Climate Change Scenarios, Impacts and the Adaptation Imperative

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INTERNATIONAL CONFERENCE

NO ONE CAN HIDE FROM CLIMATE CHANGE – CHALLENGES AND RESPONSES

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Outline

- What does the future hold?
- Climate change scenarios for the 21st century
- The impacts of climate change
- Adaptation to climate change
- Concluding remarks

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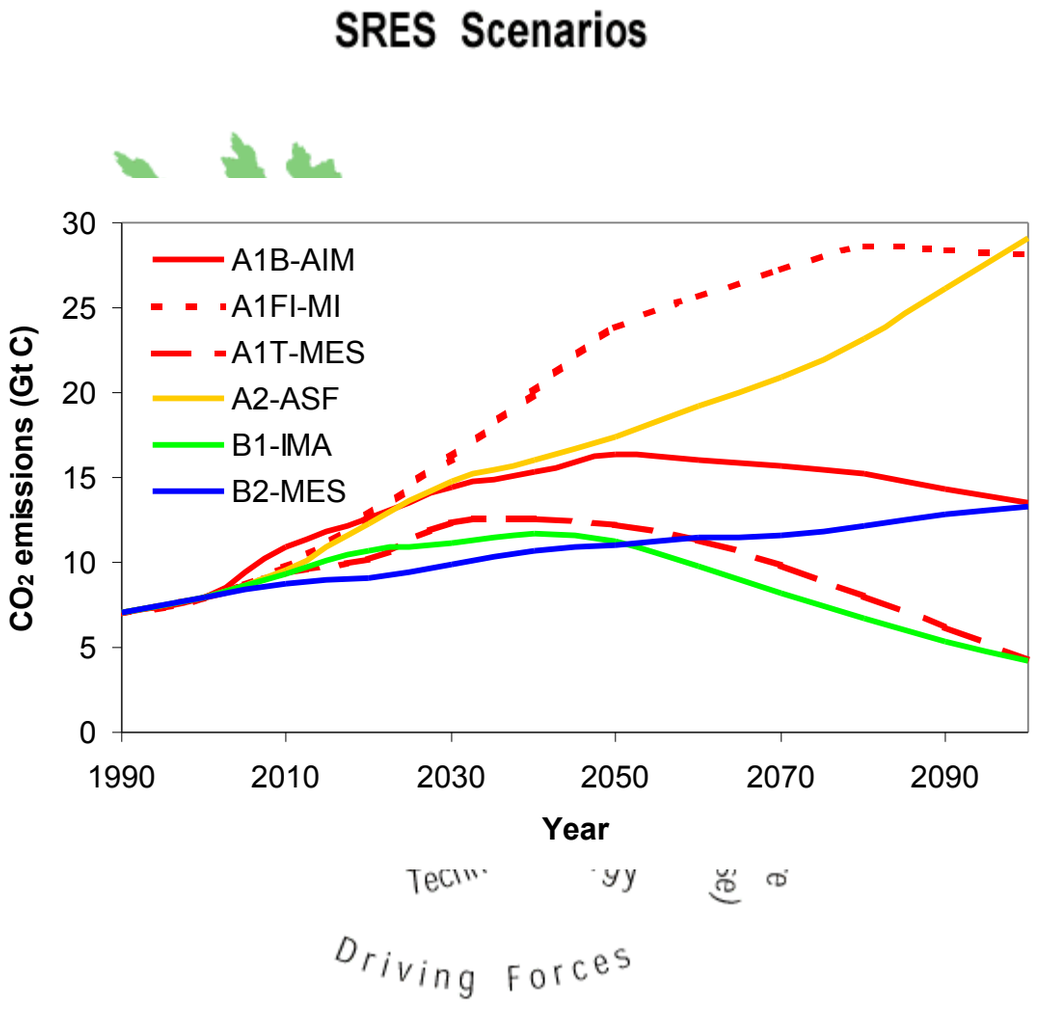
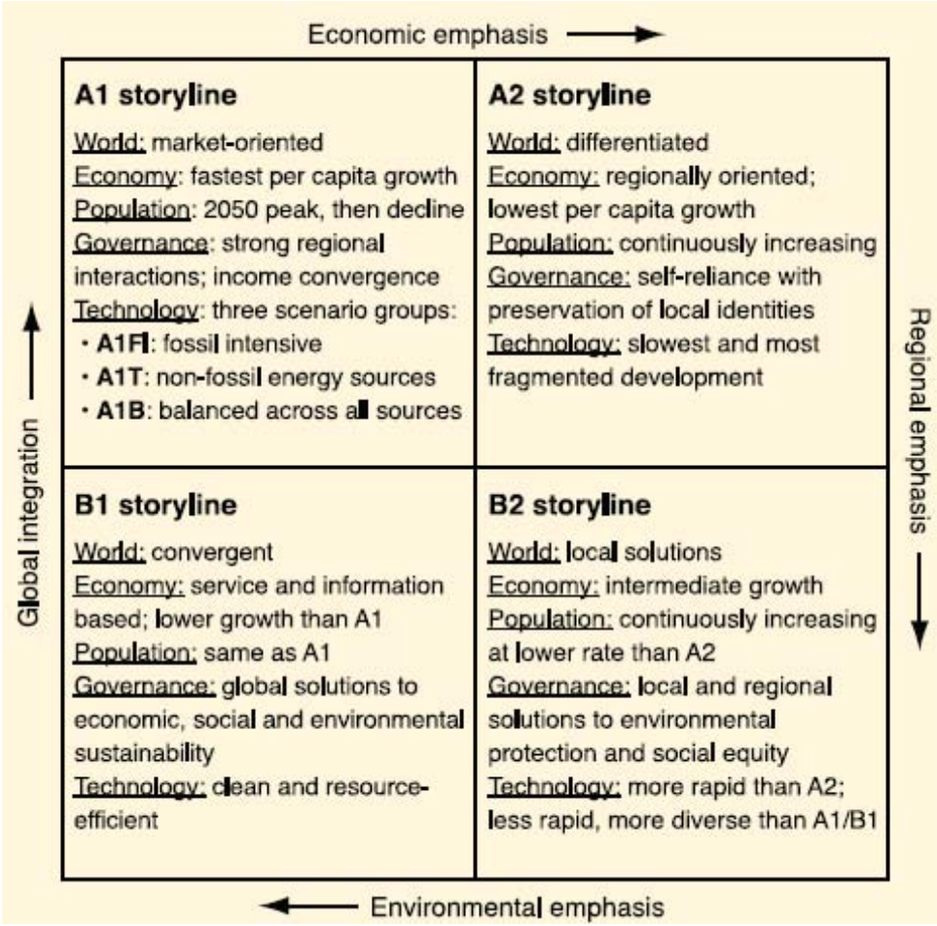
Looking into the future





Nakicenovic et al. 2000. Emissions Scenarios. A Special Report of Working Group III of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge.

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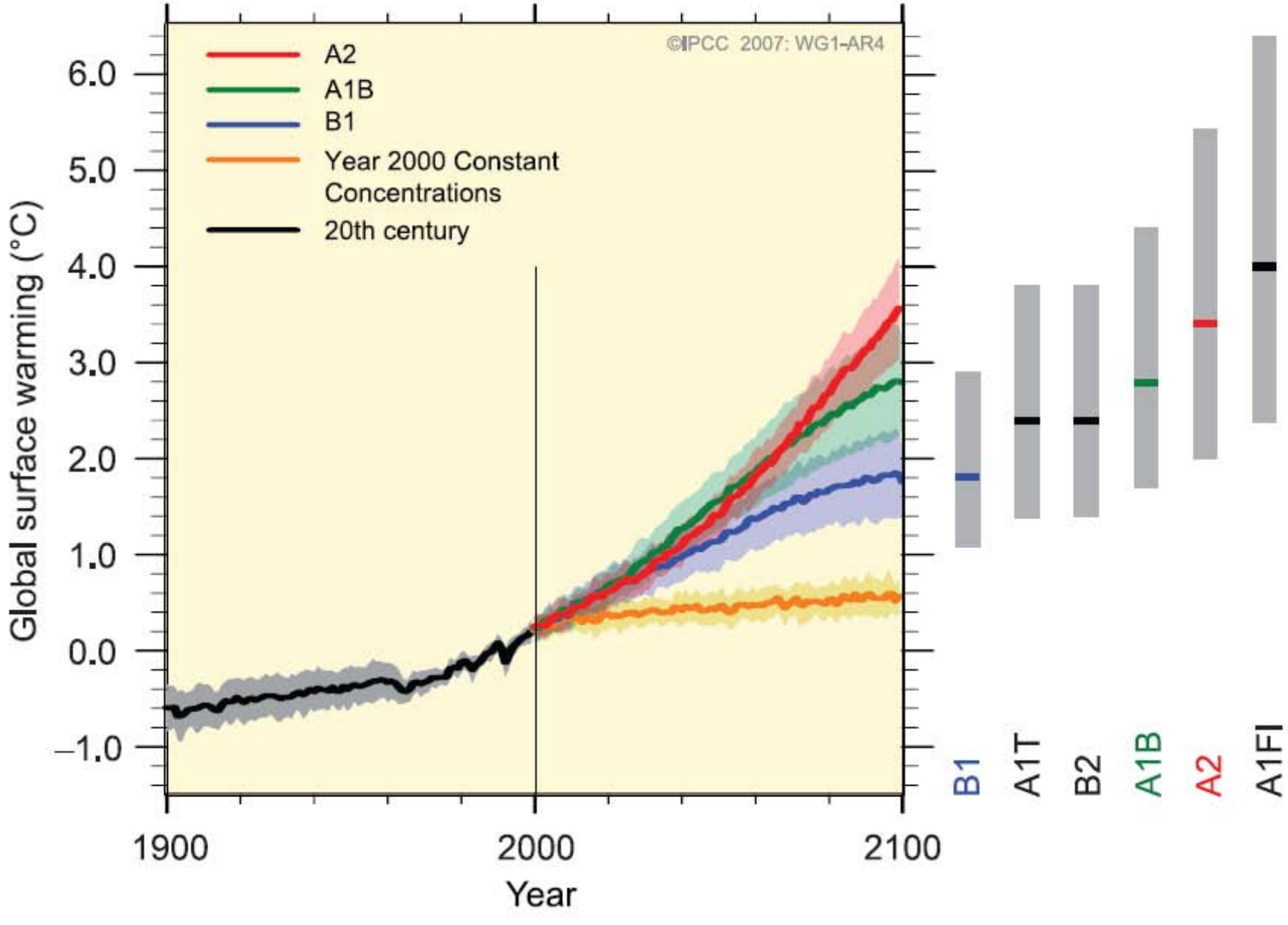
Multi-Model Averages and Assessed Ranges for Surface Warming



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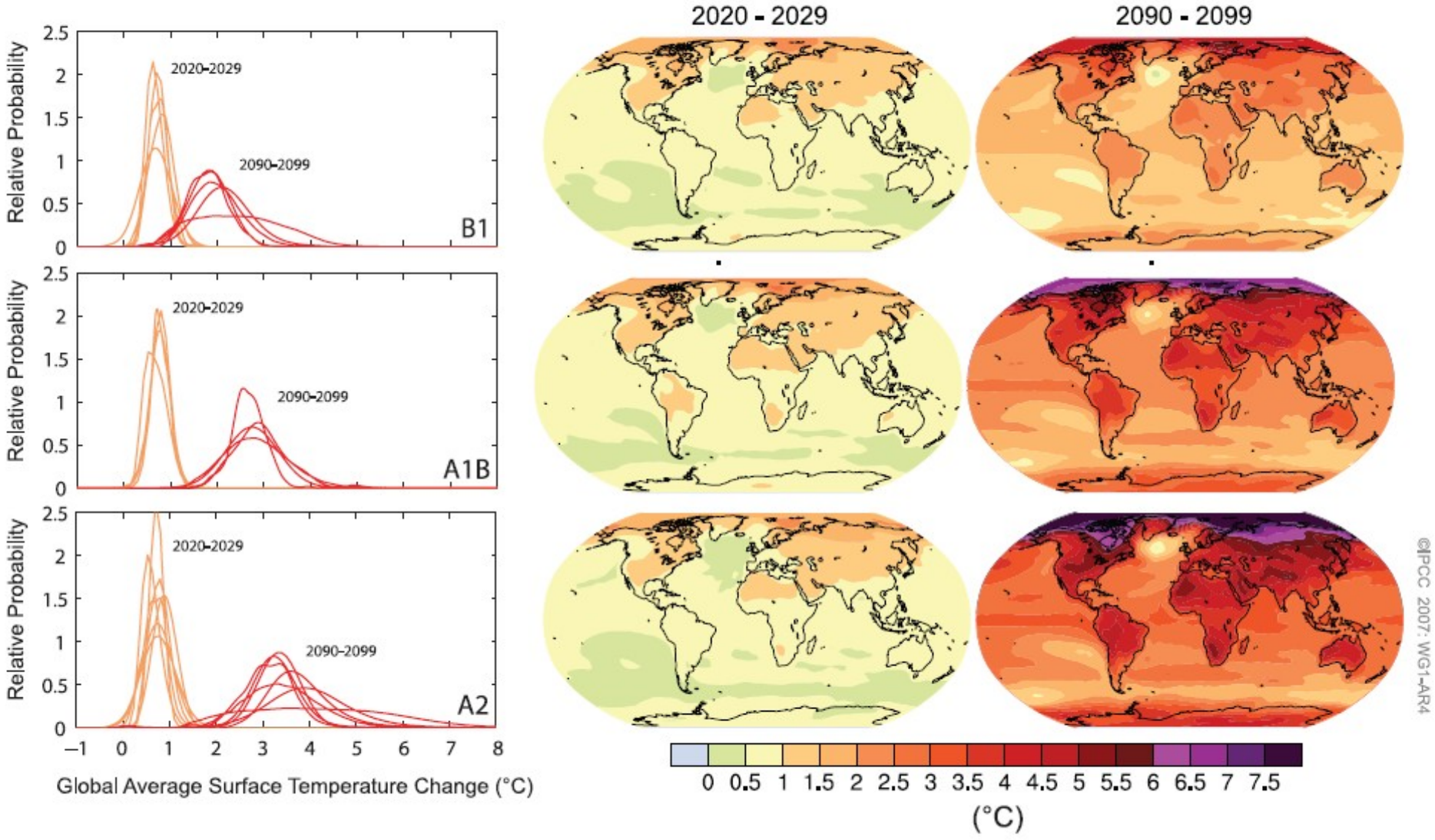
Global climate change scenarios



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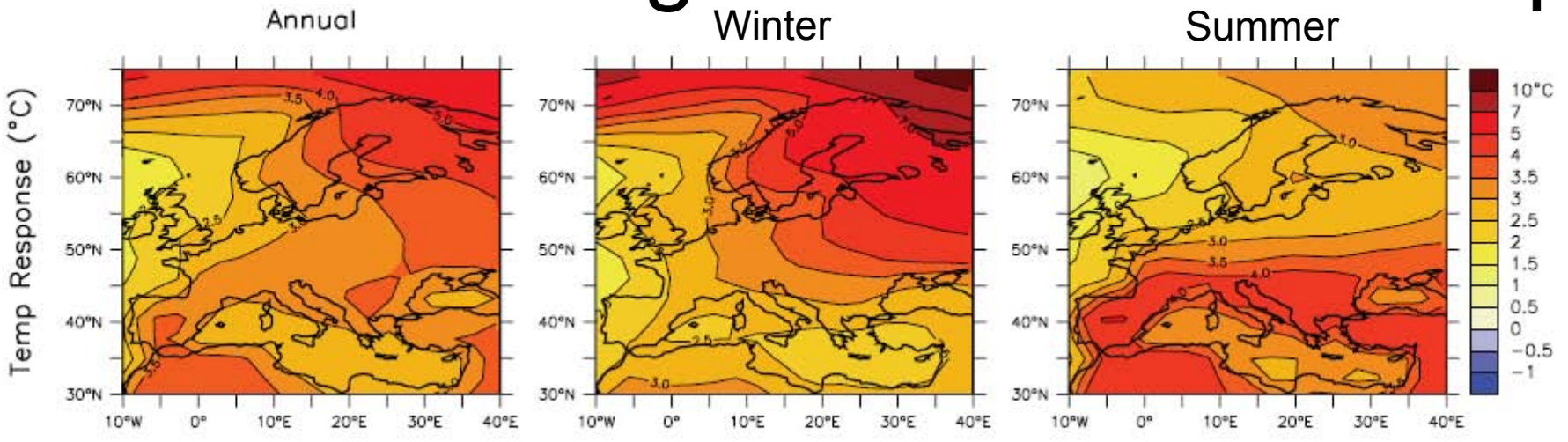
Climate change scenarios for Europe



SRES A1B

Average of 21 models comparing 1980-99 with 2080-2099

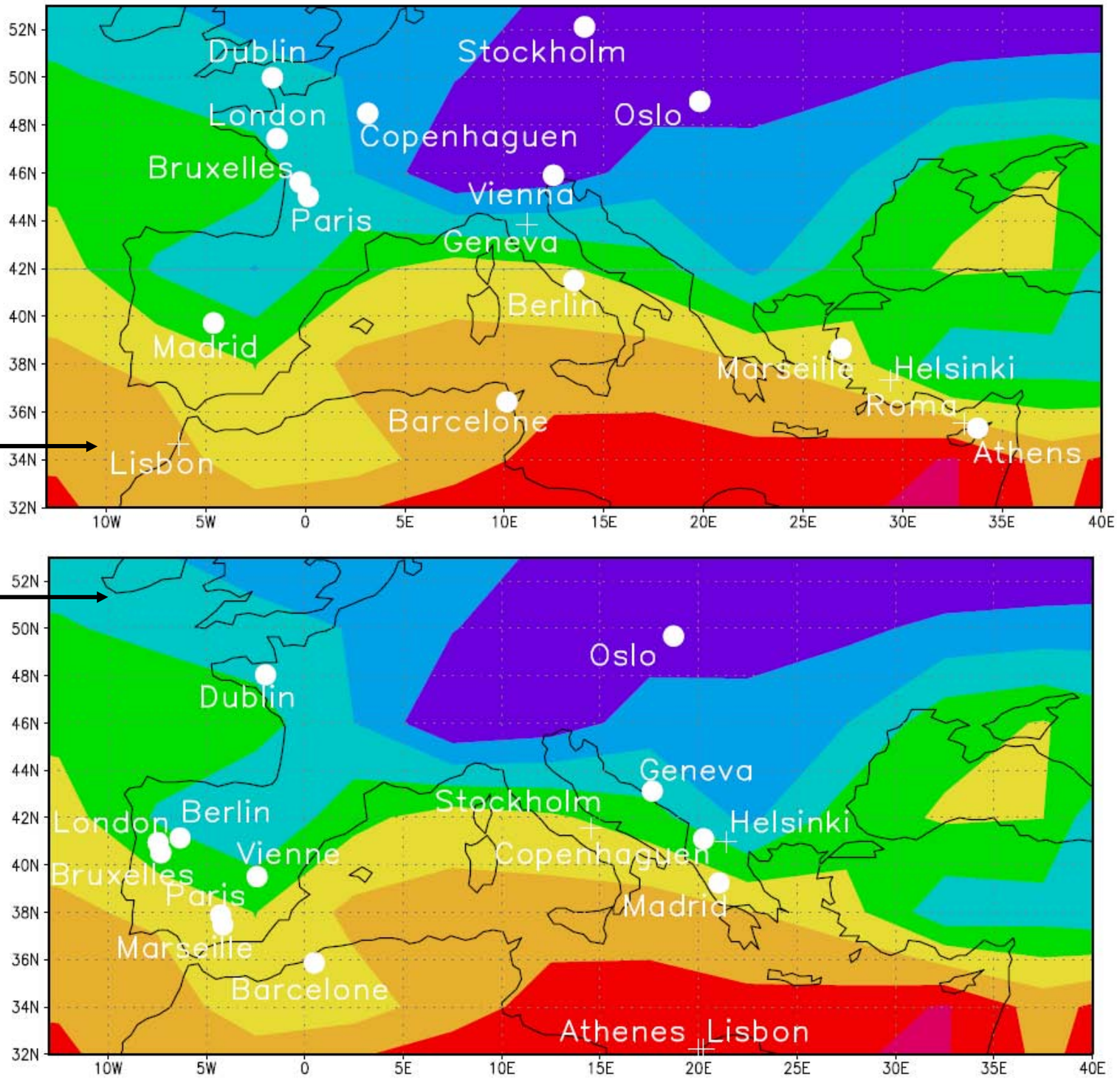
Number of models that show increases in precipitation

Climate ‘relocation’ of European cities

CNRM ARPEGE-Climat model

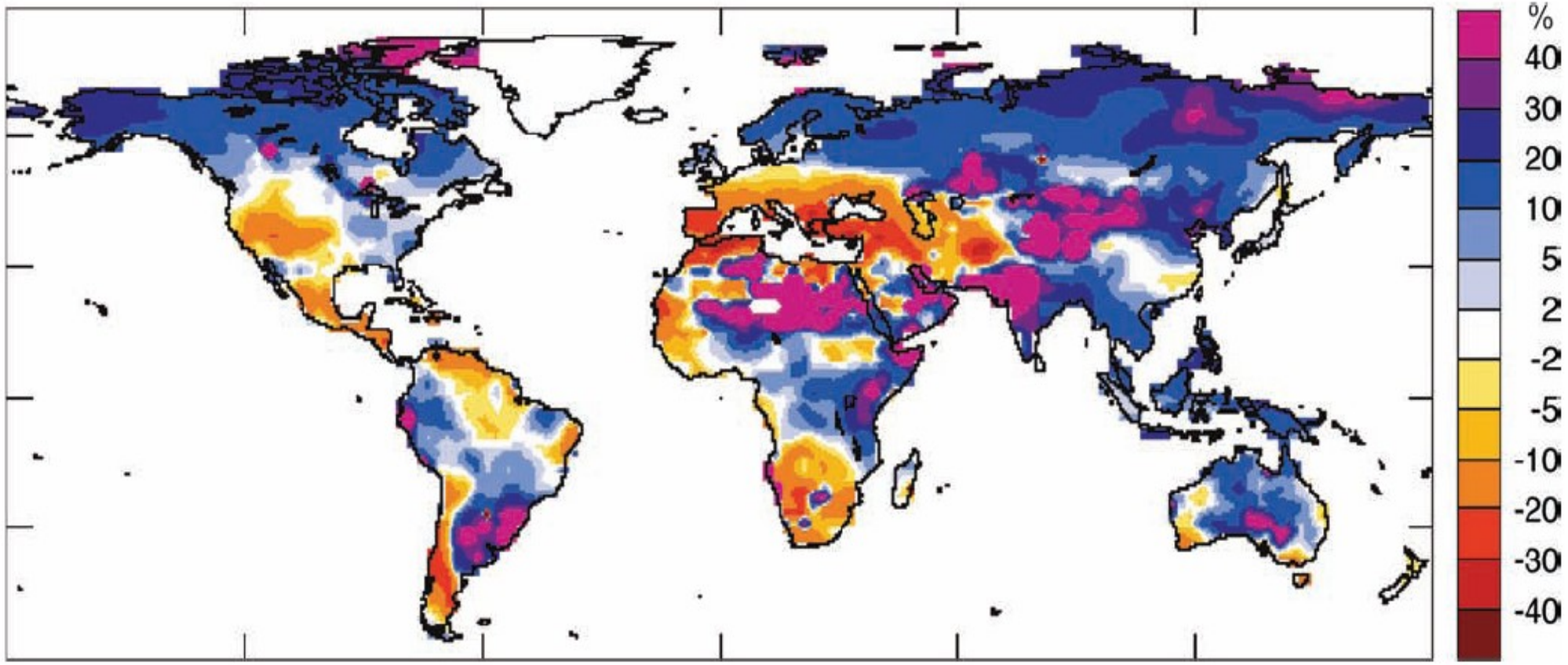
Hadley Centre HadRM3H model

2080s under SRES A2 scenario



Hallegatte et al.(2007) Using climate analogues for assessing climate change economic impacts in urban areas. *Climatic Change* 82:47–60

Climate change impact on water



Change in annual runoff by 2041-60 relative to 1900-70, in percent, under the SRES A1B emissions scenario and based on an ensemble of 12 climate models (Milly et al., 2005).

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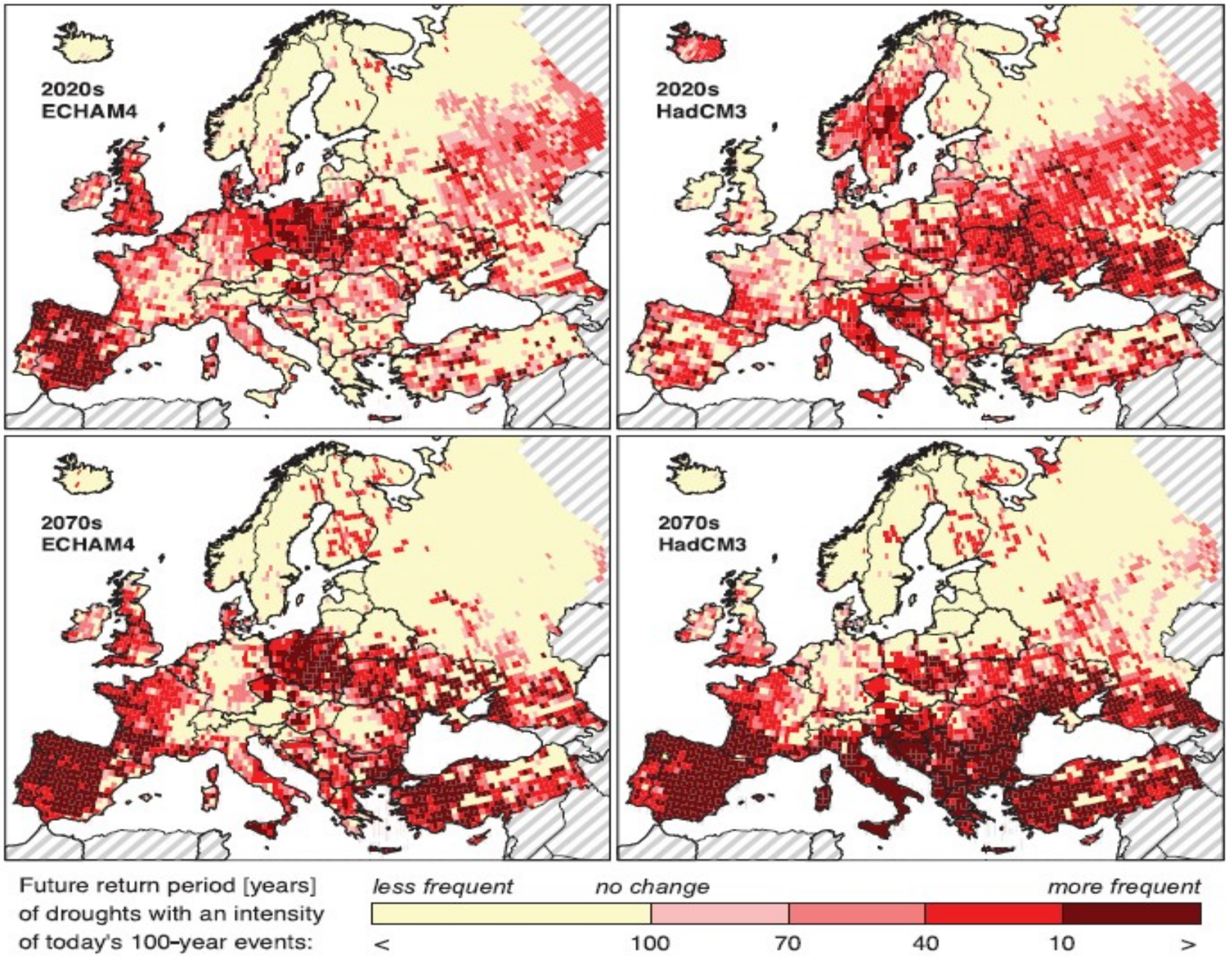
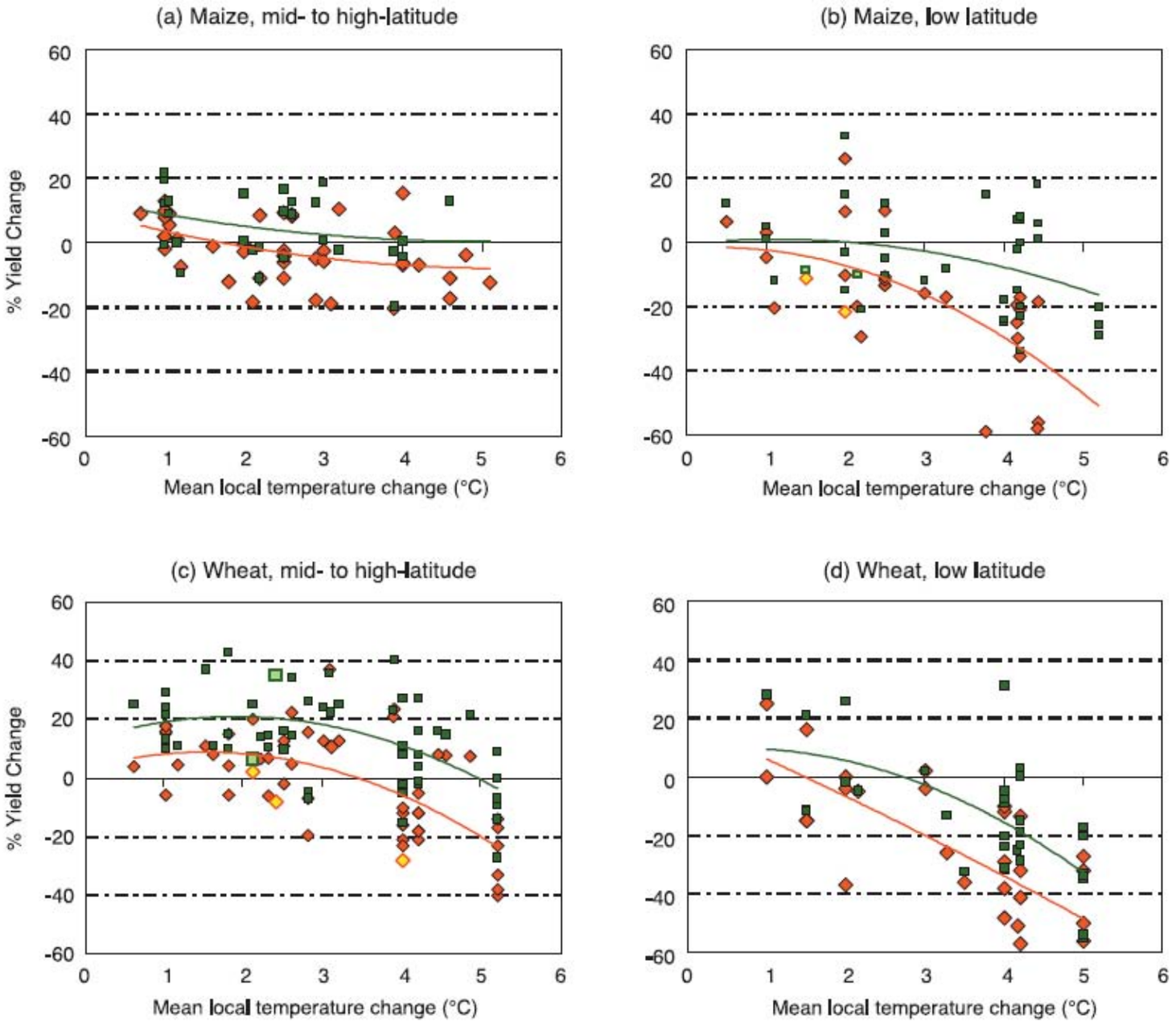
Changes in the frequency of droughts in Europe



Change in the recurrence of 100-year droughts, based on comparisons between climate and water use in 1961 to 1990 and simulations for the 2020s and 2070s (based on the ECHAM4 and HadCM3 GCMs, the IS92a emissions scenario and a business-as-usual water-use scenario). Values calculated with the model WaterGAP 2.1 (Lehner et al., 2005b).

Sensitivity of cereal yield to climate change



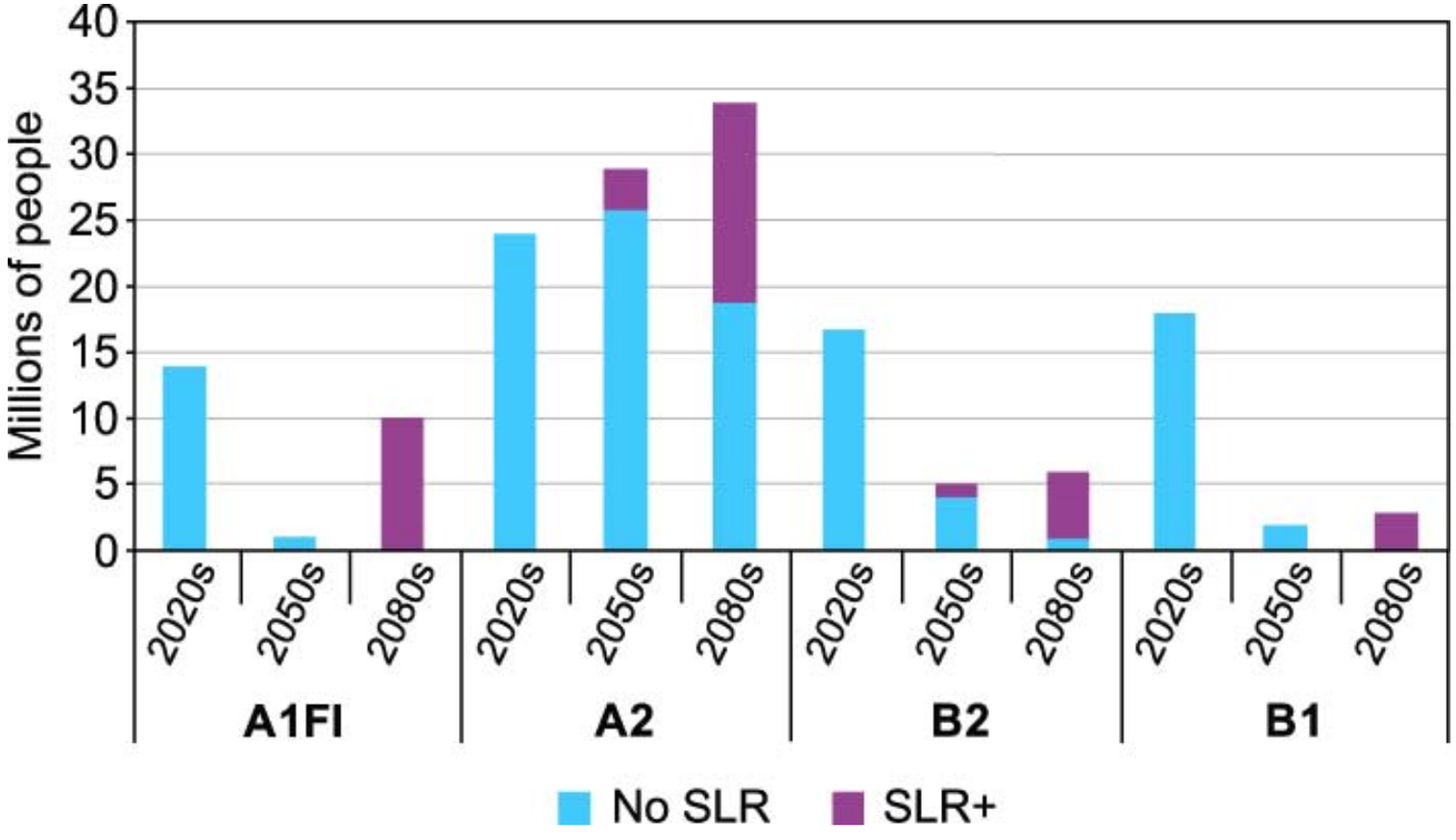
Temperate vs. Tropical Regions

With and without simulated adaptation

Red = without adaptation

Green = with adaptation

People at risk globally from coastal flooding per annum



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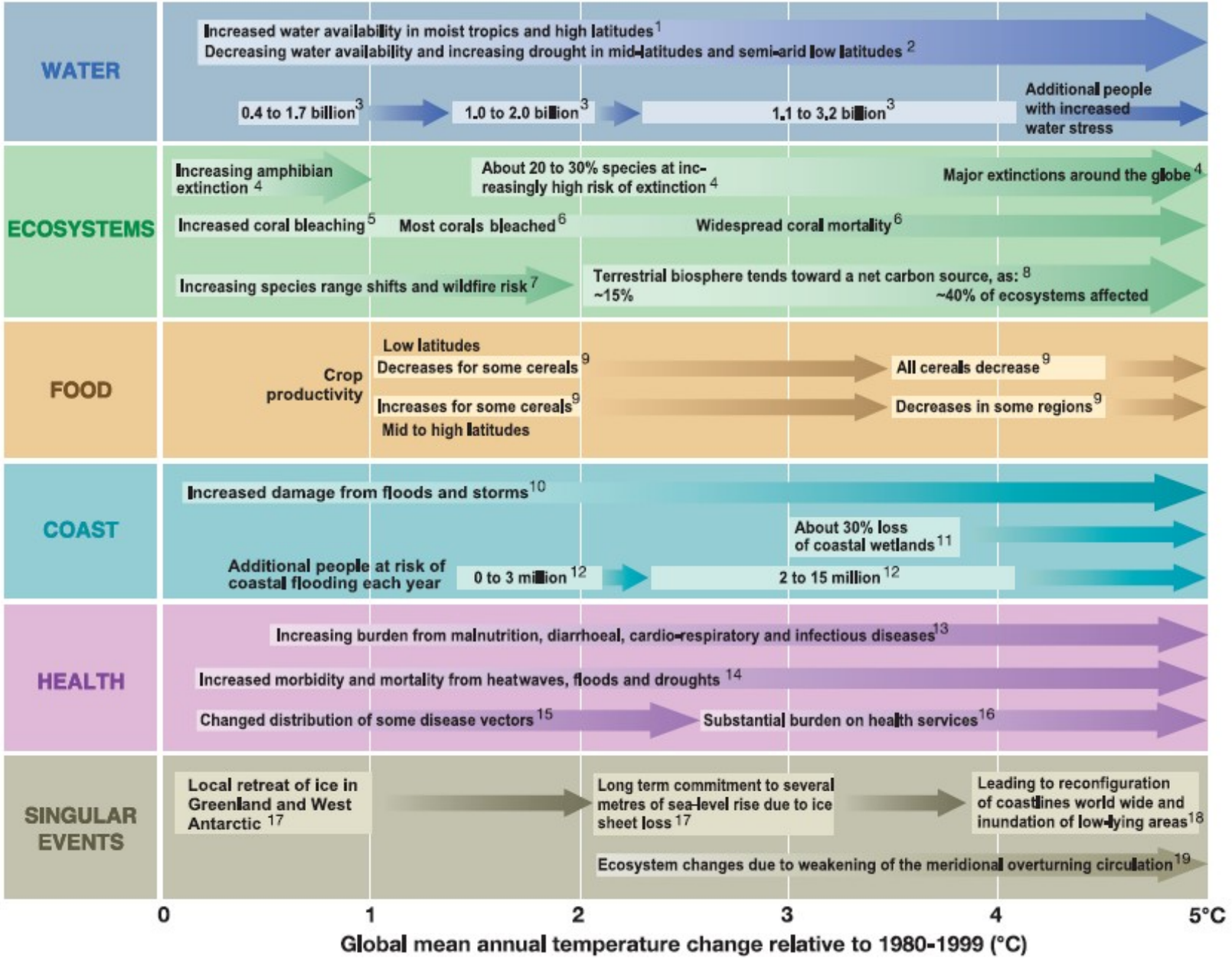
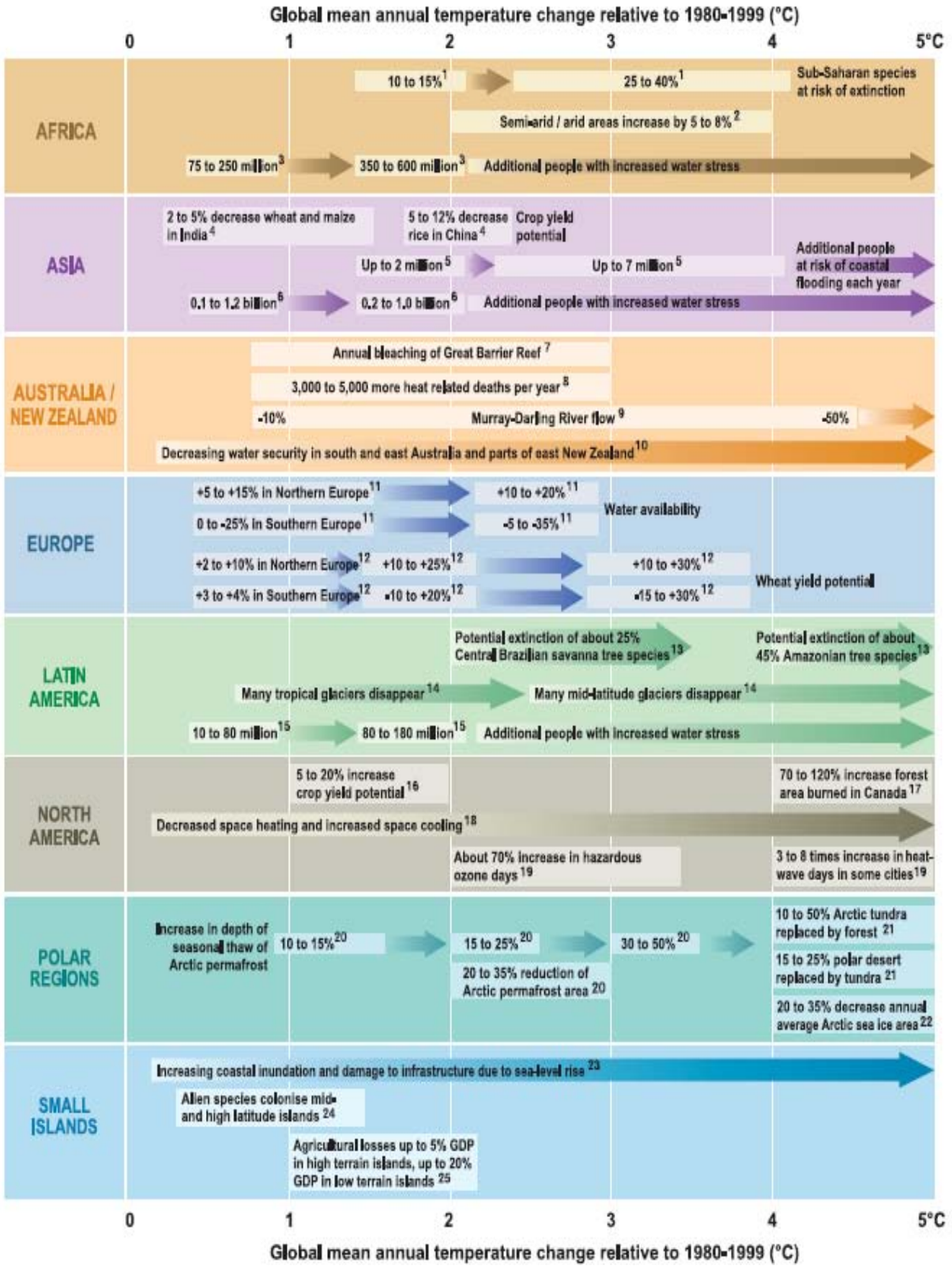
Climate change impacts by sector

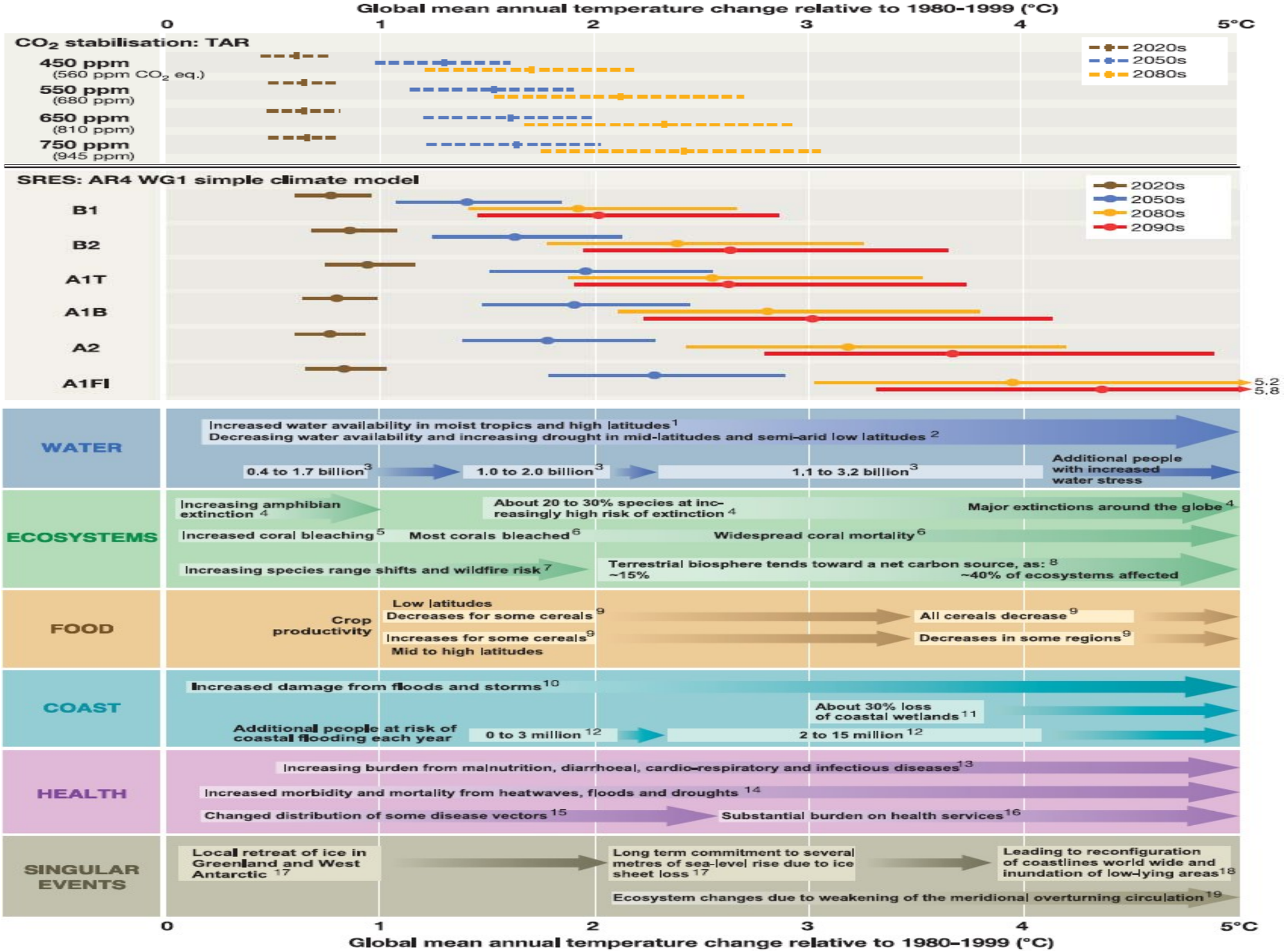




Climate change impacts by region

Major responses to climate change

- Mitigation: reduction of greenhouse gas sources and emissions, and enhancing greenhouse gas sinks
- Adaptation: Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities


Global mean annual temperature change relative to 1980–1999 (°C)
0
1
2
3
4
5°C
CO2 stabilisation: TAR
450 ppm (560 ppm CO2 eq.)
550 ppm (680 ppm)
650 ppm (810 ppm)
750 ppm (945 ppm)
2020s
2050s
2080s
SRES: AR4 WG1 simple climate model
B1
B2
A1T
A1B
A2
A1FI
2020s
2050s
2080s
2090s
5.2
5.8
WATER
Increased water availability in moist tropics and high latitudes 1
Decreasing water availability and increasing drought in mid-latitudes and semi-arid low latitudes 2
0.4 to 1.7 billion 3
1.0 to 2.0 billion 3
1.1 to 3.2 billion 3
Additional people with increased water stress
ECOSYSTEMS
Increasing amphibian extinction 4
About 20 to 30% species at increasingly high risk of extinction 4
Major extinctions around the globe 4
Increased coral bleaching 5
Most corals bleached 6
Widespread coral mortality 6
Increasing species range shifts and wildfire risk 7
Terrestrial biosphere tends toward a net carbon source, as: 8
~15%
~40% of ecosystems affected
FOOD
Crop productivity
Low latitudes
Decreases for some cereals 9
All cereals decrease 9
Increases for some cereals 9
Decreases in some regions 9
Mid to high latitudes
COAST
Increased damage from floods and storms 10
About 30% loss of coastal wetlands 11
Additional people at risk of coastal flooding each year
0 to 3 million 12
2 to 15 million 12
HEALTH
Increasing burden from malnutrition, diarrhoeal, cardio-respiratory and infectious diseases 13
Increased morbidity and mortality from heatwaves, floods and droughts 14
Changed distribution of some disease vectors 15
Substantial burden on health services 16
SINGULAR EVENTS
Local retreat of ice in Greenland and West Antarctic 17
Long term commitment to several metres of sea-level rise due to ice sheet loss 17
Leading to reconfiguration of coastlines world wide and inundation of low-lying areas 18
Ecosystem changes due to weakening of the meridional overturning circulation 19
0
1
2
3
4
5°C
Global mean annual temperature change relative to 1980–1999 (°C)

The challenge of adaptation

- Even if atmospheric composition were fixed today, global-mean temperature and sea level rise would continue due to oceanic thermal inertia
- There is evidence that societies are not "well" adapted to current climate variability

commentary

Adapting to the inevitable

Greenhouse-gas emissions tai impacts of climate change. We

Martin Parry, Nigel Arnell, Mike Hulme, Robert Nicholls and Matthew Livermore

In Kyoto last December, at the third ence of the United Nations Framewo vention on Climate Change, targe agreed for reductions in greenhc emissions. On 2 November in Buenc negotiators will reconvene at the frai convention's fourth conference to a mechanisms and a timetable for imple

Lifting the taboo on adaptation

Renewed attention to policies for adapting to climate change cannot come too soon for **Roger Pielke, Jr, Gwyn Prins, Steve Rayner** and **Daniel Sarewitz.**

During the early policy discussions on climate change in the 1980s, adaptation was understood to be an important option for society. Yet for much of the past two decades the mere

Observed changes in the climate system

- Global mean temperature has increased by 0.76°C
- Ocean temperature is increasing
- Glaciers and snow are decreasing
- Many changes in the climate have been observed (heavy precipitation, droughts, heatwaves)

Adaptation

- Adaptation is already taking place, mostly to observed impacts, but is limited
- Adaptation planning to future impacts have started to be considered in a few sectors
- There are substantial limits and barriers to adaptation
- Investment and financial flows needed for adaptation are likely to be tens of billions of dollars per year several decades from now

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Concluding remarks

- The climate is changing and will continue to change in the future
- Climate change scenarios and impact assessments can help inform adaptation decisions
- Adaptation is on-going and absolutely necessary, but it will be costly and painful
- A twin-track approach of mitigation and adaptation is needed
- Societal debates about the trade-offs between mitigation and adaptation are needed at the local, national, regional and international level

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