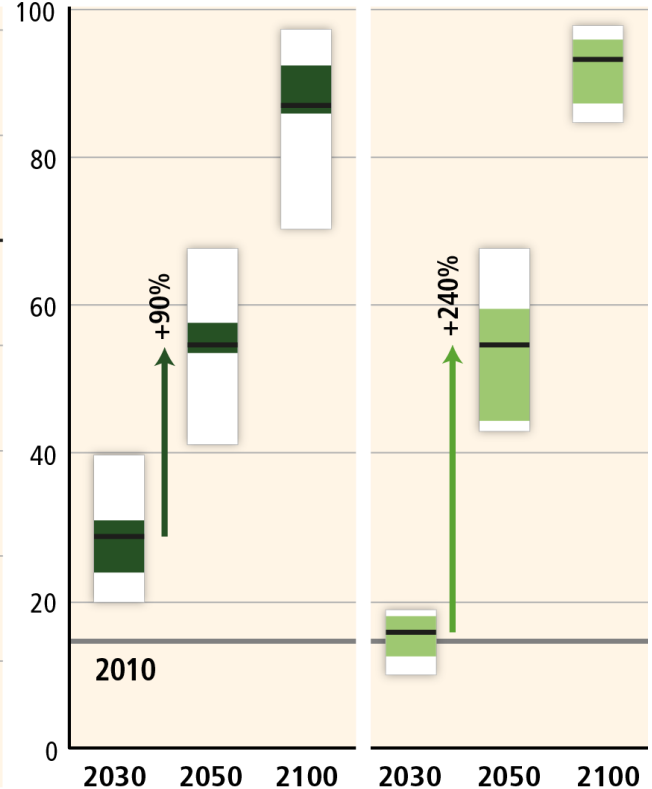


After 2030

Rate of CO₂ Emission Change [%/yr]



Share of Low-Carbon Energy [%]



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

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

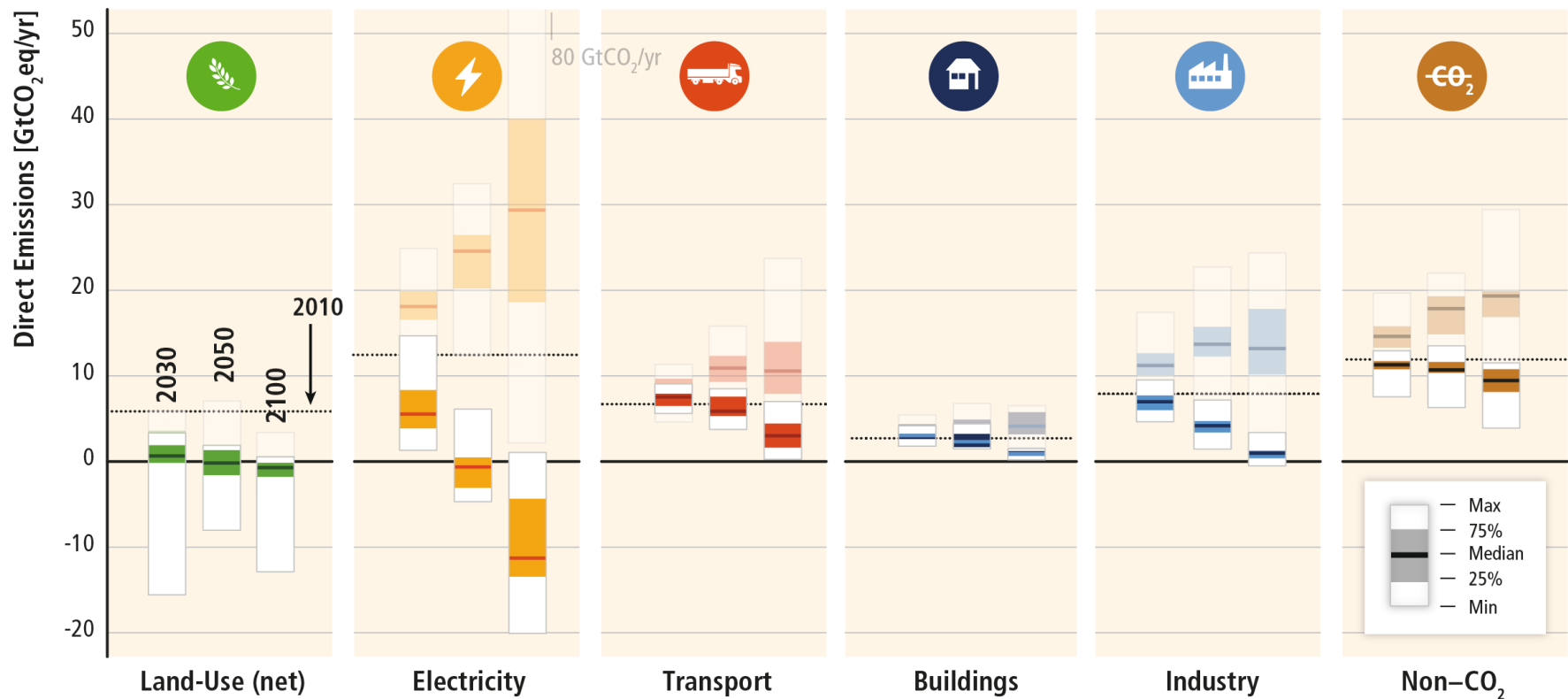


Lifestyle and behavioural changes

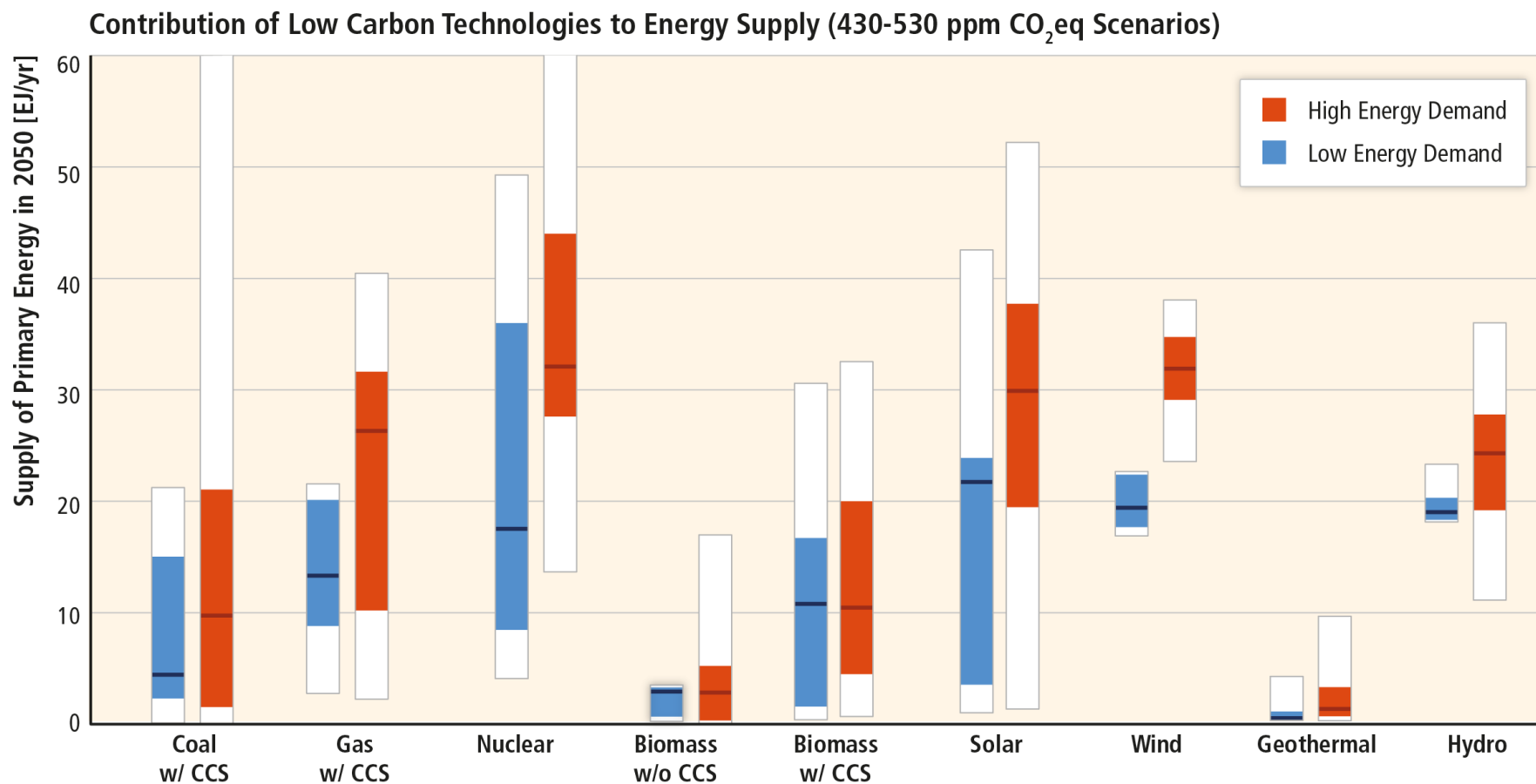
AR5 WGIII SPM

Emission patterns would need to change throughout the economy.

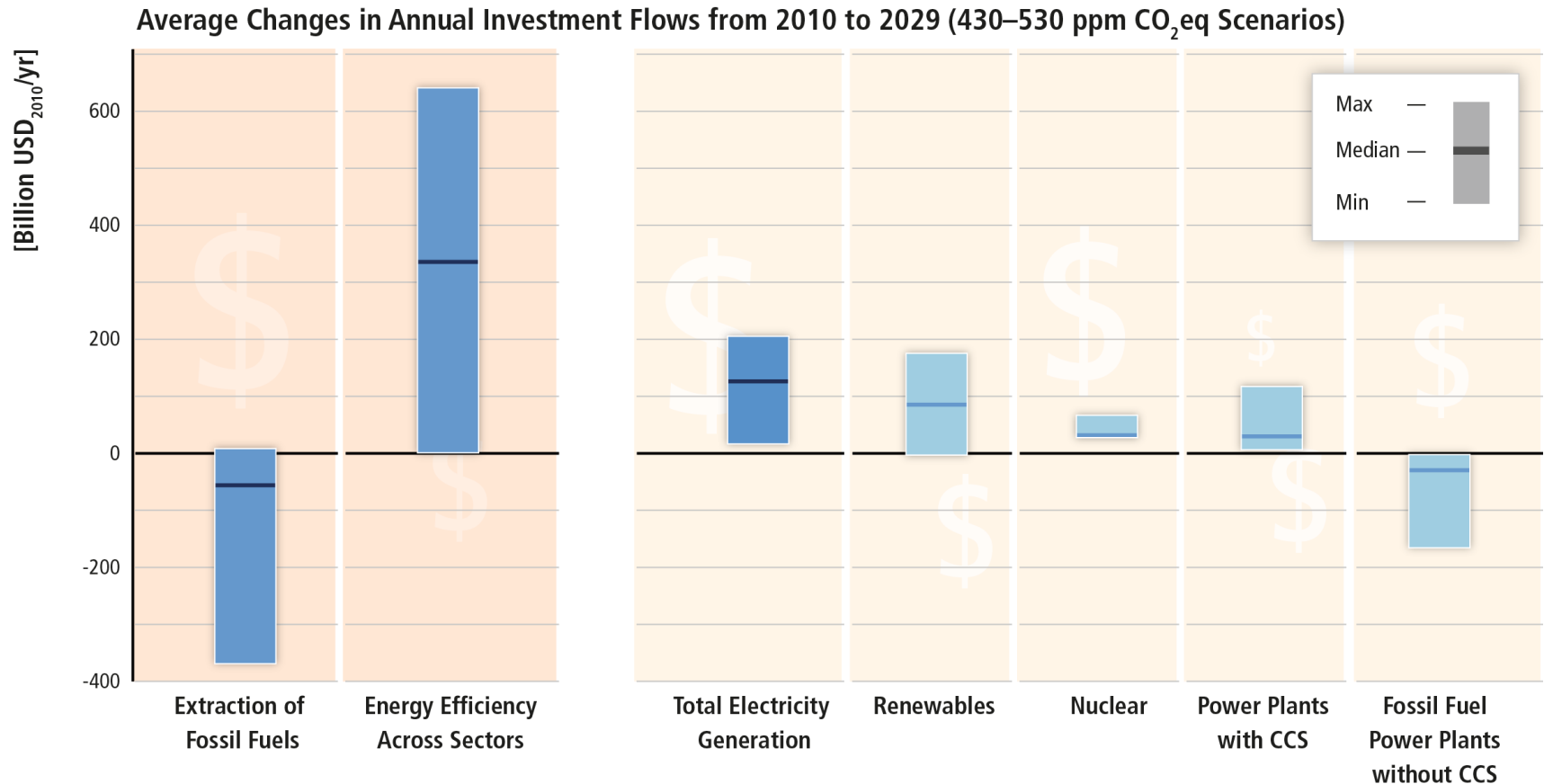
450 ppm CO₂eq with Carbon Dioxide Capture & Storage



Decarbonization of energy supply would be needed.



Substantial reductions in emissions would require large changes in investment patterns.



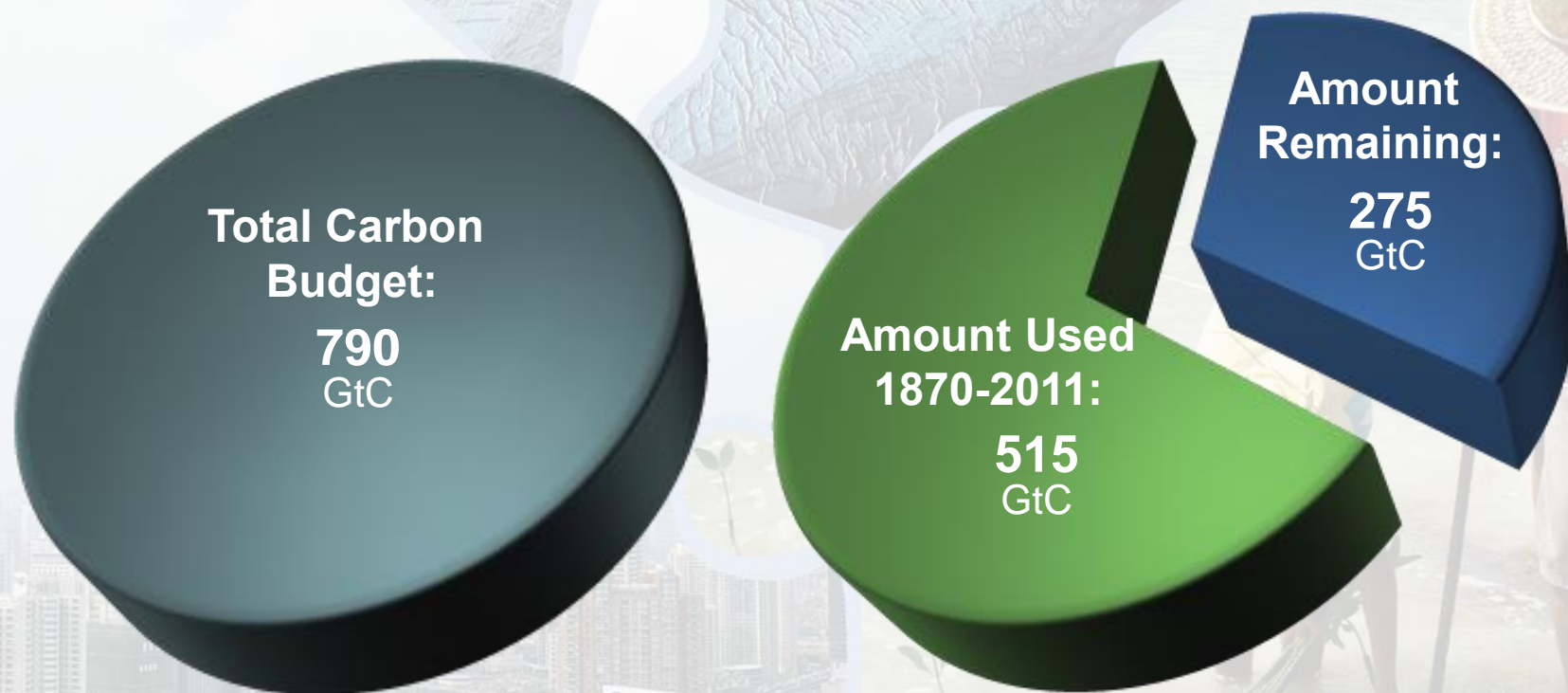
Ambitious Mitigation Is Affordable

- 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

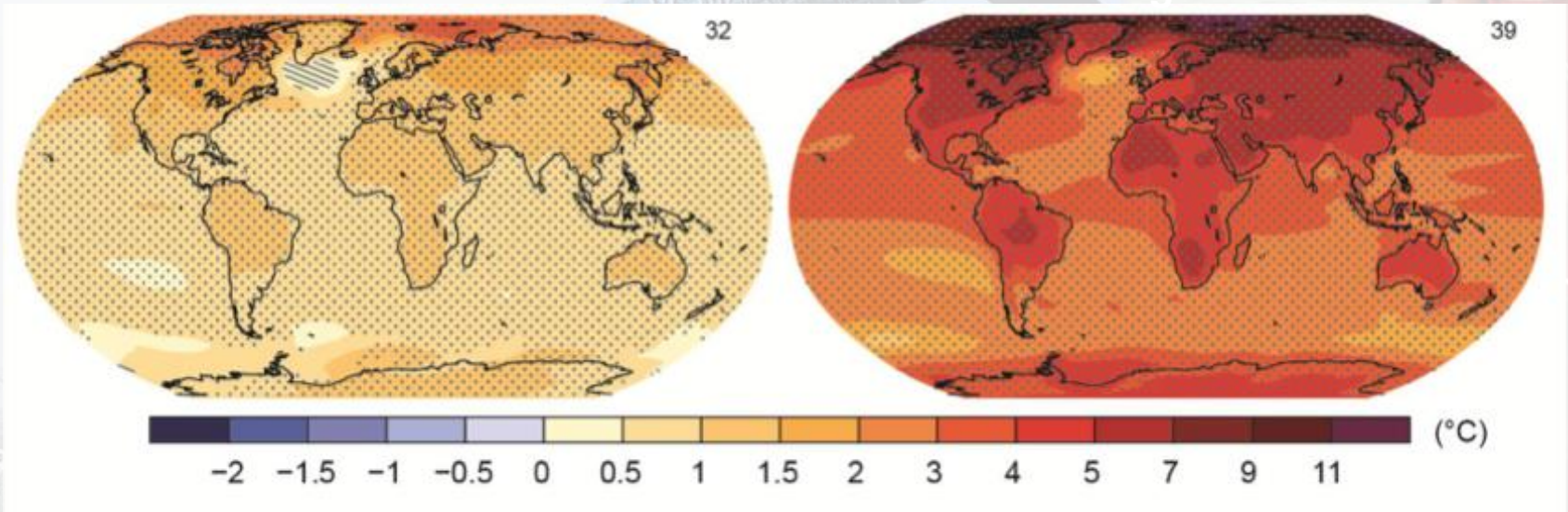


AR5 WGI SPM

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