Responding to Climate Change - FAQ

What is Climate Change?

What is the difference between weather and climate?

To understand climate change, it's important to recognise the difference between weather and climate. Weather is the temperature, precipitation (rain, hail, sleet and snow) and wind, which change hour by hour and day by day. Climate is the average weather and the nature of its variations that we experience over time.

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What is the difference between global warming and climate change?

The Earth is warming faster than it has in the past thousand years, hence the term global warming. But climate change is a better description than global warming, as some areas may, in fact, cool. It also describes other effects like rising sea levels and more extreme weather.

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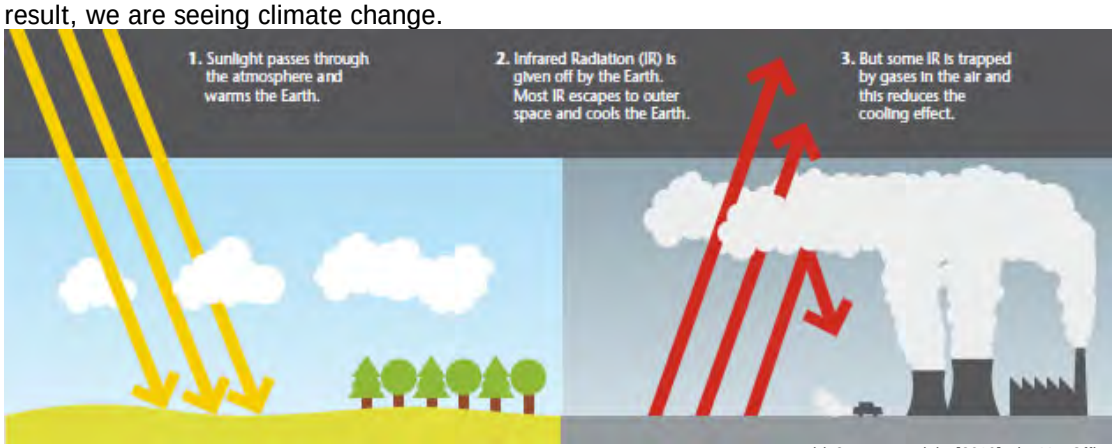
What is the greenhouse effect?

The greenhouse effect is the natural process of the atmosphere letting in some of the energy we receive from the Sun (ultraviolet and visible light) and stopping it being transmitted back out into space (infrared radiation or heat). This makes the Earth warm enough for life.

For several thousands of years the atmosphere has been delicately balanced, with levels of greenhouse gases relatively stable. Human influence has now upset that balance and, as a result, we are seeing climate change.



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How are we causing climate change?

Human activities, like burning coal, oil and gas, have led to an increase in greenhouse gases in the atmosphere, causing an enhanced greenhouse effect and extra warming.

As a result, over the past century there has been an underlying increase in average temperatures which is continuing. Globally, the ten hottest years on record have all been since 1997.

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Which gases are causing the most change?

The main greenhouse gas responsible for recent climate change is CO_2. This has been released in huge quantities by our modern way of life. Levels have also increased due to the destruction of rainforests, which play an important role in absorbing CO_2.

Human activities are increasing other greenhouse gases too, such as methane and nitrous oxide. Methane is produced by bacteria that live in places like landfill sites, peat bogs and in

the guts of animals like cows and sheep. Nitrous oxide is increased by the use of nitrogen fertiliser in agriculture.

Both these gases have a powerful greenhouse effect and also contribute to climate change. However, they have not been released in such large quantities as CO_2 and methane does not last for as long in the atmosphere. So, while they make a significant contribution to climate change, it is man-made CO_2 which has by far the greatest influence.

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Isn't the climate always changing?

Yes. There is natural variability in Earth's climate but the current climate change is very unusual as it is not exclusively part of a natural cycle.

Natural factors include volcanic eruptions, aerosols and phenomena such as El Niño and La Niña (which cause warming and cooling of the Pacific Ocean surface). Natural climate variations can lead to periods with little or no warming, both globally and regionally, and other periods with very rapid warming. However, there is an underlying trend of warming that is almost certainly caused by man's activities.

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Aren't all these changes down to the Sun and natural factors?

No. Many factors contribute to climate change. Only when all the factors are considered can we explain the size and patterns of climate change over the last century.

Although some people claim that the Sun and cosmic rays are responsible for climate change, measured solar activity shows no significant change in the last few decades, while global temperatures have increased significantly. Since the Industrial Revolution, additional greenhouse gases have had about ten times the effect on climate as changes in the Sun's output.

Much of the relatively small climate variability over the last 1,000 years, but before industrialisation, can be explained by changes in solar output and occasional cooling due to major volcanic eruptions. Since industrialisation, CO_2 has increased significantly. We now know that man-made CO_2 is the likely cause of most of the warming over the last 50 years.

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Has climate changed in the past?

There is little doubt, from the evidence so far, that there have been enormous changes in climate in the past. These ranged from a complete absence of ice over the Poles to ice sheets extending across much of Europe, Asia and North America. The last major extension of polar ice retreated only 10,000 years ago. Since then, the climate has sometimes been warmer and sometimes cooler than it is now.

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Has the climate changed recently?

Natural sources, such as tree rings and glaciers, as well as human records, show that climate has changed significantly over the past few hundred years. There was a relatively warm

period in Europe during the 14th century, followed by a quite sudden change to cooler conditions in the 15th century. This extended into the Little Ice Age of the 17th and 18th centuries, followed by a warming trend that has recently accelerated. The evidence for this recent warming comes largely from direct measurements of temperature.
In the more temperate northern latitudes, winters are less severe than 30 years ago, with cold snaps generally being short-lived.

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Do climate scientists really agree about climate change?

Yes. The overwhelming majority of climate scientists agree on the fundamentals of climate change — that climate change is happening and has recently been caused by increased greenhouse gases from human activities.

The core climate science from the Intergovernmental Panel on Climate Change (IPCC) was written by 152 scientists from more than 30 countries and reviewed by more than 600 experts. It concluded that most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in man-made greenhouse gas concentrations.

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Are computer models reliable?

Yes. Computer models are an essential tool in understanding how the climate will respond to changes in greenhouse gas concentrations, and other external effects, such as solar output and volcanoes.

Computer models are the only reliable way to predict changes in climate. Their reliability is tested by seeing if they are able to reproduce the past climate, which gives scientists confidence that they can also predict the future.

But computer models cannot predict the future exactly. They depend, for example, on assumptions made about the levels of future greenhouse gas emissions.

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Surely, the impact of human activity is small?

No. Greenhouse gases are produced naturally and commercially. Both types influence climate change.

All the greenhouse gases combined (the main ones being water vapour, CO_2, methane and nitrous oxide) are only a tiny part of the atmosphere, making up less than 0.5%. Yet it is scientifically proven that these gases trap heat, keeping the planet 30 °C warmer than it would be otherwise and able to sustain life. Any changes in the levels of these gases, such as those recently brought about by human activity, will have a significant effect on global temperatures.

Keeping the climate stable is important for the well-being of the Earth. But there is now very strong evidence that man-made greenhouse gases are causing climate change.

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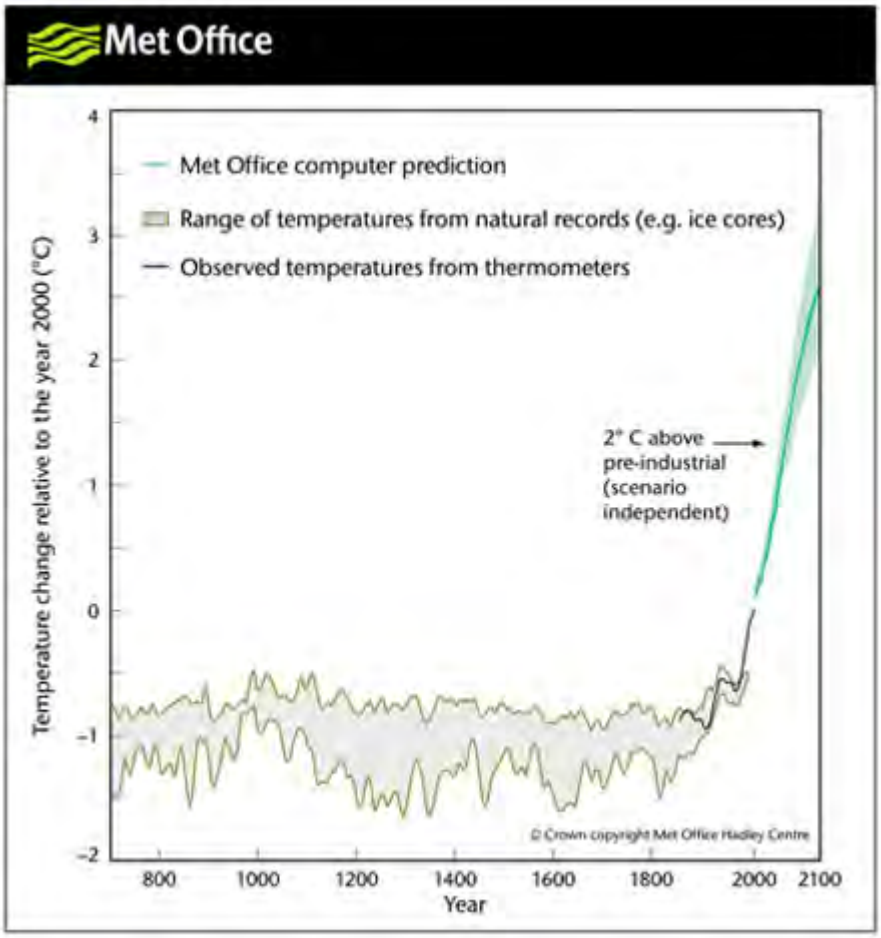
Are you sure there's a link between temperature rise and CO_2?

Yes. Temperature and CO_2 are linked. Studies of polar-ice layers show that in the past, rises in temperature have been followed by an increase in CO_2. Now, it is a rise in CO_2 that is causing the temperature to rise.

Concentrations of CO_2 have increased by more than 35% since industrialisation began, and they are now at their highest for at least 800,000 years.

When natural factors alone are considered, computer models do not reproduce the climate warming we have observed. Only when man-made greenhouse gases are included do they accurately recreate what has happened in the real world.



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Isn't the recent warming due to the growth of our towns and cities?

No. The climate is warming everywhere because of CO_2 emissions. Temperatures in cities are unnaturally high because of the warmth from heating homes and offices, heavy traffic, high concentrations of people and heat stored in buildings and concrete.

Our observations come from urban and rural areas on land and from the sea, which covers 70% of the Earth. We manage data from cities carefully to ensure they do not skew our understanding of climate change.

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If we're meant to have global warming, why is the weather so miserable a lot of the time?

This is the fundamental difference between weather and climate. Even in a warming climate we will still get individual weather systems which will bring 'miserable' weather. There is indisputable evidence that the climate is changing. The average global surface temperature has risen by 0.6 °C in the past 140 years. Globally, nine out of the ten hottest years ever recorded have occurred since 1990. Here in the UK, four out of five of the hottest years ever recorded over a 330-year period have occurred since then.

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Is lots of rain a sign of climate change?

A research project, carried out by Met Office and the Centre for Ecology and Hydrology, looked at extreme flooding in October and November 2000. It concluded that, though the events were extreme, they could not in themselves be attributed to climate change. However, heavy rainfall and peak river flows of similar duration have been increasing in frequency and

magnitude over the past 50 years. This pattern is consistent with model predictions of how human-induced climate change affects rainfall.

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How does El Niño affect our climate?

El Niños are natural variations in climate. When there is an El Niño the tropical eastern Pacific is warmer than average and global temperatures are also warmer. A particularly strong El Niño occurred in 1998 — the warmest year on record across the globe.

The opposite effect is La Niña. When La Niña occurs, it's cold in the eastern Pacific, resulting in cooler than average temperatures. 2007 and 2008 saw a long-lasting La Niña, but 2008 was still the tenth warmest in the global record.

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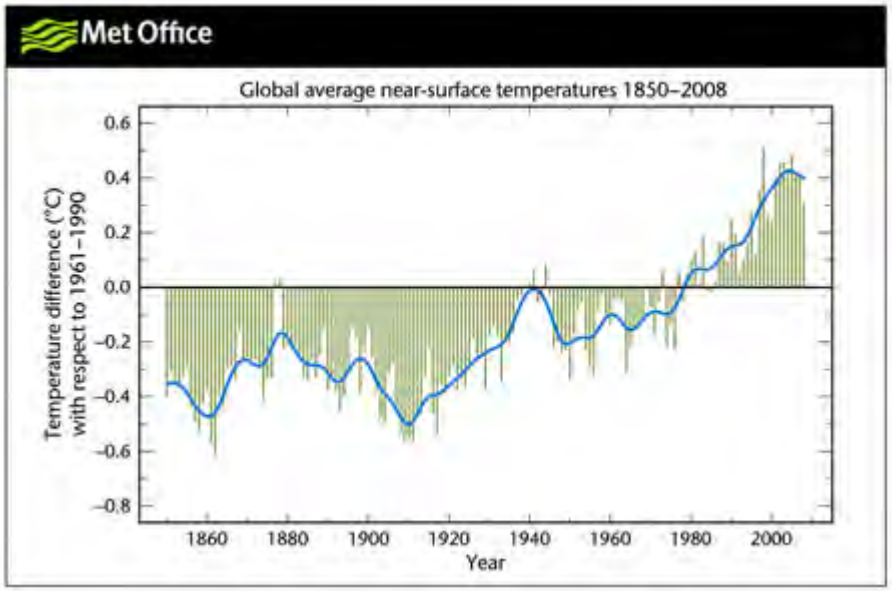
Has global warming now stopped?

No. The rise in global surface temperature has averaged more than 0.15 °C per decade since the mid-1970s. The 10 warmest years on record have occurred since 1997. Global warming does not mean that each year will necessarily be warmer than the last because of natural variability, but the long-term trend is for rising temperatures. The warmth of the last half century is unprecedented in, at least, the previous 1,300 years.



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Weather forecasts aren't always accurate a few days ahead, so how can you possibly predict what climate over the next 100 years?

Although they are made by the same sort of mathematical model, weather forecasts and climate predictions are really quite different. A weather forecast tells us what the weather (for example, temperature or rainfall) is going to be at a certain place and time over the next few days.

A climate prediction tells us about changes in the average climate, its variability and extremes. So, it might say that Somerset, in 40–60 years time, will have, on average 25% more rain in winter with three times the current number of heavy rainfall events. It not forecast that it will be raining in Somerset on the morning of 15 October 2044.

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Is climate change a bad thing?

There will be winners as well as losers. Warmer weather would allow a longer growing season in temperate latitude and reduce the need for heating. However, reduced rainfall in

tropical regions can lead to the expansion of deserts and rises in sea level would threaten low-lying coasts and islands.

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Can anything be done about climate change?

On present evidence, global warming could be slowed if emissions of methane and carbon dioxide were reduced. The main artificial sources of these gases are (a) for methane — agriculture, emissions from landfill sites and natural gas and (b) for carbon dioxide — the burning of fossil fuels, cutting down and burning trees. This may seem to be something that only governments or large organisations can tackle, but the individual can also contribute significantly by, for example, not using a car unnecessarily and recycling.

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What implications for our lives does Climate Change have?

What does it mean for the world?

Climate change will mean warmer temperatures which will change rainfall patterns, cause snow and ice to melt and affect the intensity of extreme weather such as storms and heatwaves. We have already begun to experience some of these impacts and many other knock-on effects:

- Water and food — around 1.5 billion people currently live in water-stressed regions. Climate change and population growth could increase this to seven billion by the 2050s, intensifying competition for this life-giving resource. Some areas could become more fertile; others more barren. This may lead to regional food shortages, mass migration and poverty. Malnutrition is expected to increase in developing countries. *Source: IPCC 2007*.

- Health — our well-being will be threatened by more frequent and intense heatwaves, floods, storms, wildfires and droughts. However, deaths from cold-related diseases will reduce. Patterns of disease will also change, with wide areas of the world at risk from major diseases, such as Dengue.

- Environment — coastal areas will experience more flooding from rising sea-levels, especially large river deltas which tend to be highly populated, e.g. the Nile Delta. Meanwhile, some areas will attract more tourism as their climates alter.

- Ecosystems — Amazonia is already damaged by deforestation. Climate change may magnify this impact by increasing the risk from fire. Other precious areas of high biodiversity, such as in South Africa, may see major losses of species as habitat conditions change. Around the world, some animals and plants may benefit and flourish in a changing climate, while others are likely to suffer.

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What about the UK?

Even across relatively small areas like the UK, climate change is expected to cause marked regional differences in temperature and rainfall by the end of the 21st century.

How our climate has changed:
- Central England temperatures have increased by 1 °C since 1970s.
- Total summer rainfall has decreased in most parts of the UK.
- Sea surface temperature around the UK has risen by about 0.7 °C, over the past three decades.
- The UK has experienced nine of the 10 warmest years on record since 1990.
- Sea-levels around the UK have risen 10 cm since 1900.

How our climate may change

- Under a medium emissions scenario, the annual average temperature rise by the end of the century is very likely to be more than 2 °C and less than 5 °C. The central estimate is 3.5 °C.
- Temperatures are expected to rise across the UK with more warming in summer than in winter. The summer average temperature rise in the south-east is very likely to be above 2 °C and below 6.4 °C. The central estimate is 4 °C.
- The urban heat island effect already warms central London by more than 10 °C on some nights. Increased urbanisation and release of waste heat would increase this still further — on top of the effects of global warming.
- As summers become warmer and drier droughts are more likely, particularly in the south-east. There may also be more intense downpours of summer rainfall, which could lead to flash flooding.
- The extreme heatwave of 2003, where average summer temperatures were 2 °C higher than normal, led to more than 2,000 additional deaths in the UK. Such hot summers could happen every other year by the 2040s.
- Heavier winter precipitation is expected to become more frequent, potentially causing more flooding.
- Sea-level across the UK is projected to rise between 11 and 76 cm by the end of the century. In the worst case, rises of up to 1.9 m are possible but highly unlikely.

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Will climate change mean that we will see more severe weather events?

Experts predict that fierce storms and floods, such as those that brought chaos to parts of the UK in October 2000, are likely to become more frequent in the future. Over the past 100 years, warming has been accompanied by a reduction in the frequency of frosts and an increase in the number of heatwaves in many parts of the world. The amount of rainfall is getting heavier in some countries in terms of volume per downpour.

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What will happen if we don't act to reduce emissions?

If emissions continue to grow at present rates, CO_2 concentration in the atmosphere is likely to reach twice pre-industrial levels by around 2050. Unless we limit emissions, global temperature could rise as much as 7 °C above pre-industrial temperature by the end of the century and push many of the world's great ecosystems (such as coral reefs and rainforests) to irreversible decline.

Even if global temperatures rise by only 2 °C, 20–30% of species could face extinction. We can expect to see serious effects on our environment, food and water supplies, and health.

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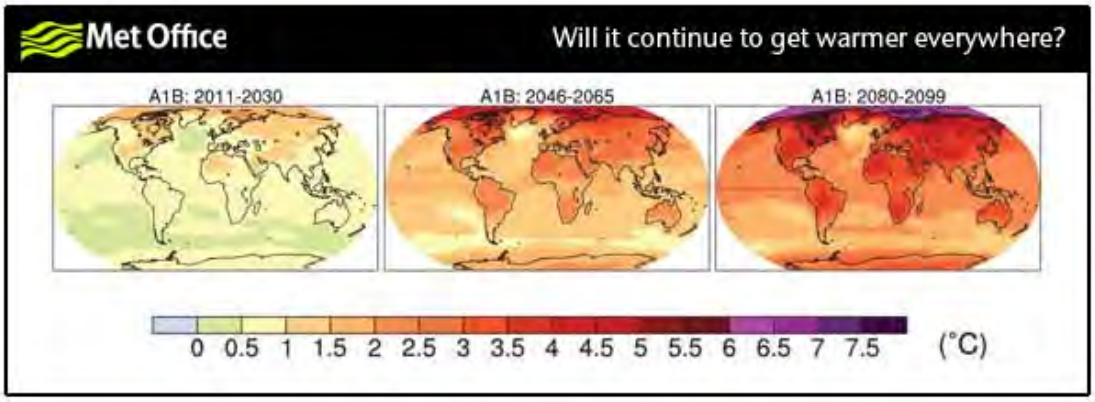
Will it get hotter everywhere?

Yes. Even if the concentrations of greenhouse gases and aerosols stabilised at the year 2000 levels then we would still expect temperatures to reach 1.4 °C above pre-industrial levels by 2100 (Source: IPCC).

Even if emissions peak in 2015 and decrease rapidly at around 3% every year after that, there may only be a 50:50 chance of keeping global temperature rise below 2 °C. Every delay of ten years in the peak emissions would add about 0.5 °C of warming.



Map showing how the world will warm by early, mid, late 21st century for a medium–high emissions scenario (courtesy of IPCC)

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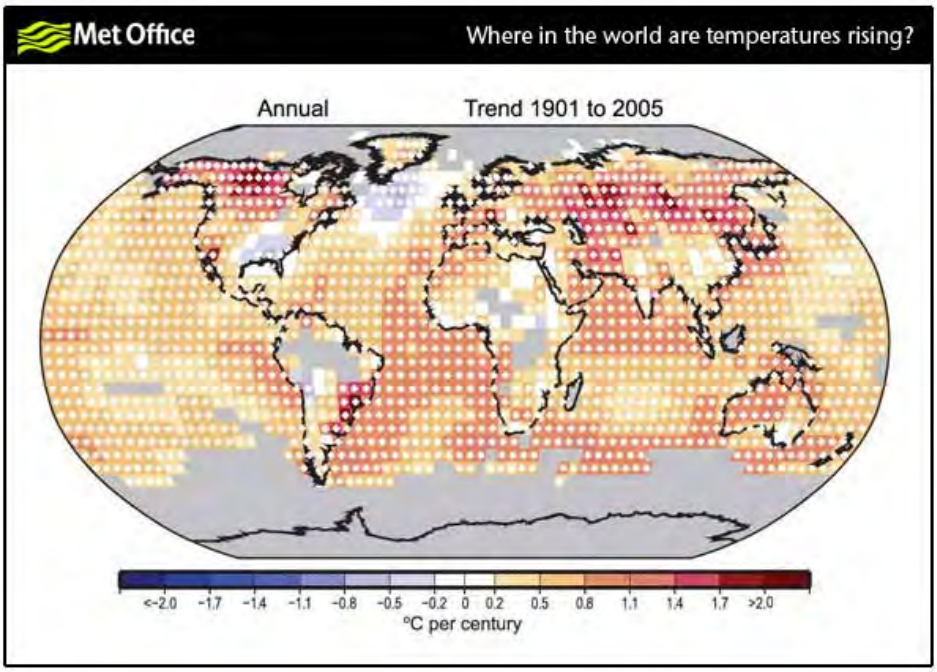
Which areas are warming the most?

In recent decades the Arctic has been heating twice as fast as the rest of the world, largely because Arctic ice, which reflects sunlight and keeps the surface cool, has decreased. In particular, summer Arctic sea-ice has shrunk by about 10% per decade since 1979. Land-ice and snow-cover have also decreased — a bigger effect in the short-term because land heats up more quickly than the sea.

The Northern Hemisphere is warming more than the Southern Hemisphere. This is because the Northern Hemisphere has more land mass, which heats faster than water.



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Why are sea-levels rising?

A warming climate raises sea-levels in two ways:

1) Thermal expansion — as water warms it expands, like liquid in a thermometer. A warming climate will heat oceans, causing sea-levels to rise.

2) Ice-melt — large amounts of water are locked in glaciers, permafrost and ice-caps around the world. Warmer weather is causing these to melt. Water from land-based ice will flow into

the oceans, raising sea-levels. Sea-levels around the UK have already risen by 10 cm since 1900 and scientists are still researching how quickly they will continue to rise.

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Will ice sheets melt with climate change?

The two major ice sheets are on Greenland and in the Antarctic. The Greenland Ice Sheet contains enough water to contribute about 7 m to sea level, and the West Antarctic ice sheet (WAIS), which is the part of the Antarctic ice sheet most vulnerable to climate change, contains about 6 m.

A sustained rise in local temperatures of about 3 °C, equivalent to a global-mean warming of about 1.5 °C, which is likely to be reached by the end of the century if man-made emissions are not controlled, would melt the Greenland Ice Sheet, although it is estimated that this would take a few thousand years. A major collapse of the WAIS is thought to be very unlikely during the 21st century, although recent measurements suggest that contributions to sea-level rise from this source may be greater than previously estimated.

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Is climate change affecting tropical cyclones?

The impact of climate change — specifically global warming caused by the burning of fossil fuels — on tropical cyclone activity is the subject of ongoing debate and research in the scientific community. Although there is no clear consensus on whether global warming is currently having any measurable impact on tropical cyclones, climate models indicate that there may be an increase in tropical cyclone intensity in the future, while tropical cyclone frequency will either remain unchanged or decrease.

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What can I do?

What's being done to tackle the problem?

Internationally, countries are negotiating a global agreement through the United Nations. The agreement aims to avoid dangerous climate change, set ambitious emission reduction targets, and encourage low carbon development — particularly supporting the poorest countries. At the same time, many governments all over the world are putting in place policies that aim to reduce emissions in their own countries. These policies include measures to increase energy efficiency in homes and businesses, and increase the use of renewable energy sources and more sustainable forms of transport. They are also working towards other adaptations necessary to cope with the changes in climate already happening.

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What's the rush?

Urgent steps need to be taken to tackle climate change. The earlier action is taken, the more effective it will be. If we want to hand on this world to our children in a fit state, we must do something about our emissions and climate change.

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Why should I make changes?

Within this century average summer temperatures in the UK are expected to rise between three and four degrees. Heatwaves, torrential rain and floods are likely to become more common; summers will get drier and winters wetter.

You can help to tackle climate change by saving water and energy, and reducing your carbon footprint.

There are also many things you can do at home to be ready for changes in the weather. You could consider some adaptations when it's time to decorate or when you're doing DIY. You

might need to get planning permission for some projects, or consult an expert before starting work.

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How can I help?

Over 40% of current CO_2 emissions are caused by the choices we make as individuals. Simple actions can save money and energy; and there are many things you can do to reduce your CO_2 emissions, from switching off electrical appliances when they are not being used to insulating your home properly and walking instead of driving one short trip a week. Find more suggestions about how you can make a difference on Act on CO_2 website.

The Met Office's Climate Change Centre has details on the actions you can take to help combat climate change.

Other useful links are DECC, the Department of Energy and Climate Change (DECC) is responsible for all aspects of UK energy policy, and for tackling global climate change and Defra, the Department for Environment, Food and Rural Affairs (Defra) is responsible for helping the country adapt to inevitable climate change.

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What can we as a congregation do?

How can we calculate our carbon footprint?

Gather information about your energy use from your fuel bills, enter the information into the carbon calculator which you can find at http://www.churchofscotland.org.uk/councils/churchsociety/downloads/csmeasurefootprint.doc and it will calculate your carbon emissions for you.

You can also calculate the impact of your car travels by using the calculator at http://www.ecocongregation.org/scotland/uploads/m13_carbon%20calculator_car%20travel.xls.

As a Church of Scotland congregation, how can we follow the instruction of the General Assembly 2009?

The deliverance agreed by the General Assembly 2009 is to *Instruct Presbyteries, in association with the Church and Society Council, to produce a plan for each congregation in their bounds, setting out how they will measure energy consumption in their church buildings, ascertain their carbon footprint and achieve a year-on-year reduction of 5% of their carbon footprint using the Eco-Congregation Scotland footprint module; and instruct the Church and Society Council, in consultation with the General Trustees, to report to the General Assembly of 2010 on the implementation of this instruction.*

- We recommend that your first step should be to work out the carbon footprint of your church buildings – the summary sheet tells you how to do this. *insert link to document*-
- Then, can you make a commitment to reduce this by 5% a year?
- If so we then suggest you contact the Energy Saving Trust for advice: www.energysavingtrust.org.uk/scotland.
- Best of all, there are eco-congregations across Scotland already developing experience of this work, so some of your neighbouring parishes may be able to advise on work they have done, how much money they have saved, and hopefully inspire you!
- At present, we are holding Presbytery meetings across the country, to offer advice and support to local congregations. For information about your local meeting, please contact your presbytery clerk or get in touch with us.

What is the average carbon footprint for a church?

There is no average carbon footprint for a church; it depends on the size, style and age of the church building, as well as the amount of time during which it is used through the week. A small church that is only used for 3 hours every Sunday will have a much smaller carbon footprint than a church that is used for community purposes every day of the week. The type of fuel used will also affect the amount of carbon emissions. There are churches with a

carbon footprint of less than 5 tons a year and others with a carbon footprint of over 200 tons.

What would be a reasonable carbon footprint for a Manse?
There are so many different sizes and styles of manses that there is no one average figure for a carbon footprint.

In order to cut our carbon footprint, should we just reduce the use of the church and church buildings?
We would urge all congregations to do nothing that compromises the mission of the Church and we certainly do not want congregations to reduce their activities. This may lead to increased fuel bills but there are examples where this can actually lead to a reduction in a local community's overall carbon footprint, by concentrating activity in one place or by reducing the need to travel.

Our carbon footprint is already very low. What can we do?
If you have already taken steps to insulate your church buildings, install efficient heating and heating controls, the next step is to think about other aspects of your congregation's carbon footprint. can you cut the carbon emissions of your home or travel or shopping? The Eco-Congregation Module 13 on Climate Change will give you more suggestions: http://www.ecocongregation.org/scotland/module13.html.

Where can we get advice and support as a church?
- *Energy Saving Trust* for advice, support and possible grant aid for churches and for your home: www.energysavingtrust.org.uk/scotland
- *General Trustees* of the Church of Scotland for advice on property management : www.churchofscotland.org.uk/extranet/xgentrustees/xgtresources.htm#energy
- *Church of England Shrinking the Footprint:* http://www.shrinkingthefootprint.cofe.anglican.org/
- *A Rocha* is a Christian nature conservation organization active in many countries around the world: www.arocha.org/int-en/index.html
- *Church Buildings Maintenance in Scotland* for detailed guidance on looking after church buildings: www.maintainyourchurch.org.uk

Are there materials to help us to link our faith to our environmental engagement?
- *Eco-Congregation Scotland* Modules are containing a range of resources for worship and practical action www.ecocongregation.org/scotland/materials.html
- *Churches Together in Britain and Ireland*, *Creationtime* resources: www.ctbi.org.uk
- *European Christian Environment Network* for resources around Europe in English and other languages www.ecen.org

Church and Society Council
Church of Scotland
121 George Street, Edinburgh, EH2 4YN
Phone: 0131 225 5722
www.churchofscotland.org.uk
Charity Number: SC011353