

# The future of climate science

A public forum with world-leading IPCC  
climate researchers





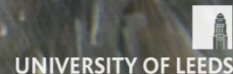
# Professor Neil Adger

University of Exeter





UNIVERSITY OF  
EXETER



Peter Gibbs

BBC and Met Office



# Professor Thomas Stocker

Co-Chair of Working Group I

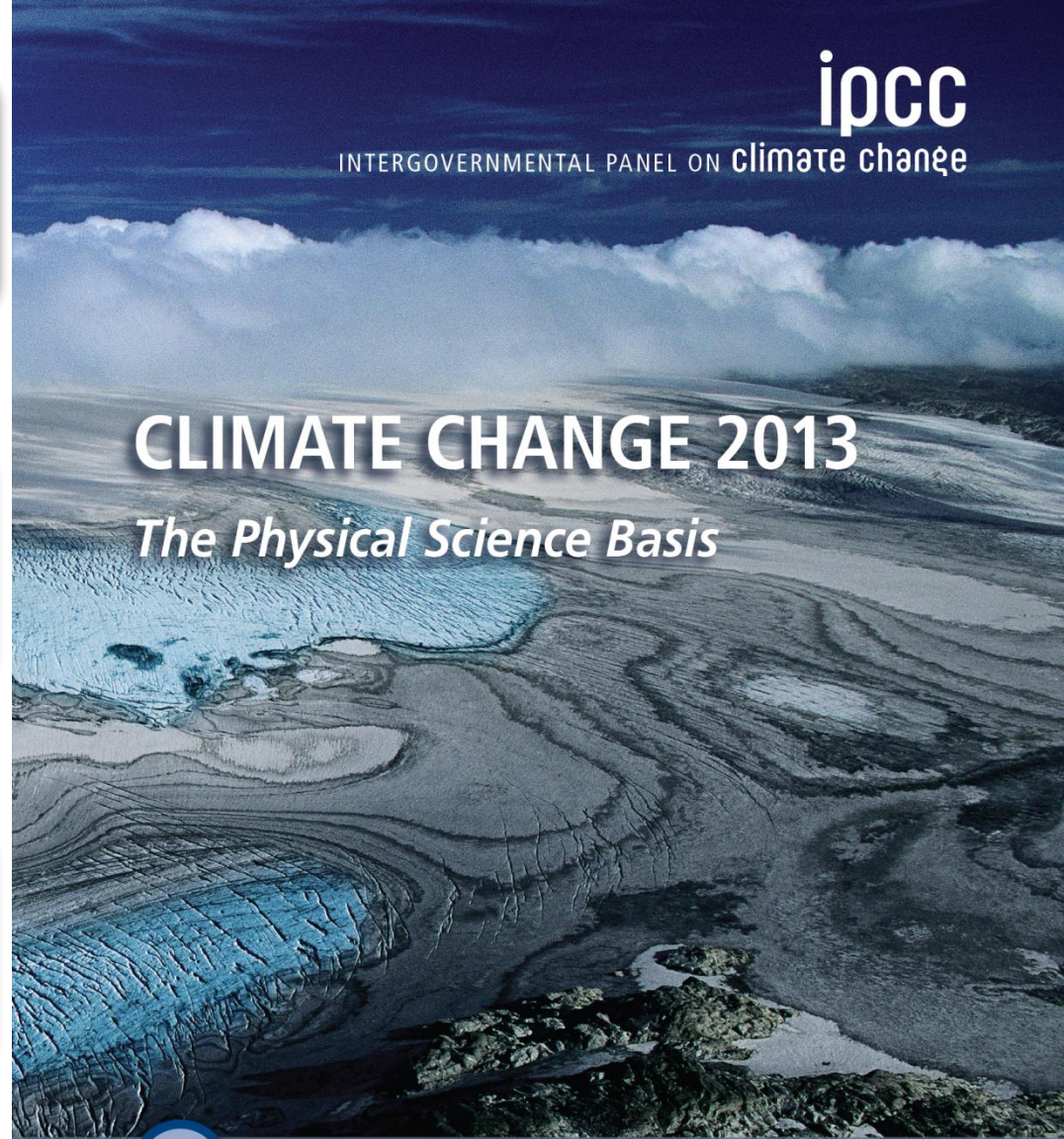


Observations

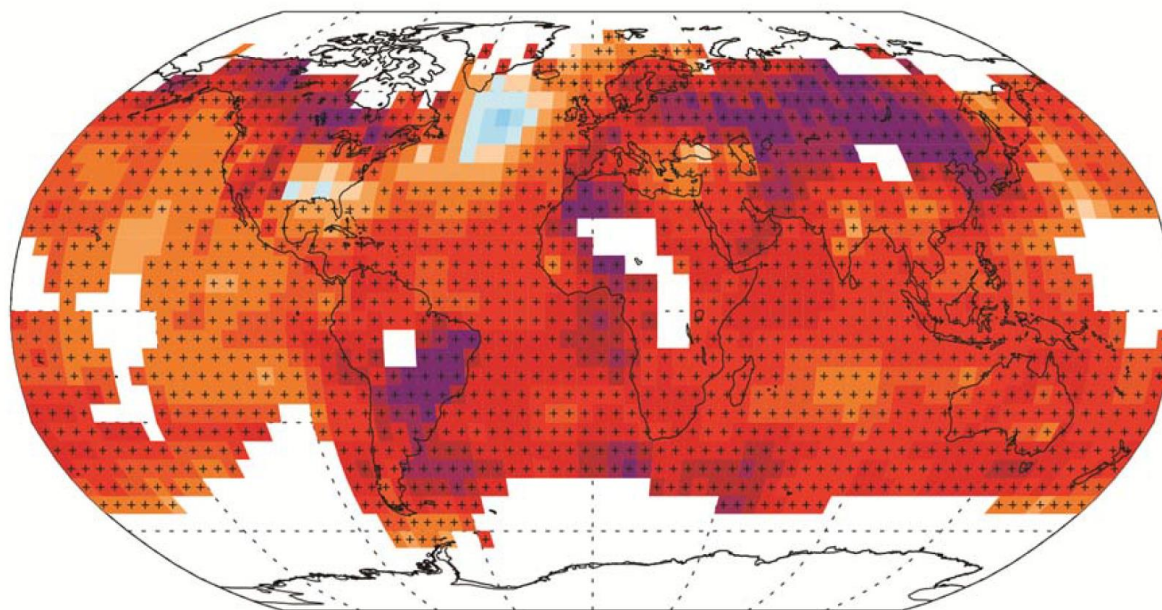
Understanding

Future

[www.climatechange2013.org](http://www.climatechange2013.org)



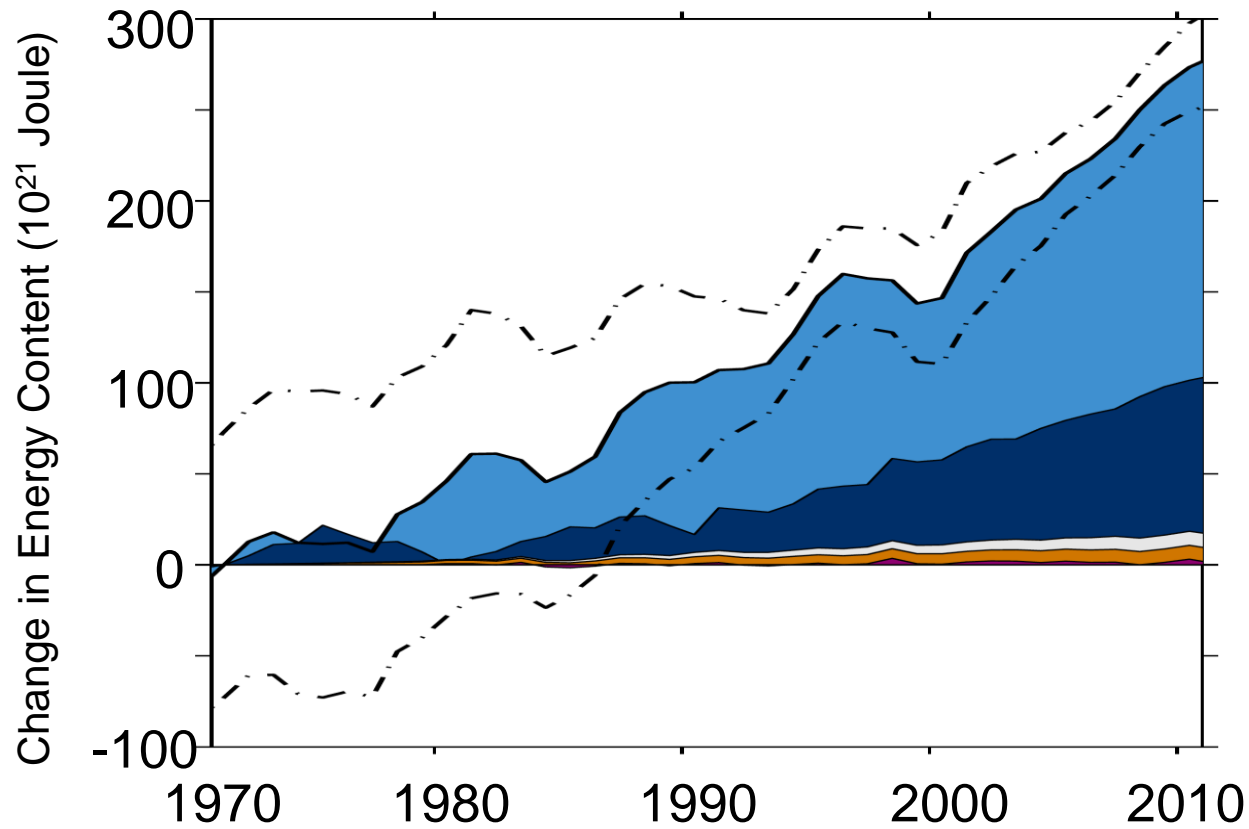
IPCC 2013, Fig. SPM.1b



Temperature Difference 1901 to 2012 based on trend (°C)

Warming of the climate system  
is unequivocal

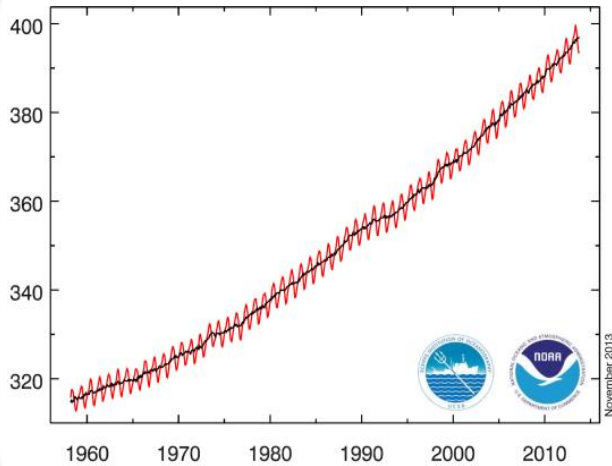




Warming of the climate system  
is unequivocal

# Worldwide Effects

## Cause



atmosphere, land, ocean

extreme events

water cycle

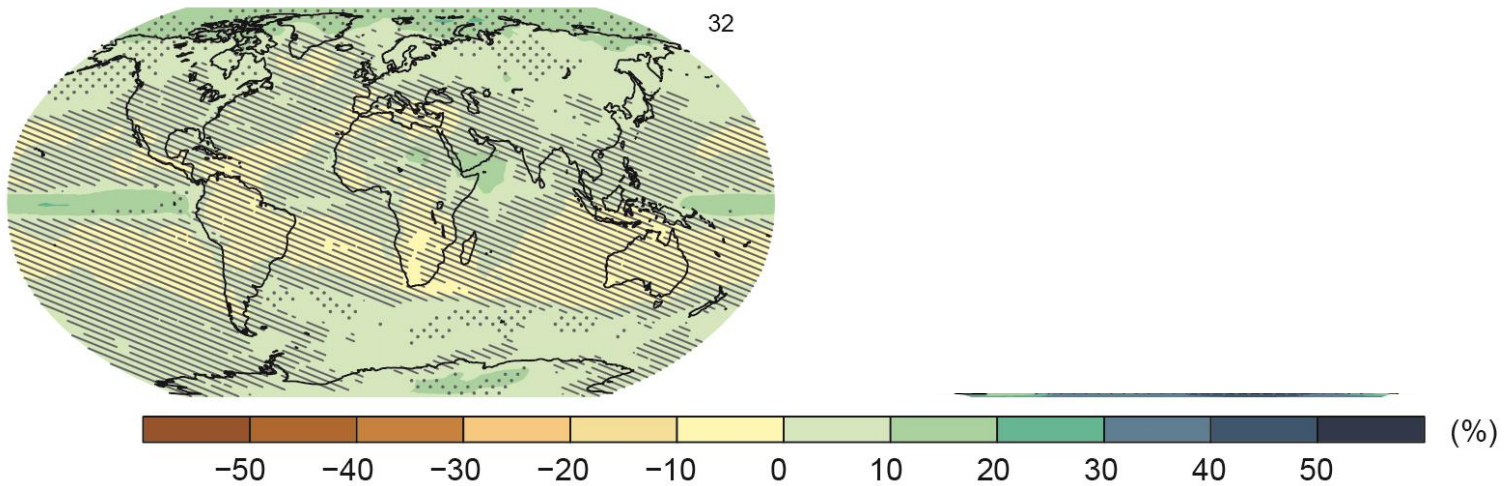
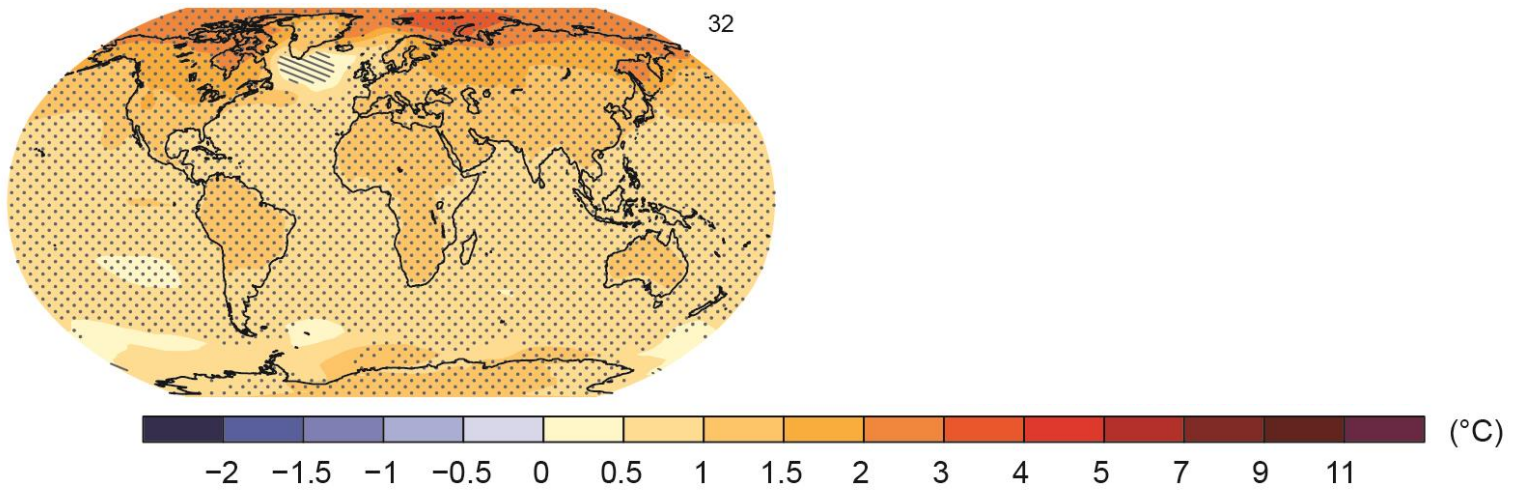
sea ice, glaciers, ice sheets

global mean sea level

Human influence on the climate system is clear.

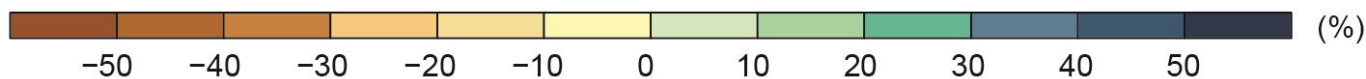
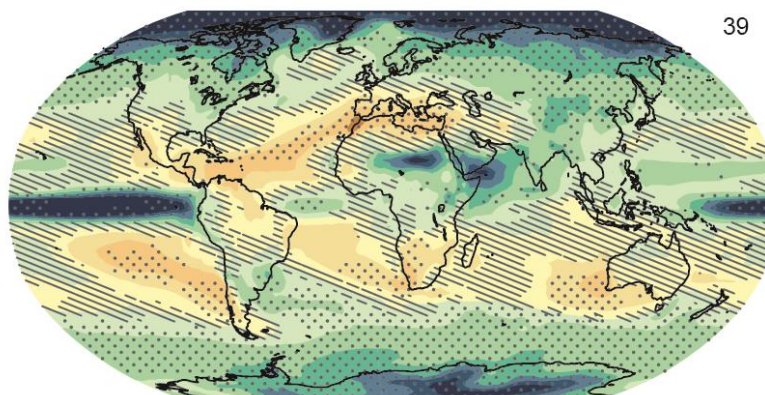
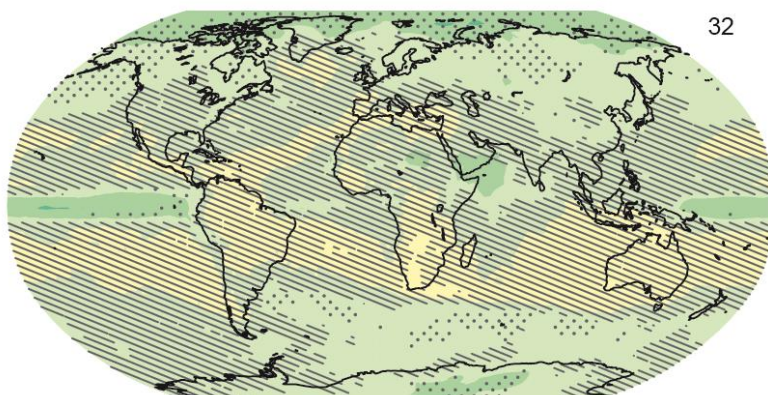
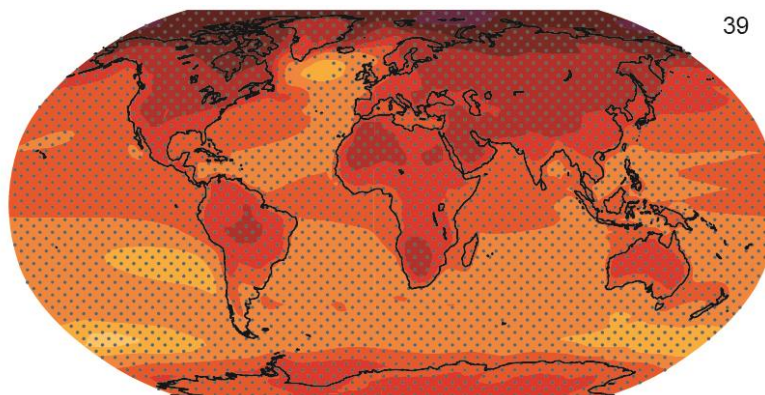
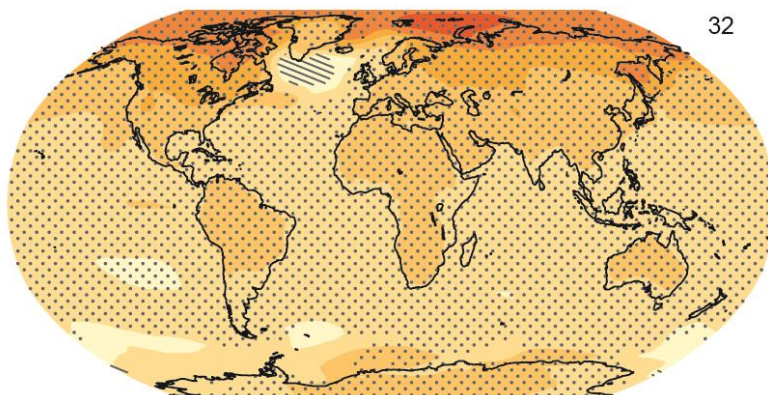


# 2°C world

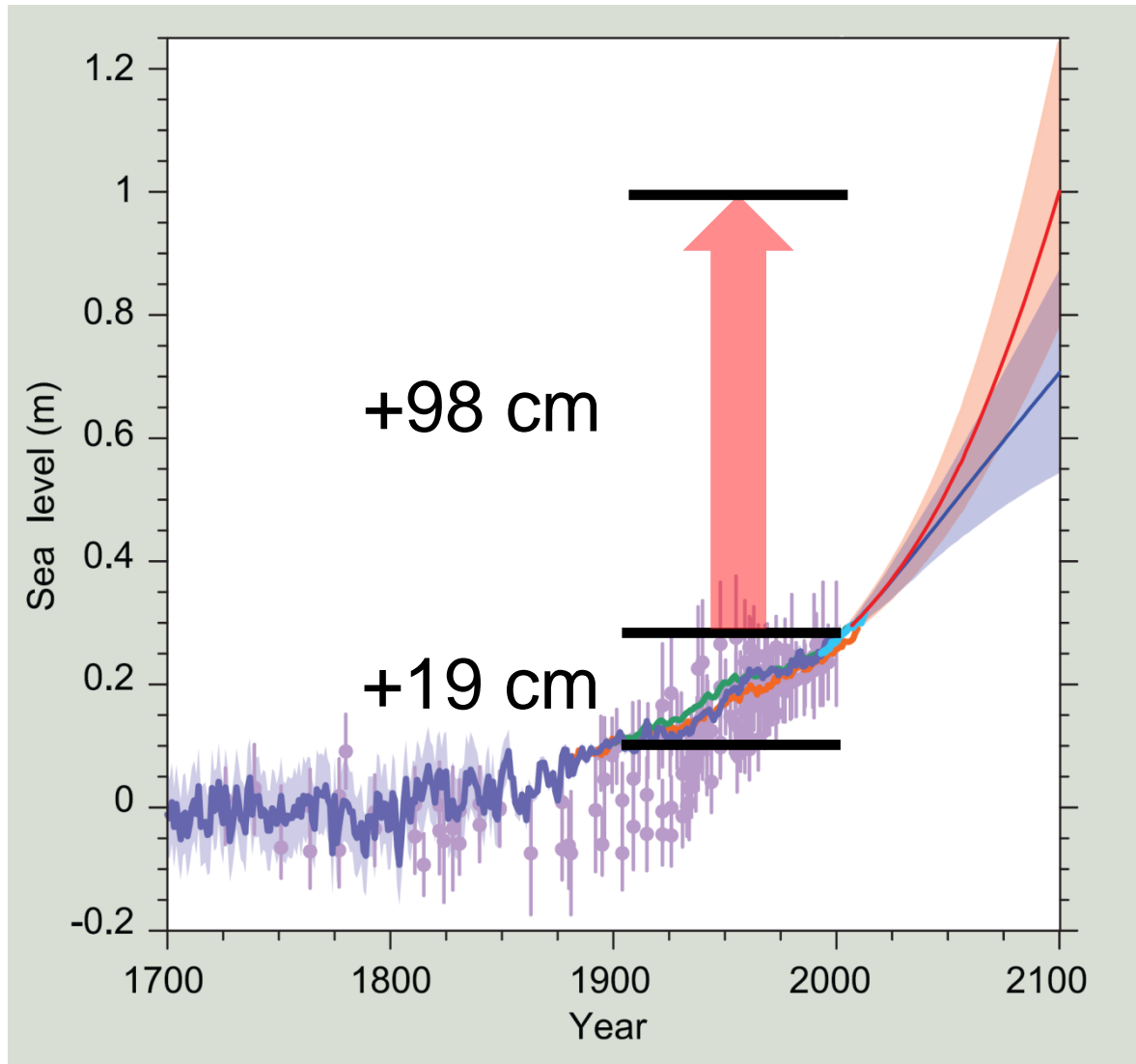


# 2°C world

# 4.5°C world

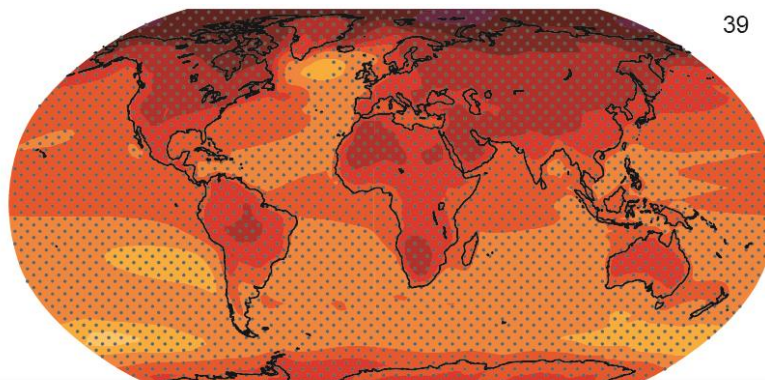
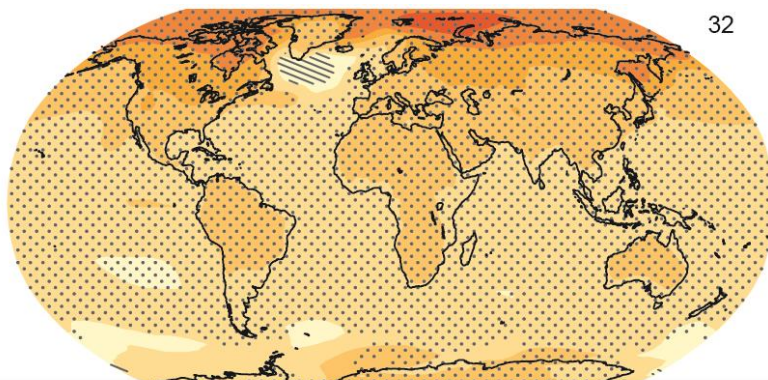




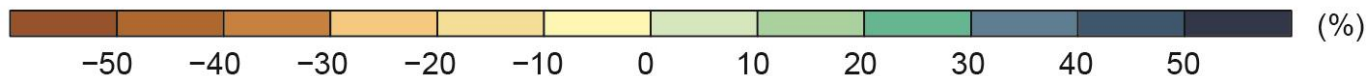
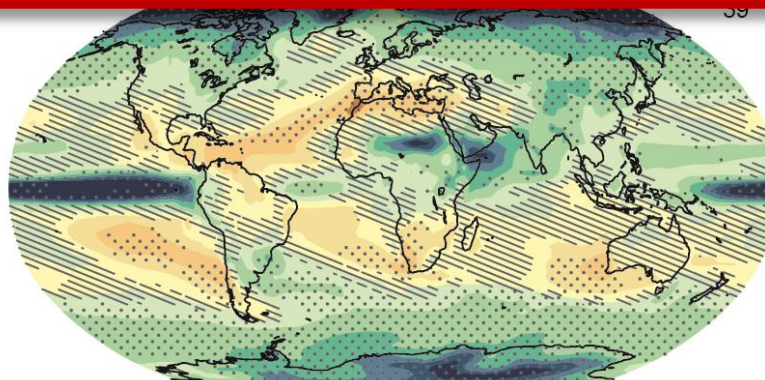
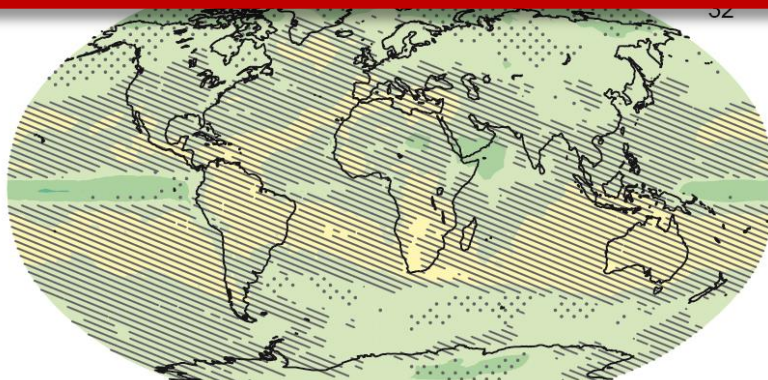


2°C world

4.5°C world



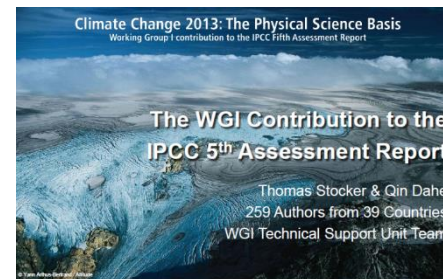
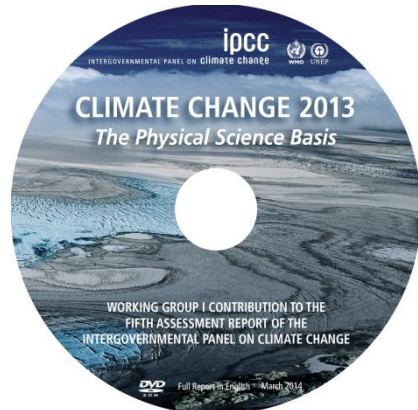
Today we have a choice.



(%)



# www.climatechange2013.org





UNIVERSITY OF  
EXETER



# Professor Chris Field

Co-Chair of Working Group II





# THE WORKING GROUP II

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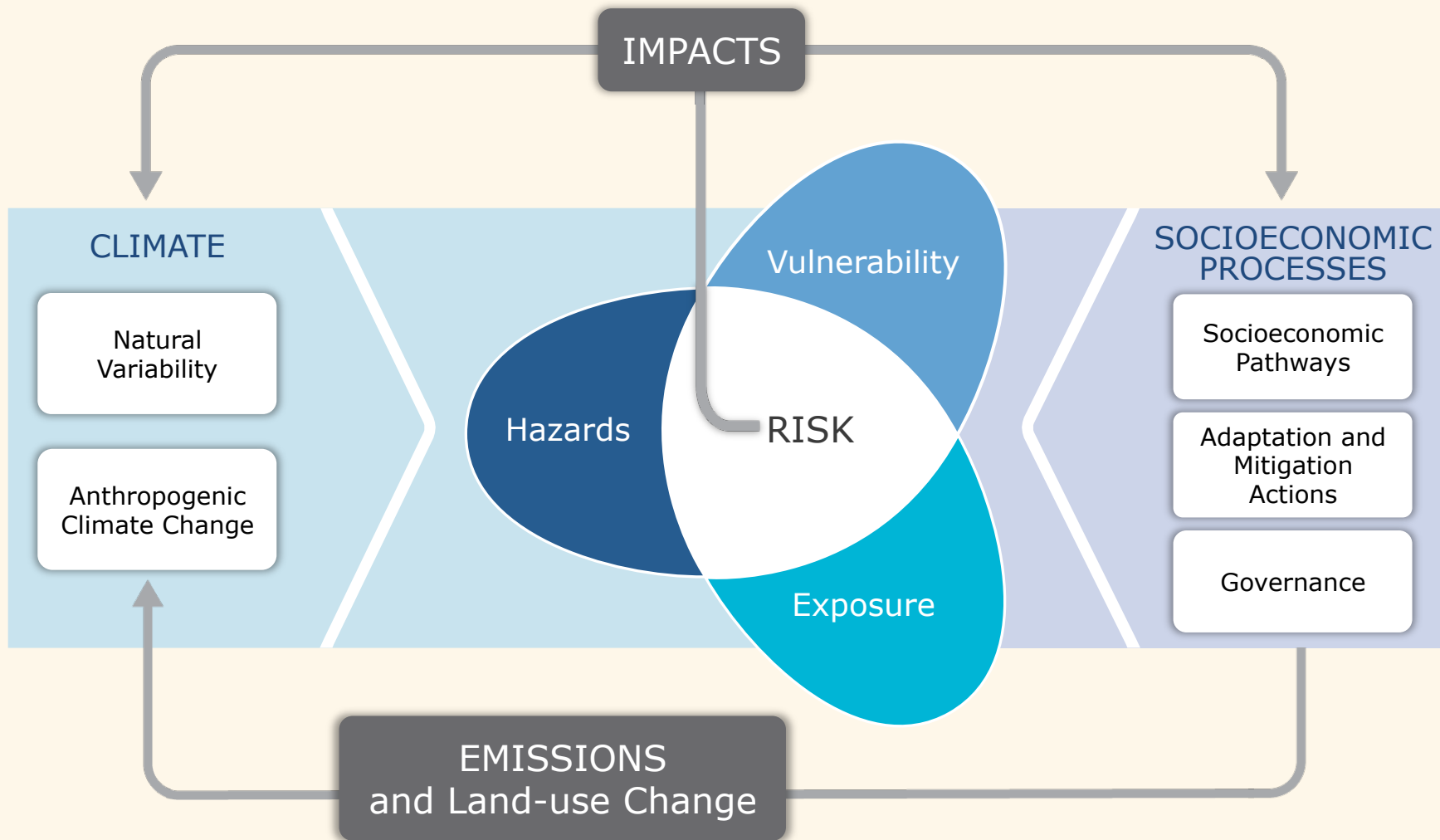
## CONTRIBUTION TO THE IPCC'S FIFTH ASSESSMENT REPORT





# CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY









# WIDESPREAD OBSERVED IMPACTS

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# A CHANGING WORLD



An underwater photograph of a coral reef. The water is a deep, murky green. In the foreground, there is a dense field of coral, mostly brown and yellow, indicating bleaching. A single, prominent, light-colored, fan-shaped coral structure stands out in the center. The background shows more coral and some small fish swimming in the distance.

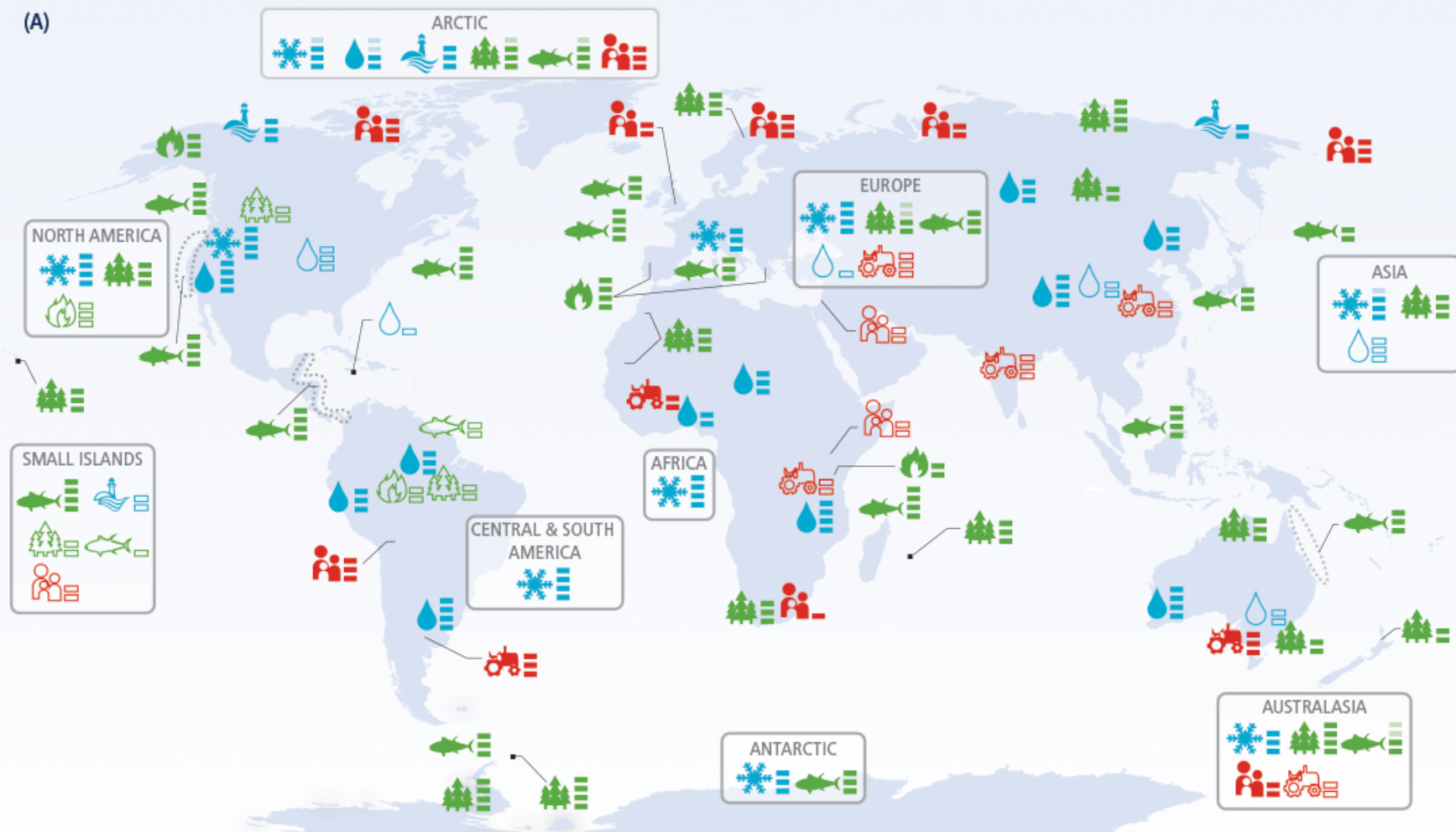
# WIDESPREAD OBSERVED IMPACTS

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# A CHANGING WORLD



(A)



Confidence in attribution to climate change

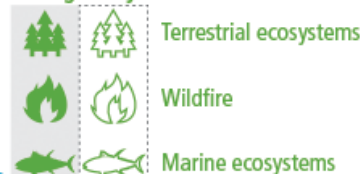


Observed impacts attributed to climate change for

**Physical systems**



**Biological systems**



**Human and managed systems**

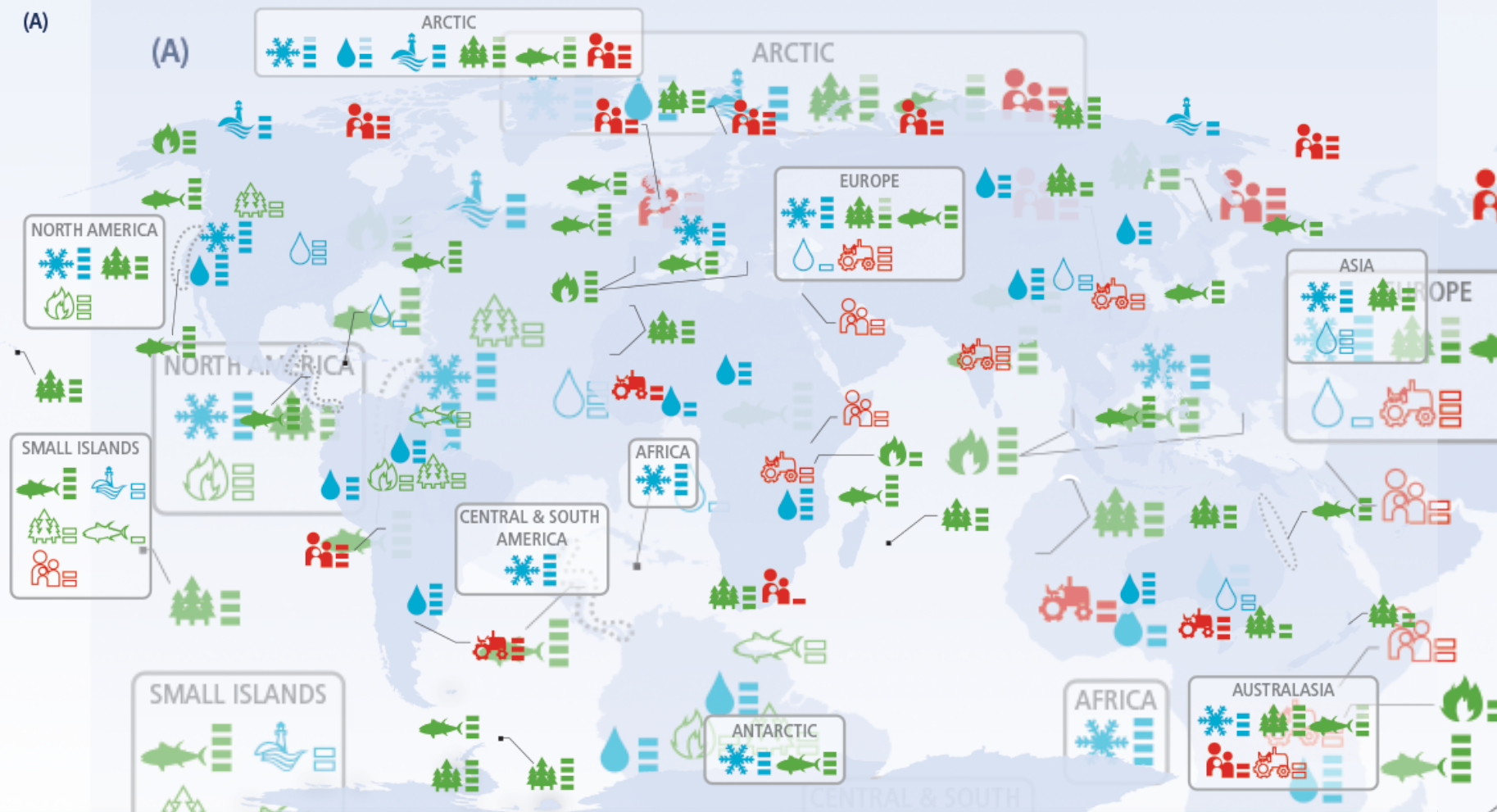


Regional-scale impacts

**Outlined symbols** = Minor contribution of climate change  
**Filled symbols** = Major contribution of climate change



(A)



Confidence in attribution to climate change

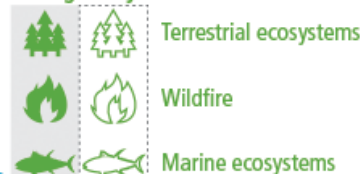


Observed impacts attributed to climate change for

Physical systems



Biological systems

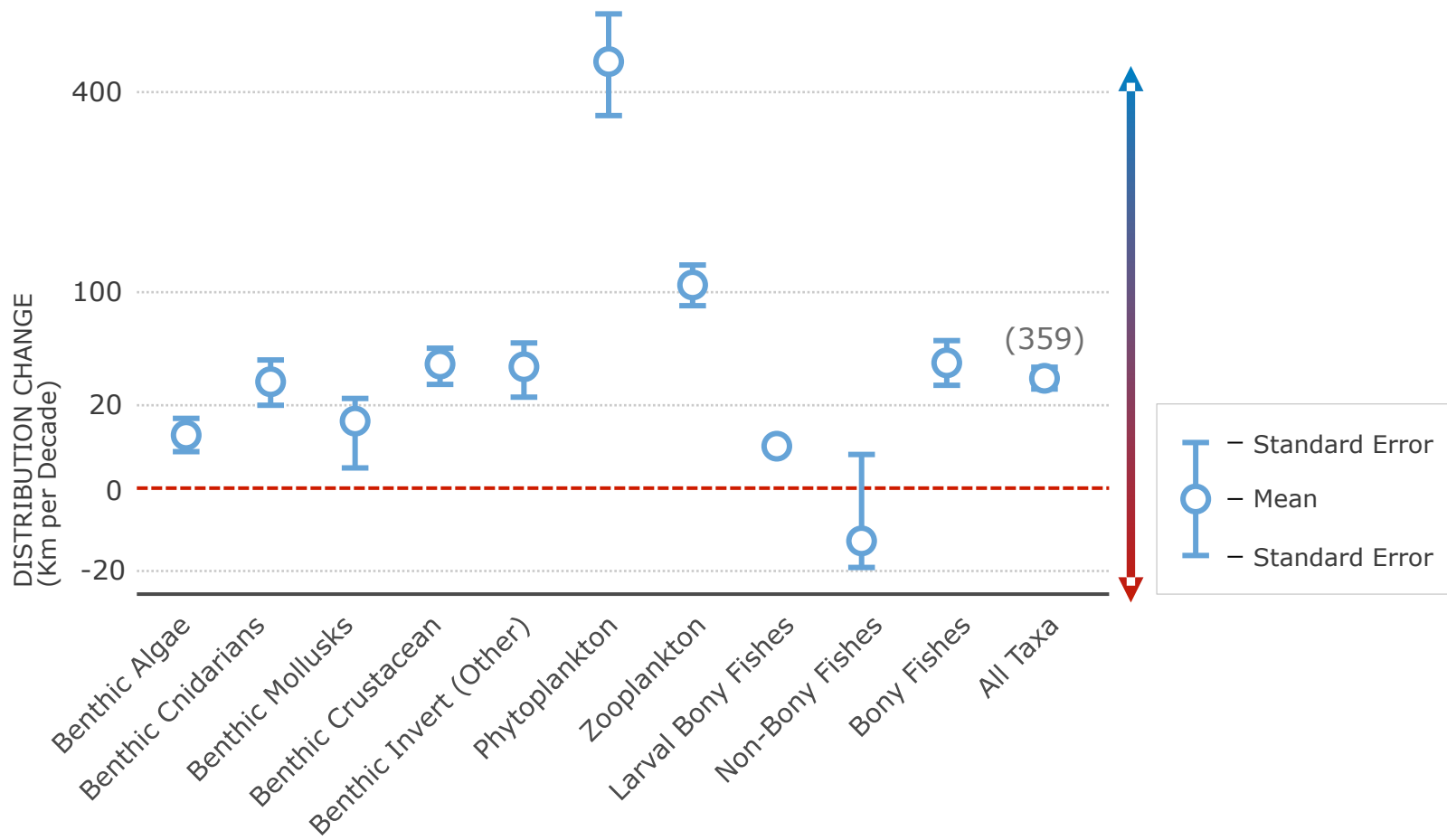


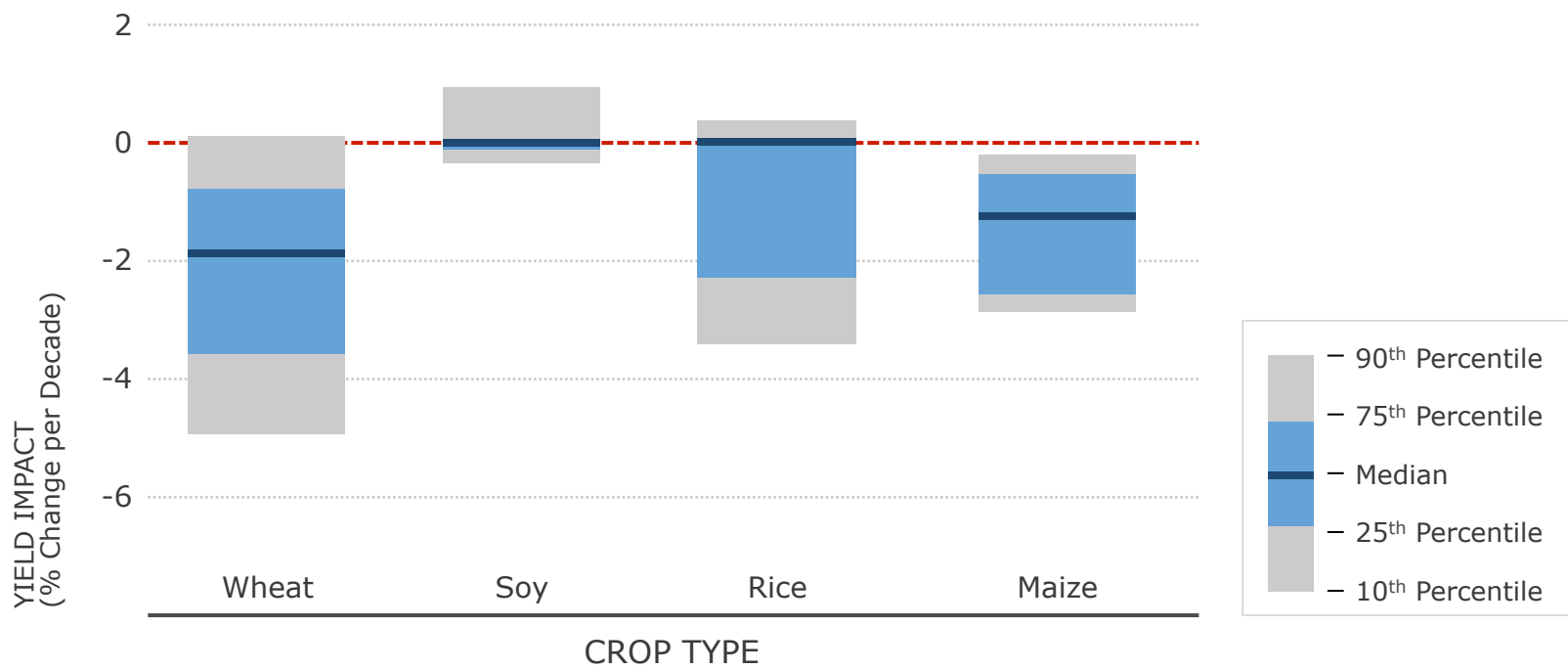
Human and managed systems



Regional-scale impacts

Outlined symbols = Minor contribution of climate change  
Filled symbols = Major contribution of climate change









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# VULNERABILITY AND EXPOSURE

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## AROUND THE WORLD



A photograph of a city street completely flooded with water. The water is dark and reflects the surrounding buildings and the overcast sky. On the left, a tall brick building with many windows lines the street. On the right, another brick building with a modern glass-enclosed walkway is visible. In the distance, a person in a red jacket is wading through the water, and a dark car is partially submerged. The overall atmosphere is somber and highlights the vulnerability of urban infrastructure to flooding.

# **VULNERABILITY AND EXPOSURE**

## **AROUND THE WORLD**





**ADAPTATION IS  
ALREADY OCCURING**





**ADAPTATION IS  
ALREADY OCCURING**





# CLIMATE CHANGE

## REDUCING AND MANAGING RISKS

ipcc

INTERGOVERNMENTAL PANEL ON climate change



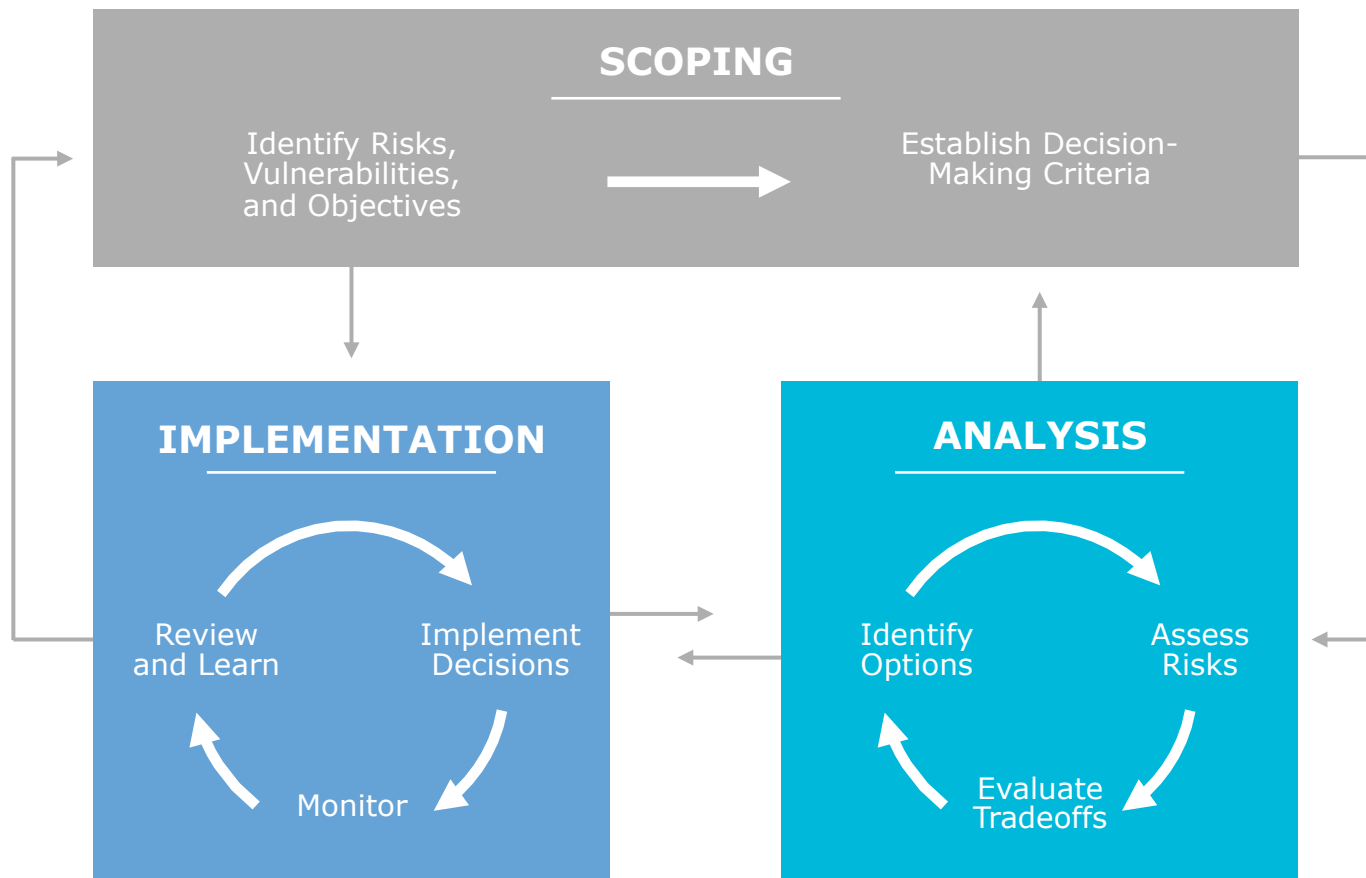


INCREASING MAGNITUDES  
OF WARMING INCREASE  
THE LIKELIHOOD OF

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**SEVERE AND  
PERVASIVE IMPACTS**

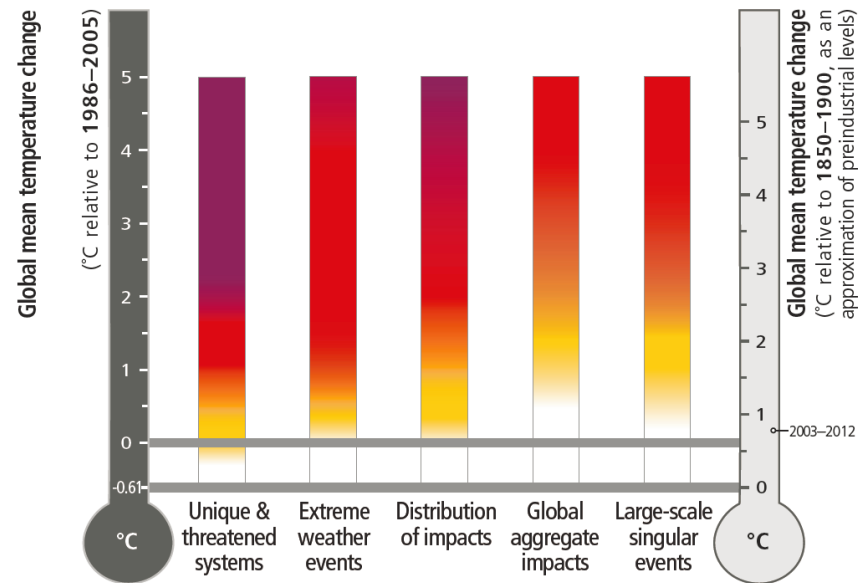
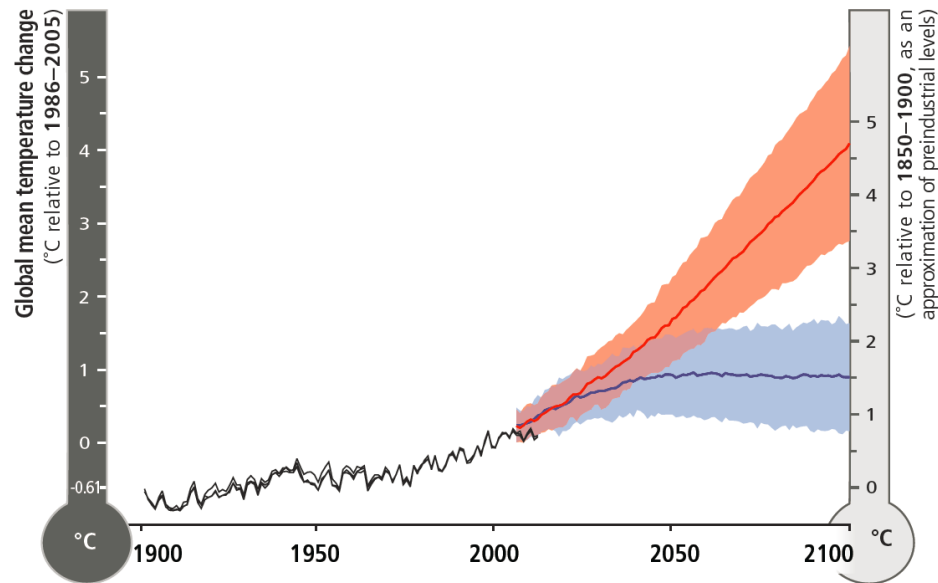




A close-up photograph of several dried corn cobs in a field. The husks are brown and brittle, with some showing signs of mold or damage. The background is a blurred field of similar corn plants.

RISKS OF  
CLIMATE CHANGE  
**INCREASE**  
WITH CONTINUED  
HIGH EMISSIONS





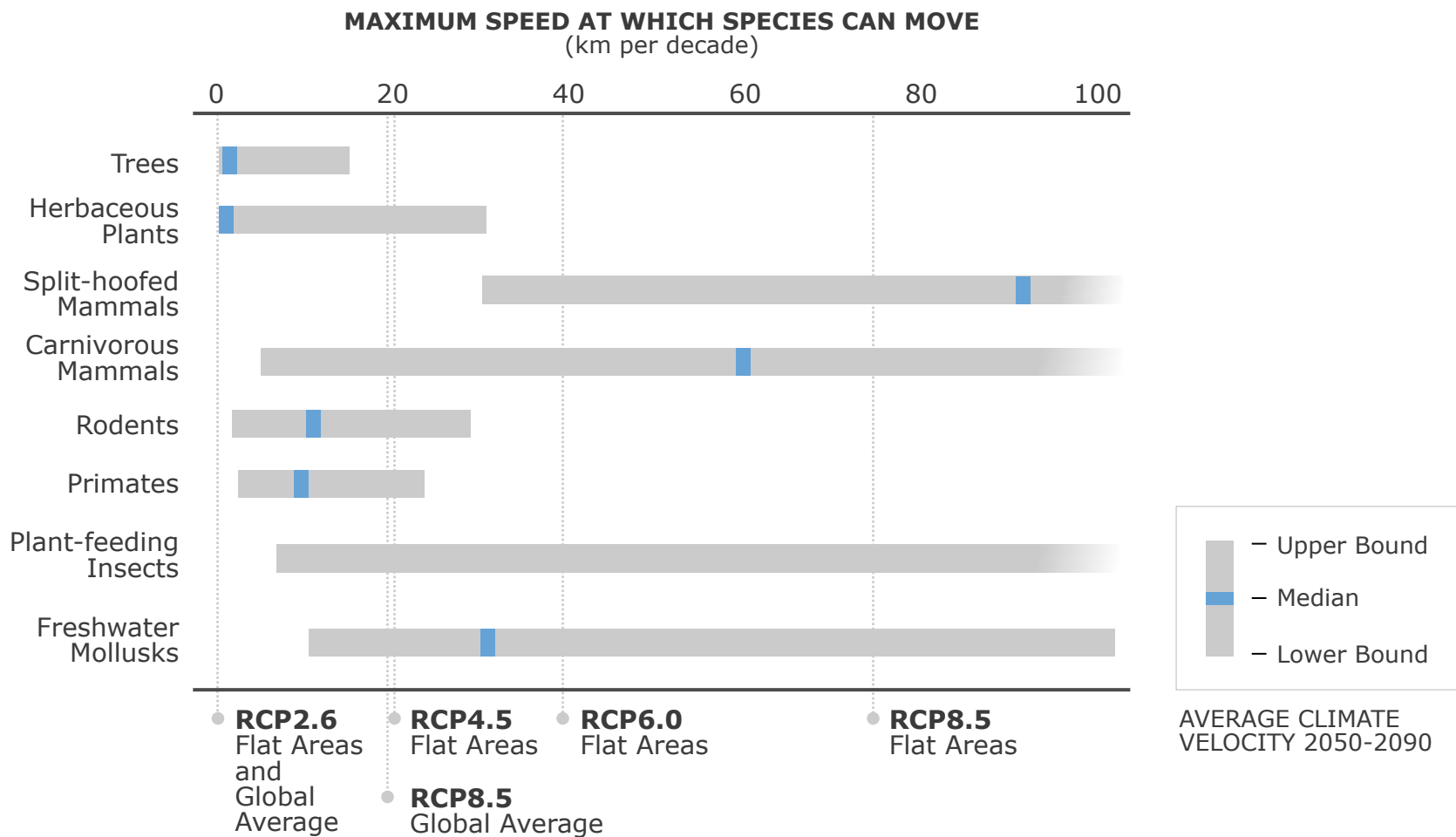
#### Level of additional risk due to climate change

Undetectable

Moderate

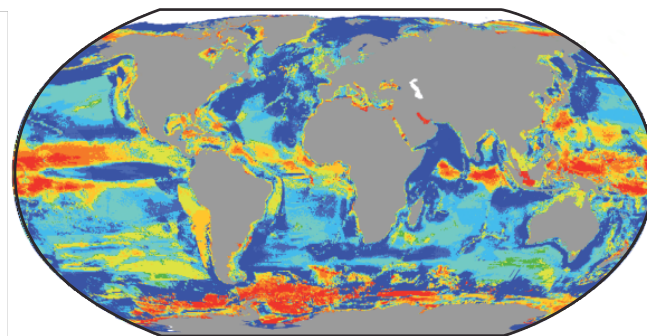
High

Very high

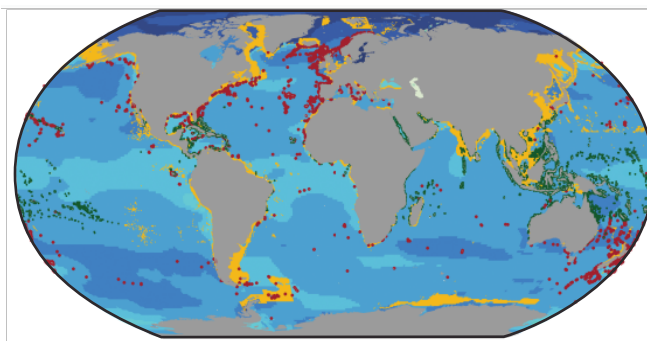
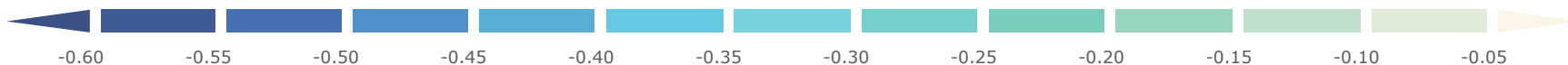




## CHANGE IN MAXIMUM CATCH POTENTIAL (2051-2060 COMPARED TO 2001-2010, SRES A1B)



## CHANGE IN pH (2081-2100 COMPARED TO 1986-2005, RCP 8.5)

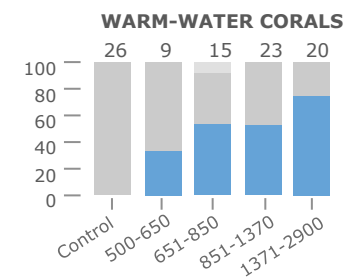
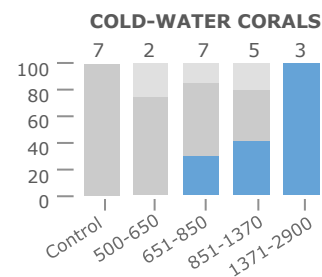
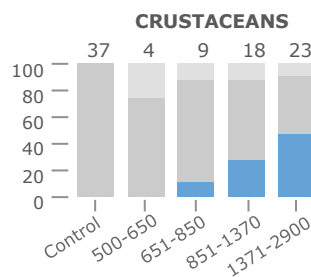
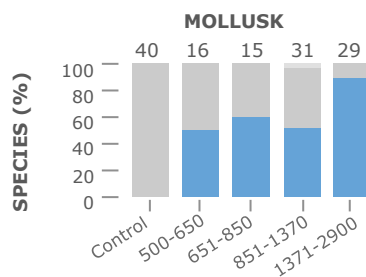


■ Mollusk and Crustacean Fisheries  
Present-day annual catch rate  $\geq 0.005$  tonnes  $\text{km}^2$

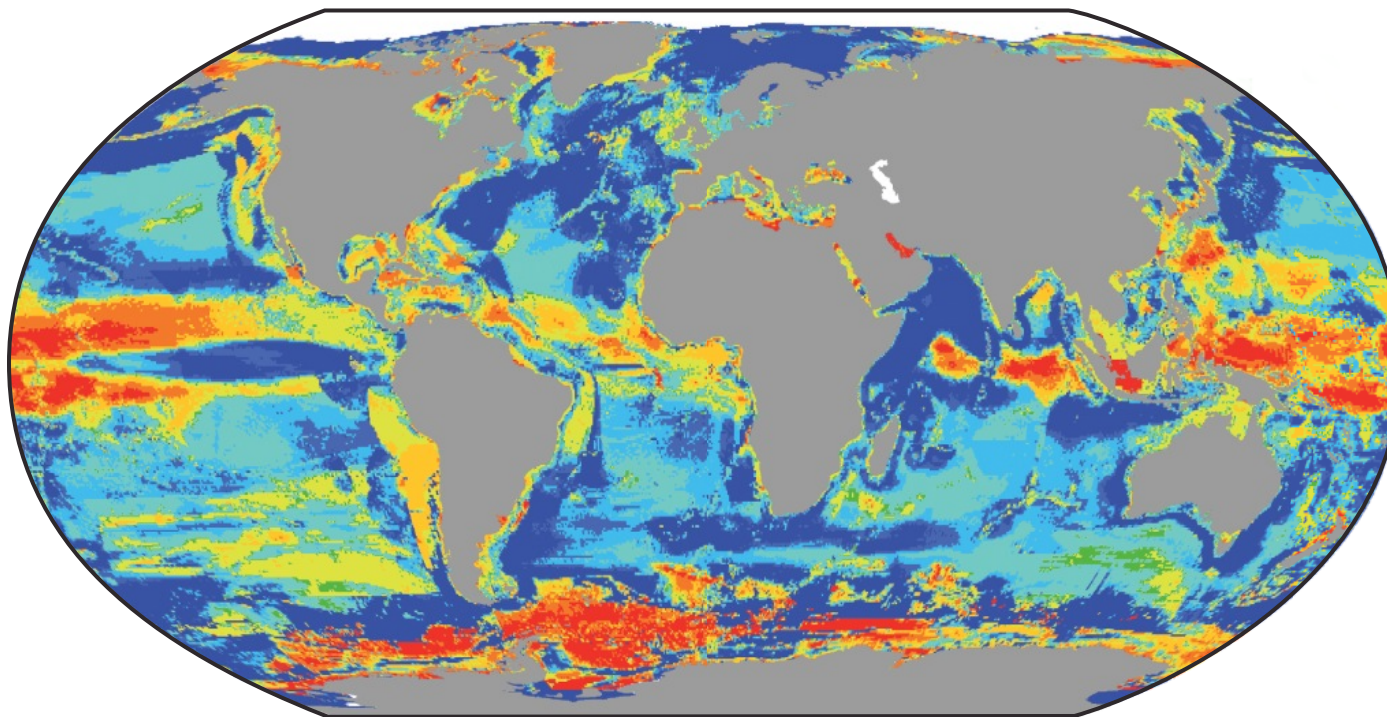
■ Cold-Water Corals

■ Warm-Water Corals

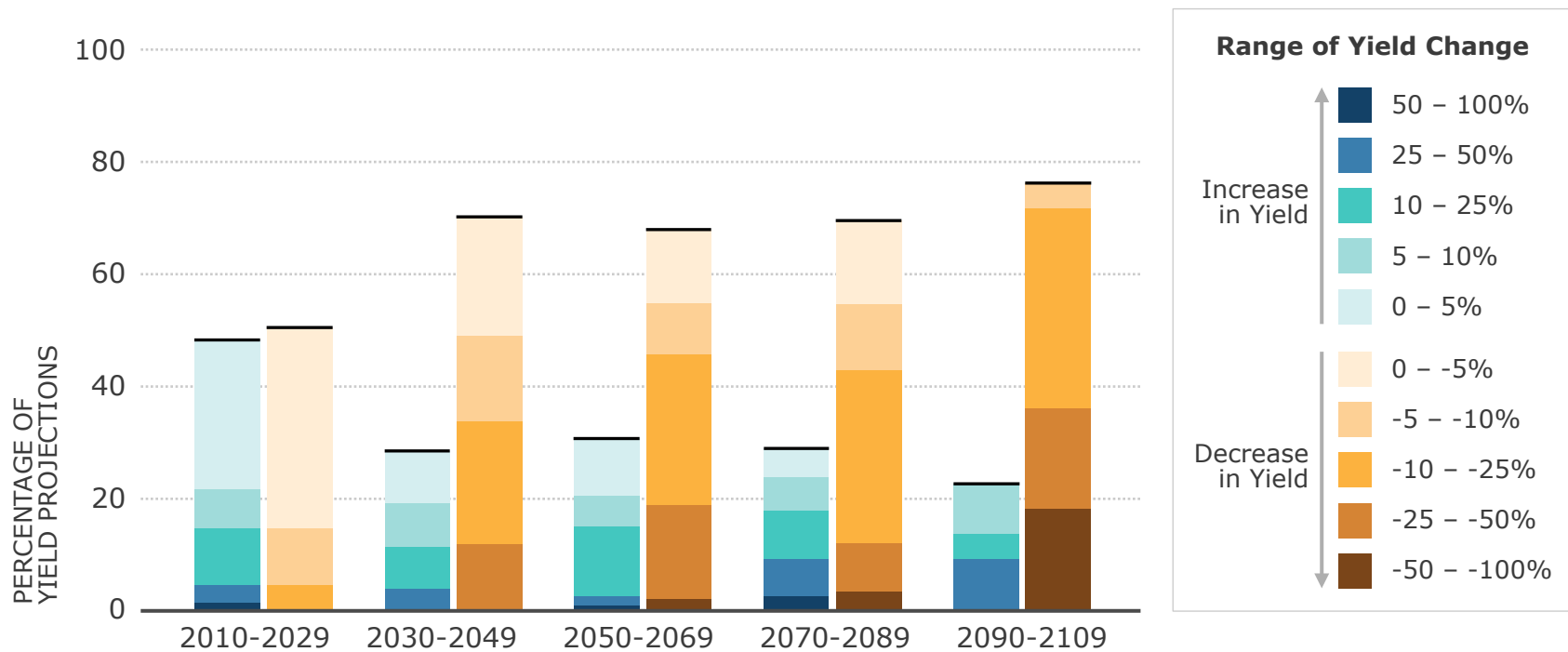
■ Positive Effect  
■ No Effect  
■ Negative Effect



CHANGE IN MAXIMUM CATCH POTENTIAL (2051-2060 COMPARED TO 2001-2010, SRES A1B)

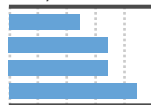




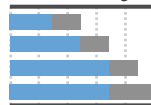


## POLAR REGIONS

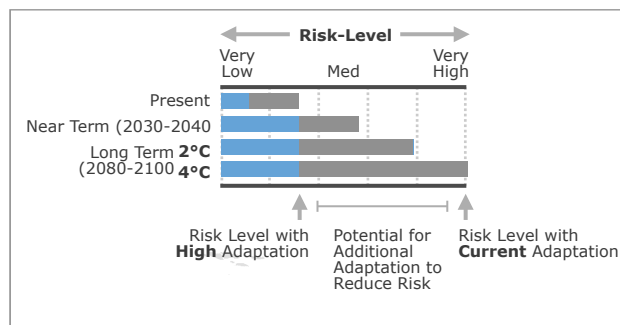
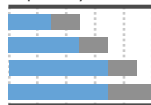
Risks for Ecosystems



Risks for Health and Well-Being



Unprecedented Challenges, Especially from Rate of Change

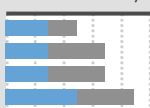


## NORTH AMERICA

Increased Risks from Wildfires



Heat-Related Human Mortality

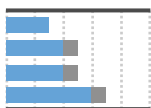


Damages from River and Coastal Urban Floods

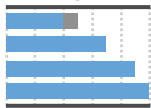


## THE OCEAN

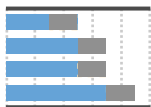
Reduced Fisheries Catch Potential at Low Latitudes



Increased Mass Coral Bleaching and Mortality

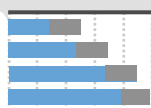


Coastal Inundation and Habitat Loss

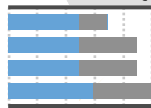


## CENTRAL AND SOUTH AMERICA

Reduced Water Availability and Increased Flooding and Landslides



Reduced Food Production and Quality

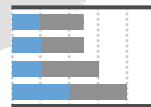


Vector-Borne Diseases



## EUROPE

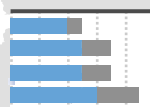
Increased Flood Losses and Impacts



Increased Water Restrictions

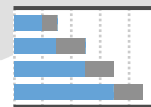


Increased Losses and Impacts from Extreme Heat Events

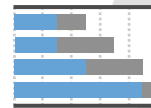


## AFRICA

Compounded Stress on Water Resources



Reduced Crop Productivity and Livelihood and Food Security



Vector- and Water-Borne Diseases

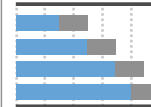


## SMALL ISLANDS

Loss of Livelihoods, Settlements, Infrastructure, Ecosystem Services, and Economic Stability

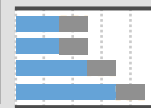


Risks for Low-Lying Coastal Areas

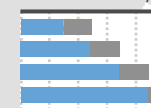


## ASIA

Increased Flood Damage to Infrastructure, Livelihoods, and Settlements



Heat-Related Human Mortality



Increased Drought-Related Water and Food Shortage

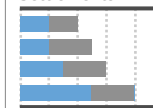


## AUSTRALASIA

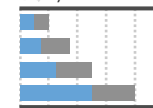
Significant Change in Composition and Structure of Coral Reef Systems



Increased Flood Damage to Infrastructure and Settlements



Increased Risks to Coastal Infrastructure and Low-Lying Ecosystems







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# EFFECTIVE CLIMATE CHANGE ADAPTATION

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## A MORE VIBRANT WORLD



# IPCC WGI: Building on the 'miracle' of consensus

Professor Peter Cox  
University of Exeter



# IPCC Working Group 1 : The Physical Basis

## IPCC Working Group I Author Team

209 Lead Authors and 50 Review Editors from 39 countries  
Over 600 Contributing Authors from 32 countries



# Thorny Issues and Personal Opinions



- How do you get so many (very argumentative!) scientists to reach a consensus?



Intergovernmental Panel  
for Cat Control?..☺



## Thorny Issues and Personal Opinions

- How do you get so many (very argumentative!) scientists to reach a consensus?

*Because many of the key messages have been obvious for a long-time....*



## More and More Sure About the Obvious?



IPCC SAR, 1995: *discernible* impact of humans on climate.

IPCC TAR, 2001: ... is *likely* to have been due to the increase in greenhouse gas concentrations.

> 66%

IPCC AR4, 2007: .... is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations.

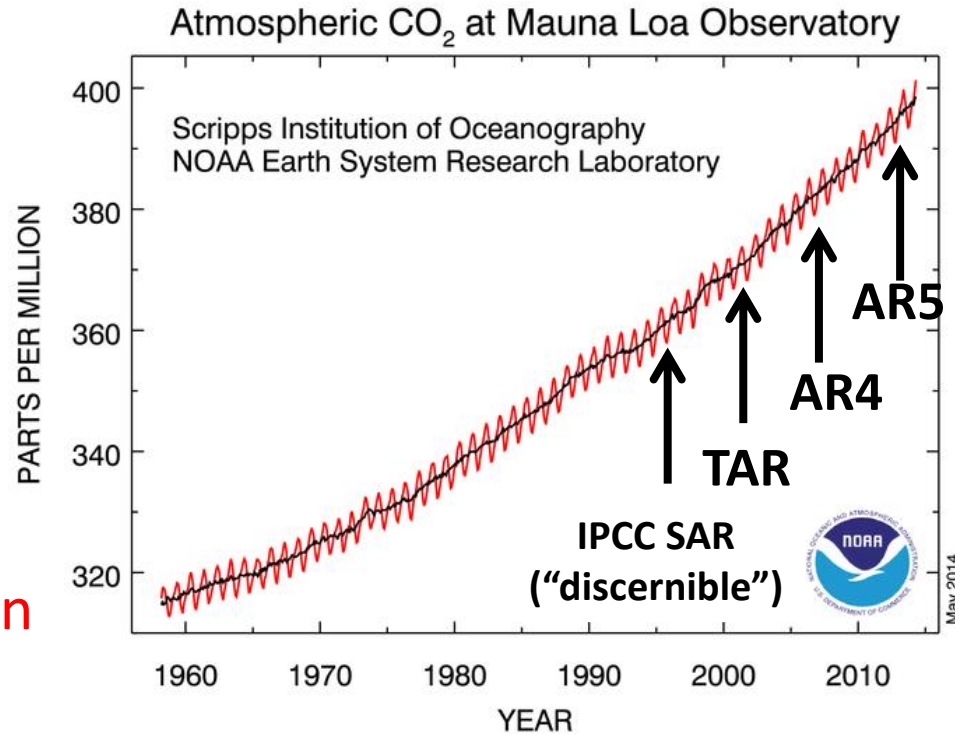
> 90%

IPCC AR5, 2013: It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century.

Confidence > 95%

Yet CO<sub>2</sub> keeps  
going-up...

CO<sub>2</sub> increase of 40ppmv since human  
impact became “discernible”...



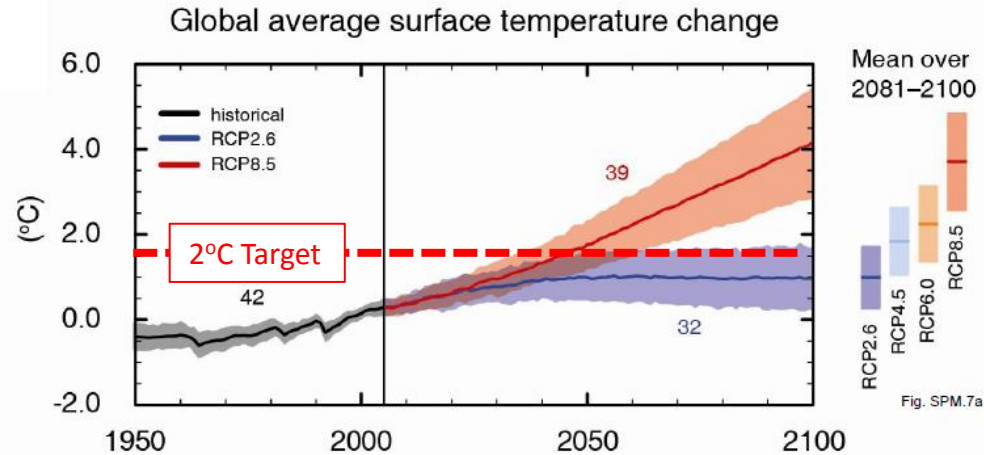
>400ppmv

Highest-level for  
at least 800,000 yrs



# Thorny Issues and Personal Opinions

- **Is it still possible to avoid 2°C with conventional mitigation alone?**

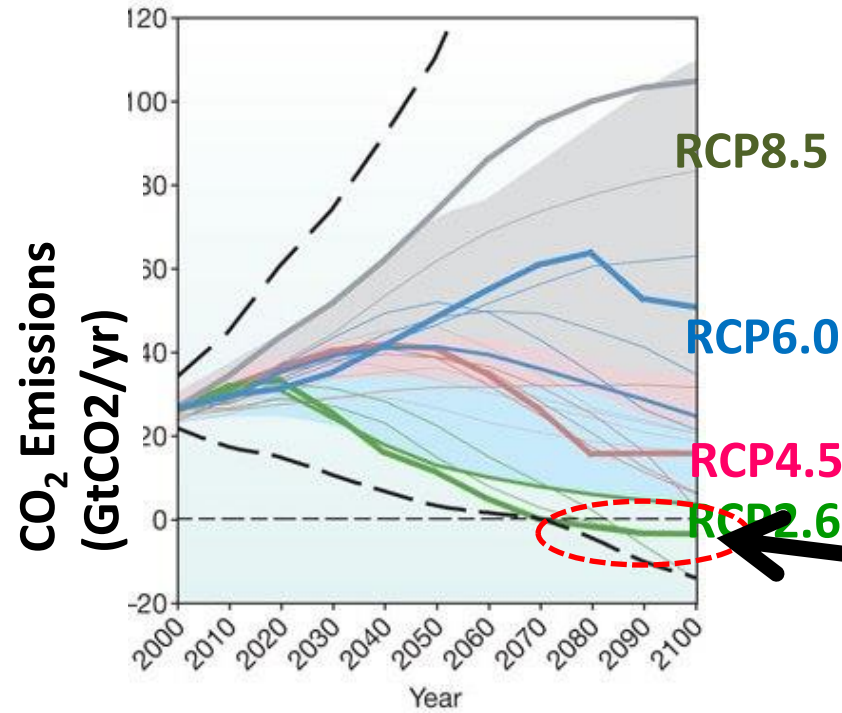


*...and will almost certainly exceed the 2°C target for all but the most aggressive mitigation scenario !*

Global surface temperature change for the end of the 21st century is *likely* to exceed 1.5°C relative to 1850 for all scenarios

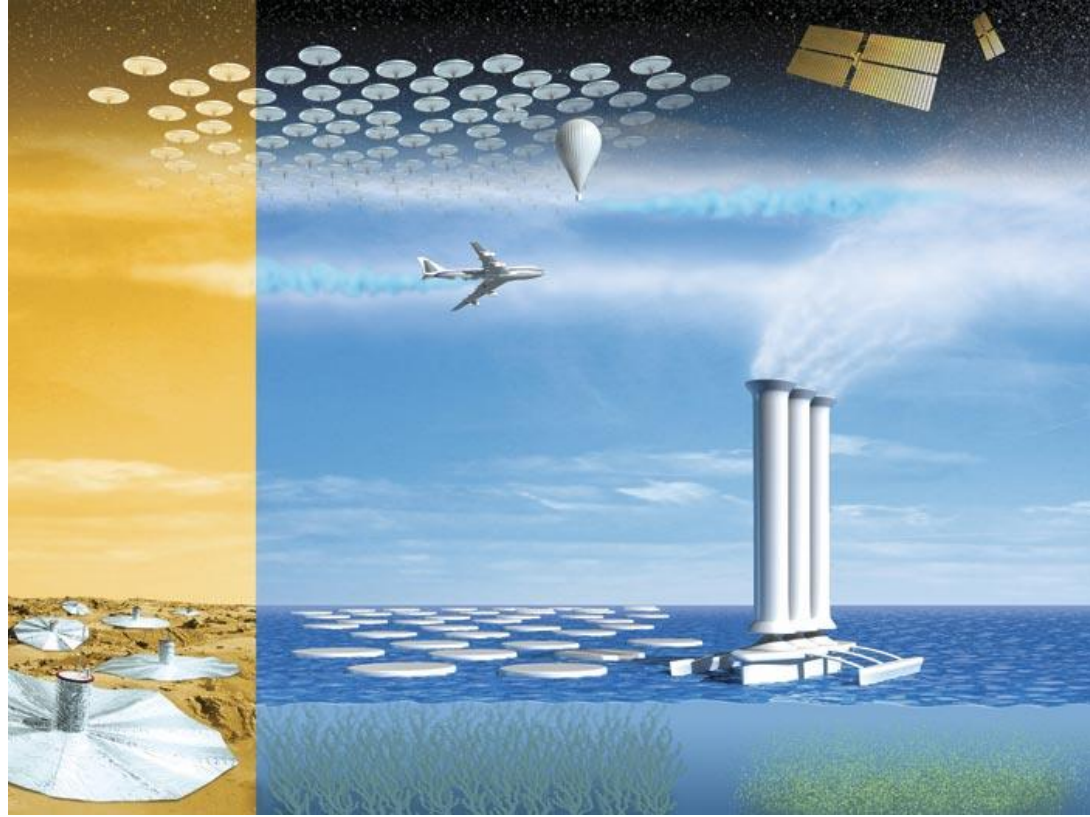


# Can we Avoid 2°C through Conventional Mitigation Alone?



*Avoiding 2°C may require periods of Negative Global CO<sub>2</sub> Emissions !*

*...which implies  
Geoengineering  
of some sort!!*





## Thorny Issues and Personal Opinions

- How do you get so many (very argumentative!) scientists to reach a consensus?

*Because many of the key messages have been obvious for a long-time....*

- Is it still possible to avoid 2°C with conventional mitigation alone?

*Probably not.....*

- Should we give up on the 2°C target or consider more Radical approaches to avoid 2°C - such as Geoengineering or Negative Emissions Technologies?

*You decide.... 😊.*



UNIVERSITY OF LEEDS

# Climate change and the future of food

Professor Andy Challinor  
University of Leeds



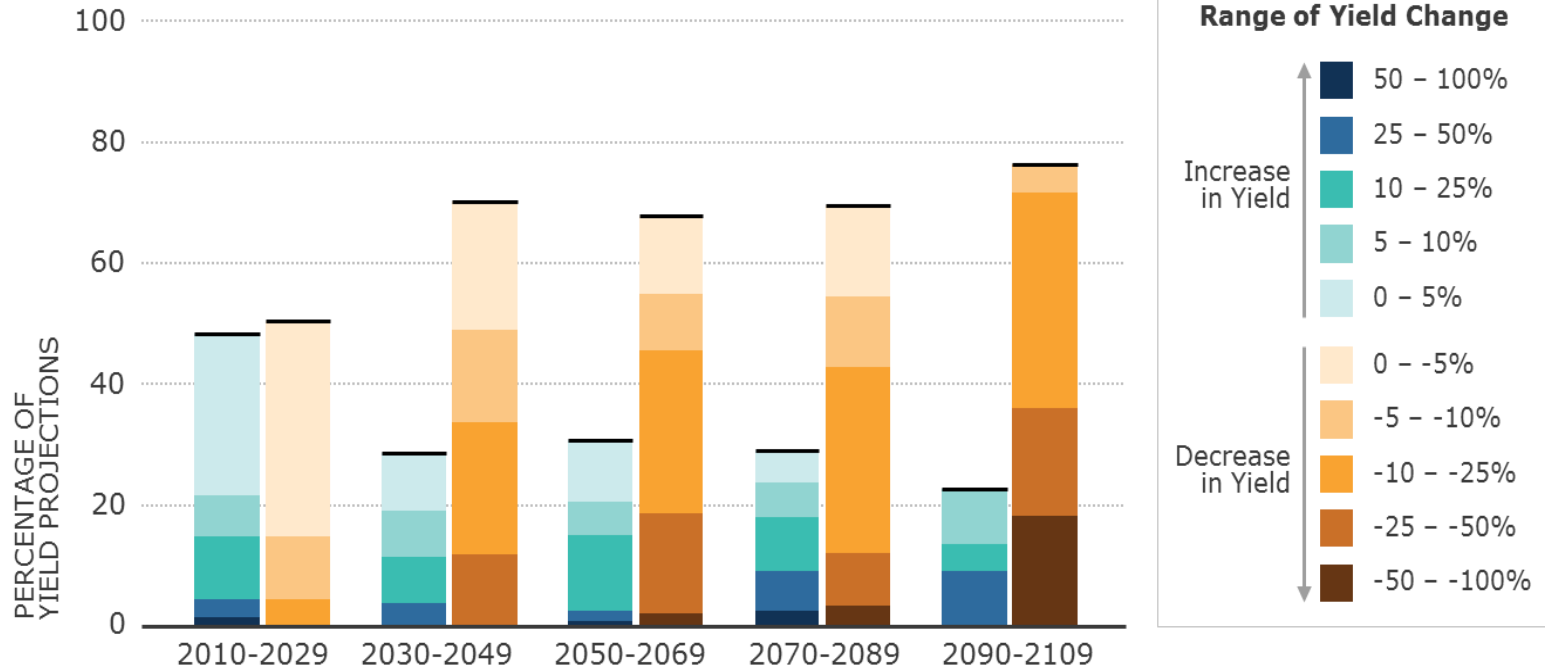


## Poor people are worst affected

Poor people spend a higher proportion of their income on food – so price rises affect them more

HOW MUCH OF THEIR INCOME DO POOR PEOPLE SPEND ON FOOD?







## We will need major innovations in how we eat and farm

To cope with climatic changes, we may need to consider:



Completely different diets



Shifting production areas for familiar crops, livestock and fisheries



New approaches to managing waste, water and energy in food supply chains



Restoring degraded farmlands, wetlands and forests

A background image showing a person standing on a dark, rocky cliff edge, looking out at a large, white, crashing wave. The sky is a clear, pale blue.

# IPCC Working Group II: making climate science and scientists really useful

Dr Richard Jones  
University of Exeter







# IPCC Working Group II: policy for climate change

Professor Catherine Mitchell  
University of Exeter

**Emissions accelerate globally despite reduction efforts. Most emission growth is CO<sub>2</sub> from fossil fuel combustion.**

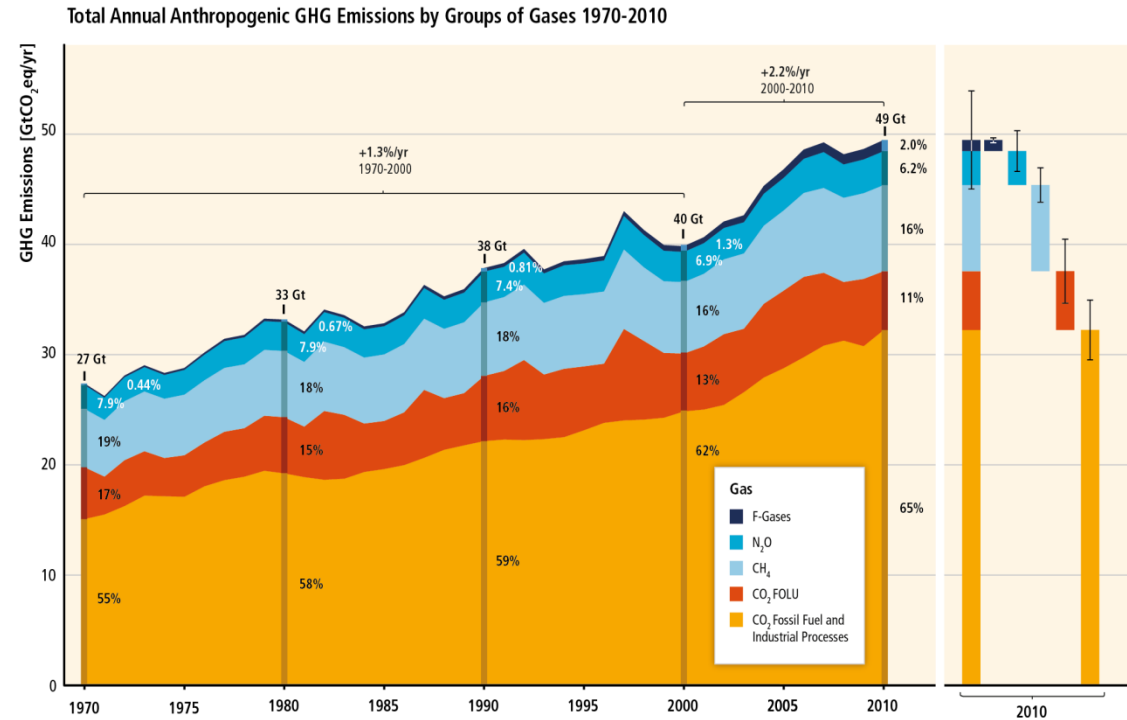
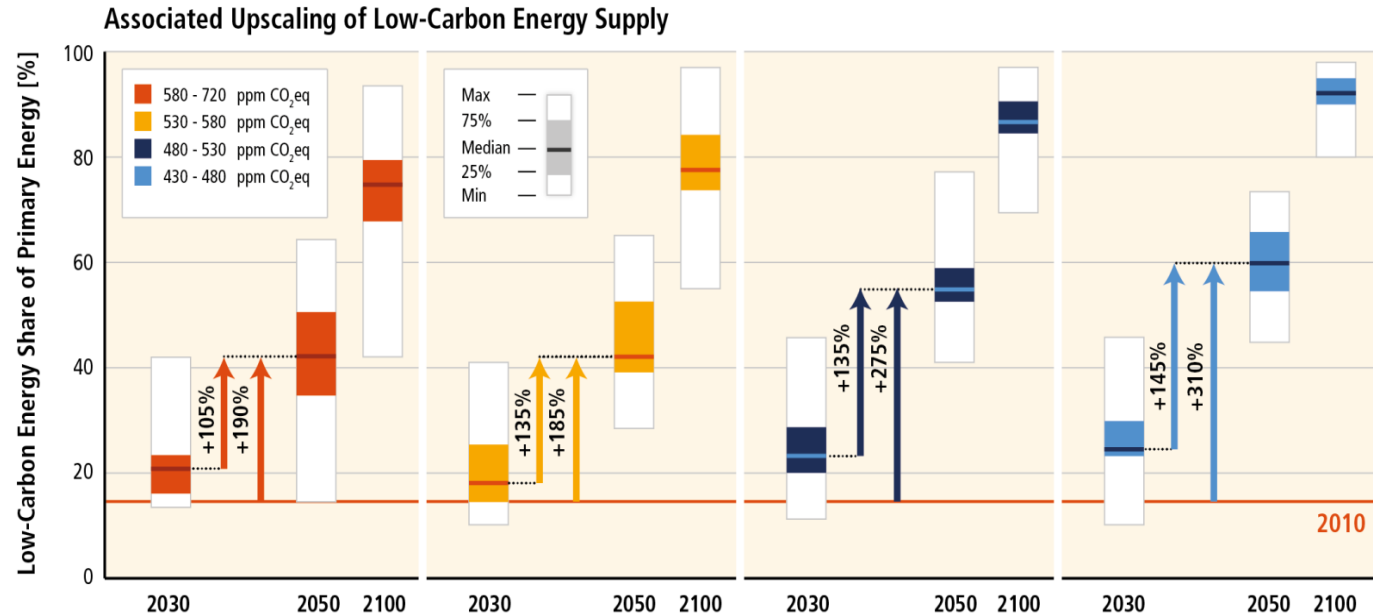


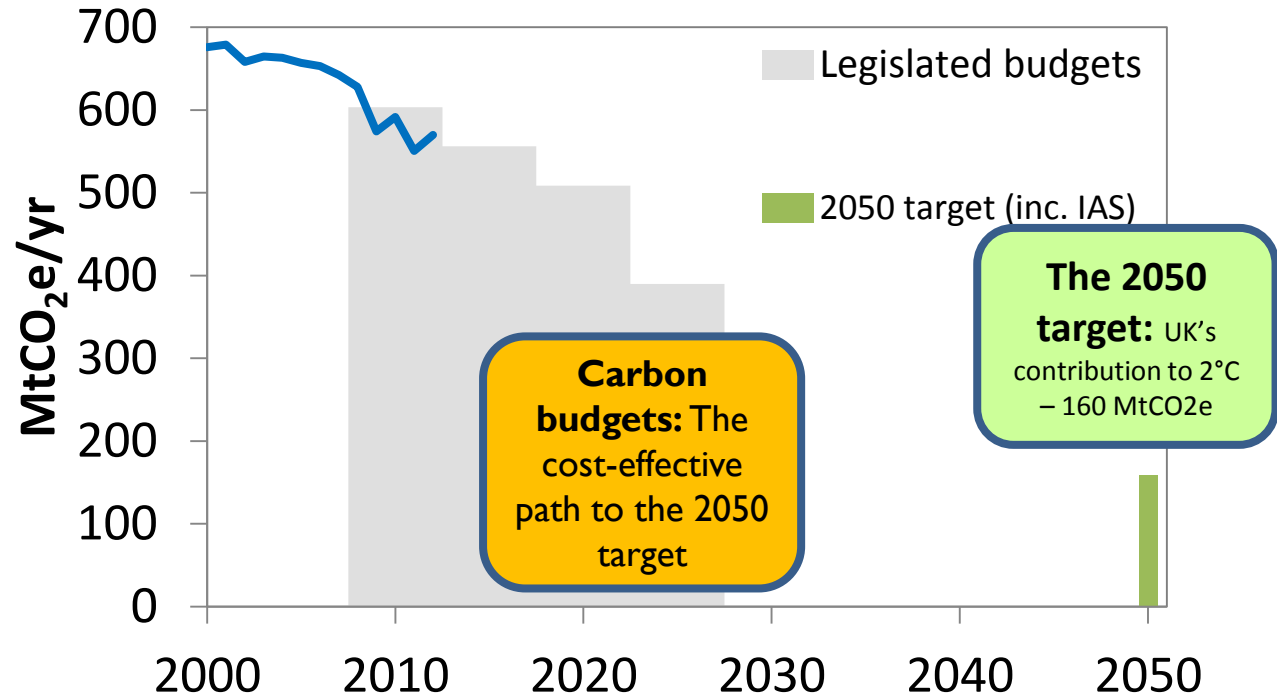
Figure SPM.1



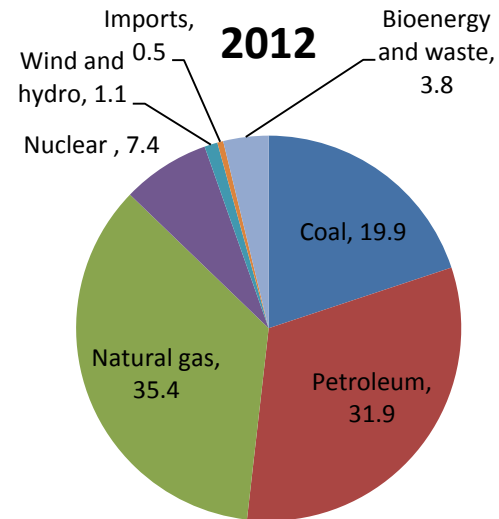
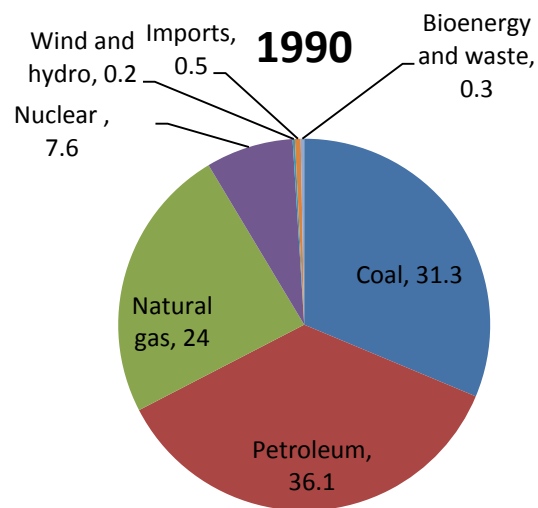
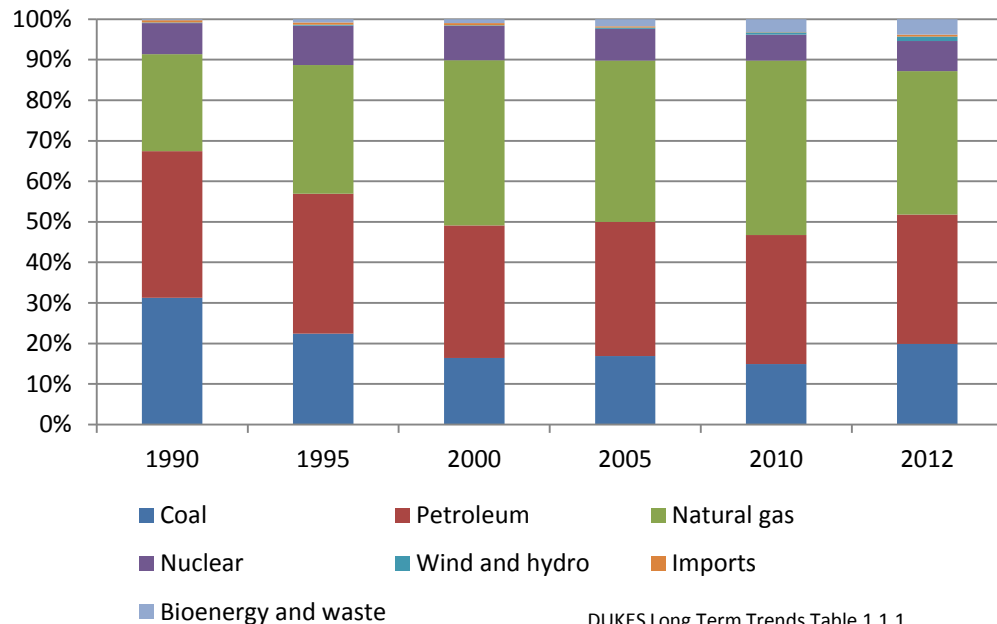


**Mitigation requires major technological and institutional changes including the upscaling of low- and zero carbon energy.**

# The UK 2050 target and carbon budgets (CCC, 2010)



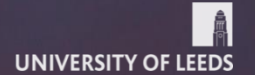
## UK energy supplied





# Panel question and answer session





# Professor Nick Talbot

University of Exeter



# Thank you for coming tonight.

Keep the conversation  
going at #climate2014

