Recent changes in the climate are widespread, rapid, and intensifying, and unprecedented in thousands of years.
Unless there are immediate, rapid, and large-scale reductions in greenhouse gas emissions, limiting warming to 1.5°C will be beyond reach.
It is indisputable that human activities are causing climate change, making extreme climate events, including heat waves, heavy rainfall, and droughts, more frequent and severe.
Climate change is already affecting every region on Earth, in multiple ways.

The changes we experience will increase with further warming.
There’s no going back from some changes in the climate system…
“…However, some changes could be slowed and others could be stopped by limiting warming.”
There’s no going back from some changes in the climate system. However, some changes could be slowed and others could be stopped by limiting warming.
To limit global warming, strong, rapid, and sustained reductions in CO2, methane, and other greenhouse gases are necessary.

This would not only reduce the consequences of climate change but also improve air quality.
BY THE NUMBERS

Author Team

234 authors from 65 countries
28% women, 72% men
30% new to the IPCC

Review Process

14,000 scientific publications assessed
78,000+ review comments
46 countries commented on Final Government Distribution
Interactive atlas

https://interactive-atlas.ipcc.ch/

#IPCCData  #IPCCAtlas
Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

**Figure SPM.1**

Changes in global surface temperature relative to 1850-1900

- **a)** Change in global surface temperature (decadal average) as **reconstructed** (1-2000) and **observed** (1850-2020)
- **b)** Change in global surface temperature (annual average) as **observed** and simulated using **human & natural** and **only natural** factors (both 1850-2020)
Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

Figure SPM.1

a) Change in global surface temperature (decadal average) as reconstructed (1-2000) and observed (1850-2020)
Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

b) Change in global surface temperature (annual average) as observed and simulated using human & natural and only natural factors (both 1850-2020)
Observed warming is driven by emissions from human activities, with greenhouse gas warming partly masked by aerosol cooling.

Figure SPM.2
Observed warming is driven by emissions from human activities, with greenhouse gas warming partly masked by aerosol cooling.
Observed warming is driven by emissions from human activities, with greenhouse gas warming partly masked by aerosol cooling.
Observed warming is driven by emissions from human activities, with greenhouse gas warming partly masked by aerosol cooling

Figure SPM.2

- Contributions to 2010-2019 warming relative to 1850-1900, assessed from radiative forcing studies

- Mainly contribute to changes in non-CO₂ greenhouse gases
- Mainly contribute to changes in anthropogenic aerosols
Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes.
Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes.

a) Synthesis of assessment of observed change in **hot extremes** and confidence in human contribution to the observed changes in the world’s regions.

**Type of observed change in hot extremes**
- Increase (41)
- Decrease (0)
- Low agreement in the type of change (2)
- Limited data and/or literature (2)

**Confidence in human contribution to the observed change**
- High
- Medium
  - Low due to limited agreement
  - Low due to limited evidence

Figure SPM.3
Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes.

b) Synthesis of assessment of observed change in heavy precipitation and confidence in human contribution to the observed changes in the world’s regions.
Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes.

c) Synthesis of assessment of observed change in **agricultural and ecological drought** and confidence in human contribution to the observed changes in the world’s regions.
Future emissions cause future additional warming, with total warming dominated by past and future CO$_2$ emissions
Future emissions cause future additional warming, with total warming dominated by past and future CO₂ emissions
Future emissions cause future additional warming, with total warming dominated by past and future CO$_2$ emissions

Figure SPM.4
Future emissions cause future additional warming, with total warming dominated by past and future CO$_2$ emissions.
Future emissions cause future additional warming, with total warming dominated by past and future CO₂ emissions

Nitrous oxide (MtN₂O/yr)

- SSP3-7.0
- SSP5-8.5
- SSP2-4.5
- SSP1-2.6
- SSP1-1.9
Future emissions cause future additional warming, with total warming dominated by past and future CO$_2$ emissions

Sulfur dioxide (MtSO$_2$/yr)

Figure SPM.4
Future emissions cause future additional warming, with total warming dominated by past and future CO₂ emissions
With every increment of global warming, changes get larger in regional mean temperature, precipitation and soil moisture

Figure SPM.5
With every increment of global warming, changes get larger in regional mean temperature, precipitation and soil moisture.

**Figure SPM.5**

- **a)** Annual mean temperature change (°C) at 1 °C global warming
  - Warming at 1 °C affects all continents and is generally larger over land than over the oceans in both observations and models. Across most regions, observed and simulated patterns are consistent.

- **b)** Annual mean temperature change (°C) relative to 1850-1900
  - Across warming levels, land areas warm more than oceans, and the Arctic and Antarctica warm more than the tropics.
With every increment of global warming, changes get larger in regional mean temperature, precipitation and soil moisture.

Figure SPM.5

c) Annual mean precipitation change (%) relative to 1850-1900

Precipitation is projected to increase over high latitudes, the equatorial Pacific and parts of the monsoon regions, but decrease over parts of the subtropics and in limited areas of the tropics.

Simulated change at 1.5 °C global warming

Simulated change at 2 °C global warming

Simulated change at 4 °C global warming

Relatively small absolute changes may appear as large % changes in regions with dry baseline conditions.

Drier

Change (%)

Wetter
With every increment of global warming, changes get larger in regional mean temperature, precipitation and soil moisture

<table>
<thead>
<tr>
<th>d) Annual mean total column soil moisture change (standard deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulated change at 1.5 °C global warming</td>
</tr>
<tr>
<td>Simulated change at 2 °C global warming</td>
</tr>
<tr>
<td>Simulated change at 4 °C global warming</td>
</tr>
</tbody>
</table>

Across warming levels, changes in soil moisture largely follow changes in precipitation but also show some differences due to the influence of evapotranspiration.

Relatively small absolute changes may appear large when expressed in units of standard deviation in dry regions with little interannual variability in baseline conditions.

![Maps showing soil moisture changes](image-url)
Projected changes in extremes are larger in frequency and intensity with every additional increment of global warming

Figure SPM.6
Projected changes in extremes are larger in frequency and intensity with every additional increment of global warming.

**Figure SPM.6**

**Title:** Hot temperature extremes over land

**10-year event**
- Frequency and increase in intensity of extreme temperature event that occurred once in 10 years on average in a climate without human influence.

**50-year event**
- Frequency and increase in intensity of extreme temperature event that occurred once in 50 years on average in a climate without human influence.

<table>
<thead>
<tr>
<th>Future global warming levels</th>
<th>1850-1900</th>
<th>Present 1 °C</th>
<th>1.5 °C</th>
<th>2 °C</th>
<th>4 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTENSITY increase</td>
<td>Once</td>
<td>now likely occurs 2.8 times (1.8 - 3.2)</td>
<td>will likely occur 4.1 times (2.8 - 4.7)</td>
<td>will likely occur 5.6 times (3.8 - 6.0)</td>
<td>will likely occur 9.4 times (8.3 - 9.6)</td>
</tr>
<tr>
<td>FREQUENCY per 10 years</td>
<td>+6 °C</td>
<td>+5 °C</td>
<td>+4 °C</td>
<td>+3 °C</td>
<td>+2 °C</td>
</tr>
<tr>
<td></td>
<td>+1.2 °C hotter</td>
<td>+1.9 °C hotter</td>
<td>+2.6 °C hotter</td>
<td>+5.1 °C hotter</td>
<td>+6 °C hotter</td>
</tr>
</tbody>
</table>

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<tr>
<th>Future global warming levels</th>
<th>1850-1900</th>
<th>Present 1 °C</th>
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<th>2 °C</th>
<th>4 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTENSITY increase</td>
<td>Once</td>
<td>now likely occurs 4.8 times (2.3 - 6.4)</td>
<td>will likely occur 8.6 times (4.3 - 10.7)</td>
<td>will likely occur 13.9 times (6.9 - 16.6)</td>
<td>will likely occur 39.2 times (27.0 - 41.4)</td>
</tr>
<tr>
<td>FREQUENCY per 50 years</td>
<td>+6 °C</td>
<td>+5 °C</td>
<td>+4 °C</td>
<td>+3 °C</td>
<td>+2 °C</td>
</tr>
<tr>
<td></td>
<td>+1.2 °C hotter</td>
<td>+2.0 °C hotter</td>
<td>+2.7 °C hotter</td>
<td>+3.4 °C hotter</td>
<td>+5.1 °C hotter</td>
</tr>
</tbody>
</table>
Projected changes in extremes are larger in frequency and intensity with every additional increment of global warming.

Figure SPM.6

Heavy precipitation over land

10-year event

Frequency and increase in intensity of heavy 1-day precipitation event that occurred once in 10 years on average in a climate without human influence.

<table>
<thead>
<tr>
<th>Frequency per 10 years</th>
<th>1850-1900</th>
<th>Present 1 °C</th>
<th>1.5 °C</th>
<th>2 °C</th>
<th>4 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once</td>
<td>now likely occurs 1.3 times (1.2 - 1.4)</td>
<td>will likely occur 1.9 times (1.4 - 3.7)</td>
<td>will likely occur 1.7 times (1.6 - 2.0)</td>
<td>will likely occur 2.7 times (2.3 - 3.4)</td>
<td></td>
</tr>
<tr>
<td>Intensity increase</td>
<td>+6.7% wetter</td>
<td>+10.5% wetter</td>
<td>+14.0% wetter</td>
<td>+30.2% wetter</td>
<td></td>
</tr>
</tbody>
</table>
Projected changes in extremes are larger in frequency and intensity with every additional increment of global warming.
The proportion of CO$_2$ emissions taken up by land and ocean carbon sinks is smaller in scenarios with higher cumulative CO$_2$ emissions.

Total cumulative CO$_2$ emissions taken up by land and oceans (colours) and remaining in the atmosphere (grey) under the five illustrative scenarios from 1850 to 2100.

For scenarios with higher cumulative CO$_2$ emissions...

...the amount of CO$_2$ emissions taken up by land and ocean carbon sinks is larger, but more of the emitted CO$_2$ emissions remains in the atmosphere...

...meaning that the proportion of CO$_2$ emissions taken up by land and ocean carbon sinks from the atmosphere is smaller in scenarios with higher CO$_2$ emissions.
Human activities affect all the major climate system components, with some responding over decades and others over centuries. 

Figure SPM.8

a) Global surface temperature change relative to 1850-1900
Human activities affect all the major climate system components, with some responding over decades and others over centuries.

Figure SPM.8

b) September Arctic sea ice area

10^6 km^2

- Practically ice-free

1950  2000  2015  2050  2100

SSP1-1.9
SSP1-2.6
SSP2-4.5
SSP3-7.0
SSP5-8.5
Human activities affect all the major climate system components, with some responding over decades and others over centuries.
Human activities affect all the major climate system components, with some responding over decades and others over centuries.

**Figure SPM.8**

Global mean sea level change relative to 1900

*Low-likelihood, high-impact* storyline, including ice sheet instability processes, under **SSP5-8.5**
Human activities affect all the major climate system components, with some responding over decades and others over centuries.

Figure SPM.8
Multiple climatic impact-drivers are projected to change in all regions of the world.

Number of land & coastal regions (a) and open-ocean regions (b) where each climatic impact-driver (CID) is projected to increase or decrease with high confidence (dark shade) or medium confidence (light shade).
Multiple climatic impact-drivers are projected to change in all regions of the world.

**Figure SPM.9**

Changes refer to a 20–30 year period centred around 2050 and/or consistent with 2°C global warming compared to a similar period within 1960-2014 or 1850-1900.
Every tonne of CO₂ emissions adds to global warming

**Figure SPM.10**

The near linear relationship between the cumulative CO₂ emissions and global warming for five illustrative scenarios until year 2050.

Future cumulative CO₂ emissions differ across scenarios, and determine how much warming we will experience.
Every tonne of CO$_2$ emissions adds to global warming

Global surface temperature increase since 1850-1900 ($^\circ$C) as a function of cumulative CO$_2$ emissions (GtCO$_2$)

The near linear relationship between the cumulative CO$_2$ emissions and global warming for five illustrative scenarios until year 2050

Historical global warming

Cumulative CO$_2$ emissions since 1850

GtCO$_2$
Every tonne of CO₂ emissions adds to global warming

Future cumulative CO₂ emissions differ across scenarios, and determine how much warming we will experience.
Thank you.

More Information:

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