

Global Warming of 1.5° C

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Global Warming of 1.5°C

An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.

The report in numbers

91 Authors from 40 Countries

133 Contributing authors

6000 Studies

1 113 Reviewers

42 001 Comments

Cumulative emissions of CO₂ and future non-CO₂ radiative forcing determine the probability of limiting warming to 1.5°C

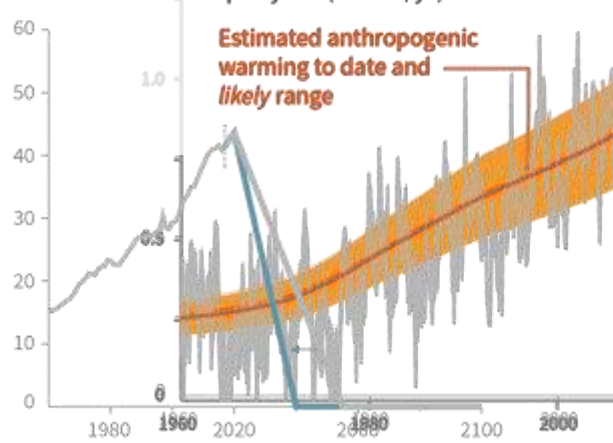
a) Observed global temperature change and modeled responses to stylized anthropogenic emission and forcing pathways

Global warming relative to 1850-1900 (°C)

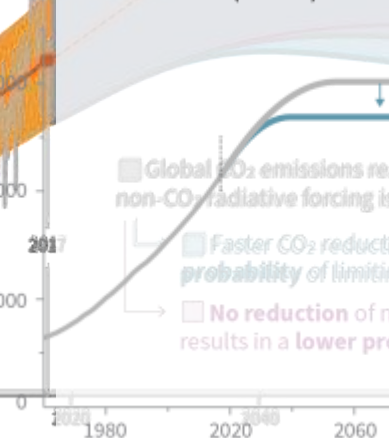


Maximum temperature rise is determined by cumulative net CO₂ emissions and net non-CO₂ radiative forcing due to methane, nitrous oxide, aerosols and other anthropogenic forcing agents

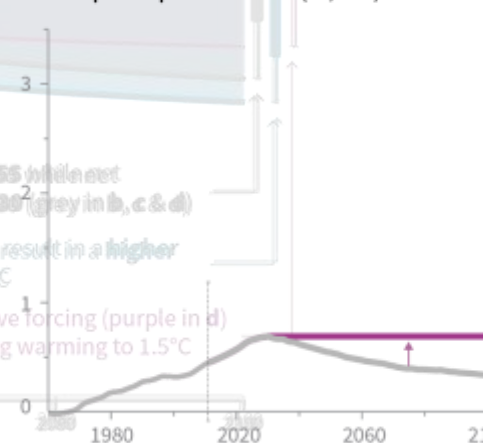
b) Stylized net global CO₂ emissions and observed monthly global mean surface temperature



c) Cumulative net CO₂ emissions



d) Non-CO₂ radiative forcing pathways



Global CO₂ emissions reach net zero in 2055 when net non-CO₂ radiative forcing is reduced after 2030 (grey in b, c & d)

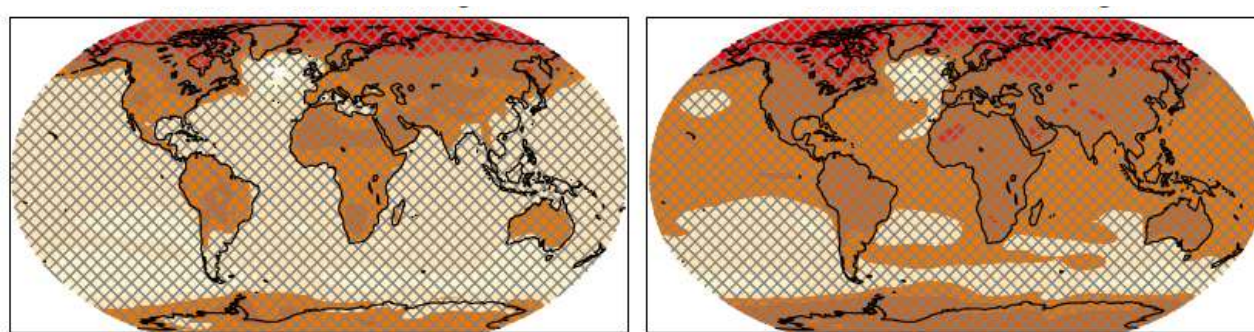
Faster CO₂ reductions (blue in b & c) result in a higher probability of limiting warming to 1.5°C

No reduction of net non-CO₂ radiative forcing (purple in d) results in a lower probability of limiting warming to 1.5°C

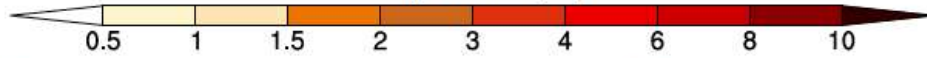
Spatial patterns of changes in mean temperature

Global warming of 1.5°C

2°C



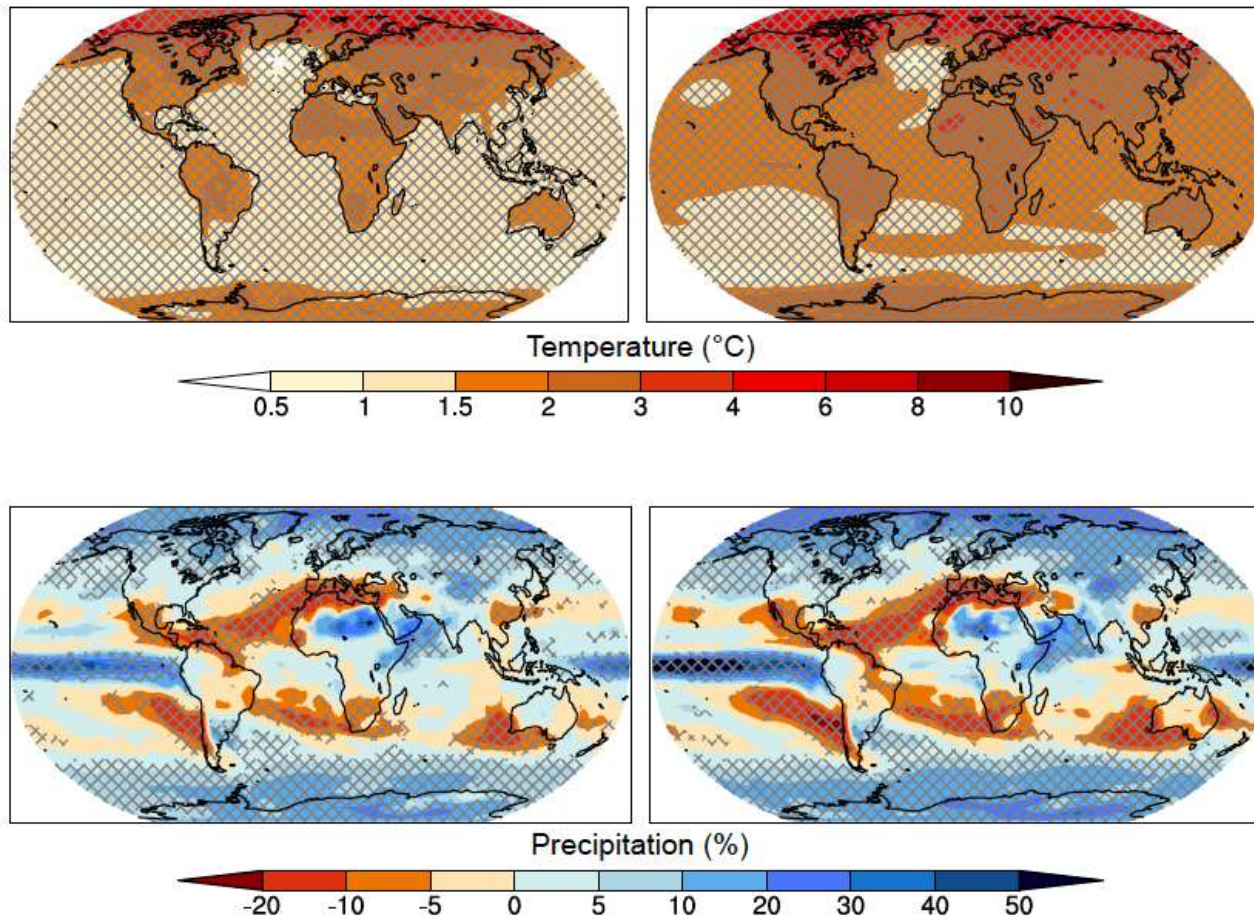
Temperature (°C)



Spatial patterns of changes in mean temperature and precipitation

Global warming of 1.5°C

2°C



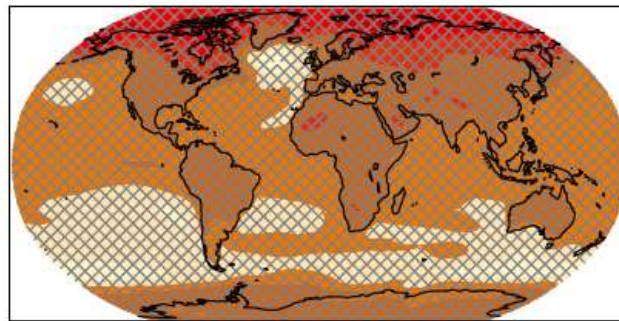
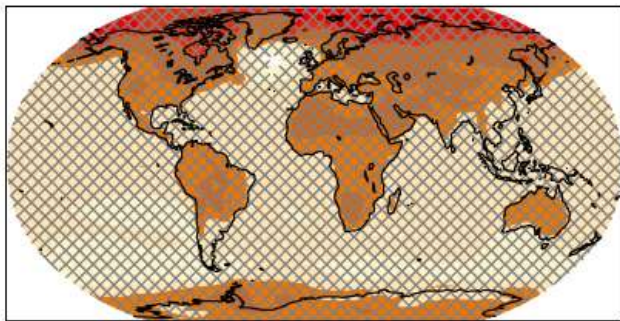
26 CMIP5 models; hatching : 66% model agreement

Spatial patterns of changes in mean temperature and precipitation

Global warming of 1.5°C

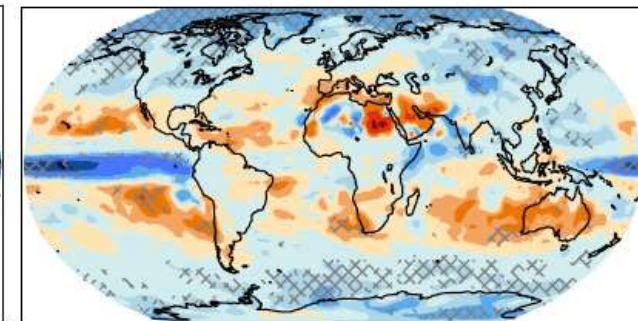
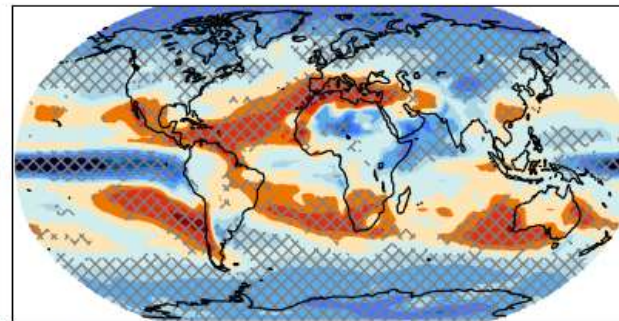
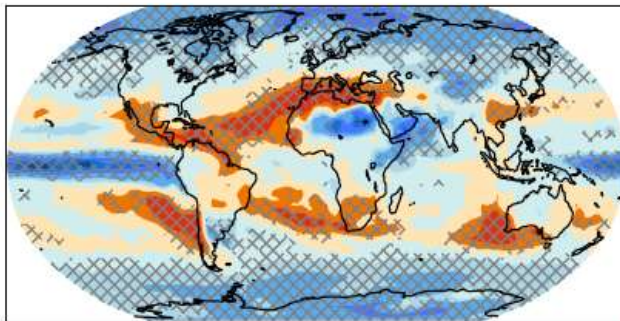
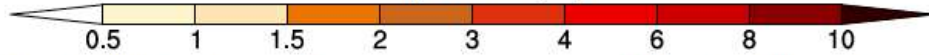
2°C

Difference



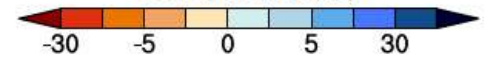
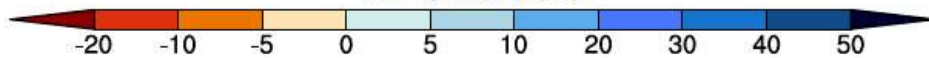
Temperature (°C)

Temperature (°C)



Precipitation (%)

Precipitation (%)



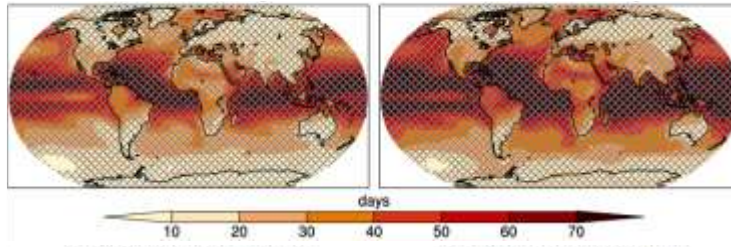
26 CMIP5 models; hatching : 66% model agreement

Spatial patterns of changes in extreme temperature

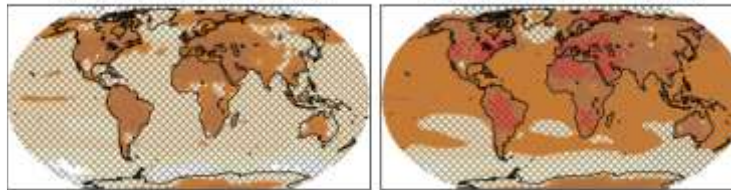
Global warming of 1.5°C

2°C

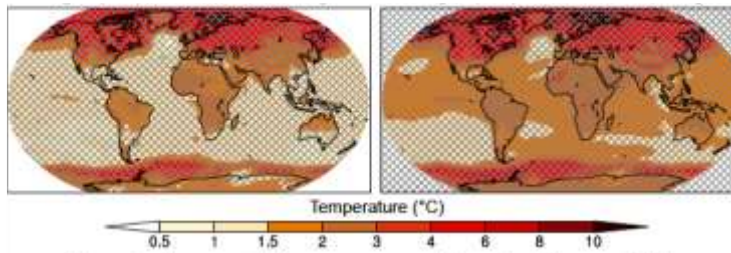
*Number of hot days
(days)*



*Temperature of
hottest days (°C)*



*Temperature of
coldest nights (°C)*

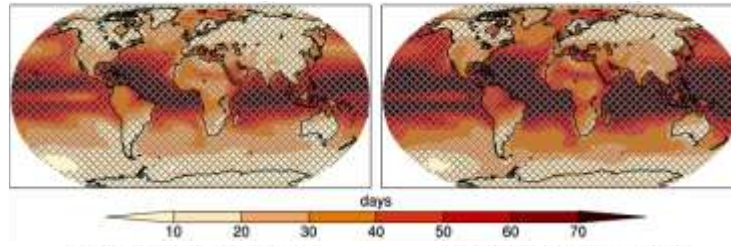


Spatial patterns of changes in extreme temperature and precipitation

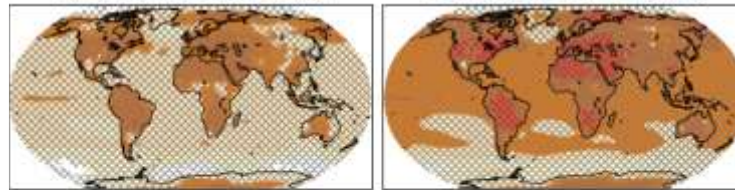
Global warming of 1.5°C

2°C

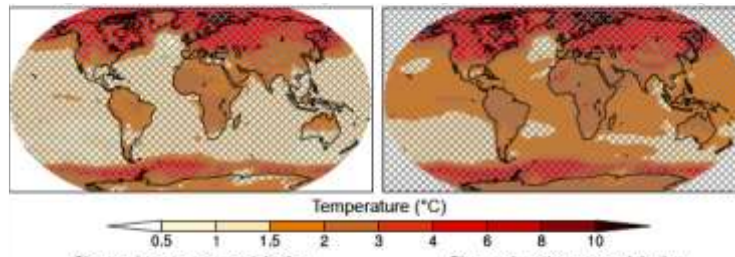
Number of hot days (days)



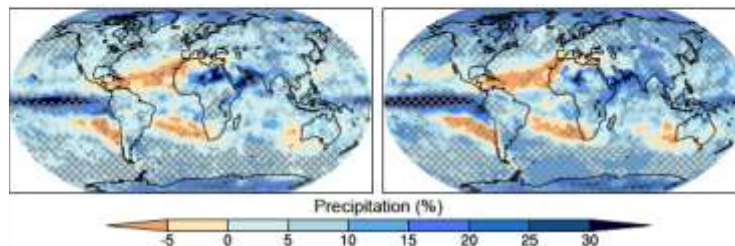
Temperature of hottest days (°C)



Temperature of coldest nights (°C)



Extreme precipitation (%)



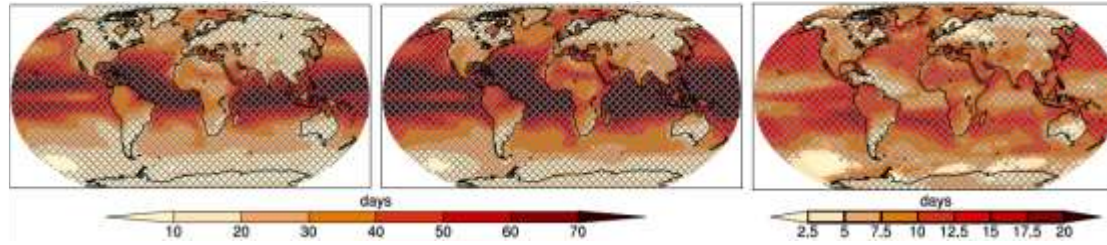
Spatial patterns of changes in extreme temperature and precipitation

Global warming of 1.5°C

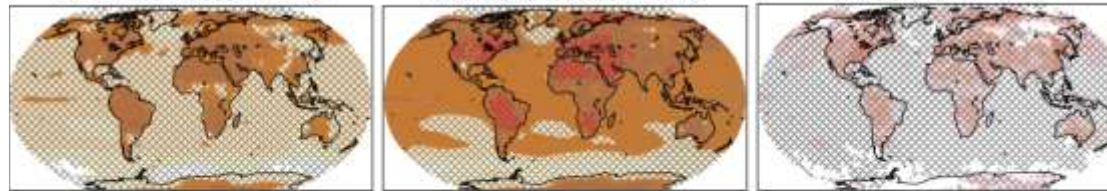
2°C

Difference

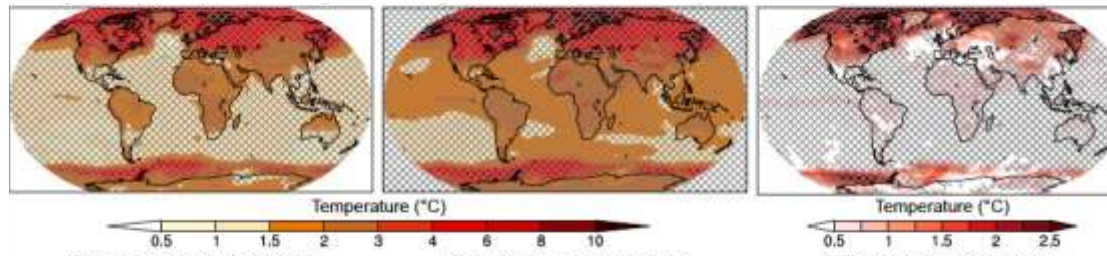
Number of hot days (days)



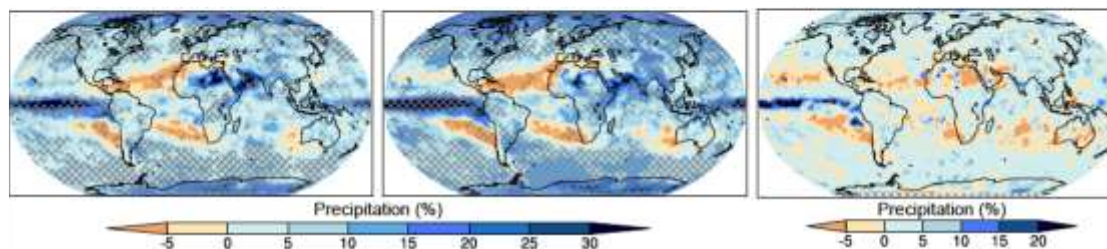
Temperature of hottest days (°C)



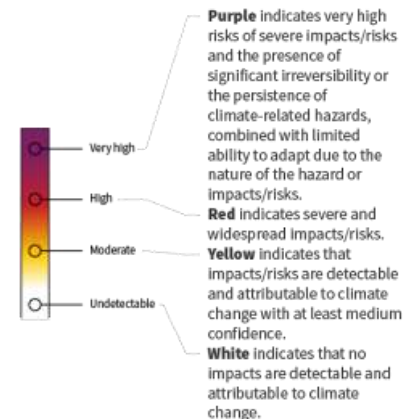
Temperature of coldest nights (°C)



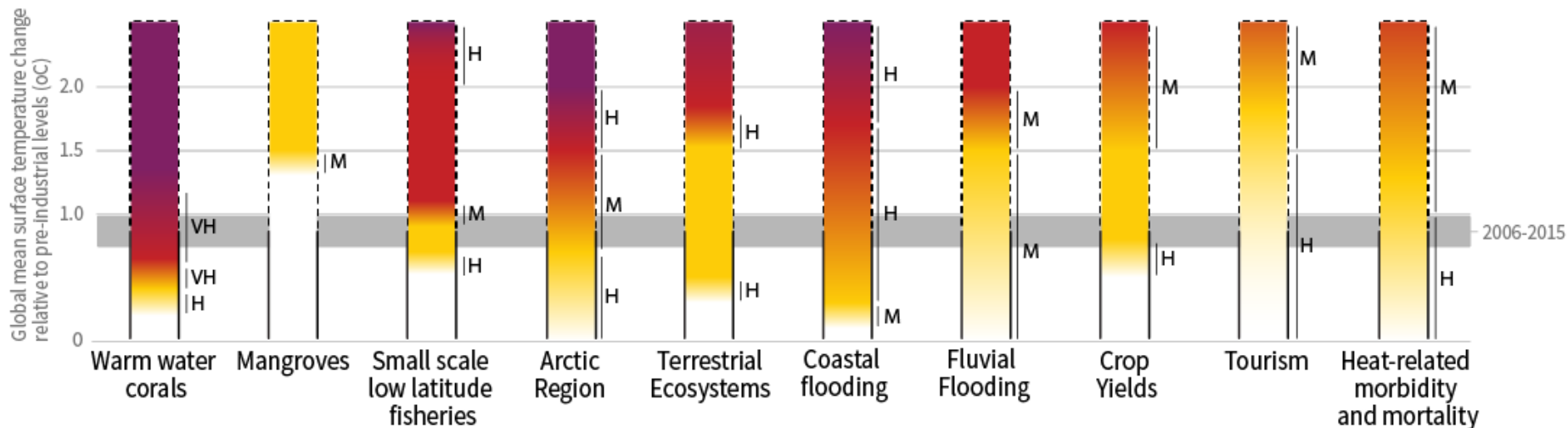
Extreme precipitation (%)



How do climate-related risks change as a function of the level of global warming?

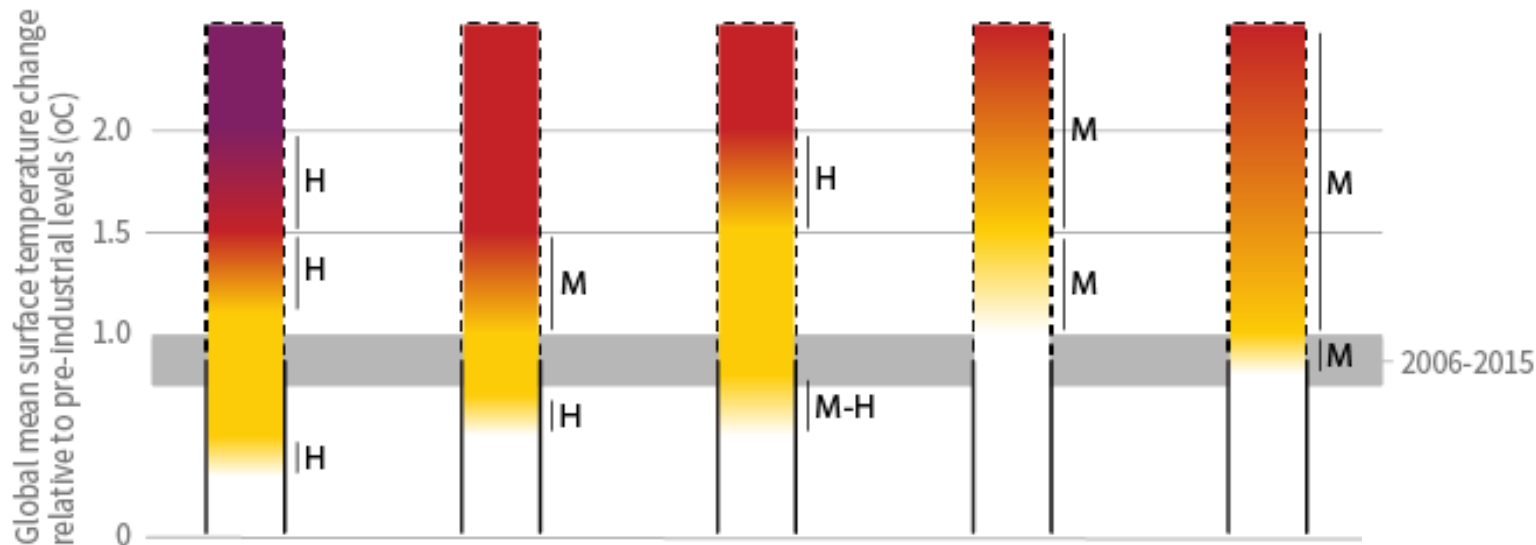


Impacts and risks for selected natural, managed and human systems



Confidence level : M, medium; H, high; VH; very high

How do climate-related risks for “Reasons For Concern” change as a function of the level of global warming?



RFC1
Unique and threatened systems

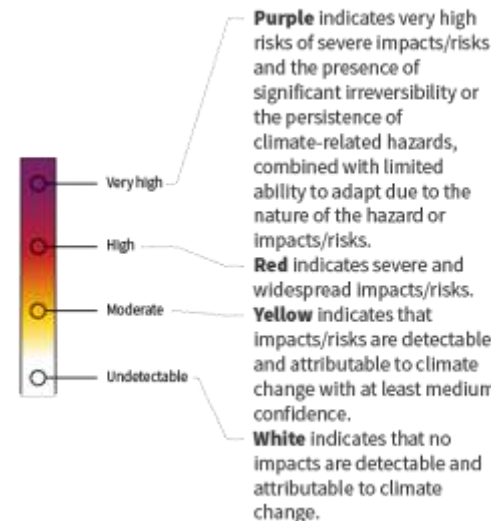
RFC2
Extreme weather events

RFC3
Distribution of impacts

RFC4
Global aggregate impacts

RFC5
Large scale singular events

Confidence level : M, medium; H, high; VH; very high





At 1.5°C compared to 2°C

- Up to several hundred million fewer people exposed to climate-related risk and susceptible to poverty by 2050
- Disproportionately high risk for Arctic, dryland regions, small island developing states and least developed countries
- Lower risks for health, livelihoods, food security, water supply, human security and economic growth
- Wide range of adaptation options which can reduce climate risks; less adaptation needs at 1.5°C

Jason Florio / Aurora Photos

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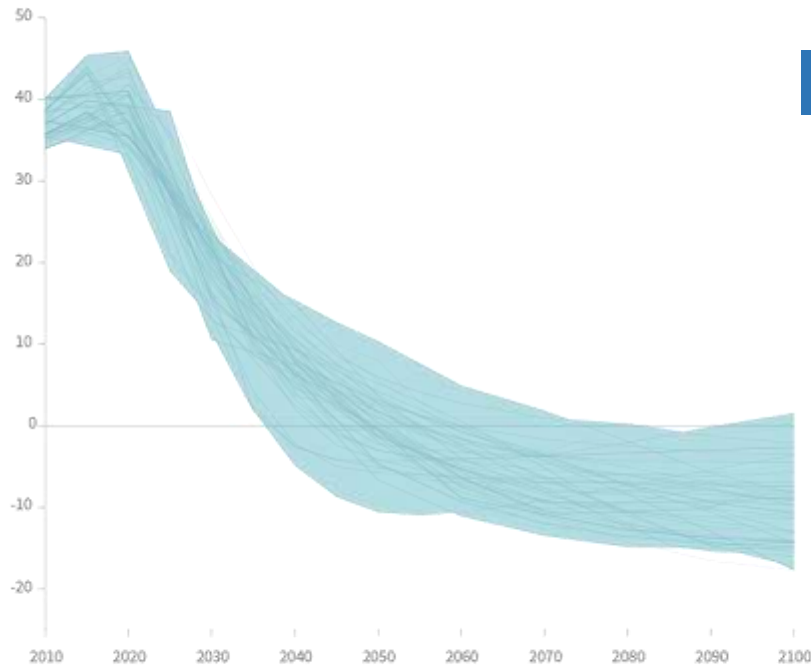
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What are greenhouse gas emission pathways compatible with limiting warming to 1.5°C?

Global total net CO₂ emissions

Billion tonnes of CO₂/yr



<https://data.ene.iiasa.ac.at/iamc-1.5c-explorer/>

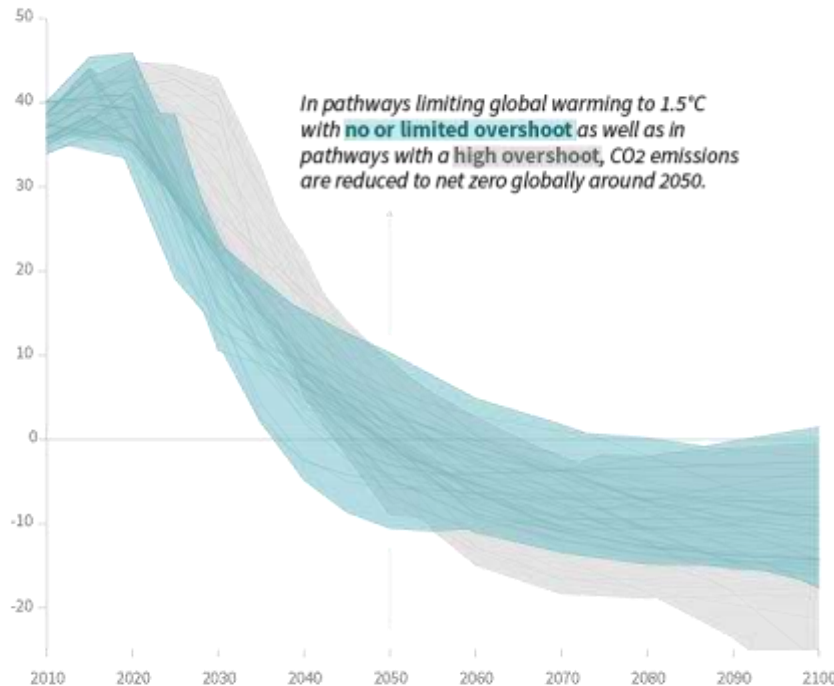
Timing of net zero CO₂
Line widths depict the 5-95th
percentile and the 25-75th
percentile of scenarios

Pathways limiting global warming to 1.5°C with no or low overshoot

What are greenhouse gas emission pathways compatible with limiting warming to 1.5°C?

Global total net CO₂ emissions

Billion tonnes of CO₂/yr



Timing of net zero CO₂

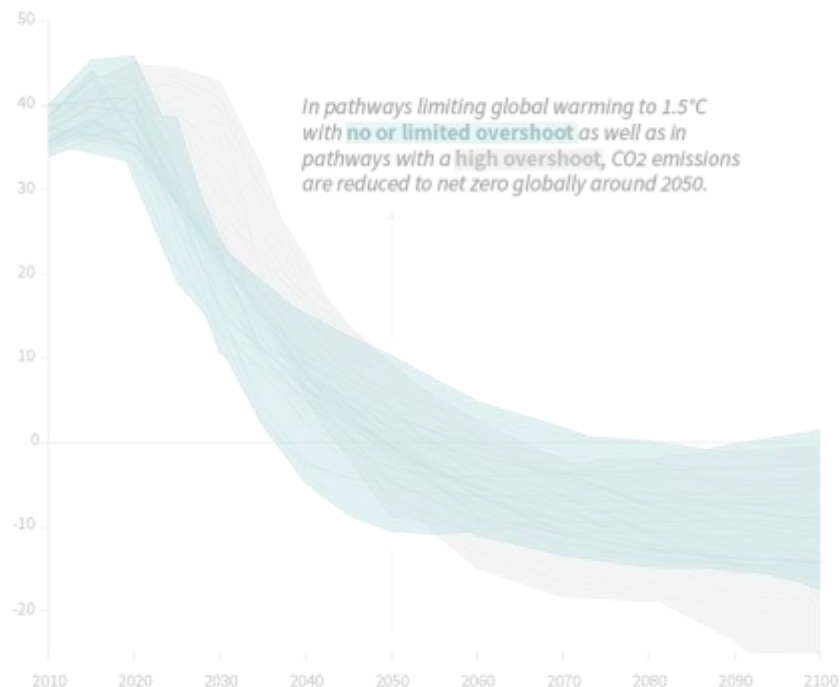
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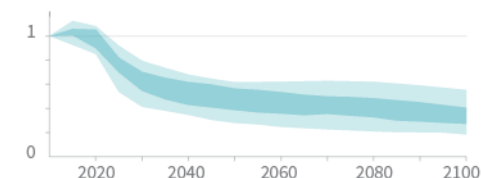
Timing of net zero CO₂
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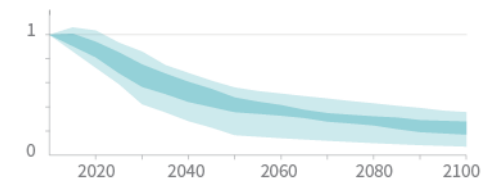
Non-CO₂ emissions relative to 2010

Emissions of non-CO₂ forcings are also reduced or limited in pathways limiting global warming to 1.5°C with **no or limited overshoot**, but they do not reach zero globally.

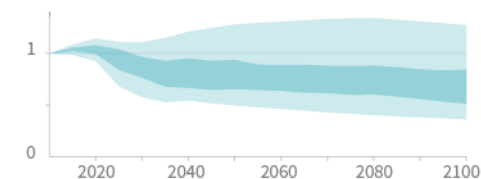
Methane emissions



Black carbon emissions



Nitrous oxide emissions



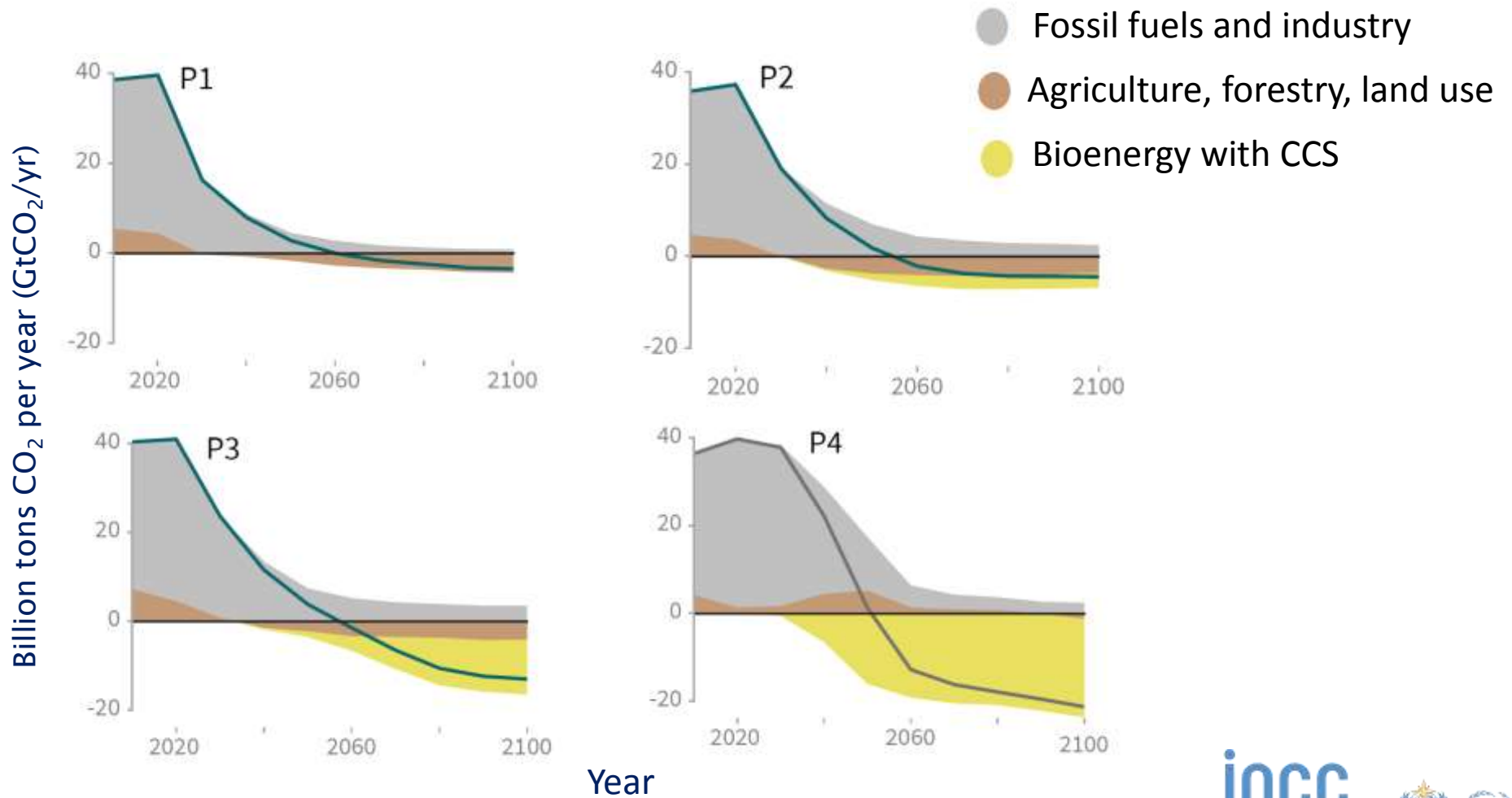


Limiting warming to 1.5°C

Would require rapid, far-reaching and unprecedented changes in all systems

- A range of technologies and behavioural changes
- Scale up in annual investment in low carbon energy and energy efficiency by factor of five by 2050
- Renewables supply 70-85% of electricity in 2050
- Coal declines steeply, ~zero in electricity by 2050
- Deep emissions cuts in transport and buildings
- Changes in land use and urban planning

Four illustrative model pathways



An aerial photograph of a farmer in a blue shirt and hat, walking through a field with rows of young green plants. The field is divided into sections of green crops and brown soil. The background is a bright yellow gradient.

Where are we?

- National pledges are not enough to limit warming to 1.5°C
- Avoiding warming of more than 1.5°C would require carbon dioxide emissions to decline substantially before 2030



Climate change and sustainability

- Ethical and fair transitions
- Different pathways have different synergies and trade-offs with UN Sustainable Development Goals (SDGs)
- Careful mix of measures to adapt to climate change and reduce emissions can help achieve SDGs
- Low energy demand, low material consumption and low carbon food carry highest benefits
- Cooperation, governance, innovation and mobilisation of finance key for feasibility

Ashley Cooper/ Aurora Photos



ipcc.ch/report/sr15 :

Summary for Policy Makers

10 Frequently Asked Questions

5 Chapters

Glossary

Global warming of 1.5°C (SR1.5)

Chapter 1: Framing and context (*integration WGI-WGII-III*)

Chapter 2: Mitigation pathways compatible with 1.5°C in the context of sustainable development (*integration WGI-WGIII, pathways*)

Chapter 3: Impacts of 1.5°C global warming on natural and human systems (*integration WGI-WGII, global – regional*)

Chapter 4: Strengthening and implementing the global response to the threat of climate change (*systems transitions, dimensions of feasibility*)

Chapter 5: Sustainable development, poverty eradication and reducing inequalities (*ethics, equity, societal transformation, SDGs*)