Climate Change
Geography

www.metoffice.gov.uk/education

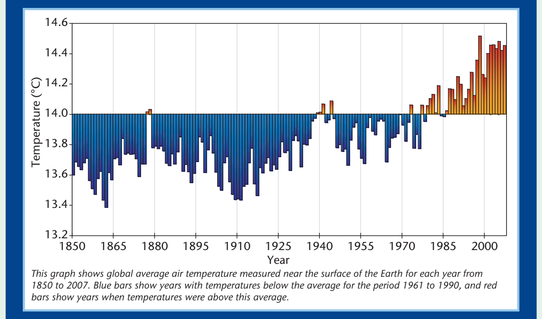
Recent climate change

Global climate change

The world's climate is changing. Evidence for this has come from many sources, including:

- observations of increases in air and ocean temperatures
- long-term changes in precipitation (rain, snow, sleet and hail) over large regions
- widespread melting of snow and ice
- shrinking of Arctic sea-ice
- rising global average sea level

Average surface air temperature of the world has risen by about 0.7 °C over the last century.



This graph shows global average air temperature measured near the surface of the Earth for each year from 1850 to 2007. Blue bars show years with temperatures below the average for the period 1961 to 1990, and red bars show years when temperatures were above this average.

Widespread changes in extreme temperatures have also been observed. For example, cold days, cold nights and frosts have become less frequent, while hot days, hot nights and heatwaves have become more frequent.

Mountain glaciers and snow cover have reduced in both the northern and southern hemispheres, and Arctic sea-ice has shrunk over the last 30 years.

Sea level has risen throughout the 20th Century by about 17 cm.

The number of heavy precipitation events has increased over most land areas.

Arctic sea-ice shrinkage in September 2004 was much greater than the long-term average for the time of year (red line).

Regional climate change

Temperature changes have varied a lot between regions around the world.

Over the last 100 years, the Arctic has warmed almost twice as fast as the rest of the world.

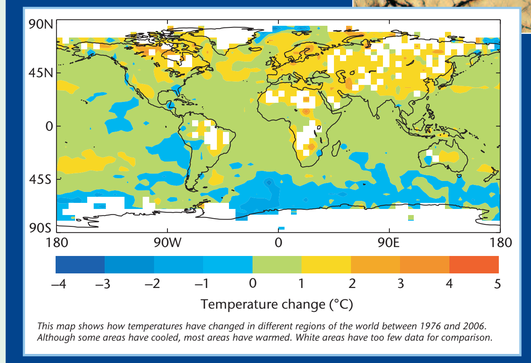
The northern hemisphere has warmed more than the southern hemisphere. Similarly, more warming has happened over land than sea.

Over most land areas days and nights have got warmer and heatwaves have become more frequent.

Precipitation has increased in eastern parts of North and South America, northern Europe and north and central Asia.

Over the last 30 years, higher temperatures and decreased precipitation have led to drying in the Sahel (the southern edge of the Sahara desert), the Mediterranean, South Africa and parts of southern Asia.

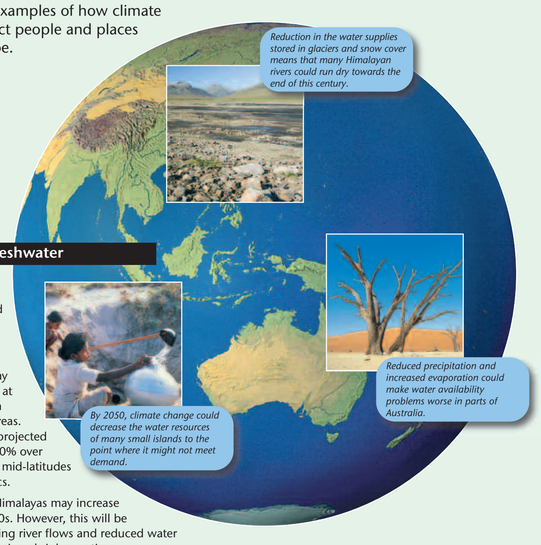
There have been more intense and longer droughts over wider areas since the 1970s, particularly in the tropics and sub-tropics.



This map shows how temperatures have changed in different regions of the world between 1976 and 2006. Although some areas have cooled, most areas have warmed. White areas have too few data for comparison.

Climate change impacts

Here are some examples of how climate change can affect people and places around the globe.



Freshwater

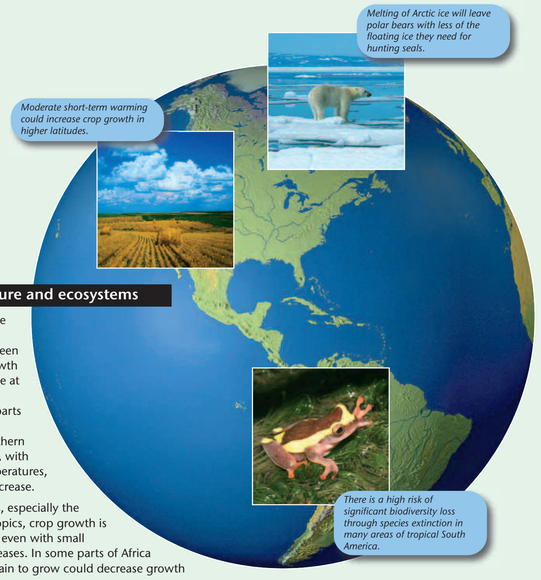
By 2020, between 75 and 250 million people are projected to experience water shortages due to climate change.

Water availability may increase by 10–40% at high latitudes and in some wet tropical areas. Water availability is projected to decrease by 10–30% over some dry regions at mid-latitudes and in the dry tropics.

Glacier melt in the Himalayas may increase flooding by the 2030s. However, this will be followed by decreasing river flows and reduced water availability as the glaciers shrink over time.

Over the 21st Century, water supplies stored in glaciers and snow cover could decline. This would reduce water availability in regions supplied by meltwater from major mountain ranges. Currently, more than one-sixth of the world's population depends on this water.

By 2050, climate change could decrease the water resources of many small islands, like those in the Caribbean and Pacific, to the point where there may be insufficient water to meet demand.



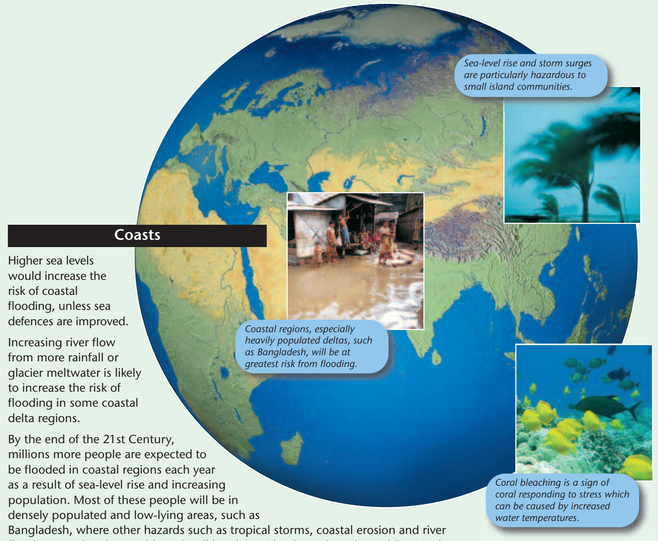
Agriculture and ecosystems

For global average temperature increases of between 1–3 °C, crop growth is likely to increase at higher latitudes, including many parts of Siberia, North America and northern Europe. However, with even higher temperatures, this is likely to decrease.

At lower latitudes, especially the seasonally dry tropics, crop growth is likely to decrease even with small temperature increases. In some parts of Africa crops that need rain to grow could decrease growth by 50% by 2020.

Roughly 20–30% of plant and animal species in the world are likely to be at high risk of extinction if the global average temperature rises by 1.5–2.5 °C beyond 1990 levels.

Over the next century many ecosystems are likely to be damaged by a combination of climate change, associated disturbances (e.g. flooding, drought, wildfire, insects), and other global changes (e.g. land use change, population, over-exploitation of resources). For example, melting of Arctic ice will leave polar bears with less of the floating ice they need for hunting seals.



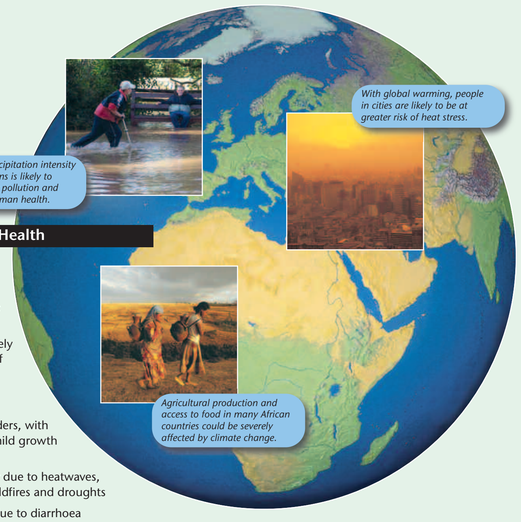
Coasts

Higher sea levels would increase the risk of coastal flooding, unless sea defences are improved.

Increasing river flow from more rainfall or glacier meltwater is likely to increase the risk of flooding in some coastal delta regions.

By the end of the 21st Century, millions more people are expected to be flooded in coastal regions each year as a result of sea-level rise and increasing population. Most of these people will be in densely populated and low-lying areas, such as Bangladesh, where other hazards such as tropical storms, coastal erosion and river flooding are already a problem. Small low-lying islands, such as the Maldives in the Indian Ocean, are also very vulnerable.

Corals are vulnerable to changes in temperature. Increases in seawater temperatures of 1–3 °C could result in more coral dying and the complete destruction of some areas of coral.



Health

People who do not have the facilities to adapt are most vulnerable to climate change impacts.

Climate change is likely to affect the health of millions of people through:

- malnutrition and consequent disorders, with implications for child growth and development
- disease and injury due to heatwaves, floods, storms, wildfires and droughts
- increased illness due to diarrhoea
- changes in the location of some infectious disease carriers, like mosquitoes that carry malaria

Access to food in many African regions could be severely affected by future changes in climate. This is expected to happen as a result of decreases in the areas suitable for agriculture and fisheries.

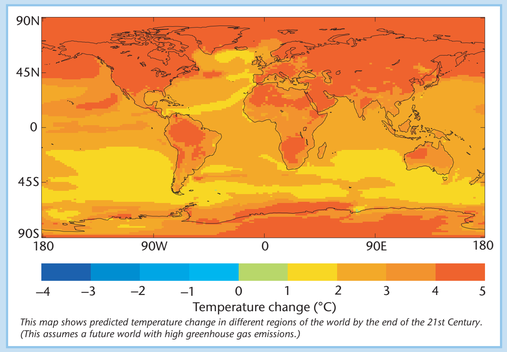
Cities are warmer than the surrounding countryside because of the 'urban heat island' effect. With global warming, people in cities are likely to be at greater risk of heat stress, especially during heatwaves, such as the one in Europe in August 2003 when about 30,000 more people died than normal for the time of year.

Future climate change

Global climate change

One of the key factors affecting future climate change is the amount of greenhouse gases emitted into the atmosphere. This depends on things like population growth, economic development, technology and changes in people's behaviour. Climate takes a while to respond to greenhouse gases; so any greenhouse gases put into the atmosphere now will still affect the climate by the time you are your parents' age.

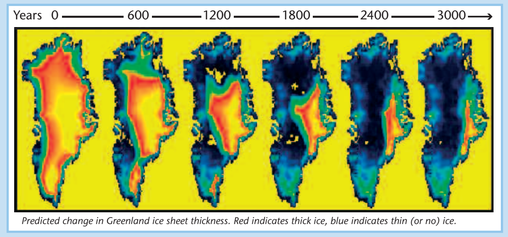
Regional climate change



This map shows predicted temperature change in different regions of the world by the end of the 21st Century. (This assumes a future world with high greenhouse gas emissions.)

Warming is expected to be greatest over land and at most high northern latitudes. It is very likely that heatwaves and heavy precipitation events will become more frequent across the globe. Snow cover and sea-ice are expected to decrease in the Arctic. Warmer sea temperatures and melting land ice is expected to continue to contribute to the rise in sea levels.
In the UK, average annual temperature increases of between 2–3.5 °C have been predicted by the end of this century and more warming is expected in the South East than in the North West.

Greenland ice sheet
If the Greenland ice sheet melts completely, global sea level will rise by about 7 m. Warmer temperatures have recently caused it to melt faster than expected, and more melting is predicted for the future. However, because it's so big, it isn't expected to melt completely for about 3,000 years.



Predicted change in Greenland ice sheet thickness. Red indicates thick ice, blue indicates thin (or no) ice.

Droughts and wildfires
Droughts occur because there is little or no rain, and / or too much evaporation. Since 1980, the area of land experiencing drought has increased worldwide. As the climate warms, evaporation is expected to increase, and areas in drought are expected to expand. This could lead to more failed harvests and famine, particularly where people rely on rain to grow their own food. More droughts and warmer temperatures are likely to increase wildfires. These can cause considerable damage to people, property, plants and animals. Also, when wood and soil are burnt they release carbon dioxide (CO_2), which adds more greenhouse gases to the atmosphere.

Forests
Carbon dioxide is one of the greenhouse gases that is currently increasing rapidly in the atmosphere. If they have no other limitations, most plants grow faster with higher atmospheric CO_2 and plenty of water. Therefore, forests in cold and wet areas, such as northern Russia and Canada, are expected to grow more in the future, but forests in areas where rainfall decreases are likely to decline. Some predictions show that the Amazon rainforest region could become much warmer and drier, and this may cause large areas of trees to die.

This poster is based on the findings of the Intergovernmental Panel on Climate Change.