



CLIMATE OF COLLABORATION  
Creating strong  
partnerships

SUSTAINABLE GROWTH  
Supporting business,  
innovation and skills

FEELING FLEXIBLE  
Adapting to climate  
change

# Barometer

Issue 19 [www.metoffice.gov.uk](http://www.metoffice.gov.uk) Met Office magazine





People have always anticipated and adapted to change. Met Office Chief Scientist, Professor Julia Slingo OBE, emphasises our role in helping society prepare for and respond to changes in weather and climate.

# Change is constant

Hardly a day goes by without the weather presenting a challenge somewhere in the world and we expect these challenges to increase as our climate changes. It is the Met Office's job to make sure that society has the best possible information about today's weather and what the weather might be like in future decades so that we can prepare for whatever may come.

The real world knows no boundaries between weather and climate and nor does our science and modelling. Looking forward to the coming decades, the same science is needed to forecast the weather this winter that will help us manage climate change in years to come. At the Met Office, our strength is that we work across all timescales, from hours to decades, using a single unified system.

We provide a range of advice, from helping airports and airlines make decisions on whether to fly (see page 3), to important long-term choices on major infrastructure investments, such as whether or not it is necessary to re-build the Thames Barrier to protect London from flooding. Across all timescales, reliable information is critical so the best decisions are made to ensure safety and value for money.

Working with Government and businesses, the Met Office Climate Adaptation team is helping a range of customers adapt, invest, and reduce risks. The team interacts with industry specialists, regularly rising to the challenge of understanding the relationship between the weather and its impact on infrastructure and environmental systems (page 19).

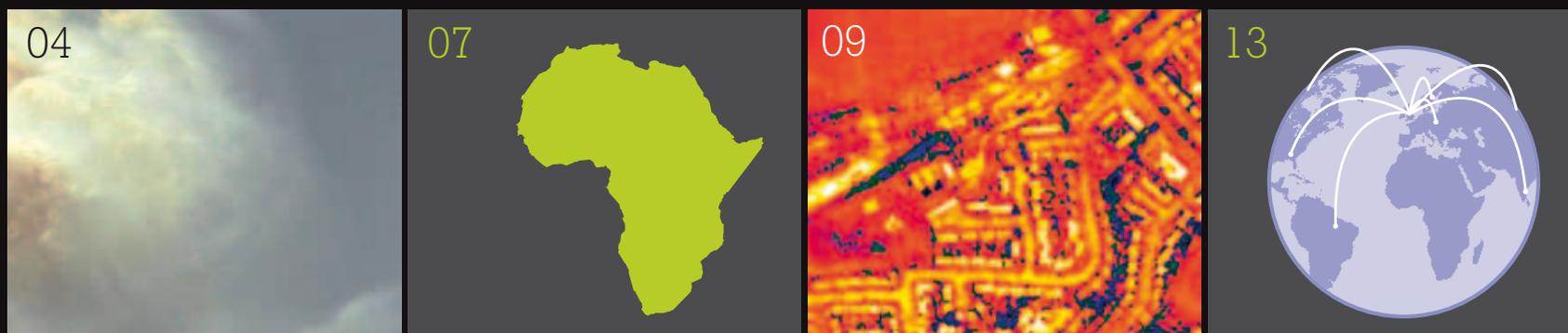
In July, the Met Office moved to the Department for Business, Innovation and Skills (BIS) (pages 17 and 18), reinforcing the link between science, services and business. The new relationship brings us even closer to other leading science organisations such as the Research Councils — particularly the Natural Environment Research Council (NERC) — with whom we already enjoy close working partnerships (see page 21).

For instance, the transition to integrated Earth System Science requires such a breadth of knowledge that we can't do it all ourselves, which is why we have established the Joint Weather and Climate Research Programme and Met Office to Academic Partnership. See pages 12-14 for a feature on Chris Gordon, Head of Science Partnerships for the Met Office.

Change is inevitable, so individuals, communities, organisations and governments must all be flexible enough to adapt. Adapting to change is a difficult challenge for many of us. We dislike it because of the disruption it can bring, but there are often chances to turn changes into opportunities. At the Met Office we'll continue to provide forecasts, science and services to make sure that society is best prepared to adapt to our changing weather and climate, and to realise the opportunities that this knowledge can deliver.

➔ **Barometer** is now available online at [www.metoffice.gov.uk/barometer](http://www.metoffice.gov.uk/barometer)

# In this issue



## News and updates

### 03 In brief

Combating winter delays  
Route-based forecasting  
Setting science in context

### 04 Key weather events

Topsy turvy temperatures

### 21 A climate of collaboration

## Features

### 05 Keeping well this winter

Providing cold weather alerts

### 07 Saving lives on Lake Victoria

Setting up a Mobile Weather Alert Service in Africa

### 09 A hot phenomenon

Understanding urban microclimates

## 15 Biodiversity benchmark

Our commitment to the environment

## 17 Helping the UK to flourish

Supporting the Department for Business, Innovation and Skills (BIS)

## People

### 12 Our people

Chris Gordon — the power of working together

### 20 Science profile

Hazel Thornton

### 22 Celebrity weather

Dallas Campbell

## Science

### 19 Science focus

Adapting to climate variability and change

*Barometer* is a controlled circulation magazine distributed free of charge to decision-makers in government, science and commerce, for whom weather and climate information has an impact.

Product information is correct at the time of publication but may be subject to change.

The *Barometer* back catalogue is available online at [www.metoffice.gov.uk](http://www.metoffice.gov.uk) where readers can also complete a subscription form.

Cover photo: Alamy

For queries about *Barometer* contact  
**Jon Stanford**, Met Office, FitzRoy Road, Exeter, Devon, EX1 3PB, UK

For any queries about Met Office products or services, contact our Customer Centre (24 hrs):

[enquiries@metoffice.gov.uk](mailto:enquiries@metoffice.gov.uk)

Tel: 0870 900 0100

Fax: 0870 900 5050

From outside the UK:

Tel: +44 (0)1392 885680

Fax: +44 (0)1392 885681

[www.metoffice.gov.uk](http://www.metoffice.gov.uk)

© Crown copyright 2011 11/0365  
Met Office and the Met Office logo are registered trademarks



## Combating winter delays

This winter, we're working closely with some of the world's leading airlines and airports to help them run their operations safely and smoothly, save money and reduce delays.

Keeping runways open in severe weather is a huge challenge. By using OpenRunway® from the Met Office, airports are able to plan ahead to reduce the negative impacts of weather on their operations. For example, the airport company BAA uses OpenRunway to help keep runways open for trouble-free departures and arrivals.

During cold weather, ice can form on aircraft wings presenting a serious danger to aircraft safety. Our Aircraft De-icing Service is proven to give accurate forecasts of icing up to

five days ahead. The airline bmi has benefited from our De-icing Service by reducing unnecessary aircraft de-icing costs and related delays.

Now, the Met Office has developed WeatherWindows, a new online tasked-based planning tool for airports. It enables decision-makers to plan weather-dependent tasks up to 15 days ahead. So, whatever the weather throws at us this winter, we're on hand to help airports and airlines stay on schedule.

## Route-based forecasting

Heavy rain, snow and ice can result in dangerous conditions, particularly on the roads. Our route-based forecasts are helping those responsible for managing the UK road network to optimise their winter maintenance activities to keep road users safe.

Every winter, we contribute to keeping the country moving by providing accurate forecasts and warnings. To limit the impact on the travelling public, it's vital that road maintenance decision-makers have warnings of hazards like ice so they can apply precautionary treatment, such as salting the roads.

This year, our route-based forecasts are providing considerable benefits since they became operational in October as part of our OpenRoad forecast package. Now, winter maintenance operatives can determine much more

accurately which sections of road need gritting. This means they can selectively treat routes, or segments of routes, in order to manage salt supplies more effectively, operate more efficiently, and reduce costs without compromising safety.



## Setting science in context

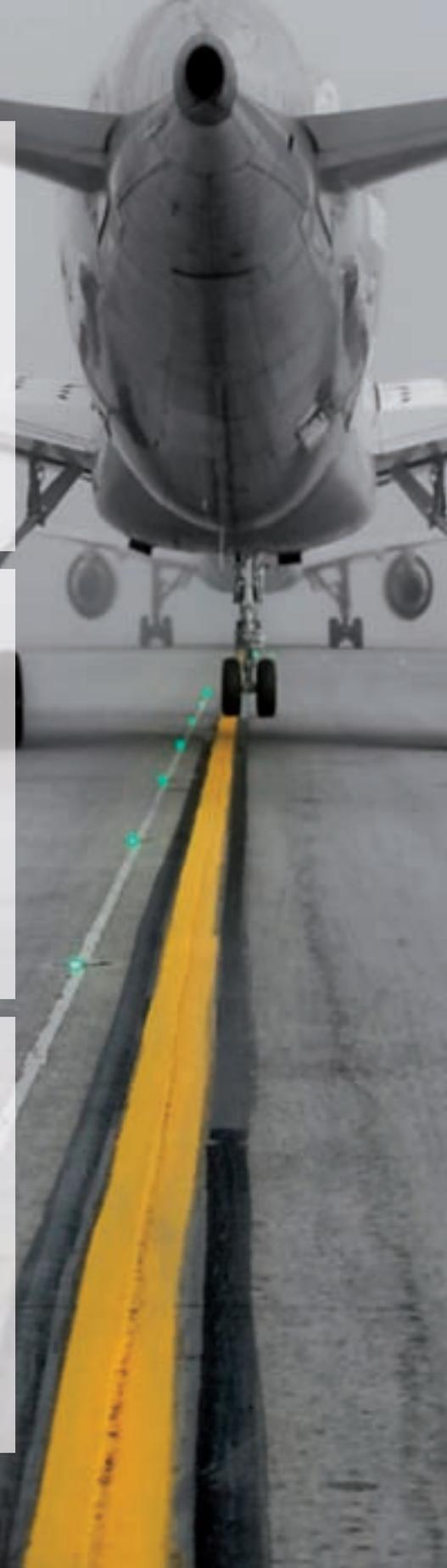
Working with the Department of Energy and Climate Change (DECC) we analysed observations and evaluated the impacts of climate change on different countries around the world for the United Nations annual conference of the parties (COP) held in Durban, South Africa earlier this month.

Preparing the reports drew on experience across the Met Office Hadley Centre, looking at historic changes in regional climate extremes and future change in global and regional climate change and impacts.

The work required extensive international engagement as stakeholders from the various countries contributed to the scientific reports. Observational data was supplied by some of the countries while scientific experts provided input to the study of impacts and helped to review the reports.

Closer to home, the work involved collaborating with the Walker Institute for Climate Change Research to look at the potential effects of climate change on impacts such as water availability, crops and flooding, and with the University of Southampton on coastal impacts.

Following COP, a series of factsheets based on these reports will help to communicate the results more widely. The novel scientific findings from the study will also be published in scientific journals.



# Topsy turvy temperatures

With a fairly cool summer followed by a sunny spell in October that produced new record temperatures, you could be forgiven for thinking that things were back to front.

After a generally fine, warm start to July, the weather became unsettled, cool with heavy, sometimes prolonged showers across northern areas. A brief settled period was followed by more cool, unsettled conditions. The last week saw higher temperatures and drier weather, but still with plenty of cloud.

Overall, mean temperatures ranged from about 1 °C below average over England and Wales to about 0.5 °C below over Scotland. Several chilly nights made it the coldest July across the UK since 1980.

Rainfall was close to average but with significant regional variation. Sunshine was generally close to or below average, especially across parts of southern England, but it was sunnier than normal over Northern Ireland and south-west Scotland.

Heavy rain in early August led to flooding across Scotland, particularly in Aberdeenshire, which disrupted both road and rail transport. We worked with the Scottish Environment Protection Agency (SEPA) through the Scottish Flood Forecasting Service to advise emergency responders in Scotland. Met Office Public Weather Service Advisors supported Scotland's Strategic Co-ordinating and Tactical Groups and also briefed ministers in the Scottish Government Cabinet Sub-Committee.

August was another cool month with cloud cover keeping daytime temperatures down. Mean temperatures ranged from about 0.3 °C below the average over eastern England and the Midlands to about 0.8 °C below over Northern Ireland, much of Scotland and parts of western England and Wales.

It was the coolest August since 1993 across Scotland and Northern Ireland, but similar to August 2010 across England and Wales. Rainfall was highly

variable, but it was a dull month everywhere, with sunshine totals around 75% of normal.

Changeable weather in September brought showers and longer spells of rain, especially in the North West. The mean temperature was 1.5 °C above the average, bringing the warmest September since 2006 and the equal sixth warmest in the last 100 years.

In mid-September, an area of low pressure containing the remnants of Tropical Storm Katia brought stormy weather to the UK. The storm left its mark, damaging property with wind speeds of up to 80 miles per hour in northern and western parts of the UK.

In many areas, September ended with warm sunshine which continued into October. There were exceptionally high temperatures for the time of year with a new record temperature for October of 29.9 °C, recorded at Gravesend in Kent on 1 October.



Photo: PA Photos

It just beat the previous record of 29.4 °C recorded at March in Cambridgeshire, which had stood since 1 October 1985. Wales also had a new national record of 28.2 °C recorded at Hawarden, Flintshire.

The new records came at the end of an increasingly hot week across many parts of the UK, which made it feel like things were a bit topsy turvy. The high temperatures made the end of September and start of October feel much more like summer than July and August.



Photo: North News & Pictures

# Keeping well this winter

The Met Office is working in partnership with the Department of Health and the Health Protection Agency to provide cold weather alerts.

There's a strong link between weather and health, especially when it's cold. Older people are especially vulnerable in cold weather, so this year we're working closely with Age UK, providing the charity with Cold Weather Alerts so it can help keep people well this winter as part of its 'Spread the Warmth' campaign.



## Cold weather alerts

A Cold Weather Health Watch system operates in England from 1 November to 31 March every year, in association with the Department of Health. Met Office alerts are sent to NHS Trusts in England and are also available on our website and via other media.

We developed the alerts with the Department of Health and the Health Protection Agency to pinpoint when winter weather will impact on people's health. Alerts are issued if mean temperatures are below 2 °C for 48 hours or longer, if there is heavy snow or widespread ice.

## Reducing hospital admissions

People with Chronic Obstructive Pulmonary Disease (COPD) have a significantly increased risk of ill-health during cold weather and high levels of circulating respiratory infections.

Our forecast alert service, Healthy Outlook® helps people with COPD stay well and out of hospital. Healthy Outlook® provides a phone call, warning people when the weather or high levels of circulating respiratory infections are likely to put their health at risk.

By reducing hospital admissions, Healthy Outlook® saves lives and money. It is commissioned by Primary Care Trusts and Health Boards across the UK with case studies showing a consistent 20% reduction in hospital admissions.

## Level 1 – Green

**Winter preparedness and long-term planning**  
This is the minimum state of vigilance during winter. Social and healthcare services ensure that there is ongoing awareness and preparedness.

## Level 2 – Yellow

**Alert and readiness**  
Triggered as soon as the risk is 60% or above for any of the three thresholds to be breached. This is an important stage for social and healthcare services which work to ensure readiness and swift action to reduce harm from a potential period of cold weather.

## Level 3 – Amber

**Cold weather action**  
Triggered when weather breaches any of the three thresholds (mean temperatures below 2 °C for 48 hours or longer, heavy snow or widespread ice). This stage requires social and healthcare services to target specific actions at high-risk groups.

## Level 4 – Red

**Emergency**  
Reached when weather is so severe and or prolonged that its effects extend outside the health and social care system. This warning is issued on advice from, or in collaboration with, our Government partners. At this level, illness and death can occur among the fit and healthy, not just high-risk groups and co-ordination across multiple agencies is needed.

➔ For more information about how cold weather can affect your health please visit [www.nhs.uk](http://www.nhs.uk)



# The cold is more **dangerous** than you think...

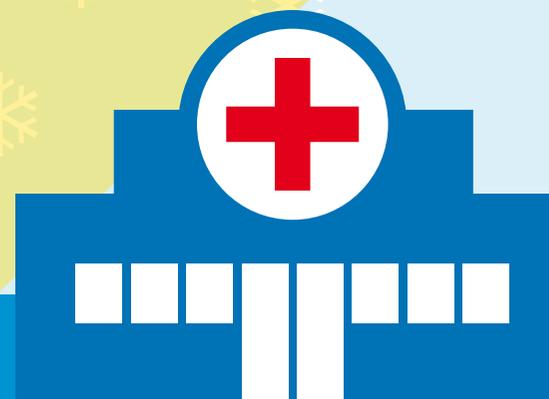
There are 27,000 extra deaths each year as a result of cold weather.

Last year was the coldest December on record. In some areas temperatures fell as low as  $-10^{\circ}\text{C}$  and  $-20^{\circ}\text{C}$  overnight.

For every  $1^{\circ}\text{C}$  decrease in average winter temperature there are approximately 8,000 extra deaths.

## However

Healthy Outlook<sup>®</sup> provides support for thousands of people with COPD and reduced hospital admissions by 20% last winter.



The Met Office has a long-standing commitment to help developing countries improve their meteorological services. Recently, we supported an effort led by the World Meteorological Organization (WMO), with the Uganda Department of Meteorology and global telecommunications company Ericsson, to set up a Mobile Weather Alert service on Lake Victoria, Africa — and help protect the lives of the people who depend on this huge stretch of water for their livelihoods.

# Saving lives



Most people associate lakes with placid waters — but this is not always the case, as the 200,000 fishermen on Lake Victoria can testify. Bordering Uganda, Kenya and Tanzania, Lake Victoria is the size of Ireland, making it large enough to create its own weather. Conditions can change suddenly, with winds quickly whipping up six-foot waves that can capsize ferries and fishing boats. Many lives are lost each year on the lake so the Met Office has helped set-up the Mobile Weather Alert Service, launched in May 2011, to help fishermen avoid dangerous weather conditions.

### Bringing life-saving forecasting to the region

Through this service, forecasters at the Uganda Department of Meteorology have adopted the Met Office system

**A system that works for everyone** Tom and Paul worked with the project partners to devise an alert system that built on the Met Office's long experience of issuing tailored severe weather warnings to a variety of user communities in the UK. To support the project on an ongoing basis, the Met Office has set up a 4 km resolution weather forecast model over Lake Victoria. This helps to capture more accurate information about the local weather conditions. It was a necessary step, as Tom explains:

“A lot of the weather patterns on the lake happen on quite a small scale and are driven by the difference in temperature between the lake's water and the surrounding land. You get warm moist air at night, rising above

Rescue. It was especially vital to use Lake Rescue's links with the community of fishermen. As Tom puts it, “Even if you have a neat technical solution, you can't assume it's going to work”.

With Lake Rescue and Paul's help, and feedback from the fishermen, colleagues from the Uganda Department of Meteorology adopted a meaningful way of conveying the alert messages: a traffic light system. It's an elegantly simple solution created by the Met Office that gets around any literacy issues, with each colour representing forecast, hazard rating and advice, all in one.

For example, green means winds of less than five knots and no significant weather conditions predicted, a

that triggered an alert,” recounts Paul. “We worked closely with the Uganda Department of Meteorology to forecast, and later alert fishermen of, an enhanced risk of damaging winds over the lake. This is a partnership that works extremely well in real-time,” he adds.

Looking to the future, the WMO and Met Office want to extend the project across Lake Victoria. “We're hoping to go from 1,000 subscribers to 200,000,” says Tom. It's a great leap in numbers, but as far as the locals are concerned, it will also be a great leap forward in safety and peace of mind.

# on Lake Victoria



of colour-coded weather warnings. Text messages are sent to the mobile phones of local fishermen, giving them the opportunity to plan their day and take appropriate action if conditions look too rough. Before its launch there were no forecasting services relevant to fishermen in the region, making access to weather information — and therefore forward planning — incredibly difficult.

The project was led by the WMO and its Development and Regional Activities Department, to which Tom Butcher, External Relations Manager at the Met Office, was seconded for a year working on a range of initiatives including the Mobile Weather Alert Project. To help take the Lake Victoria project from concept to reality, he also drew on the vital expertise of people within the Met Office, including Chief Forecaster, Paul Davies.

the lake and sucking in colder air from over the land surface — a convective process that creates a lot of storms.”

The next step involved working in partnership with the forecasters at the Uganda Department of Meteorology. Paul worked with them to understand where the gaps were in the forecast process — and advised on changes to improve the way they were producing forecasts.

To truly help the local community, however, the project had to look beyond weather. As Tom explains, “Safety on the lake is a compound problem that requires a compound solution. You need to be working on it from several different angles in order to have a genuine impact.”

This is why the project pulled together expertise from several different bodies, including a Ugandan-based Lake

very low hazard threshold, and ‘nil’ advice. Whereas red means a high likelihood of winds over 20 knots, or severe thunderstorms, a high hazard threshold, and advice to ‘take action’.

### An enthusiastic reception

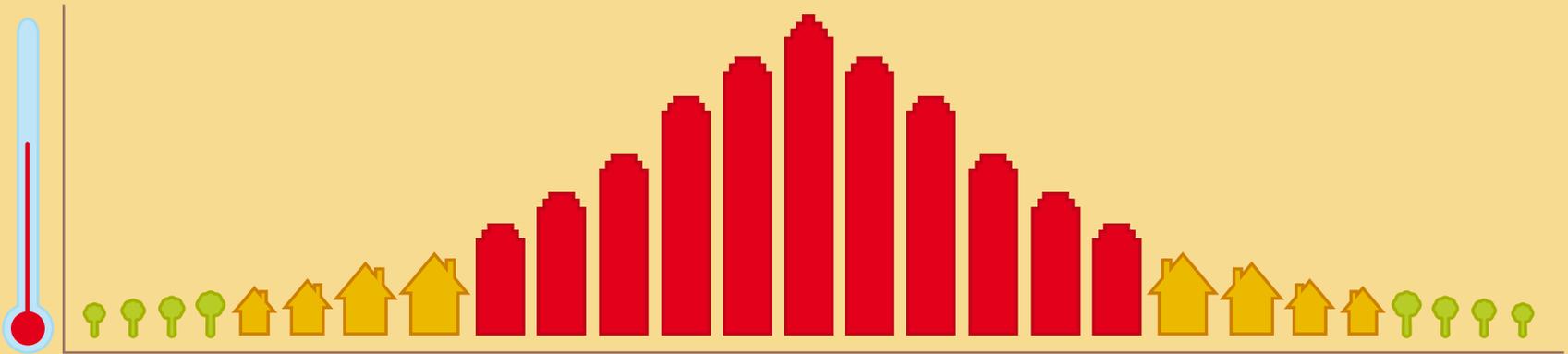
To roll out the pilot, Tom led a training workshop for the local fishermen, together with his colleagues from the WMO, the Uganda Department of Meteorology, Ericsson and Lake Rescue. They trained 20 people in how to interpret the weather alert messages and what appropriate action to take. They also advised them on how to pass on this knowledge to other fishermen.

The reception of the project was highly enthusiastic. Within a few weeks those 20 fishermen had recruited over 1,000 people to take part in the pilot. What's more, it turned out to be a tool that really is saving lives.

“There was a windstorm back in June



“We provide scientific evidence so the decision makers can go away and weigh up the costs against the various impacts, adaptations and strategies”



# A hot phenomenon

The world is warming and more people live in cities than ever before. While these two facts might seem completely unrelated, they have an important connection due to a phenomenon called the urban heat island. The Met Office is working to better understand urban microclimates and how they affect city-dwellers around the world.

Between 1806 and 1830, a scientist called Luke Howard researched and published a paper demonstrating that London was warmer than its surrounding areas. He had identified a phenomenon known as the urban heat island — something which is now receiving special focus from the Met Office’s Climate Impact Research team. Dr Mark McCarthy is one of the team’s climate scientists studying the cumulative impacts of increasing temperatures and urban growth — and how it might affect the lives of people today and in the future.

## Hot in the city

Put simply, an urban heat island is a man-made area that’s significantly warmer than the surrounding countryside — especially at night. Heat islands exist because the urban land surface, made up of materials like tarmac and stone, absorb and store heat. That, coupled with concentrated energy use and less ventilation than in rural areas, creates a heating effect. Or, to put it in Mark’s words: “You can visualise a heat island as a ‘warm island’ in a ‘cool sea’ of the surrounding natural environment.”

As a general rule, urban areas are warmer than their surroundings — but not always. During the daytime some towns and cities, particularly in arid climates are cooler because the buildings keep the Sun away from street level and are built from materials that don’t warm up as rapidly as the surrounding desert.

But for many cities, the additional heat might sometimes cause problems. In Europe, for example, the 2003 heatwave (recorded as the hottest summer on record) is estimated to have resulted in an extra 35,000 deaths, many of them in major towns and cities, but it is yet to be determined what contribution the urban heat island might have played.

Conversely, the heat island can also keep cities warmer in winter and reduce heating costs providing the residents with a potential benefit. As the world becomes increasingly urbanised, more people will become vulnerable to changes in climate, and the extreme weather events it brings, such as heatwaves and hot summer spells. As Mark says, “Even where >



## Advising governments around the world

Mark and the Met Office's Climate Impact Research team are actively contributing to the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5). The report is a body of evidence created by thousands of authors from the international climate community. It provides a comprehensive synopsis of climate science. It's the objective, scientific evidence that global governments sign up to and use in the discussions for climate mitigation strategies.

The AR5 will, for the first time, include a chapter that specifically considers climate impacts and adaptation in urban areas. The Met Office is one of only two climate

modelling centres to directly include urban areas within its climate model experiments that have been provided for assessment in the IPCC Fifth Assessment Report (the other is the National Center for Atmospheric Research (NCAR) in the US).

One of the Met Office's key findings is that urban areas don't necessarily warm at the same rate as rural ones in response to a changing climate — some could warm slightly less, and some slightly more. It is however, still work in progress, with the ultimate aim of better defining how the 21st Century urban landscape will shape our exposure to climate change.

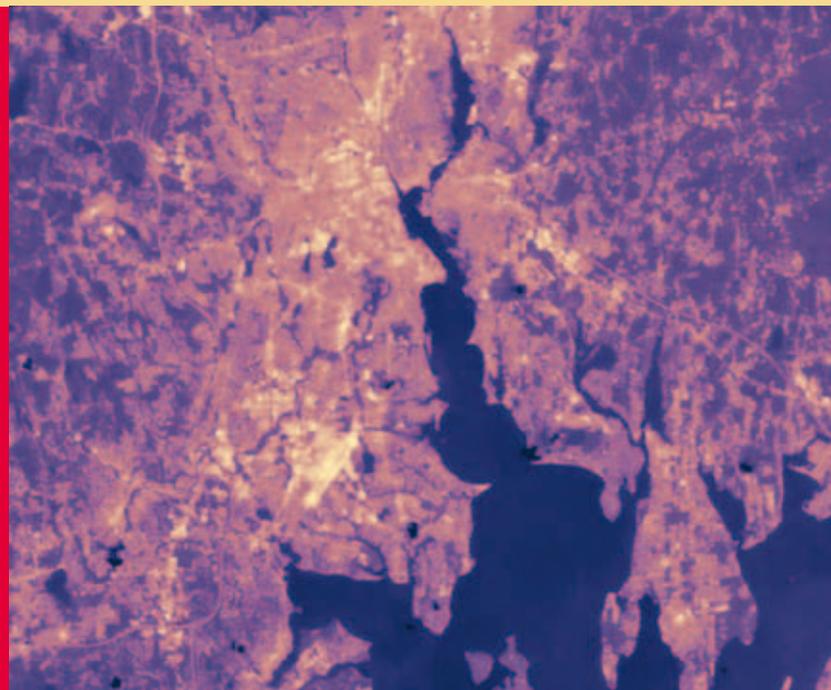


Photo: NASA

urban heat islands are not a major problem now, they could exacerbate some of the impacts of a changing climate.”

### Adapting to change

Mark believes that it's not too soon to have a strategy for managing the affects of urban heat islands, and societies have been doing so for centuries. For example, one need only compare the traditional architecture of Mediterranean towns designed to help people stay comfortable in the heat, with those from Northern Europe.

“It's important to start thinking about the future and how we might adapt for climate change or offset some of its impacts — especially in the cities that haven't been built yet. But, in doing so, make sure we also don't remove any of the potential benefits the urban microclimate can provide.”

Mark and the team look at possible future scenarios such as how existing settlements might grow or where new

ones might be built — and then analyse the possible consequences they will face.

These projects include interdisciplinary collaborations with other scientists and academics. In fact, they bring together various disciplines including climate research, the built environment and social and health sectors. These projects provide information for governments, the world over.

“We provide scientific evidence so the decision-makers can go away and weigh up the costs against the various impacts, adaptations and strategies,” says Mark.

Managing the urban microclimate can influence many areas of urban planning. For example, city planners could insist on new buildings being designed to maintain consistent temperatures indoors. Or investments could be made into green infrastructure, as more vegetation and trees can actually cool cities down.

However governments choose to tackle this problem in the future, one thing is for certain: they will be looking for maximum benefit for minimum cost — which makes the need for accurate and insightful data even more acute.

Mark and his team are doing fantastic things to understand how climate change may impact the urban microclimate, but the challenge is highly complicated and relies on action being taken by a broad range of parties.

Mark concludes, “Most cities are expected to get warmer, and it's our job to provide the right information to governments — in the UK and around the world — so they can take action to ensure our towns and cities are comfortable and safe places to live, both now and in the future.”

For **Chris Gordon**, Head of Science Partnerships at the Met Office, successful weather and climate science is increasingly about collaboration. It's his role to develop and manage the relationships the Met Office has with other leading organisations in the UK and around the globe – relationships that have, in many cases, led to genuine leaps forward in scientific capability.

# The power of working together



The Scientific Partnerships team aims to build relationships with world-leading organisations, developing scientific collaborations that deliver powerful results.

One such collaboration is with the Natural Environment Research Council (NERC). It commissions a large amount of climate and weather research in the UK and – while Met Office scientists have worked with its scientists for many years – there existed the opportunity to collaborate more strategically. With this objective in mind, the Joint Weather and Climate Research Programme (JWCRP) was formed in 2009.

“When we talk of strategic collaborations, we’re referring to the Met Office partnering with other organisations in a programmed context, rather than just individual scientists working together,” says Chris.

Today, under the JWCRP, the Met Office and NERC commission and manage a variety of projects, including a high performance computer for collaborative research (known as MONSooN), an aircraft used for airborne observations, and a range of projects concerned with evaluating and improving weather and climate models.

## Building relationships

The collaboration with NERC focuses primarily on the development of large national science capability, but not all Met Office relationships work this way. The Met Office Academic Partnership is a new initiative for which the Met Office has jointly created professorships at the universities of Reading, Exeter and Leeds (each of which are considered to be leading institutions in weather and climate science). The academics work closely with Met Office scientists on

common research themes, to advance weather and climate science and predictions.

“This scheme was initiated by the Met Office’s Chief Executive and Chief Scientist in consultation with the universities’ Vice Chancellors. The initiative has paid off – within a year, the scheme is already proving very successful.”

## Reaching further

As an internationally renowned organisation, it’s natural for the Met Office’s collaborations to reach beyond the UK. For example, the Met Office’s Unified Model – considered to be one of the world’s best weather and climate modelling systems – is now being used by other operational centres around the world. In fact, over the last five years, nations such as South Korea, Norway, New Zealand, Australia and India have adopted the model as part of their own in-country weather forecasting and, in some cases, climate modelling activities.

The model develops as it’s used in each country and information on model performance and changes to the underlying code are fed back to

the Met Office, which ultimately helps improve the system as a whole.

As Chris explains: “Clearly, running the Met Office Unified Model collaborations, and ensuring the benefits are orchestrated to the benefit of all, is a very major science management undertaking.”

## Planning ahead

There are more projects in the pipeline for Chris – as he helps develop future relationships as well as nurturing those that already exist. There is a joint seasonal forecasting system with South Korea due to launch next year, for example. Two joint workshops with China are also being planned for later this year and early in 2012.

But these are all projects Chris embraces wholeheartedly; he finds working with experienced people at the leading edge of their field, very rewarding. He especially enjoys the way in which collaborations provide a wider discussion forum on key issues around weather forecasting and climate research. >

**UNITED STATES**

National Center for Atmospheric Research, Colorado  
 National Aeronautics and Space Administration, California  
 National Oceanic and Atmospheric Administration, Maryland  
 Johns Hopkins University, Maryland  
 University of Maryland Science Systems and Applications, Maryland  
 Colorado State University  
 Naval Research Laboratory, California  
 California Institute of Technology  
 Lawrence Livermore National Laboratory, California  
 University of California, Los Angeles  
 University of Colorado  
 University of Washington  
 George Mason University, Virginia  
 Los Alamos National Laboratory, New Mexico  
 NOAA National Center for Environmental Prediction, Maryland  
 Pacific Northwest National Laboratory, Washington  
 University of California San Diego, California  
 University Corporation for Atmospheric Research, Colorado  
 University of Hawaii  
 University of Maryland  
 University of Miami, Florida  
 Columbia University, New York  
 Cooperative Institute for Climate and Satellites, Maryland  
 Center for Ocean-Land-Atmosphere Studies, Virginia  
 Harvard University, Boston  
 Health and Climate Foundation, Washington  
 NOAA Earth System Research Laboratory, Colorado  
 Oregon State University  
 Princeton University, New Jersey  
 University of California, Berkeley  
 University of Utah  
 University of Wisconsin  
 Yale University, Connecticut

**UNITED KINGDOM**

University of Reading  
 University of Leeds  
 European Centre for Medium-Range Forecasts, Reading  
 University of East Anglia, Norwich  
 University of Cambridge  
 University of Exeter  
 University of Oxford Imperial College, London  
 Centre for Ecology and Hydrology, Wallingford  
 University of Bristol  
 University of Edinburgh  
 University of Manchester  
 Kings College London  
 National Oceanography Centre, Southampton  
 University of Aberdeen  
 University of Lancaster  
 University of Sheffield  
 Rothamsted Research, Harpenden  
 University College London  
 Institute for Animal Health, Pirbright  
 Joint Centre for Hydro-Meteorological Research, Wallingford  
 Macaulay Land Use Research Institute, Aberdeen  
 Proudman Oceanographic Laboratory, Liverpool  
 RD Scientific, Newbury  
 University of Southampton  
 University of St Andrews  
 University of Sunderland

**CANADA**

Environment Canada, Fredericton  
 University of Toronto  
 University of Victoria  
 McGill University, Quebec  
 Canadian Center for Climate Modelling and Analysis, Victoria  
 University of Western Ontario





<b>GERMANY</b>	<ul style="list-style-type: none"> <li>Max Plank Institute for Meteorology, Hamburg</li> <li>Deutsche Zentrum für Luft und Raumfahrt, Cologne</li> <li>Max Plank Institute for Chemistry, Mainz</li> <li>Institute for Atmospheric Physics, Oberpfaffenhofen</li> <li>Forschungszentrum Jülich</li> <li>Leibniz-Centre for Agricultural Landscape Research, Munchenberg</li> <li>University of Bonn</li> <li>University of Giessen</li> <li>European Organization for the Exploitation of Meteorological Satellites, Darmstadt</li> </ul>
<b>SWEDEN</b>	<ul style="list-style-type: none"> <li>Lulea University of Technology</li> <li>Swedish Meteorological and Hydrological Institute, Norrköping</li> <li>Stockholm University</li> <li>Lund University</li> <li>University of Stockholm</li> </ul>
<b>SWITZERLAND</b>	<ul style="list-style-type: none"> <li>Swiss Federal Institute of Technology, Zurich</li> <li>World Radiation Center, Davos</li> <li>Swiss Federal Institute of Technology, Zurich</li> <li>University of Bern</li> <li>Meteo-Swiss, Locarno</li> <li>Physical-Meteorological Observatory, Davos</li> <li>World Meteorological Organization, Geneva</li> </ul>
<b>FRANCE</b>	<ul style="list-style-type: none"> <li>Météo-France, Paris</li> <li>UPMC, Paris</li> <li>University of Paris</li> <li>University of Toulouse</li> <li>Centre National de Recherche Meteorologiques, Toulouse</li> <li>Centre National de la Recherche Scientifique, Toulouse</li> <li>Université de Versailles Saint-Quentin-en-Yvelines, Versailles</li> </ul>
<b>JAPAN</b>	<ul style="list-style-type: none"> <li>Japan Agency for Marine-Earth Science and Technology, Yokosuka</li> <li>National Institute for Environmental Studies, Tsukuba-City</li> <li>Japan Meteorological Agency, Tokyo</li> <li>Meteorological Research Institute, Tsukuba-City</li> <li>University of Tokyo</li> </ul>
<b>CHINA</b>	<ul style="list-style-type: none"> <li>Chinese Academy of Sciences, Beijing</li> <li>Centre National Research Meteorology, Beijing</li> </ul>
<b>INDIA</b>	<ul style="list-style-type: none"> <li>National Institute Oceanography, Panaji</li> <li>Space Physics Laboratory Kerala</li> </ul>
<b>NEW ZEALAND</b>	<ul style="list-style-type: none"> <li>National Institute of Water and Atmospheric Research, Wellington</li> <li>Bodeker Scientific, Otago</li> </ul>
<b>AUSTRALIA</b>	<ul style="list-style-type: none"> <li>Centre for Australian Weather and Climate Research, Melbourne</li> <li>Commonwealth Scientific and Research Organization, Tasmania</li> <li>Bureau of Meteorology, Melbourne</li> </ul>
<b>ITALY</b>	<ul style="list-style-type: none"> <li>University of Aquila</li> <li>Istituto Nazionale di Geofisica e Vulcanologia, Palermo</li> </ul>
<b>BRAZIL</b>	<ul style="list-style-type: none"> <li>National Institute Space Research, Sao Jose Dos Campos</li> <li>Centre Weather Forecasting and Climate Studies, Sao Paulo</li> <li>University of Sao Paulo</li> </ul>



# Biodiversity benchmark

Biodiversity management has been an important part of Met Office life since 2007 when a small group of volunteer staff got together to make a difference. Since then, things have really grown and in July 2011 the Met Office's headquarters in Exeter was awarded the Wildlife Trusts' prestigious Biodiversity Benchmark Award.

To date, only 15 companies in the UK have attained the Biodiversity Benchmark Award, meeting the rigorous standards set by the Wildlife Trusts. Of these, the Met Office is the only public sector organisation leading the way, integrating environmental considerations into our day to day operations.

As Neal Pearce, Met Office Environmental Advisor explains: "The key to getting this recognition has been recognising and encouraging biodiversity around our headquarters. We've worked just as hard inside the organisation too, making sure that the environment is taken into account in the decisions

we make every day. So much so, biodiversity is now fully integrated into our management systems."

Work started in 2007 when some Met Office staff in Exeter volunteered to clear an area of invasive weeds and establish a wildflower meadow. With a combination of meadow stewardship and selective planting of native wildflowers — which the volunteers grew from seed at home — the site's biodiversity quickly improved and the wildflower meadow was extended. Man-made creature habitats such as bee hives have since been added, along with nesting boxes for swifts, which have been installed as part of a regional project supported by the RSPB and Devon Wildlife Trust.



**2008** two species of orchid



**2009** butterflies, moths and other insects, including the rare wasp spider



**2009** two more species of orchid



Peter Burgess, Devon Wildlife Trust's Wildlife Advocacy Manager describes how the Devon Wildlife Trust and the Met Office are developing a partnership building on the existing work:

"The Met Office grounds will showcase how wildlife-rich habitats can be incorporated into a busy working environment. Staff and visitors alike will benefit from closer engagement and appreciation of the stunning displays native wildlife can provide. A comprehensive five-year Biodiversity Enhancement Plan will be produced to identify new and exciting projects which will be delivered in conjunction with the Exeter Wild City project. As a link between rural

and urban environments, the Met Office occupies an important location. By enhancing the grounds, wildlife can move more freely and adapt to a changing climate."

The work of our volunteer staff was formalised in 2010/11 with specific sustainability objectives based on biodiversity management. We also set up a Biodiversity Working Group to pool staff ideas and continue to make a difference. We're now introducing similar projects to enhance the biodiversity performance across all our sites, sharing best practice and widening our commitment to biodiversity management.

Neal concludes: "This standard is very tough to achieve and maintain as it requires the grounds of our headquarters to be managed to a very high level. The Award reflects the Met Office's commitment to minimise our impacts on the environment and promote biodiversity. We're now working to make sure that our other sites meet the same very high standard."



**2011** rare 'Maiden Pink' wildflower — a nationally scarce species



**BIS**Department for  
Business Innovation  
& Skills

# Helping the UK to flourish



This year marks the beginning of an important relationship between the Met Office and the Department for Business, Innovation and Skills (BIS). That's because on 18 July 2011, the Prime Minister announced that responsibility for the Met Office would pass to BIS.

Almost everything that BIS does — from investing in skills to boosting innovation — helps drive UK growth. With world-leading science and innovation at the very heart of the Met Office, the move is a fantastic opportunity to create a centre of excellence for science that will support BIS's long-term goals. “The Met Office is a real jewel in the British crown of science and our job is to help it move forward to greater things,” says Martin Donnelly, BIS's Permanent Secretary.

The Met Office is now a Trading Fund within BIS, which means it operates on a commercial basis and meets agreed targets. Even though this means the Met Office is working in a challenging environment, with less money to go round, Martin is highly confident about its future.

“The Met Office generates nearly one in five of every pound it spends from commercial sources. It is in a great position to go on flourishing and help BIS with our wider mission, to support UK growth and jobs,” says Martin.

The Met Office will continue providing vital world-leading weather and climate services to the public, businesses, government and the Armed Forces.

As Martin says, BIS will be there to support its work, and help to find other ways to develop the Met Office, to help it remain a successful Trading Fund in the future.

#### Increasing knowledge sharing

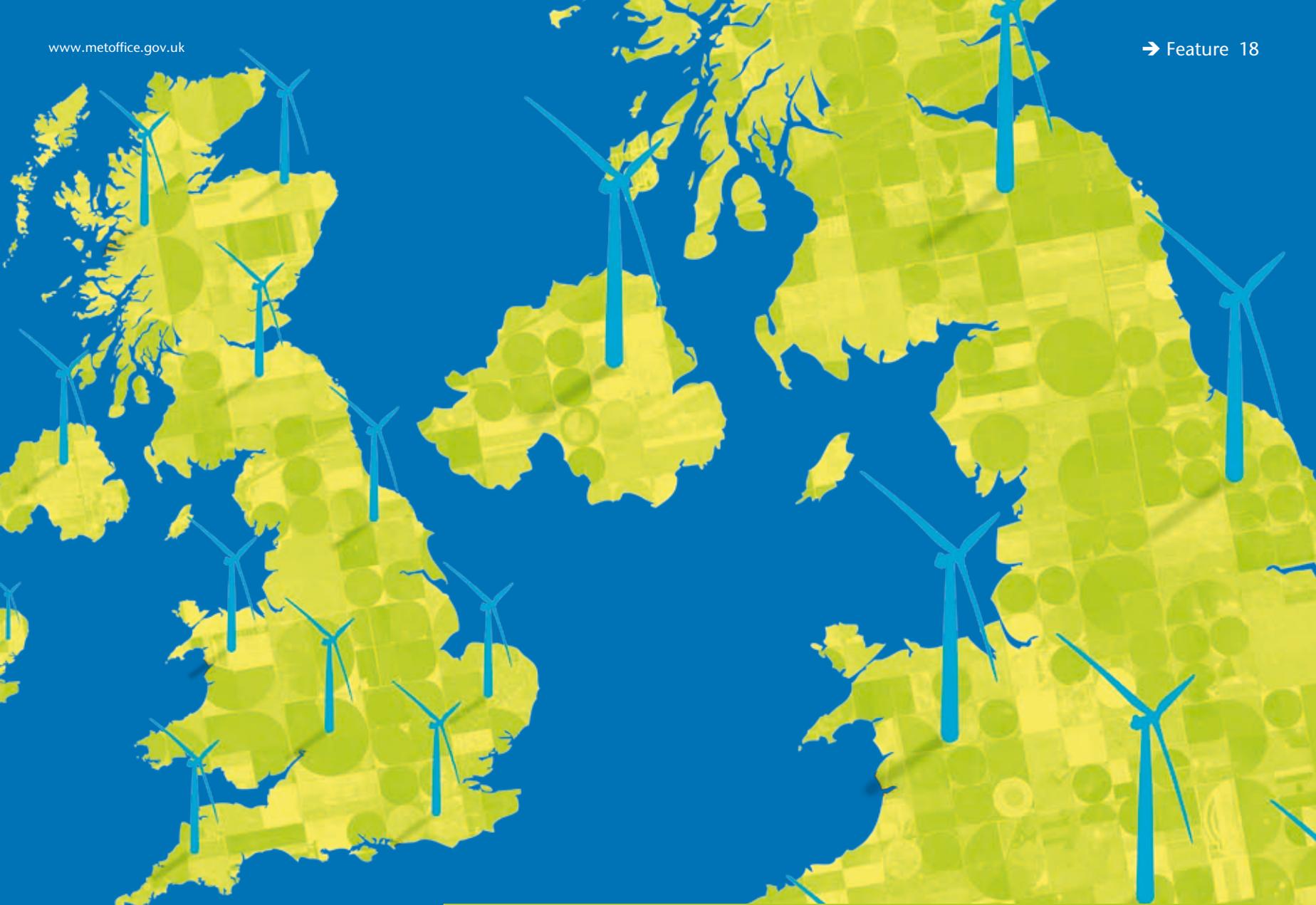
The move signifies the Government's intention to establish a Public Data Corporation (PDC), plans for which were announced in January this year. “These are early days for a PDC, but it is another great way to build on the expertise of the Met Office and find synergies that help Britain and our economy,” says Martin.

Decisions on membership, structure and the commercial strategy of the PDC have yet to be finalised. The Government carried out a public consultation on PDC data policy which was completed in October — with further discussions taking place before the end of the year.

“Now that the Met Office is part of the BIS family, we can design models that take full account of the particular needs and opportunities that the Met Office offers,” says Martin.

#### A future full of promise

The new relationship between the Met Office and BIS is already in full swing. Vince Cable, Secretary of State for BIS, and David Willetts, Minister of State for Universities and Science have already visited the Met Office in Exeter — and Martin is planning to visit soon.



Martin sees the Met Office as a shining model for what BIS is trying to do across many other sectors.

“I am very optimistic about the future of the Met Office. It symbolises the development of a knowledge-based economy into real business opportunities,” he says. “People have confidence in the Met Office — and that is a great asset to the wider British economy.”

#### **Met Office and BIS, working hand in hand**

The Met Office protects lives and livelihoods in the UK — and internationally — with weather and climate information. It also helps boost private sector growth by supporting businesses that rely on Met Office information and advice, from building and aviation, to mining and finance. Here are some recent highlights that link the Met Office and BIS together:

##### **The Thames Estuary**

The Met Office has been doing detailed work in the Thames Estuary on flood risks, looking forward over the next 90 years. The research will ensure that the right investments are made to avoid flooding or other serious water hazards in the future.

##### **Hurricane Katia**

The tail-end of the recent Hurricane Katia battered the UK, bringing gale force winds, flooding and transport chaos. The Met Office’s ability to predict and track hurricanes meant that people were protected — here and abroad — through our work supporting the US Hurricane Center. Additionally, our forecasts were vitally important to businesses that needed to assess the risk of financial loss.

##### **The next science generation**

The Met Office is keen to encourage the next generation of scientists and is taking steps to bring children and science closer together. One popular initiative is our interactive weather presenting kit that enables children to be more hands-on with science.

# Adapting to climate variability and change

The Met Office is increasingly focused on how to help society prepare and adapt to climate variability and change. The Climate Adaptation team in the Met Office Hadley Centre is right at the heart of this, working closely with Government, companies and whole industry sectors.

Organisations often want to better understand how climate variability and change may affect their current and future operations. The Climate Adaptation team has developed innovative techniques to apply observational and modelling climate information to aid decision-making for a range of customers.

Two important projects investigating critical infrastructure resilience include climate change risk assessments for the UK energy and rail industries (as mentioned in the Science profile opposite). For the energy industry, weather impacts many activities, from demand planning to infrastructure failures. For example, overhead line infrastructure is severely affected by high winds and lightning strikes. The Climate Adaptation team derived statistical relationships between fault data and weather records and used climate projections to calculate future failure risk.

The analysis enabled the energy industry to better prepare for future weather risk, risk uncertainty and its implications. As a result, the industry is now planning greater use of lightning arresters to minimise the impact of projected increasing lightning risk. The Met Office is also helping the nuclear power industry to plan for future climate extremes to ensure safety of building design.

Extreme weather causes the most damage, so the team works with different organisations to determine how climate change could alter the frequency, severity and location of extreme events. This awareness of risk is crucial for the insurance industry which is why AXA, a global insurance company, is funding the Met Office as part of an international team to research the changing future European risk and characteristics of hail and wind storms.

Working with Government, the team analyses the implications of climate variability and change for policy developments. For the Department for Environment Food and Rural Affairs, the team contributed to the first nationwide climate change

risk assessment, looking across many different sectors. We are also helping the Department of Energy and Climate Change analyse the impacts of climate variability and change on renewable energy production. In addition we offer support to foreign governments, for example, we are working with the Egyptian government to understand how the River Nile may change in the future.

Much of the Climate Adaptation team's work involves interacting with industry specialists to ensure common understanding and usefulness of the risk information. Appreciating how customers use climate records and projections means we can enhance the targeting of our underpinning climate research to be of most benefit to society.



Photo: Millepost02½



Photo: SPL

## The Climate Adaptation team at the Met Office:

- Systematically assesses an organisation's vulnerability to current weather and climate.
- Gathers together known impacts information, such as weather-asset relationships or key vulnerability thresholds.
- Investigates where relationships or thresholds aren't known.
- Identifies useful risk metrics, combining both hazard and vulnerability information.
- Calculates current and future risk using climate observations and projections.
- Explores how different adaptation options may reduce future risks.

# Science profile

The Met Office employs professionals and experts who are constantly expanding the boundaries of weather and climate prediction. Here we meet one of them...



**Hazel Thornton**  
Manager, Climate  
Adaptation team

Since starting at the Met Office as a Stratospheric Data Assimilation Scientist in 2002, the focus of Hazel Thornton's work has shifted considerably.

Her initial role focused her attention on a very specific area of meteorology — how to make best use of humidity observations in the upper atmosphere to improve daily weather forecasts. But now, as a manager within the Climate Adaptation team, her focus is firmly on the practical side of climate science — and how climate knowledge can be applied in a society that is vulnerable to weather.

"I enjoy understanding how climate science can be applied to everyday matters — so my job in the Climate Adaptation team, is an exciting opportunity."

As part of this role, she advises a variety of government and commercial customers, helping them explore the variety of risks posed by our variable and changing climate. Hazel's academic background is well suited for this. Having studied Environmental Science at the University of East Anglia, she went on to read a Masters in Atmospheric and Ocean Science in Paris, understanding the features and processes of the Earth system and analysing their impact on our weather.

### Climate impacts

Hazel thrives on the challenge of understanding the relationship between the weather and its impact on such things as infrastructure and environmental systems. At the outset of any project for a customer, her team looks at how weather conditions — such as heavy rainfall or heatwaves — could affect the customer's assets and daily operations. Then, as she explains:

"We try to mathematically quantify those vulnerabilities and use our climate projections to see how the industry may be affected in the future."

The applications for this kind of work are broad so Hazel has worked with many different sectors. Two projects



she is currently leading are for the UK rail industry and the Department of Energy and Climate Change (DECC). High temperatures can cause speed restrictions on railway lines and, if critical, rails can buckle causing trains to derail. Heavy rainfall can also disrupt journeys due to flooding of lineside equipment and, in the longer term, erode the foundations of bridges.

Working with rail engineers, the team established key impact thresholds, identifying temperatures and rainfall quantities responsible for disruption. Projections of climate suggest an increase in the frequency of disruption. Consequently, Hazel's team is now exploring how engineering adaptation options could reduce future delays.

Hazel is working with the energy industry and DECC to better understand how natural climate variability and climate change could impact on renewable energy. Wind power is playing a progressively more important role in UK energy supply. Certain weather patterns give low wind speeds and low temperatures across the whole of the UK. Balancing energy supply and demand during these periods will become more

difficult with increasing wind power. This work is therefore helping to inform Government policy on renewable energy.

### Rising to the challenge

Due to the broad scale of climate models, there are limitations to how detailed the information can be.

"The challenge is to provide robust science-led guidance that usefully helps the customer understand their current and future risks."

The team is developing novel presentation techniques and tools to clearly present the risks and their uncertainties to the customer. For the Climate Adaptation team, one thing is certain: with continuing high-impact weather events around the globe and the societal demand for better resilience, the team will be busy. But for Hazel?

"It's exciting to be constantly challenged by customer requests. My personal goal is continue developing novel approaches to help society make the most intelligent use of weather and climate projections."

# A climate of collaboration

Dr Chris Huntingford, a Climate Modeller at the Natural Environment Research Council (NERC) Centre for Ecology and Hydrology in Wallingford, explains why collaborating with the Met Office Hadley Centre works so well — and how that link aids climate science.



## Q. Why the Met Office?

A. My relationship with the Met Office began 17 years ago, when I joined NERC's Centre for Ecology & Hydrology (CEH) on an initial two-year contract after my PhD in Applied Mathematics. I became aware of how much NERC and the Met Office depend on each other — forging successful links through climate research and building models to capture the many components of the Earth system and their interactions with humans. To this day, it's rare to feel tripped up by institutional boundaries getting in the way — something I'm grateful for.

## Q. Why is collaboration important?

A. Both NERC and the Met Office benefit hugely from collaborating with each other. NERC has a wealth of experience of the natural system, while the Met Office operates a world-leading Global Climate Model (GCM) that pulls together all of those pieces of information. This combined effort creates a GCM that is ever-more accurate in its prediction of future climate. The collaboration occurs through many channels, including the JULES land surface model, the AVOID programme, and general interpretation of climate model projections. It's satisfying to know that our collective knowledge ends up in briefing notes for government ministers.

## Q. What's your experience of the Met Office Hadley Centre?

A. I'm always made to feel very welcome, and I'm grateful for IT access and a pass. The open plan area is very different to my own office at CEH — seeing up to 300 people — from the ones working on intricate climate models, to those putting together briefing documents for Whitehall. I know other CEH colleagues who come to Exeter also report enjoying their visits.

## Q. Are your visits a critical part of collaboration?

A. Yes. The Met Office is very generous in letting me sit at one of its desks, and I try to get to Devon roughly once every fortnight. I'm also extremely grateful to CEH for the internal science budget that pays for my time and travel to Exeter. Often, after a day spent with Met Office staff I'm exhausted but exhilarated by the new scientific concepts emerging to explore. I often journey back with my head spinning. The day after is frequently spent distilling notes and ideas. Having the Met Office Unit in CEH Wallingford (The Joint Centre for Hydro-Meteorological Research), for local collaboration with its personnel and IT access, helps enormously too, and in preparation for my next visit.

## Q. Do you pass on the results of your joint research to an international body?

A. Yes, we do. The Met Office Hadley Centre provides the UK Government with estimates of implications of different emissions scenarios. Doing so can lead to joint peer-reviewed research papers between the Met Office and CEH. Every seven years the Intergovernmental Panel on Climate Change (IPCC) writes a major report on climate change, and we are hopeful that some of these papers will be selected for citation in the next report.

## Q. What has been the focus of your work with the Met Office?

A. Most input from CEH has centered on predicted ecological and hydrological change. We know, at present, the land surface is mitigating the effects of about 25% of carbon dioxide emissions across the world. However, it's uncertain whether this natural mitigation of carbon dioxide emissions can be relied on in the future. One strand of collaboration is to try to reduce such uncertainty, by building better descriptions of the land surface, where the associated mathematical equations end up in the climate model.

# Science with a bang

Understanding how the world works is at the heart of the BBC One programme 'Bang Goes the Theory'. Here, one of the show's presenters, **Dallas Campbell**, shares his passion for science, and explains why weather is best made with a laboratory the size of a planet.

Dallas Campbell is not a scientist — but that hasn't stopped him from making some of the most popular programmes about science on TV including, most recently, the BBC One show, 'Bang Goes the Theory'.

In fact, his mantra is you don't have to be a scientist to be in love with science. And no one is better proof of this than Dallas, himself. At university he studied Drama and English and, after he realised he wasn't going to become a champion alpine skier like his childhood hero, Franz Klammer, he pursued an alternative dream: to become an actor. This is something he succeeded at, with acting credits including *Casualty*, *Holby City* and *Moll Flanders*.

His inspiration for making science shows came later and was sparked during a Richard Dawkins Royal Institution Christmas Lecture he attended. "It was the first time the simplicity, beauty and power of evolution and natural selection really hit home," remembers Dallas. Later, with the help of the late director/comedian Ken Campbell — who was also a keen science fan — Dallas wrote what he calls "a layman's guide to achieve the impossible and understand how the world works."

The result was his first science show, 'Dallas in Wonderland'.

## Basic principles

Like the Met Office, one of Dallas' key roles is making complicated information accessible for a wide audience.

"Even with complex things, you can get to the nub of it and find that the principles are simple," explains Dallas. "Take the Large Hadron Collider. It's right at the edge of physics and fabulously complicated. Yet it's grabbed the public. People are excited about the LHC because it has a natural appeal to their imaginations," he says.

Of course, for Dallas this also means talking about complicated science doesn't mean you have to dumb

it down. "People often say that if you're making science palatable you must be dumbing it down. But then you're just reinforcing the idea that only scientists can like and understand these things," he says.

And this really is central to 'Bang Goes the Theory' — a show in which Dallas and his co-presenters put a wide variety of topics to the test — including the weather. As last year was the coldest winter in 31 years — with an average temperature of 1.51 °C — the team wanted to "get under the bonnet of the weather," as Dallas says.

In the hour-long weather special, the team not only explored why our weather is so changeable, they also tried to make their own clouds, rain and snow. For this, they converted a large shipping container into a weather chamber.

"We actually made a few snowflakes," recalls Dallas, "but it was a real challenge because you need a big atmosphere. Weather is best made in a laboratory the size of a planet," he adds jokingly.

## Keeping a sense of wonder

With UK audiences hungry for science shows, Dallas has several other projects in the pipeline — including another show for BBC One, looking at great engineering projects. And a Horizon Guides programme in which they take a science topic and examine the Horizon archives on that subject over the last 50 years.

"You get a wonderful view of science through this process," says Dallas, "how it's a continuous evolution of ideas based on the given evidence, imagination and discipline in equal measures," he adds enthusiastically.

One thing is certain. Dallas Campbell truly is a man who lives his motto — and is head over heels for science.



Photo: Ruth Crafer

METEOROLOGICAL REPORTS.

Wednesday, July 31, 8 to 9 a.m.	B.	E.	M.	D.	F.	C.	I.
Nairn.. ..	29.54	57	56	W.S.W.	6	9	o.
Aberdeen .. ..	29.60	59	54	S.S.W.	5	1	b.
Leith .. ..	29.70	61	55	W.	3	5	c.
Berwick .. ..	29.69	59	55	W.S.W.	4	4	c.
Ardrossan .. ..	29.73	57	55	W.	5	4	c.
Portrush .. ..	29.72	57	54	S.W.			
Shields .. ..	29.80						
Galway							
Scarborough							
Liverpool							
Valentia							
Queenstown							
Yarmouth.							
London .. ..							
Dover.. ..							
Portsmouth							
Portland .. ..							
Plymouth.. ..							
Penzance .. ..							
Copenhagen							c.
Helder .. ..				W.S.W.	6	5	c.
Brest .. ..	30.03	60	—	S.W.	2	6	c.
Bayonne .. ..	30.13	68	—	—	—	9	m.
Lisbon .. ..	30.18	70	—	N.N.W.	4	3	b.



150 years of forecasting for the nation

In 1861 The Times published the first weather forecast (shown opposite). 150 years later, to celebrate the occasion, we ran a range of activities from July to September 2011, including a photo competition inviting people to send us photos capturing the British indomitable spirit in challenging weather.

Trishia Bloor of Bideford, Devon sent in the winning photo, shown here. It was taken by her husband at Hartland Quay in North Devon.

Trishia explains, “We have wild and wonderful weather here as it juts out into the Atlantic. As you can perhaps tell, the wind was so strong I had to hold onto the railings to keep my feet. I have two coats, a bodywarmer and the charming hat is to keep my ears from the cold.”

General weather probable during next two days in the—  
North—Moderate westerly wind ; fine.