Conclusions of the IPCC Working Group I Fifth Assessment Report, AR4, SREX and SRREN

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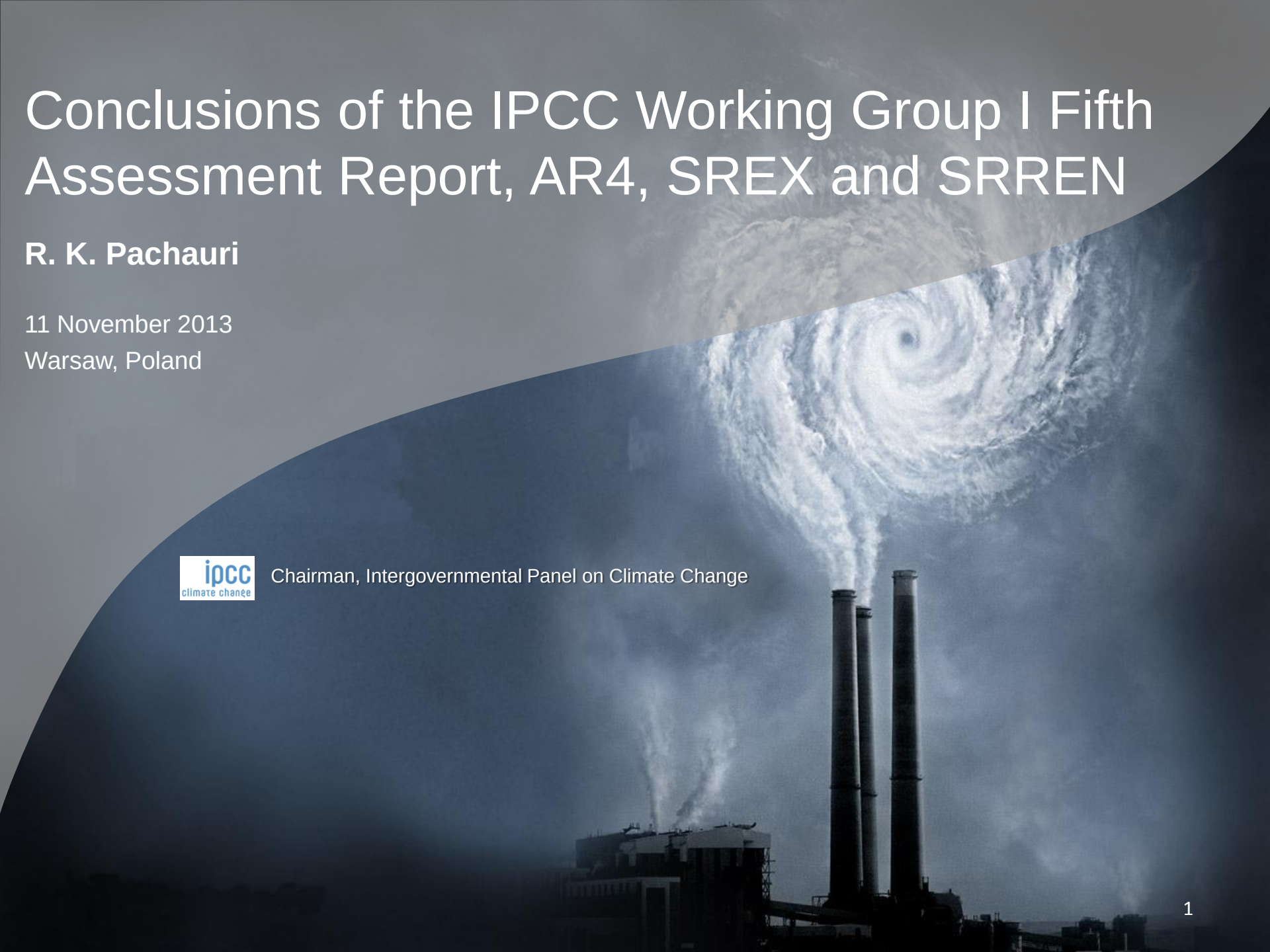
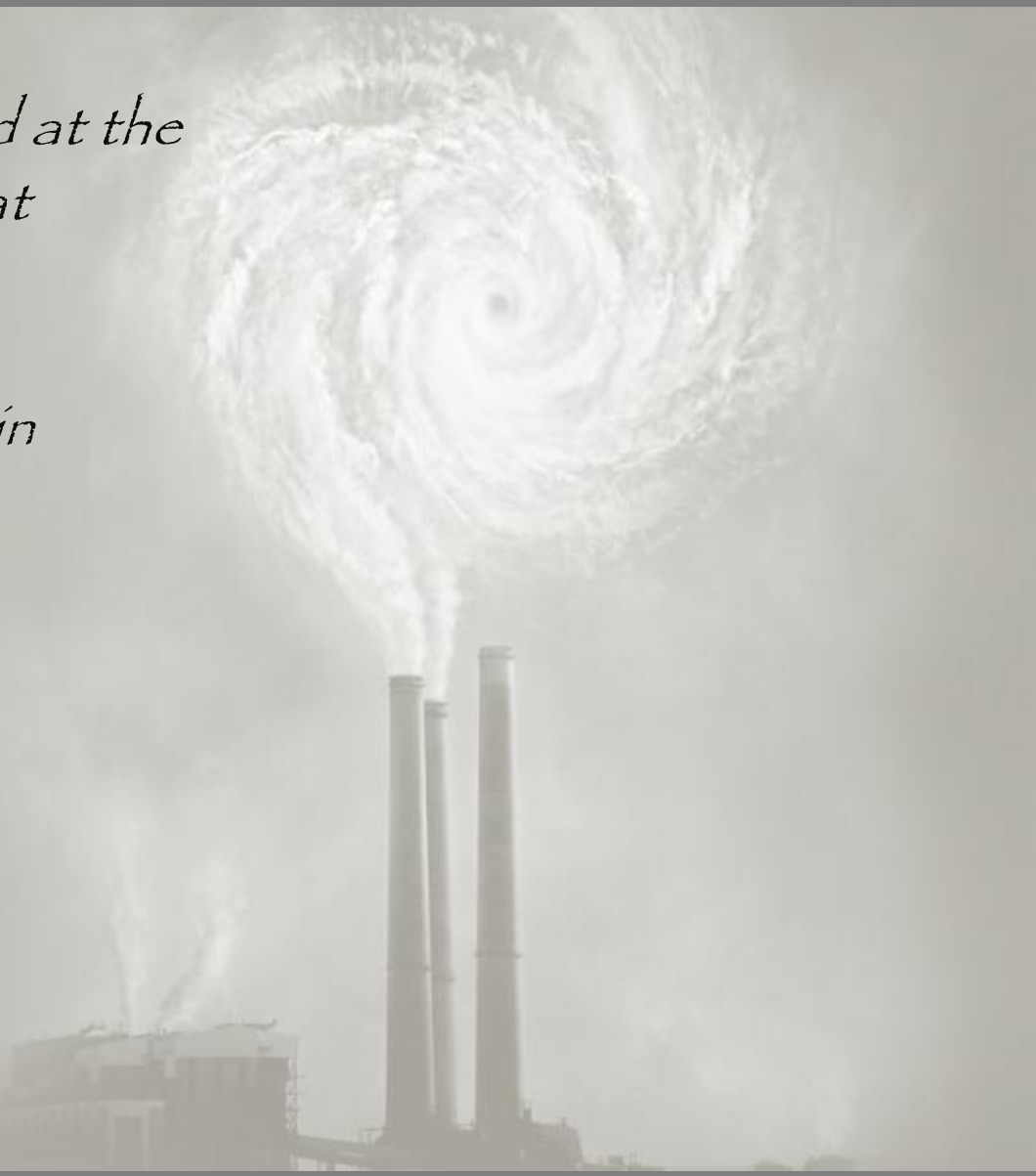
Warsaw, Poland



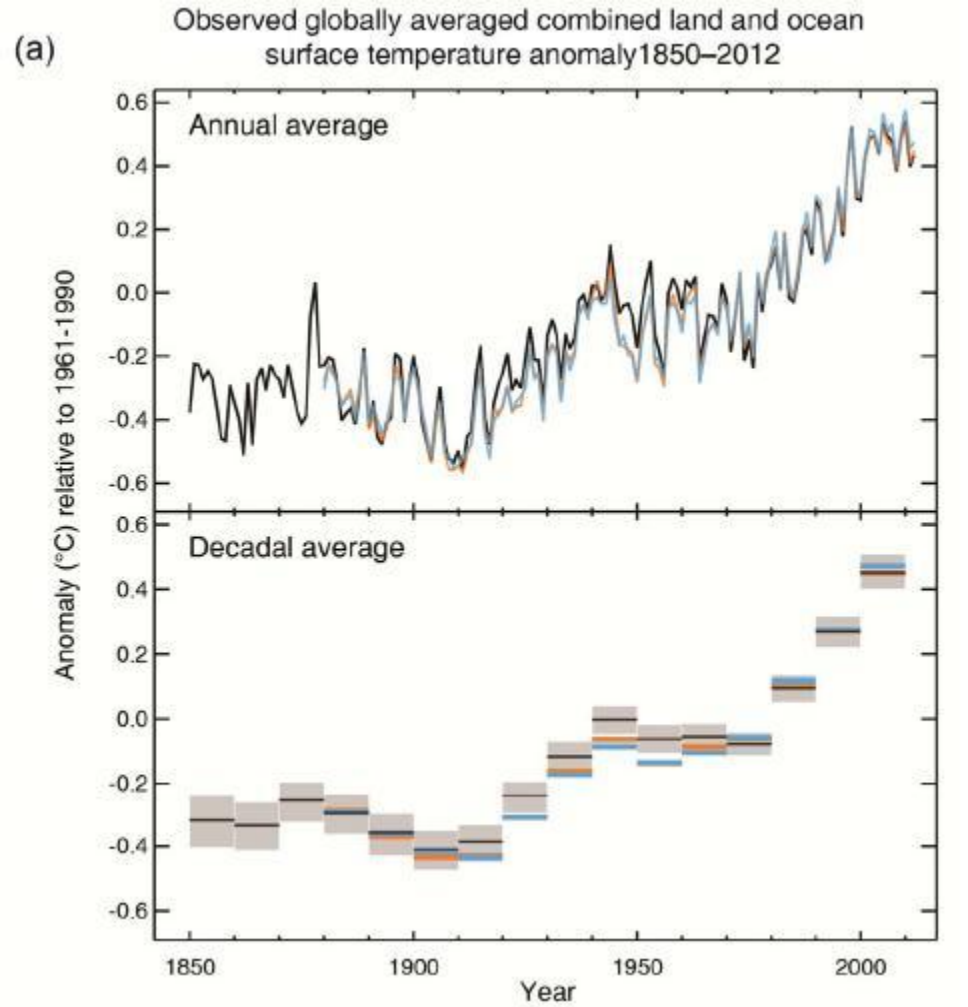
Chairman, Intergovernmental Panel on Climate Change

"Problems cannot be solved at the same level of awareness that created them."

- Albert Einstein



Warming of the climate is unequivocal



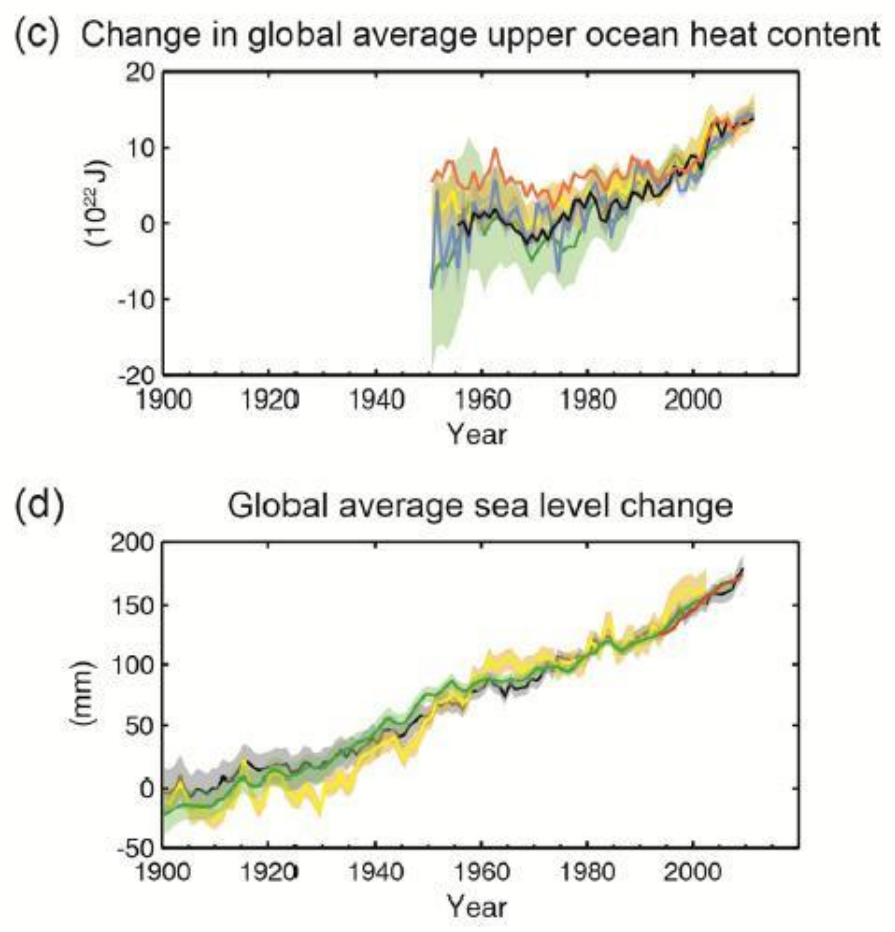
Since the 1950s many of the observed changes are unprecedented over decades to millennia:

- The atmosphere and the oceans have warmed
- The amounts of snow and ice have diminished
- Sea level has risen
- The concentrations of GHGs have increased

Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850.

Source : IPCC AR5

Observed changes in the climate system

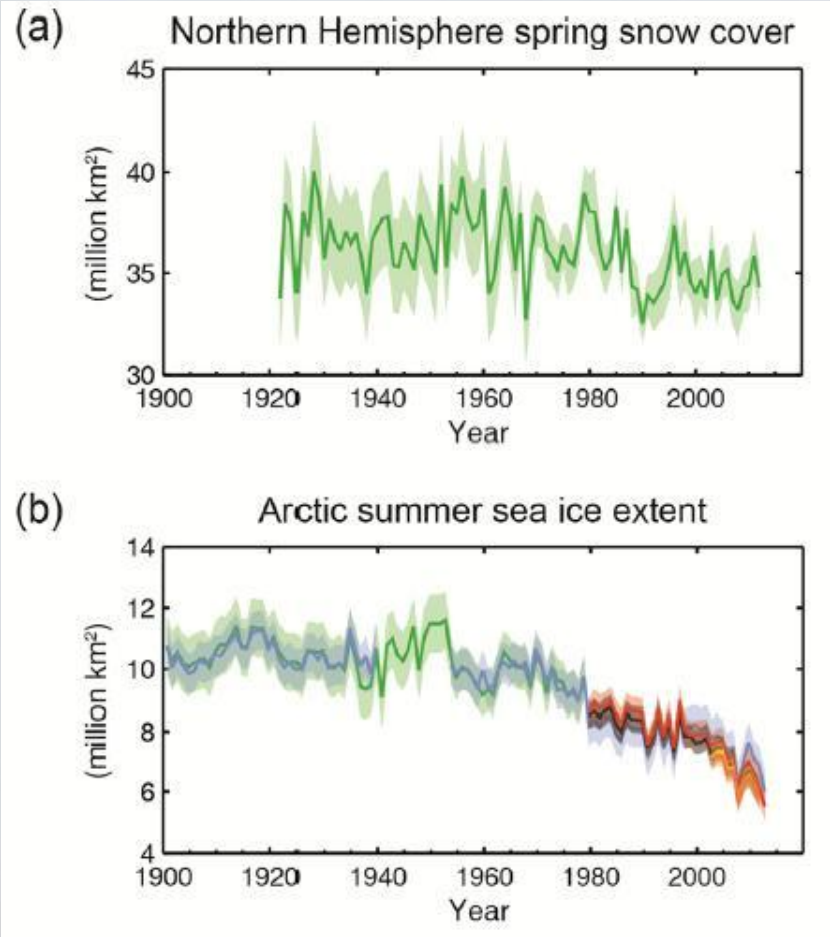


- It is virtually certain that the upper ocean (0-700m) warmed from 1971 to 2010.
- The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia.
- Over the period 1901-2010, global mean sea level rose by 19 cm.

Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90% of the energy accumulated between 1971 and 2010.

Source : IPCC AR5

Observed changes in the climate system



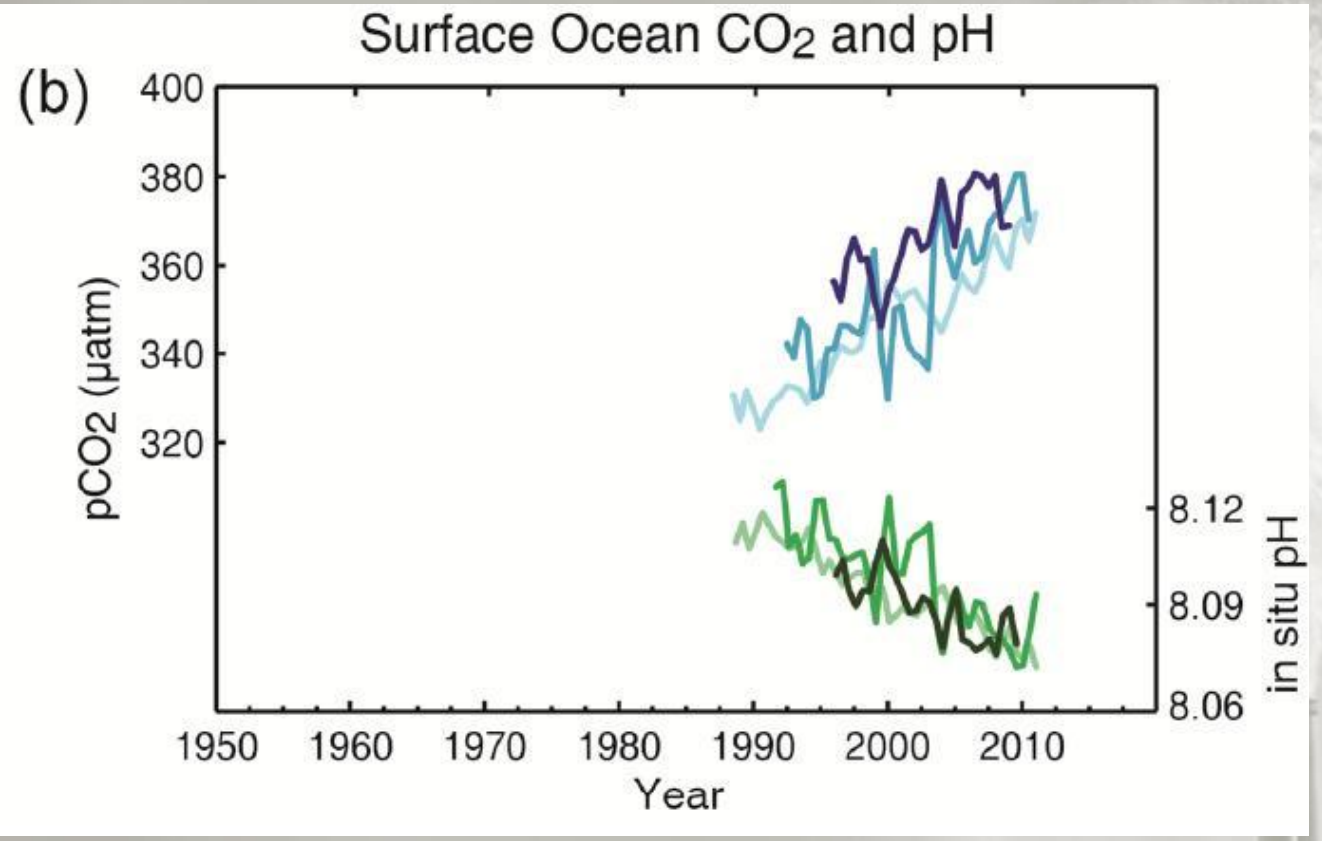
Over the last two decades:

- the Greenland and Antarctic ice sheets have been losing mass
- glaciers have continued to shrink almost worldwide
- Arctic sea ice and Northern Hemisphere spring snow cover have continued to decrease in extent.

Since the early 1970s, glacier mass loss and ocean thermal expansion from warming together explain about 75% of the observed global mean sea level rise.

Source : IPCC AR5

Understanding the causes of change



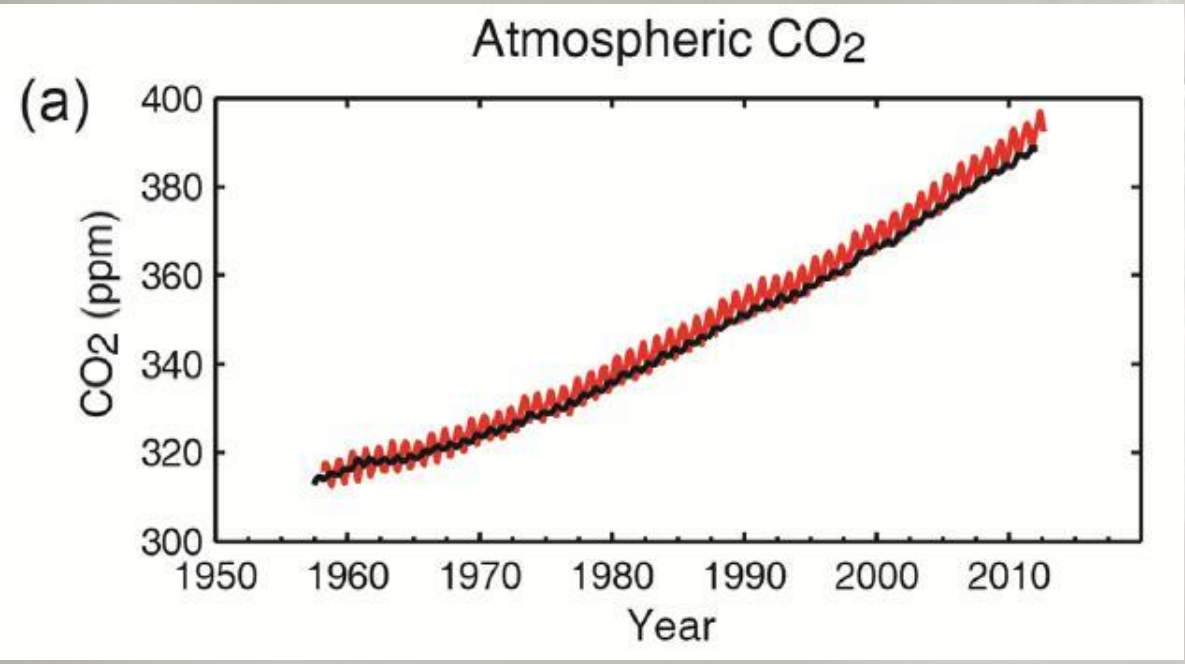
Partial pressure of dissolved CO2 at the ocean surface (blue curves) and *in situ* pH (green curves), a measure of the acidity of ocean water.

- CO2 concentrations have increased by 40% since preindustrial times from fossil fuel emissions and net land use change emissions.
- The ocean has absorbed about 30% of the emitted anthropogenic carbon dioxide, causing ocean acidification.

The atmospheric concentrations of CO2, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years.

Source : IPCC AR5

Understanding the causes of change

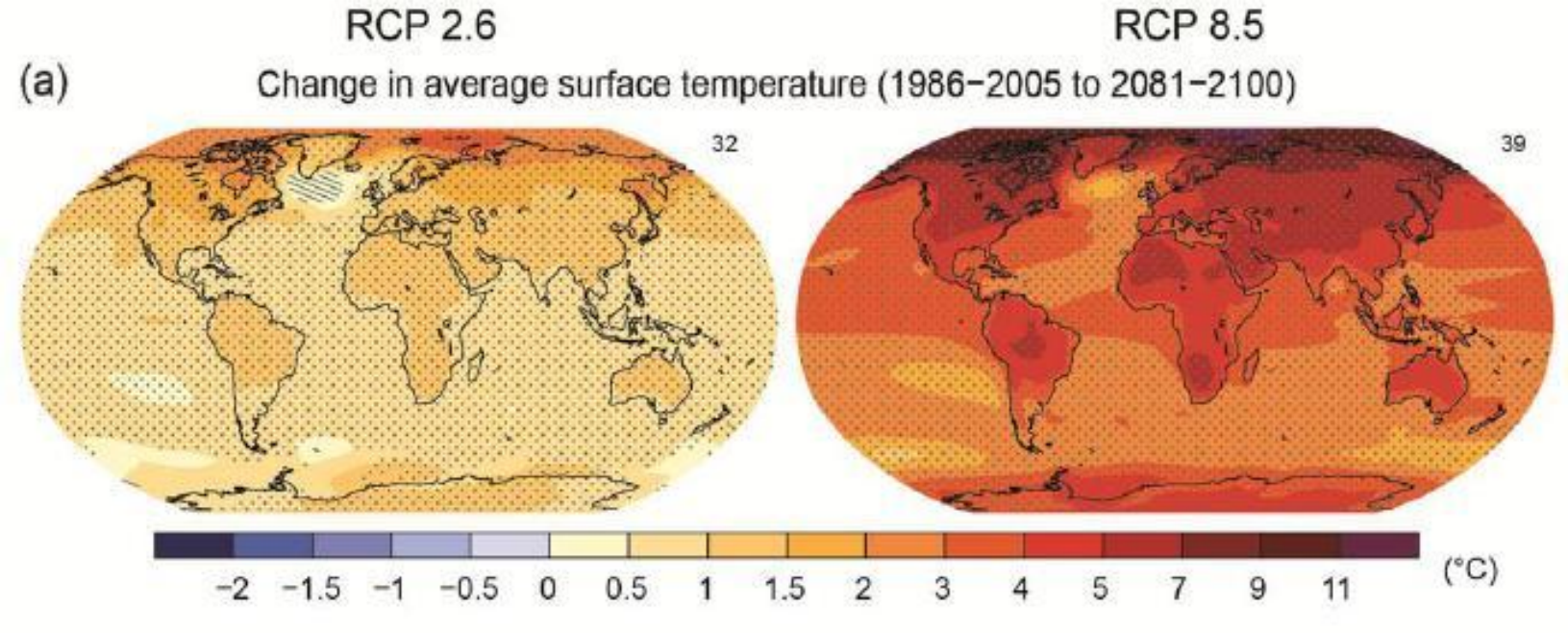


- Human influence on the climate system is clear.
- There is *high confidence* that changes in total solar irradiance have not contributed to the increase in global mean surface temperature over the period 1986 to 2008.
- Continued emissions of GHGs will cause further warming and changes in the climate system.

It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century.

Source : IPCC AR5

Warming will continue beyond 2100 under all RCP scenarios except RCP2.6.

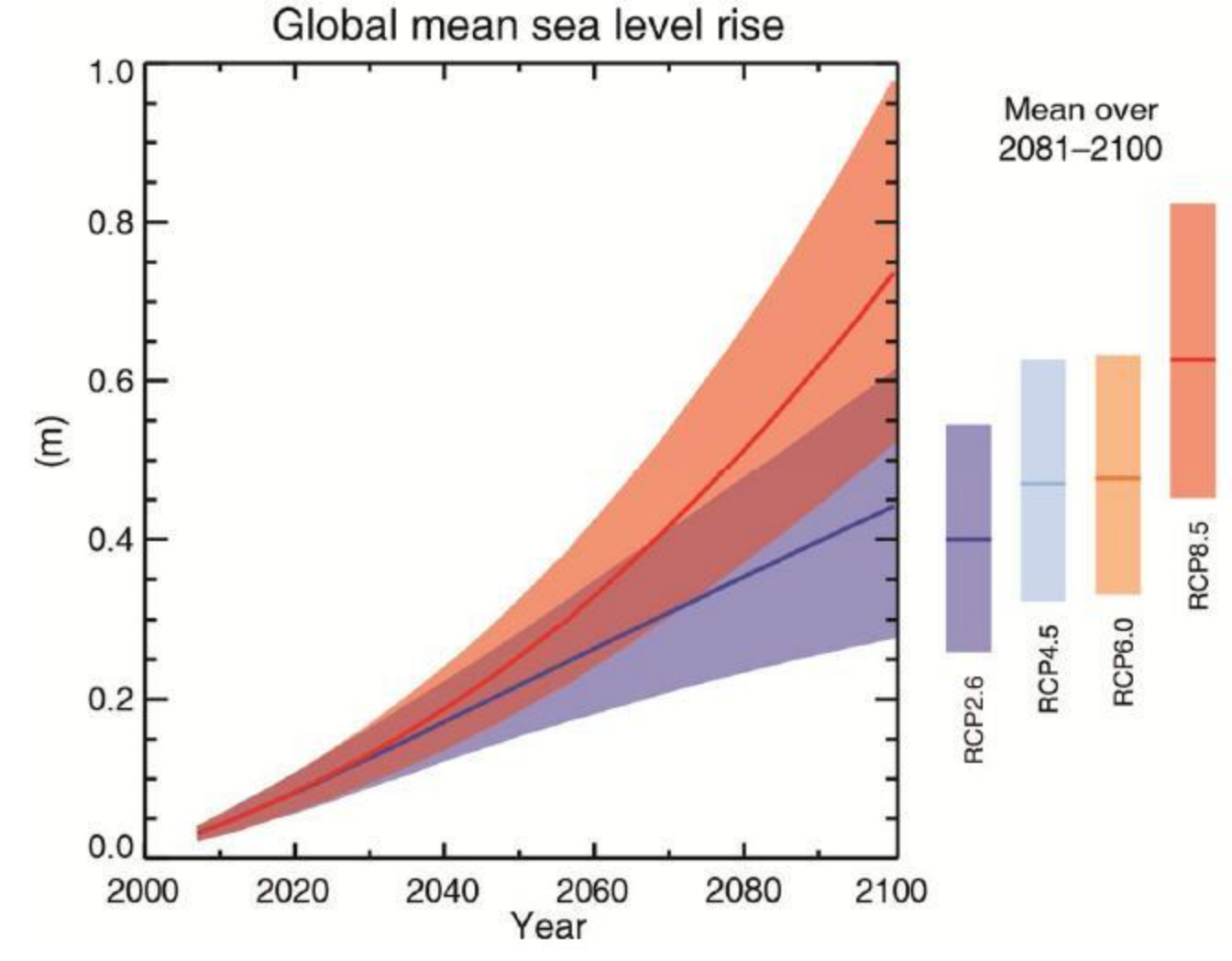


Global surface temperature change for the end of the 21st century:

- is *likely* to exceed 1.5°C relative to 1850 to 1900 for all RCP scenarios except RCP2.6.
- is *likely* to exceed 2°C for RCP6.0 and RCP8.5
- *is more likely than not* to exceed 2°C for RCP4.5.

Source : IPCC AR5

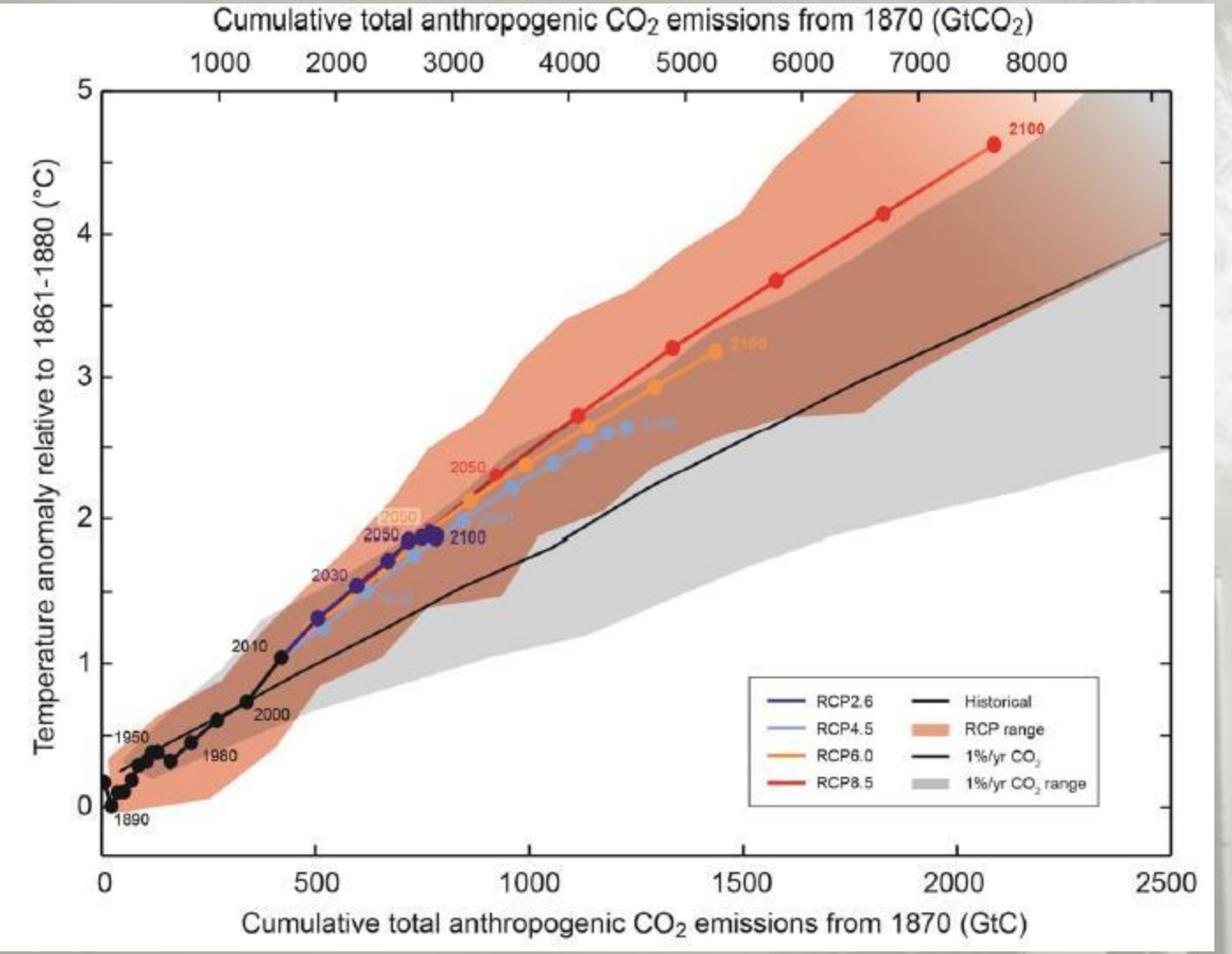
Future changes in the climate system



- The global ocean will continue to warm 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.
- Global mean sea level will continue to rise during the 21st century

Source : IPCC AR5

Future changes in the climate system



Global mean surface temperature increase as a function of cumulative total global CO2 emissions from various lines of evidence.

- Climate change will affect carbon cycle processes in a way that will exacerbate the increase in CO2 in the atmosphere.
- Further uptake of carbon by the ocean will increase ocean acidification

Source : IPCC AR5

Extreme events during and by the end of the 21st century

- It is very likely that the length, frequency, and/or intensity of warm spells or heat waves will increase over most land areas
- Under some scenarios, a 1-in-20 year hottest day is *likely* to become a 1-in-2 year event in most regions
- It is likely that the frequency of heavy precipitation or the proportion of total rainfall from heavy falls will increase over many areas of the globe

Source : IPCC SREX

Implications for sustainable development

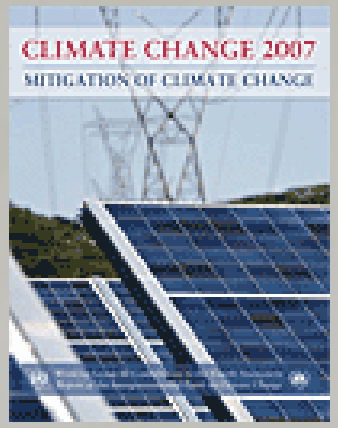
- The interactions among climate change mitigation, adaptation, and disaster risk management may have a major influence on resilient and sustainable pathways.

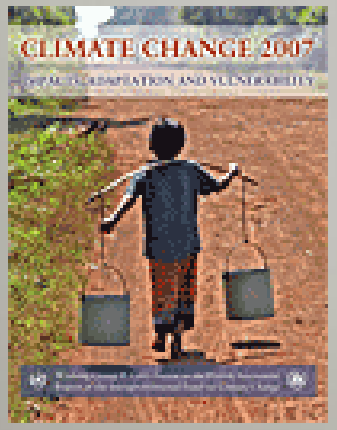
- Interactions between the goals of mitigation and adaptation will play out locally, but have global consequences.

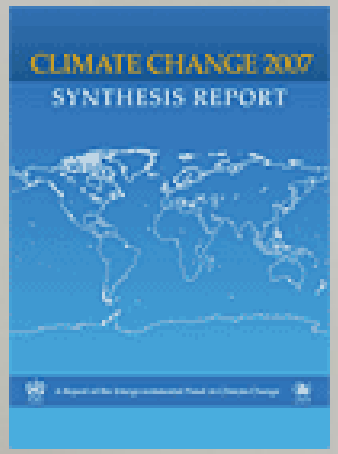
Limits to resilience are faced when thresholds or tipping points associated with social and/or natural systems are exceeded, posing severe challenges for adaptation.

Source : IPCC SREX

Adaptation and Mitigation







"Neither adaptation nor mitigation alone can avoid all climate change impacts; however, they can complement each other and together can significantly reduce the risks of climate change"

- IPCC Fourth Assessment Report

Source : IPCC AR4

Characteristics of stabilization scenarios

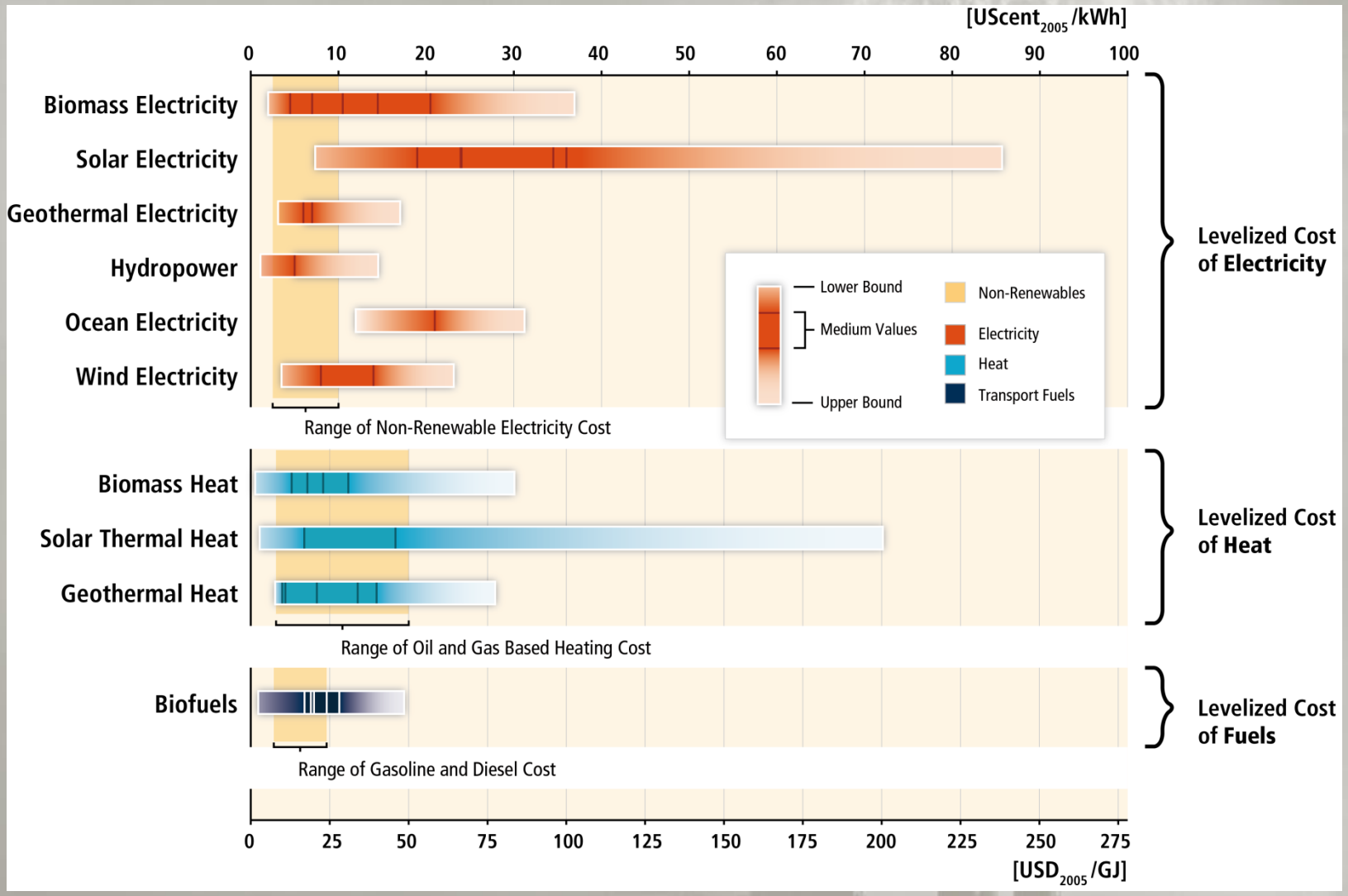
Post-tar stabilization scenarios

Stabilization level (ppm CO2-eq)	Global mean temp. increase (ºC)	**Year CO2 needs to peak**	Global sea level rise above pre- industrial from thermal expansion (m)
445 – 490	2.0 – 2.4	2000-2015	0.4 – 1.4
490 – 535	2.4 – 2.8	2000-2020	0.5 – 1.7
535 – 590	2.8 – 3.2	2010-2030	0.6 – 1.9
590 – 710	3.2 – 4.0	2020-2060	0.6 – 2.4

Delayed emissions reductions significantly constrain the opportunities to achieve lower stabilisation levels and increase the risk of more severe climate change impacts.

Source : IPCC AR4

RE costs are still higher than existing energy prices but in various settings RE is already competitive.



Source : IPCC SRREN

Overcoming barriers

A **significant increase** in the deployment of RE by 2030, 2050 and beyond is indicated **in the majority of the 164 scenarios** reviewed in this SRREN. However:

- A transition to higher shares of RE would imply increasing investments in **technologies and infrastructure**
- **Policies** play a crucial role in accelerating the deployment of RE technologies.
- Policies include regulations, financial incentives, public finance mechanisms and carbon pricing mechanisms.

‘Enabling’ policies support RE development and deployment

Source : IPCC SRREN

"A technological society has two choices. First it can wait until catastrophic failures expose systemic deficiencies, distortion and self-deceptions...
Secondly, a culture can provide social checks and balances to correct for systemic distortion prior to catastrophic failures."

- Mahatma Gandhi