Global Warming of 1.5°C
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
Where are we?

Since pre-industrial times, human activities have caused approximately 1.0°C of global warming.

- Already seeing consequences for people, nature and livelihoods
- At current rate, would reach 1.5°C between around 2030 and 2050
- Past emissions alone do not commit the world to 1.5°C
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
Cumulative emissions of CO$_2$ and future non-CO$_2$ 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.
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)

- Observed monthly global mean surface temperature
- Estimated anthropogenic warming to date and likely range

Likely range of modeled responses to stylized pathways:
- Global CO₂ emissions reach net zero in 2055 while net non-CO₂ radiative forcing is reduced after 2030 (grey in b, c & d)
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)

- Observed monthly global mean surface temperature
- Estimated anthropogenic warming to date and likely range
- Likely range of modeled responses to stylized pathways
  - Global CO₂ emissions reach net zero in 2055 while 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
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
Cumulative emissions of CO$_2$ and future non-CO$_2$ radiative forcing determine the probability of limiting warming to 1.5°C.
Cumulative emissions of CO₂ and future non-CO₂ radiative forcing determine the probability of limiting warming to 1.5°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.
Spatial patterns of changes in mean temperature and precipitation

Global warming of 1.5°C vs 2°C

Difference

26 CMIP5 models; hatching: 66% model agreement
Spatial patterns of changes in extreme temperature and precipitation

<table>
<thead>
<tr>
<th></th>
<th>Global warming of 1.5°C</th>
<th>2°C</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of hot days</strong></td>
<td><img src="image1.png" alt="Map" /></td>
<td><img src="image2.png" alt="Map" /></td>
<td><img src="image3.png" alt="Map" /></td>
</tr>
<tr>
<td></td>
<td><img src="image4.png" alt="Map" /></td>
<td><img src="image5.png" alt="Map" /></td>
<td><img src="image6.png" alt="Map" /></td>
</tr>
<tr>
<td><strong>Temperature of hottest days (°C)</strong></td>
<td><img src="image7.png" alt="Map" /></td>
<td><img src="image8.png" alt="Map" /></td>
<td><img src="image9.png" alt="Map" /></td>
</tr>
<tr>
<td></td>
<td><img src="image10.png" alt="Map" /></td>
<td><img src="image11.png" alt="Map" /></td>
<td><img src="image12.png" alt="Map" /></td>
</tr>
<tr>
<td><strong>Temperature of coldest nights (°C)</strong></td>
<td><img src="image13.png" alt="Map" /></td>
<td><img src="image14.png" alt="Map" /></td>
<td><img src="image15.png" alt="Map" /></td>
</tr>
<tr>
<td></td>
<td><img src="image16.png" alt="Map" /></td>
<td><img src="image17.png" alt="Map" /></td>
<td><img src="image18.png" alt="Map" /></td>
</tr>
<tr>
<td><strong>Extreme precipitation (%)</strong></td>
<td><img src="image19.png" alt="Map" /></td>
<td><img src="image20.png" alt="Map" /></td>
<td><img src="image21.png" alt="Map" /></td>
</tr>
</tbody>
</table>
How do climate-related risks change as a function of the level of global warming?

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?

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

https://data.ene.iiasa.ac.at/iamc-1.5c-explorer/
What are greenhouse gas emission pathways compatible with limiting warming to 1.5°C?

Pathways with no or limited overshoot
Pathways with a high overshoot
What are greenhouse gas emission pathways compatible with limiting warming to 1.5°C?
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
- Transitions in land use, scale depending on mitigation portfolio
- Urban and infrastructure system transitions, changes in urban planning practices
Four illustrative model pathways

<table>
<thead>
<tr>
<th>Year</th>
<th>Billion tons CO₂ per year (GtCO₂/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td></td>
</tr>
<tr>
<td>2060</td>
<td></td>
</tr>
<tr>
<td>2100</td>
<td></td>
</tr>
</tbody>
</table>

- **P1**: Fossil fuels and industry, Agriculture, forestry, land use, Bioenergy with CCS
- **P2**: Fossil fuels and industry, Agriculture, forestry, land use, Bioenergy with CCS
- **P3**: Fossil fuels and industry, Agriculture, forestry, land use, Bioenergy with CCS
- **P4**: Fossil fuels and industry, Agriculture, forestry, land use, Bioenergy with CCS

Intergovernmental Panel on Climate Change (IPCC)
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
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.

ipcc.ch/report/sr15:

Summary for Policy Makers

10 Frequently Asked Questions

5 Chapters

Glossary