Met Office

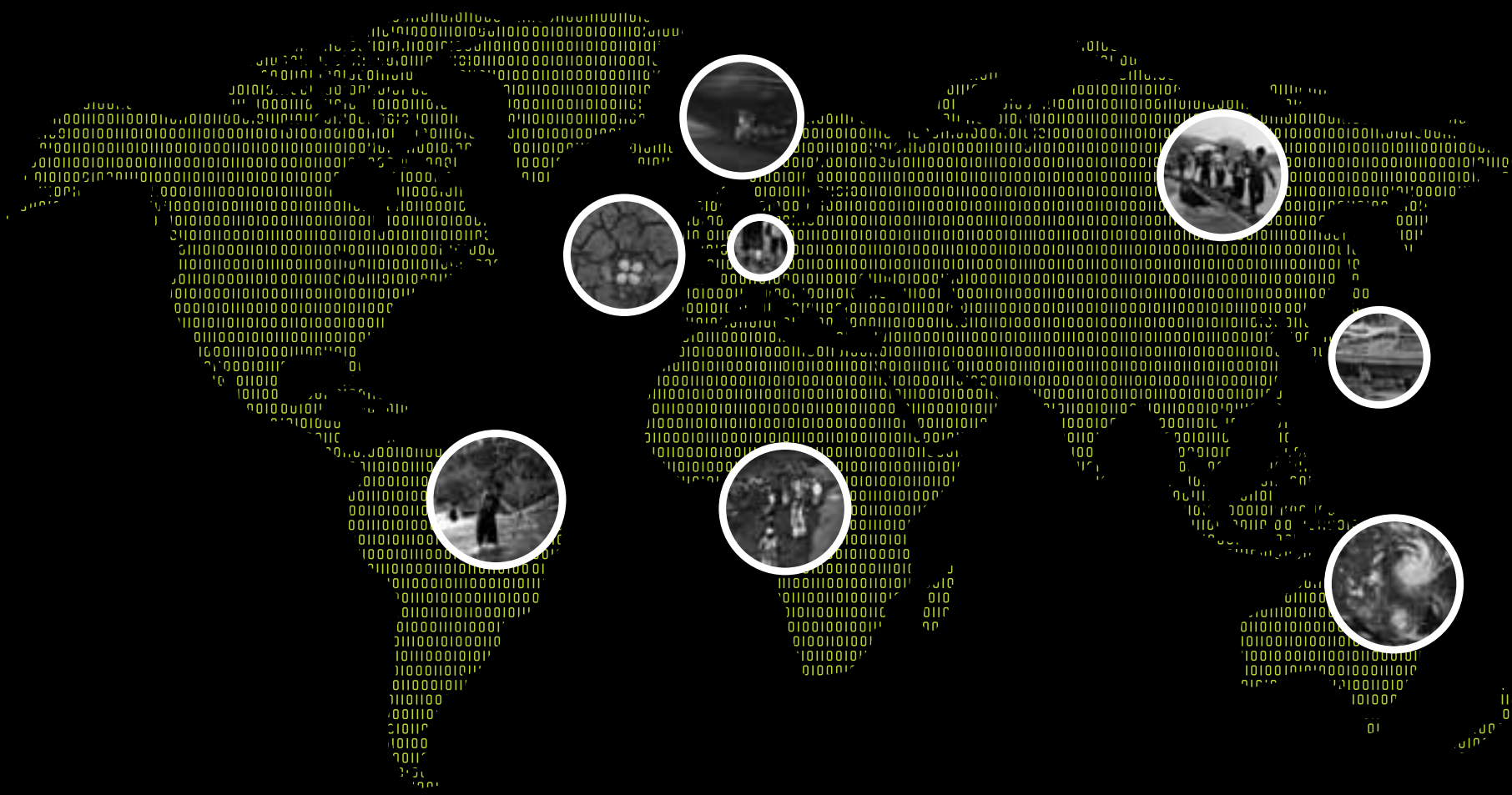
CLEAR MESSAGES
Making the most of the weather

RECORD-BREAKING SEASON
Driest spring on record

EXPLAINING THE FACTS
Understanding climate science

Barometer

Issue 18 www.metoffice.gov.uk Met Office magazine



Through our imagination and expertise, we contribute to the worldwide sustainability agenda, observes Nick Jobling, Met Office Chief Financial Officer.

Sustained effort

This *Barometer* reviews key successes of 2010/11 through the theme of 'making science accessible'. Some highlights include our work as a leading advisor on weather and climate to governments, businesses and individuals which is central to promoting and contributing to international sustainability. The global nature of our activities, especially our climate science expertise, is essential to the international sustainability agenda.

However, we are also aware of our impact on a local level, so we're committed to meeting our objectives in a sustainable way — reducing our carbon emissions and acting in a positive manner in dealings with our staff, customers, suppliers and the wider community. This year, our efforts were recognised with a gold ranking in the Business in the Community (BITC) Corporate Responsibility Index. As a member of the South West Strategic Board of BITC, I was particularly interested to read about the Mayday Network (page 3).

The Met Office Board and Executive enjoy a range of useful and interesting scientific briefings delivered by Met Office experts. This requires presenters to pitch each briefing at the right level for Board members, many of which are non-scientists. In communicating our science it's important to focus on facts not opinions as Met Office Chief Scientist, Professor Julia Slingo emphasises on page 6. Our perceived integrity and reputation is based on scientific fact but it's important to use appropriate language to explain hugely complex science to people with non-scientific backgrounds like me (page 4).

Crucially we also work with individuals such as Professor Sir Brian Hoskins CBE who is a Non-Executive Director on the Met Office Board. As a weather and climate expert he can dig deep into the science to support and challenge the Met Office Executive team, as well as help to develop the long-term Met Office strategy (page 7).

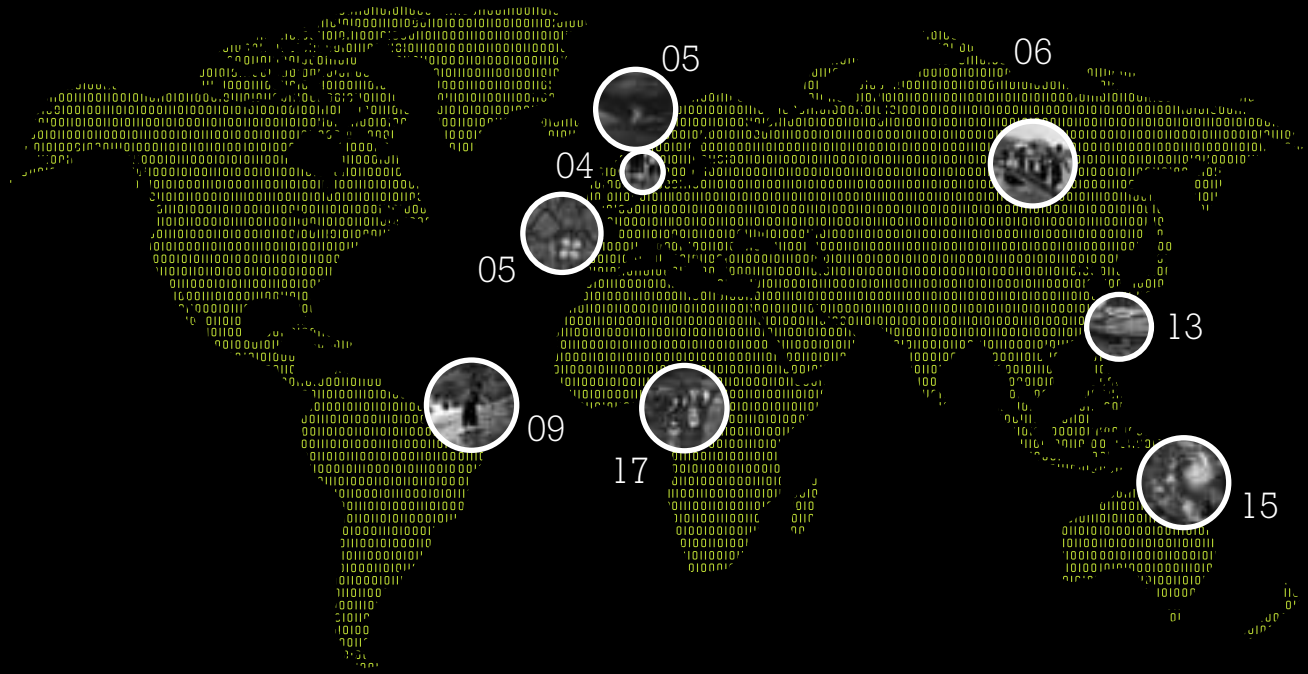
Our long-term strategy, sustainability and ability to predict the weather and climate, depends on our supercomputer capability. This critical investment comes with financial, energy and carbon costs. We should not shy away from this fact and we are committed to minimising the costs through our drive and innovation. Through some fantastic, world leading work (page 11) we have reduced our total supercomputer carbon emissions in 2010/11 despite this being the first full year of operating our new IBM machine. Our success in reducing the energy consumption of and carbon emissions from our supercomputer is just the start and we're certainly not out of ideas yet.

We consistently demonstrate our expert scientific capability. The value and relevance of our science relies on the range of research that takes place at the Met Office. It's exciting to think what the next steps might be. For example, the Met Office's recent move to the Department for Business, Innovation and Skills offers new opportunities to develop even stronger links that will help us make the most of our world-leading environmental science.

The fascinating science of forecasting tropical cyclones in the Atlantic is explored on pages 15 and 16. It's important never to underestimate our role on the international stage, working alongside others, often when natural disasters strike (page 13).

The breadth of our international activities is fascinating. For example, we are working as a consultant for the Rwanda Meteorological Service (page 17). Our work through the World Meteorological Organization's Voluntary Cooperation Programme, an example of which is on page 10, helps to ensure that the global weather and climate community works together in a sustainable way.

In collaborating with such a wide variety of people, it's essential to have high profile ambassadors, like the comedian Ben Miller (page 18), who identify with our work, but it's equally important to regularly engage with people who may have a different view, in a balanced way. It's a sustained effort — in every sense.



In this issue — a look back at the year

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Met Office Conversations...

a series of essential debates

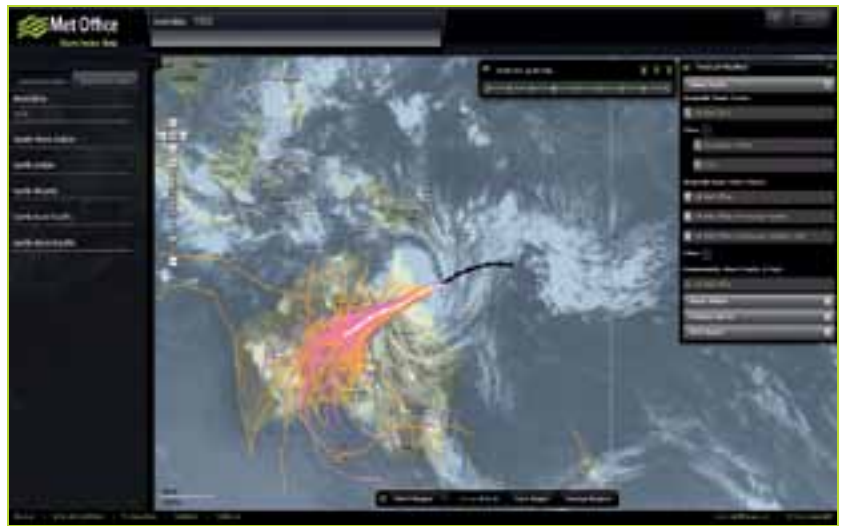
This year, instead of our annual conference, we're hosting Met Office Conversations — a series of roundtable debates.

Met Office Conversations bring together thought-leaders and key influencers to discuss topics surrounding our work. The first debate, held in London on 11 May, focussed on climate security. It explored how climate science can inform planning and policy.

Topics discussed included how well climate change research is integrated with strategic planning, how science and policymaking can join-up more effectively and what else can be done to inform understanding of how climate change may influence security issues in the UK and internationally.

Future topics for upcoming Met Office Conversations include natural hazards and their impact on the UK and the affect of weather on flying, with a focus on collaborative decision-making in aviation.

➔ Read more about the Met Office Conversations at www.metoffice.gov.uk/about-us/what/partnership/knowledge/debates



StormTracker

Tropical cyclones are among the most destructive meteorological systems on earth. StormTracker, our new tropical storm forecast service, provides unique access to 15 day forecasts and in depth visualisation of tropical storm risks.

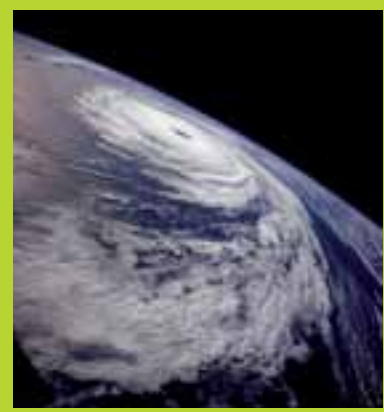


Photo: Corbis

StormTracker combines the world's best forecasting data and science to aid decision making, help with risk evaluation and enable the comparison of past and present storms.

Both free and advanced paid-for versions of StormTracker are available. The free version provides access to the latest tracks of current storms, five-day forecast tracks for current tropical storms from the Met Office Unified Model, the latest observed cloud cover and sea surface temperature. Historical tracks of more than 150 year's worth of named storms can be compared with current forecasts and storm tracks. The advanced version also includes 15 day probabilistic forecasts from three different forecasting models.

➔ **Find out more about StormTracker and register for the free version at www.metoffice.gov.uk/services/industry/financial/trading/stormtracker**

➔ **See page 15 where Julian Heming, Met Office Tropical Prediction Scientist, examines the nature and prediction of tropical cyclones.**

Mayday network

The Met Office is acting as science advisor to the Prince's Mayday Network, a collaboration of businesses that work together to find the best solutions to environmental challenges.

The Prince's Mayday Network is convened by Business in the Community and was founded by His Royal Highness The Prince of Wales in 2007. It aims to mobilise UK businesses on climate change and resource depletion.

The Network increasingly deals with broader sustainability issues not just climate change. For many Mayday network members, climate change is as much a business opportunity as a threat. Conversations are shifting from how to reduce the impacts of climate change, to how to win new business and turn sustainable strategies into winning business propositions.

The Network has launched Mayday Journey, a free online tool that businesses can use to work out their impact on the environment. It also provides ideas on how businesses can reduce their impact in response to climate change and other environmental challenges.

➔ Discover how the Mayday Journey can help you at www.maydaynetwork.com/journey

Business in the Community

THE PRINCE'S MAYDAY NETWORK

Making science accessible

From scientists communicating their latest research at international conferences, to local community events or broadcasting national TV weather forecasts — communicating our science is vital.

The Met Office is based on scientific excellence but, crucially, the understanding of our work depends on how well we communicate. That's why we're set on communicating in a clear and inspiring way using simple language to help millions of people make the most of our advice every day.

We're continually improving our communication, using a variety of methods to reach diverse audiences. We've improved our website with new content and functionally. Recent enhancements to the National Severe Weather Warning Service make our warnings even more useful. Clearer web pages make multiple warnings easier to understand by using symbols for different weather elements.

Dee Cotgrove, Head of Communications, says: "Our commitment to making our weather forecasts widely available continues with new media innovations such as our free phone apps, including the iPhone app." Not only that, the Met Office now has its own News blog, YouTube channel and Facebook page to share our latest news and science features.

"Communicating climate and weather science is challenging and we have embarked on a programme to explain the fundamental building blocks of our work — from information on our global weather-watching systems to simple guides about our delicately balanced climate system," Dee explains. "We've reached new audiences through partnering and collaborations. For instance, we worked with the Science Museum to create a new interactive climate change exhibition, 'Atmosphere'."

As the lead science advisor for Climate Week in March we provided guidance on the facts of climate change, including videos explaining the climate system. Part of our contribution to the Open Air Laboratories (OPAL) project involved answering people's questions about weather and climate on the OPAL website.

"Working with ambassadors from scientific and non-scientific backgrounds helps make science accessible to a range of audiences," says Dee. Recent examples include geologist and TV presenter Dr. Iain Stewart and comedian Ben Miller (see page 18 for an interview with Ben). Dee continues, "We worked with Ben to install a Met Office weather station to help answer a deceptively simple question; what is one degree of temperature?"

The future of the Met Office is bound to involve new and often complicated science, but we're sure to seek out ways to increase access to that science. We'll continue to do our best to communicate as clearly as possible to make a difference to people's lives — helping people make the most of the weather.

150 years of forecasting for the nation

- This year marks the 150th anniversary of public weather forecasting.
- The first ever public weather forecast was published in The Times in 1861.
- Forecasts were broadcast for the first time on BBC radio in 1922.

What does the weather mean to you?

To celebrate 150 years of forecasting for the nation, we'd like you to send us photos that capture the British indomitable spirit in challenging weather. Keep an eye on our website for details of the Met Office photo contest and prizes.

Photo: Rex Features

Photo: Mike Powles/FLPA

Photo: Corbis

An unusually warm and dry March and April across England and Wales followed a drier than average winter. The dry conditions had a direct effect on agriculture and also contributed to significant problems with wild fires across the UK. Our forecasts helped people prepare for the dry conditions and deal with the impacts of the driest spring for over 100 years.

Record-breaking spring

Less than half the normal rainfall fell across the UK in March. April was the warmest on record with many parts of the UK experiencing temperatures 3 to 5 °C warmer than normal. It was the sunniest April in the UK, England and Wales, in a series from 1929. Together, March and April were the driest in the 100-year series in East Anglia, and the second driest in England and Wales. In contrast, rainfall in Scotland was 110% above normal levels. The wet conditions ruined crops including soft fruit, potatoes and peas.

In drier parts of the UK, plants flowered earlier, bees and butterflies appeared earlier, and the ground, normally warm and wet from April showers, was parched. At the end of April, exceptionally dry vegetation contributed to wild fires breaking out across the UK. High winds and dry conditions hampered fire fighters and emergency services dealing with the various blazes which caused extensive damage to a variety of woodland, heath and farmland.

The dry weather caused concern for many livestock and arable farmers, with growers irrigating where water was available. Despite some losses, the sunshine blessed strawberry farmers with a bumper crop. Growers of asparagus harvested the crop earlier than ever before. Winemakers in the South West are hoping the unusually warm and dry spring could result in a bumper season for vineyards.

Runners and spectators at the London Marathon in April had mainly dry and fine conditions and many parts of the UK also enjoyed fair weather over the Easter weekend. The weather even stayed dry for the Royal Wedding of Prince William and Kate Middleton.

May began mostly settled and warm, but temperatures gradually fell towards normal for the season, and it became more unsettled over the late May Bank Holiday.

June had generally average temperatures, although the highest temperature of the year, and the last five years, 33.1 °C, was recorded at Gravesend on 27 June.

The Met Office website received 173,000 page views for the Glastonbury forecast, Wimbledon only experience a few interruptions to play having mainly good playing conditions.

New online pollen forecasts

This spring's hot, dry weather made things worse for those suffering with hay fever. We made our pollen forecasts available on our website in April helping millions of people across the UK to better manage their condition.

Our pollen forecasts use current pollen data collected from around the UK in conjunction with current weather information. Ultimately, weather affects the amount of pollen produced and how it's distributed. Rain stops pollen spreading, while wind blows pollen from the countryside into more populated areas.

➔ To use our daily pollen forecast to plan your activities and better manage your condition see www.metoffice.gov.uk/public/pws/invent/weathermap/

Grímsvötn volcano eruption

The Icelandic Grímsvötn volcano erupted on 21 May and caused some limited disruption to flights over northern Europe during the following week.

As the Volcanic Ash Advisory Centre (VAAC) for the north-east Atlantic region, we use state of the art computer modelling and real-time observational data such as satellite imagery and airborne measurements, to provide routine advisories and guidance on the subsequent movement and dispersion of the volcanic ash.

The aviation industry uses the VAAC advisories and guidance to help inform flight safety decision making during volcanic ash events.

Photo: Corbis

Communicating climate science

Despite incredibly strong evidence that our way of life is having a profound impact on our climate, many people still find the subject of climate change confusing. This is why the Met Office is now working to help demystify the science and make the facts accessible to all.

The role of the Met Office in climate change science has always been to tell the facts as precisely as possible, as Professor Julia Slingo, the Met Office's Chief Scientist, explains: "For the general public to understand climate change they need an appreciation of how our climate works — which involves some very complicated science. There is a lot of confusion about what is weather and what is climate. Weather provides the building blocks of climate and climate is just the long-term average of lots of weather. Unless an organisation like the Met Office can make this science more accessible for people, it will always be hard for them to understand how and why our climate is changing."

Without this understanding, it is inevitable that public opinion will be swayed by events such as Climategate — where, in 2009, sceptics claimed climate scientists had manipulated data to support their own arguments. What's more, there is a natural tendency for opinion to be influenced by current or recent weather that is seemingly at odds with a 'warming' climate — such as the particularly cold winters in the UK over the last two years. The net effect is that the real, ongoing, issues behind climate change are confusing and can get sidelined and obscured by more dramatic, headline-grabbing events.

A shift in focus

In the past, much of the communication with the public about climate change has focused on how global temperatures are increasing and how this will affect us in the future. But these concepts are often too remote for people to relate to.

However, in recent years the very real affects of extreme weather have been experienced by millions of people around the world — such as storms, floods and heatwaves. It's by focusing on these events that Met Office scientists can begin to show that climate change is not simply an abstract concept based in the future — but something that affects our lives in the here and now.

"While none of these events can be directly attributed to human-induced climate change, we can say that they are consistent with what we expect to happen as a result of global warming from the increasing greenhouse gases from human activity," says Julia.

Contextual understanding

The Met Office has been involved in a number of initiatives that take a fresh approach to explaining the facts. These initiatives accept that people learn in different ways and so adapt how the information is presented accordingly. The 'one size fits all' approach no longer measures up.

From detailed websites aimed at businesses and policymakers, to engaging with national events that attract all ages, the Met Office is trialling a variety of media to connect with people from different backgrounds, ages and interests.

As Julia says: "Whatever the medium, we want to help people understand why climate change is happening and what it will mean for all of us. And, by drawing on everyday events, we can show how it is having — or will have — a profound effect on our lives."

Preparing for change

This new approach, of turning the facts into stories people can relate to, is also a great way of communicating with decision makers in governments and businesses — who may not have a scientific background.

"While our role is purely to provide the facts and the science behind climate change, we need to make sure policymakers are fully informed and able to better prepare for the impacts of climate change," explains Julia.

But for Julia, there is a fine balance between building awareness of the risks of climate change and need for action — and not creating inertia by frightening people into thinking there's nothing that can be done.

"There are lots of things we can all do to mitigate the effects of climate change. And it's through better, clearer understanding of the issues that people across the world will be able to take positive action."

Photo: Corbis

Professor Sir Brian Hoskins FRS CBE is recognised as one of the world's leading meteorologists and climatologists. As a Non-Executive Director of the Met Office he plays a crucial role — not only in raising awareness of the challenges the organisation faces — but also in promoting the strategic importance of academic collaboration.

Encouraging a climate of good science

"The time gap between the advance of the science... and the help it offers is very short indeed."

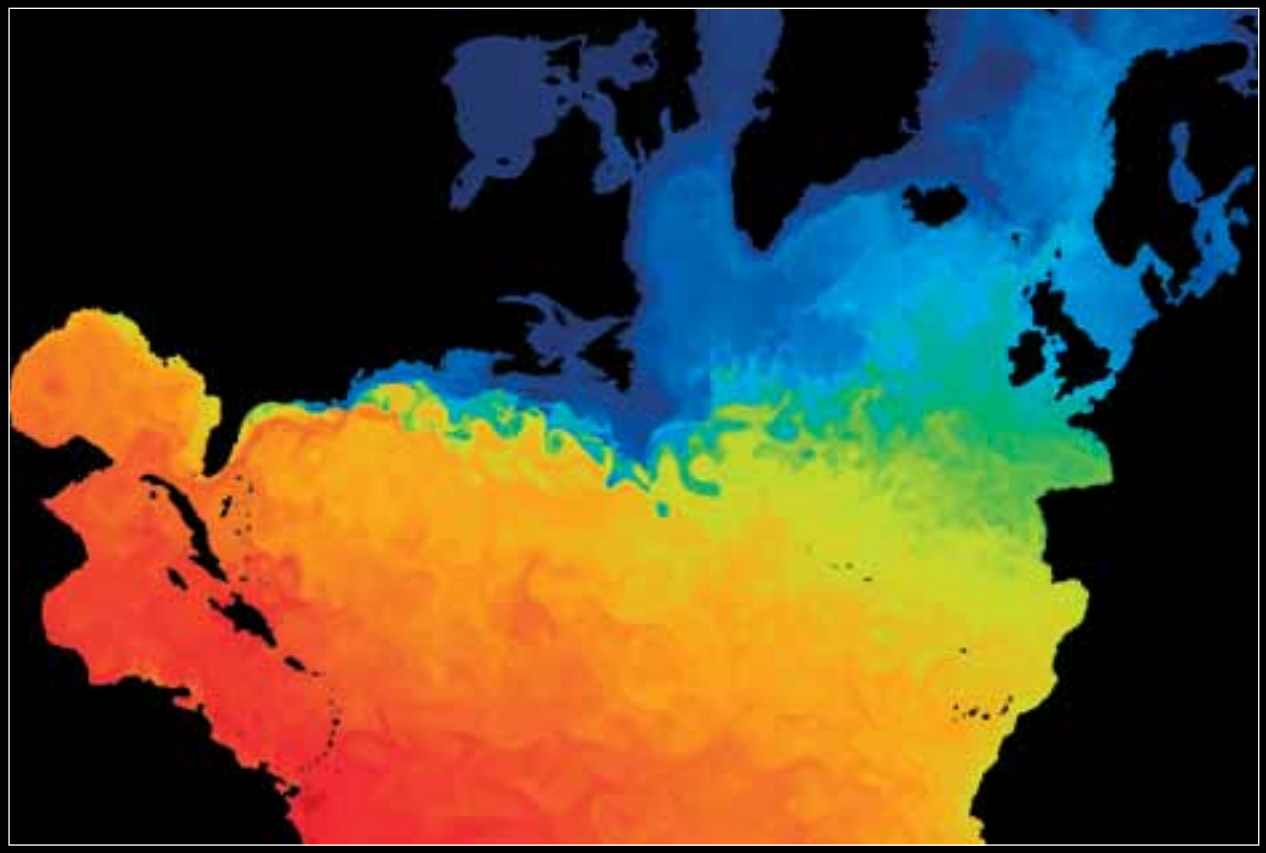
Following a first degree in mathematics at the University of Cambridge, Sir Brian completed a PhD on the formation of warm and cold fronts — at which point his life-long interest in weather and climate processes began. He became a fellow of the Royal Society in 1988 and he was knighted in 2007 for his services to environmental science.

His involvement with the Met Office began over 30 years ago when he joined the Research Sub-Committee of the Met Committee. He later became chair of this but it ceased to exist when the Met Office became a Trading Fund. A year or so later the Chief Scientist at the time, Paul Mason, asked Sir Brian to set up the Met Office's Scientific Advisory Committee (MOSAC), which helps the Met Office determine which Research and Development programmes to invest in each year.

As well as acting as Chair of MOSAC, today Sir Brian combines his work for the Met Office with one day a week at the University of Reading (where he's been since 1973) and three days as Director of the Grantham Institute for Climate Change at Imperial College London. He is also one of five world-class experts appointed to the Government's new Climate Change Committee.

Firm scientific basis

With more than 40 years of experience to offer, Sir Brian makes a unique contribution to the Met Office board. He is deeply involved in the



Satellite image showing North Atlantic Ocean surface temperatures.

development of the organisation's long-term strategy and helps the executive team deliver effectively against Business Performance Measures. He is very careful to make sure these are set within the parameters of existing scientific knowledge, as he explains: "What's important to remember is that we don't set business targets that go beyond the science required to fulfil them. We should never promise to do something, in forecasting for instance, if there's no solid scientific basis to suggest we can deliver on that promise."

While the Met Office is well known for its world-class expertise, Sir Brian is also keen to champion the many successful research collaborations it has created around the world. For example, in recent years, there have been several partnerships that draw on the Met Office Unified Model — a system that uses a single set of models to predict the weather across a range of timescales. "People are excited by the opportunities the model gives," Brian says.

A model of good science

One recent example demonstrates how academics can use Met Office models to perform forecasting and climate experiments. The objective was to gain further understanding of some of the crucial 'ingredients' that make up the global climate system — and how sensitive the atmosphere is to particular changes. To achieve this, they devised an aqua-planet version of the Met Office model — that involved stripping out all the continents of the world and putting in a very simple underlying distribution of sea surface temperatures. Then, by adding simple changes to these and also adding simple continents, the basic ingredients that affect the Atlantic storm track can be determined.

"We used the Met Office model like a laboratory experiment — simplifying the weather system then gradually building it back up to make it more like the real one."

While experiments like this are academic to begin with, the findings can suggest improvements in models and can also have a very real impact on businesses. They could help the shipping industry, for example, understand how much future investment in infrastructure is needed and help insurance companies quantify risk over the coming decades.

Academic partnership

Brian also encouraged the formation of the Met Office Academic Partnership in November 2010. This joining of forces between the University of Reading, University of Exeter and University of Leeds has helped create a stronger collaboration between research and development, funded by the Natural Environment Research Council (NERC) and the Met Office.

The MOSAC annual meetings present another opportunity for scientists from meteorological services around the world and UK academics, including Sir Brian, to get together and share knowledge. For example, MOSAC has recently been discussing the accuracy of modelling systems — including the very fine resolution, 1.5 km scale UK model for future rainfall measurements. They also examined the performance of the atmospheric composition prediction system for the 2009 Icelandic volcanic eruption — with a focus on how better observations might help in future.

Advancing the knowledge front

Ultimately, as far as Sir Brian is concerned, weather and climate will always be a fantastic subject to study — and one that deserves greater investment — because, unlike other areas of scientific advancement which can take decades in development, understanding or enhancing a basic theory in meteorology can have a real and important impact on the world in just a few years' time.

"The world is hungry for this information and the time gap between the advance of the science in our subject and the help it offers is very short indeed."

Fantastic customer service has always been a high priority for the Met Office. So when someone stands out and makes a real difference in this field they are quick to recognise the achievement.

Photo: Dieter Telemans/Panos Pictures

Designing the

In December last year, Met Office's Media Designer, David Robinson, won the Outstanding Customer Service award at the Met Office Awards for Excellence. It was awarded for the positive difference he makes to the look and design of weather forecasts, both in the UK and abroad.

In effect, David's work acts as a middleman between the forecasters and the TV viewers — turning the complex information forecasters see on their charts, into forecasts that are relevant, informative and enjoyable. David gives his work the edge by designing superior graphics and training the presenters in ways to really engage with viewers, as David explains:

"Forecasters work from very complex weather charts, and often want to put all of that detail on to the map seen on TV. As a designer it's my role to convey that detail, designing clear and informative weather graphics that simplify the information, leaving viewers with a clear understanding of the weather situation."

With over 20 years working in TV weather, David has helped to de-clutter the graphics and by using new technologies make the weather forecasts more accessible across a wide range of programmes. His work can be seen every day on ITV, Daybreak, STV, UTV, Channel 4 and the Met Office online video weather service.

Although this award recognises the ongoing improvements David has made in the UK, it also celebrates his work in developing countries.

David is also now part of a team that helps developing countries set up their own national weather broadcasts. These overseas projects are part of the World Meteorological Organization's Voluntary Cooperation Programme (VCP) that aims to get viewers to engage with the weather — especially when broadcasts could save lives.

"I originally went to Africa with the VCP team seven years ago to improve the graphics on TV and the general look of the weather, by training people to use Met Office weather graphics software, 'WeatherEye'. This software contains my designs for the map backgrounds, weather symbols and data layers to display satellite images, temperature contours, pressure and wind speeds. The software is a specially adapted version of the WeatherEye software that I have been using for many years here in the UK. Over the years, I've broadened my skills to involve the studio technical production side of building and running a studio too," says David.

It may seem surprising that television broadcast is the best medium to share information about the weather in poorer countries, but as David says, you find TV sets in most homes, even in the most unlikely of places. "You may see a 27" TV hanging on the wall, even in the poorest of communities."

Weather in Guyana

In April 2009 David set up the first TV weather broadcasts in Guyana — where low-lying coastal regions, high tides and storms can have disastrous impacts on the country's population.

The Ministry of Agriculture in Guyana also wanted to use the new broadcast to give information to workers affected by the weather — such as fishermen and farmers. David created extra graphics and gave more information, such as tide times for the fishing industry and warnings of prolonged periods of dry weather so farmers could plan their crops ahead.

When the new broadcasts were up and running, the Ministry of Agriculture received numerous letters from farmers and fishermen thanking them for this new service. A service that is now saving lives.

Photo: Getty Images

weather

To get these broadcasts up and running the VCP team installs TV weather studios within national meteorological organisations to record then deliver broadcasts to the national television broadcasters. Alternatively the production of the graphics are produced within the national meteorological organisations and sent to the country's national television broadcasters to be recorded and broadcast.

David also provides presentational training skills, giving new TV weather presenters encouragement and guidance in presenting skills that are needed for a polished performance in front of the camera. As he explains, presenting is all about engaging with viewers, remembering who you are talking to and how the viewer might use the forecast.

"It really helps when presenters explain if today's weather is colder, warmer, wetter or dryer than yesterday, and the reason behind this. Then viewers can understand by comparison. If the presenter just stands there and describes what's on the weather map, you might as well just show the basic graphics. The presenter should be there to add extra value through storytelling and making links between the maps."

Using a ChromaKey Studio, the presenter has to stand in front of a plain blue or green background, only seeing an image of themselves standing in front of the weather map on a TV monitor out of shot from the camera, when they turn and look to their right or left. It can be difficult to teach someone how to present without a map behind them, so presenters must be aware of how the final shot will look when they're super-imposed on the map. David explains, it's quite awkward for people who haven't tried it before:

"Usually, on the first attempts to record a broadcast, most presenters record a good broadcast of the side of their face, as they turn to look at the weather map displaying themselves on the TV monitors to the side, never looking back at the camera. On a trip to Guyana, I had the extra challenge of training experienced news presenters to present the weather. News presenters usually have an autocue system mounted on the camera which they read so they generally look straight into the camera. In presenting the weather we do not autocue, as the weather presenter needs to turn and interact with the weather graphics. Weather presenters rely on memory and prompts from the graphics behind them. It was interesting watching experienced news presenters trying to tell a weather story without an autocue. It can be difficult to talk for three minutes, sometimes describing a complex weather story, without the aid of autocue."

Next, David is set to travel to Comoros, an island off the coast of Madagascar, to set up their very first TV weather studio. But he has his work cut out closer to home too as the Met Office has now asked him to build a new studio at its head quarters in Exeter.

"The new studio will be used to produce a range of video content — including content for web and smart phones. This could be anything from a climate scientist explaining a complicated phenomenon, to a new video download aimed at a younger generation."

David is in no doubt that new media will help get the weather to more and more people. But one thing remains true — it takes great graphics and presentation to make people really sit up and listen.

Greener calculations

As a world-leader in climate change research, the Met Office has a unique responsibility to reduce its own carbon emissions. We already operate out of a highly efficient head office building. But with so much of our work relying on the output of two power-hungry supercomputers — we faced the huge challenge of reducing electricity consumption without compromising capability.

Our ability to predict the weather, create complex climate models and turn raw scientific data into practical forecasts and advice is thanks, in part, to our supercomputers. Roughly the size of two small single-decker buses, they can handle more than 100 trillion calculations per second — vital for the hugely complex weather and climate models they produce.

Every day, data from the machines helps organisations around the world save millions of pounds, run more efficiently and, critically, reduce their carbon emissions. What's more, the detailed forecasts produced help people prepare for severe weather — which results in countless saved lives.

There is no dispute that the supercomputers are vital to the work of the Met Office. But this kind of computing power comes at a cost — both financially and environmentally — as average power consumption runs at more than 1.6 megawatts of electricity per year.

The challenge was clear — even if the solution was not. How can the power consumption of the supercomputers be reduced without compromising performance?

Understanding power

As with so many innovations at the Met Office, the answer came from a brilliant piece of original thinking. The Met Office Property Management Building Services Engineer, Peter Clayton-White, came up with an elegant but untried idea. Rather than rethinking the processing of the computer itself, Peter looked at how the machines were powered, as he explains:

"Put simply, the supercomputers draw electricity from an AC power supply but actually run on DC power. Within the circuit, there were two stages at which AC was being converted into DC — which resulted in an energy loss in the form of heat."

Peter surmised that if both of those stages could be removed, an energy saving of around 11.5% could be made. He further realised that if they could save this energy — usually lost in the form of heat — they could also reduce reliance on the cooling system, used to stop the computer overheating, by a similar percentage — creating an additional energy saving.

Overcoming the challenges

To successfully turn theory into practice, Peter faced a number of hurdles. Not least of these was that all IT devices — from the humble laptop to massive supercomputers — are built to run on an AC (alternating current) power supply.

"One of the biggest challenges we faced was convincing IBM to convert the supercomputer so it could run on DC (direct current). But it didn't stop there, we also had to find a DC rectifier battery unit at the voltages we needed."

IBM was able to help solve the first problem by providing special power regulators — but the battery unit was a little trickier. A vital component, it will kick in if there is a power cut — yet it is no normal device. While an average car battery charger runs on around 12 volts DC, this needs 405 volts DC. You can't simply buy a device like that off the shelf, so we had to have a custom-made DC rectifier battery unit.

Groundbreaking results

Today, the Met Office is the only organisation in the world to run its supercomputers on DC power. By doing so, we expect to save 881 tonnes of CO_2 emissions per year — which equates to approximately £111,000 at current energy prices. To put that into perspective, that's equivalent to more CO_2 emissions than produced by all the flights taken by Met Office employees between 2009 and 2010.

For Peter and the Property Management team, the extraordinary achievement has not gone without recognition — they were a 'Highly Commended' Finalist at the 2010 Institute of Engineering and Technology Innovation Awards.

The Property Management team has been responsible for a number of the Met Office's 'green initiatives' — all designed to reduce energy consumption and minimise our carbon footprint.

Super cool savings

Most of the energy the supercomputer consumes is turned into heat, which needs cooling. This cooling has traditionally been achieved with large energy-consuming chillers that pump chilled water across the site into the IT halls.

To reduce the energy required, the Met Office installed a 'free cooling' system in 2010. This is a roof-mounted system that harnesses the outside air temperature, whenever possible, to naturally chill the water. It has enabled the Met Office to save 9.1% of displaced electricity, or £100,000 at today's energy prices.

Harnessing the power of nature

Other energy saving initiatives include the installation of computer controlled lighting throughout the Met Office HQ, which dim down as the daylight level increases — saving up to 95% of lighting power.

The Property Management team also conducted several feasibility studies on alternative means of energy, including biomass, solar energy and wind power.

"The problem with photovoltaics is that they are expensive to install and will only produce around 1% of our total annual needs. Wind turbines present two issues — the spinning blades corrupt the data of landing instruments at nearby Exeter airport, as well as the weather data recorded on site here. Finally, to generate electricity from a steamed boiler running on sustainably-sourced chipped wood requires a huge capital investment," explains Peter.

We may not have all the answers yet. But, undeterred, we'll continue to explore innovative ways of using new, or refining existing, technology to reduce our carbon emissions.

Earthquakes, volcanoes, floods, wildfires, landslides... the Met Office is there round the clock — ready to help whenever high impact natural events occur around the world.

Photos: Corbis

On hand when disaster strikes

While most people associate the Met Office purely with weather and climate predictions, our remit extends far beyond this. With our global forecasting capability and working with partners, we play a vital role when disasters strike — even if the event, at its source, is not directly weather-related. Over the last two years alone the Met Office has been involved in assessing the affects of the radiation leak caused by the Japanese earthquake in March 2011 and the smog created by wildfires in Russia in July 2010.

Met Office data is used by the UK Government and relief organisations around the world and feeds into critical decisions, such as when to keep roads and airports open — or whether to evacuate British citizens from disaster zones. Much of the critical information is produced by the Operations Centre at the Met Office which provides a 24/7 service. As Chief Forecaster, Nick Grahame says, "We monitor information as it comes in from around the world. We're always ready to react at short notice because, in this role, time is critical."

Support following the Japanese earthquake

The Met Office was recently put to the test when the worst earthquake in 140 years hit Japan earlier this year — creating a huge tidal wave that caused extensive damage to the Fukushima nuclear power plant.

"Using our global forecasts, we were able to provide immediate advice to UK Government on any aspect of weather that could affect their international contingency planning," says Nick.

"With so many British people living in Japan, our Government was keen to get additional information from the Met Office. So using the same computer model that forecast the transport and dispersion of the Icelandic volcanic ash cloud in April 2010, we were able to provide advice on the risk of radioactive particles being carried by north easterly winds towards Tokyo."

Help in Haiti

When a catastrophic 7.0 magnitude earthquake hit Haiti in January 2010 it devastated the island. To compound matters, among the many thousands of victims were forecasters from the Haitian National Meteorology Centre. Haiti's forecasting capabilities were severely damaged, leaving surviving infrastructure — and population — vulnerable to wind and rain. So alongside other weather services from around the world, the Met Office provided forecasts from nearby Martinique and passed on crucial weather information to relief agencies.

One such agency was an international charity called ShelterBox. They deliver emergency shelter and lifesaving essentials to families immediately after a disaster. ShelterBox became the Met Office's corporate charity two years ago and Haiti was the first time the two organisations worked on a significant project together.

As Nick explains, "ShelterBox does fantastic work in disaster stricken regions — and we're pleased to play our part by providing forecasts to their teams in the affected areas. Since Haiti, we've been involved with them in other catastrophic situations around the world."

In fact, immediately after the earthquake hit Japan, the Met Office provided services to ShelterBox — who were quick to arrive on the scene.

"We gave them top line verbal or emailed information, followed by daily operational forecasts. Word soon got round, which has prompted requests from other charities such as Christian Aid and Oxfam to use our services."

Looking to the future, a focal point for hazard information and advice is being developed with UK's leading public sector agencies. This means that a number of agencies will be working together to provide the best advice on impacts associated with hazards. For example, the Environment Agency provides flooding knowledge while seismic activity research is carried out by the British Geological Society. The aim is to combine the skills of everyone involved and create a clearer picture of how to handle high impact natural events around the world.

Seeing through the ash cloud

Volcanic ash from the Eyjafjjallajökull eruption in Iceland impacted on European and North Atlantic airspace in April and May 2010. As the International Civil Aviation Organisation (ICAO) mandated Volcanic Ash Advisory Centre (VAAC) for volcanic eruptions originating in the north-eastern Atlantic, the Met Office London VAAC was responsible for monitoring and forecasting the movement of the volcanic ash.

As Volcanic Ash Coordination Programme Manager, Ian Lisk says, "The explosive mix of magma, gas and ice in this particular eruption resulted in largely fine ash particles. This made the volcanic ash sometimes difficult to see on the satellite imagery especially when the ash was below twenty thousand feet."

Other volcanic ash observation methods were therefore used, including the use of low power LIDAR (vertically pointing laser beam) from around the UK and conventionally used for measuring cloud-bases. With some fine tuning, expert interpretation and clear skies it was possible to use these LIDAR to provide an assessment of the presence or not of volcanic ash layers."

During the Eyjafjjallajökull incident, the UK Civil Aviation Authority (CAA) working with aircraft engine manufacturers and European transport ministers defined, volcanic ash concentration safety thresholds levels for European and North Atlantic airspace. These thresholds supplemented the global ICAO standard of 'avoid all ash'.

Responding to this new requirement we produced supplementary volcanic ash concentration charts depicting concentration contours of 200 and 2,000 then latterly 4,000 micrograms per cubic metre. These charts were used by European airspace authorities as the basis for informing their flight safety related decisions.

Since last year, building on the many lessons learnt, new initiatives are helping the international aviation community to be better equipped to respond to future volcanic eruptions — something that happened sooner than some expected, as Grimsvötn — another Icelandic volcano — exploded in May 2011.

See page 5 for more on our involvement with monitoring the Grimsvötn volcano.

Photo: Corbis

Photo: Photoshot

Force of nature

Between 80 and 100 tropical cyclones develop each year, but it is the few intense systems that strike land that make the news and cause extensive damage such as Cyclone Yasi which struck Queensland Australia in February 2011. **Julian Heming**, Met Office Tropical Prediction Scientist, examines the nature and prediction of tropical cyclones.

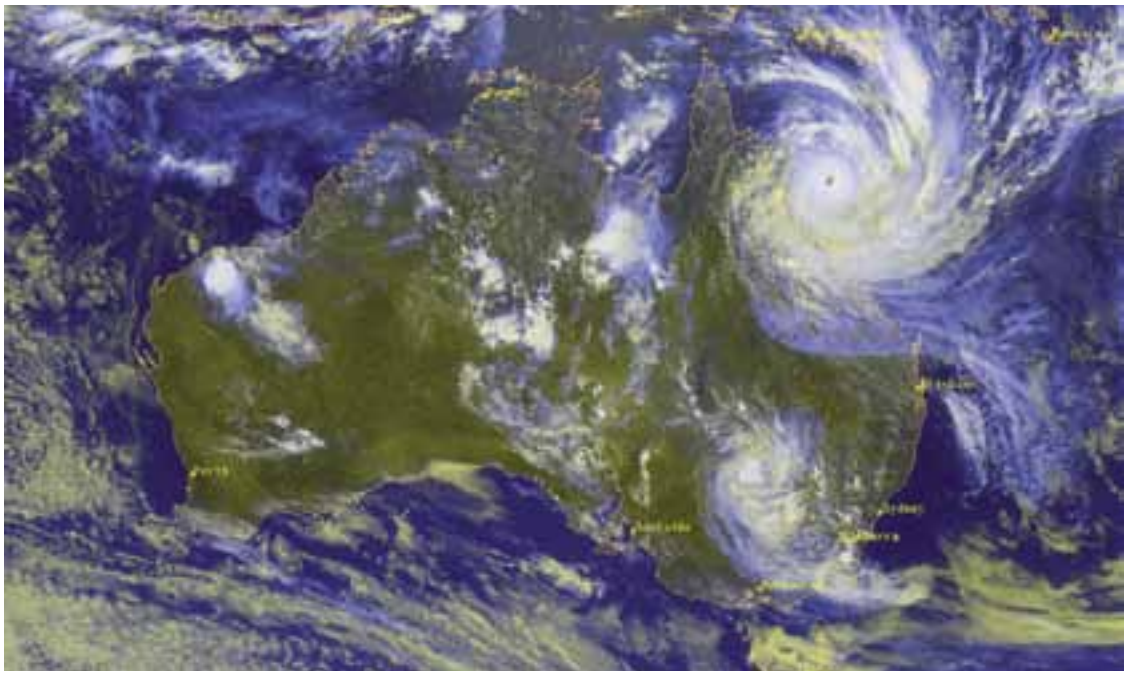


Photo: Corbis

Tropical cyclones are driven by heat and moisture, which is why they develop over the vast tropical oceans. At certain times of year, conditions are right in the atmosphere and oceans to cause them to develop. With stronger winds, some become hurricanes (a name used in the Atlantic and east Pacific) or typhoons (a name used in the west Pacific). In other regions they are known as cyclones.

In the northern hemisphere, storms usually develop between June and November and in the southern hemisphere between November and April. The number and intensity of tropical cyclones can vary greatly from year to year due to cyclical phenomena such as El Niño and La Niña. For example, there were 28 tropical storms in the Atlantic in 2005, but just nine in the following season.

Forecasting centres such as the Met Office attempt to predict the track, or path, of tropical cyclones by using numerical weather prediction models. Short period forecasts have improved vastly over the years with five-day forecasts now better than three-day forecasts were 20 years ago. In most cases, computer models give several days warning that a storm will develop. For example, the Met Office model predicted the formation of Cyclone Yasi 3,500 km away from its eventual landfall location over Queensland. The prediction of landfall six days later was accurate to within 50 km.

Beyond a week in advance, the Met Office uses ensemble techniques to predict the likely track of tropical cyclones. This involves running 24 separate forecasts from slightly different starting conditions. The spread of the forecast tracks enables a probabilistic forecast of the track to be made. These forecasts run out to 15 days ahead.

Responsibility for issuing forecasts of tropical cyclones to the public and emergency services rests with a number of designated forecasting agencies based in the tropics such as the US National Hurricane Center. However, Met Office forecasts are shared with these agencies contributing to warnings for tropical cyclones worldwide. Met Office forecasts also inform the Foreign and Commonwealth Office and aid agencies of the likelihood of tropical cyclones in their areas of interest.

On a seasonal timescale (up to six months ahead) it is impossible to predict the formation and track of individual tropical cyclones. However, it is possible to predict whether tropical cyclone activity across a whole season and whole region is expected to be above, near or below normal. Since 2007, we have issued forecasts of Atlantic tropical cyclone activity using our GloSea model and the model of the European Centre for Medium Range Weather Forecasts (ECMWF). These forecasts are useful to the reinsurance market which needs to assess the risk of financial losses from hurricane strikes months in advance.

The Met Office uses its climate model to predict trends in tropical cyclone activity on long timescales. In 2010, Met Office scientist Doug Smith and his team won the Lloyd's Science of Risk Research Prize for groundbreaking work on the prediction of Atlantic hurricane frequency on decadal timescales. Research using the Met Office climate model contributes to the ongoing international effort to predict the impact of climate change on tropical cyclone frequency and intensity.

A team at the Met Office strives to predict tropical cyclones across the timescales. This work involves evaluating and improving numerical model predictions, providing products and services to other meteorological agencies, industry and the public. It also forms part of the global research effort to improve understanding and prediction of the force of nature which is the tropical cyclone.

Get short, timely messages about storms from the Met Office by signing up to the @metofficestorms Twitter feed.

See page 3 for news on StormTracker, our new tropical storm prediction service.

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...

Joanne Camp
Climate Applications Scientist

"I'm proud to say that the Met Office is one of only a small number of centres across the world using dynamical models."

After graduating with a BSc in Meteorology from the University of Reading, Joanne Camp joined the Met Office in 2008 as a Climate Applications Scientist. Since then she's played a major role in developing seasonal predictions of tropical storm activity in the North Atlantic.

Storm chaser

It was family holidays to America that first got Joanne Camp interested in tropical storms. She'd watch hours of hurricane reports on the weather channel, fascinated by the devastation that they could cause. Years later, when Hurricane Katrina hit in 2005, she found herself once again transfixed by the destructive power of hurricanes.

As a Research Scientist in the Monthly to Decadal Prediction group, Joanne's work focuses on long-range seasonal predictions of tropical storms. One of the most challenging — and also most exciting — parts of her job happens when a tropical storm starts heading towards land. At times like these, Joanne is part of a small team of scientists who liaise closely with the press office to provide guidance about communicating the forecast: "We've got to make sure that the message the Met Office gives out is clear and consistent. Our aim is to provide warnings that are as accurate as possible, as early as possible."

Joanne also works on the development of seasonal tropical prediction products to provide forecasts for North Atlantic tropical storm activity ahead of the forthcoming season. This work provides information for both the general public and businesses. A forecast for the total number of tropical storms and Accumulated Cyclone Energy (ACE) index — a measure of the collective intensity and duration of storms during the season — is released each May on the Met Office website. But a more detailed prediction is also prepared for commercial customers, which provides in-depth forecasts, as well as exploring the factors that could affect tropical storm activity. As part of the service, Joanne and her team hold teleconferences with clients: "It's important that we work closely with clients — that they can ask us questions and we can give them feedback straight away."

These products are potentially very useful to big businesses, especially in the insurance industry where the forecasts would constitute an important component in assessing the risk of losses.

Photo: Corbis

Predicting the future

Since the Monthly to Decadal Prediction group started predicting tropical storms in 2007, it has been very successful. In fact, all forecasts have been within the range predicted — even in more extreme years. In 2008 for example, they predicted a high level of storm activity — 15 storms between July and November — all of which happened. Again, last year was also a very active season. 20 storms were predicted and 19 occurred.

Joanne puts the accuracy of the predictions down to the use of dynamical models such as GloSea4 (the Met Office Global Seasonal Forecasting system). Most seasonal forecasts of Atlantic tropical storm numbers are produced using statistical-empirical models that only look back at what has happened previously.

"I'm proud to say that the Met Office is one of only a small number of centres across the world using dynamical models — numerical models based on the laws of physics — to predict future tropical storm activity."

The same models are used for global weather and climate prediction. With regard to tropical storms, they are particularly effective at picking up changes in activity from year to year. This, Joanne believes, is the future for seasonal forecasting, and is the main focus of her development work.

"We're working towards improving these models and their resolution so we can increase the accuracy of our forecasting now and in the future."

Consulting in Rwanda

Helen Ticehurst is working as a consultant with Rwanda Meteorological Service for a year to help them increase their range of services and users. Here, Helen explains more about her role and the project — a first for the Met Office in providing an embedded consultant.

Photo: Martin Roemers/Panos Pictures

Why Rwanda?

The Rwandan Government recognise the value of weather forecasts in protecting lives and property and enhancing national economic development. This is part of an ambitious programme to deliver enhanced services to the population of Rwanda after the service's infrastructure was badly damaged after the genocide in 1994. Like many other National Meteorological and Hydrological Services in developing countries, the Rwanda Meteorlogical Service wants to become more integral to the national infrastructure.

What's the current set-up?

Rwanda Meteorological Service employs around 50 people and, while they have the equipment and skills needed to produce weather forecasts, they deliver few services and there is little awareness of their services among the general public. They need to increase their range of services and improve public access to them. They want to establish an early warning service, and provide specialist services for the various sectors in Rwanda's economy, particularly agriculture. The Met Office has worked with Rwanda Meteorological Service before through the World Meteorological Organization's Voluntary Cooperation Programme.

Helen with a Rwandan weather observer. Taking a modem to her weather station makes it possible to send in observations via email instead of having to call the HQ.

What are the aims of the project?

This new project builds on previous work, helping Rwanda Meteorological Service deliver new and improved services to a wide range of users, from farmers to insurance companies and development agencies working in the country.

Where are you based?

I've been based in Kigali since January 2011, but I'm still working with colleagues in the UK, who are providing specific expertise and training for Rwanda Meteorological Services' staff.

How are you contributing to the Rwandan weather service?

I'm working closely with the Director of the service, John Ntaganda Semafara, to strengthen the organisational structure so it supports more services. This includes hiring more staff, but also means making sure that there are good managers in place and effective support functions like IT, procurement and communications.

I'm also working with the forecasting and observations teams to help them plan how improvements can be made in their areas.

What have you achieved so far?

One of the first things the Met Office did was to bring out Met Office's Media Designer, David Robinson, to change the graphics used on the TV forecast bulletin (for more on this see pages 9 and 10). We've helped to set up a management team so there is more accountability and helped to improve the way observations are transmitted from stations.

What are you currently working on?

We're in the middle of recruiting twenty graduate trainees. Some of these will do a diploma in meteorology while we hope others will be trained at the service as forecasters by the Met Office College. We're also recruiting for 11 other posts who will act as support staff to the forecasting and climatology teams.

Who have you been working with?

As well as John Ntaganda Semafara and the rest of the team, I also work closely with colleagues from the Met Office in the UK, such as Steve Palmer, Met Office International Technical Co-operation Programme Manager.

What are your plans for the second six months?

To ensure the management team functions well and that all staff have clear job descriptions and know how they fit into the overall goals of the organisation. Other big projects will be to get forecasts broadcast on radio, redesign the website, and work with the service and other stakeholders to establish an early warning service for severe weather.

What does the future hold for you and the Rwandan weather service?

Rwanda Meteorology Service has ambitious plans for the next five years which should see it transform into a high performing national meteorology service. Our direct involvement will end in December but we'll still keep very close links with the service through the VCP programme and other projects.

Finally, what's the weather like?!

Beautiful! While Rwanda's on the equator, it's at a high altitude so it has a really pleasant climate which is warm and sunny except for a few big storms.

For more information on the Voluntary Cooperation Programme see: www.metoffice.gov.uk/about-us/what/international/development/vcp

The science of comedy

From physics PhD student to TV funny man, **Ben Miller's** career path has been far from conventional. Now best known for comedy duo Armstrong and Miller, Ben talks to us about science and satire, his visit to the Met Office and the release of his first film.

Ben was studying for a PhD in the Semiconductor Physics Group at the University of Cambridge when he first got interested in comedy. At the time he was looking for an effect known as quantum capacitance — based on the idea that if you build a capacitor small enough to store only a few electrons, you start to see them exhibit unusual quantum-type behaviour.

But, quantum physics aside, it was Ben's involvement in the university's amateur dramatic club, playing Cassio in Othello, that he discovered an unintentional knack for comedy.

"I played Othello's lieutenant and despite trying to give the part tragic weight, people just started laughing every time I came on. So I thought: go with the flow."

Ben got his first comedy break in a Smith and Jones sketch while still at university. Ben explains; "I remember stepping onto a film set for the first time and thinking it was the perfect place for me, like a mixture of acting and the army." It was then that Ben decided to leave his PhD behind for his newfound love of comedy — despite his parents' objections and friends' dismay.

Science and satire

With a successful TV career in hand, Ben still manages to include his scientific interests in his work. A genuine interest in climate change and meteorology led him to poke fun at climate change doubters last year in a sketch that highlighted the differences between weather and global warming. "The kernel of most of the sketches on 'The Armstrong and Miller Show' is someone's beef with some madness-inducing aspect of day-to-day life," he says.

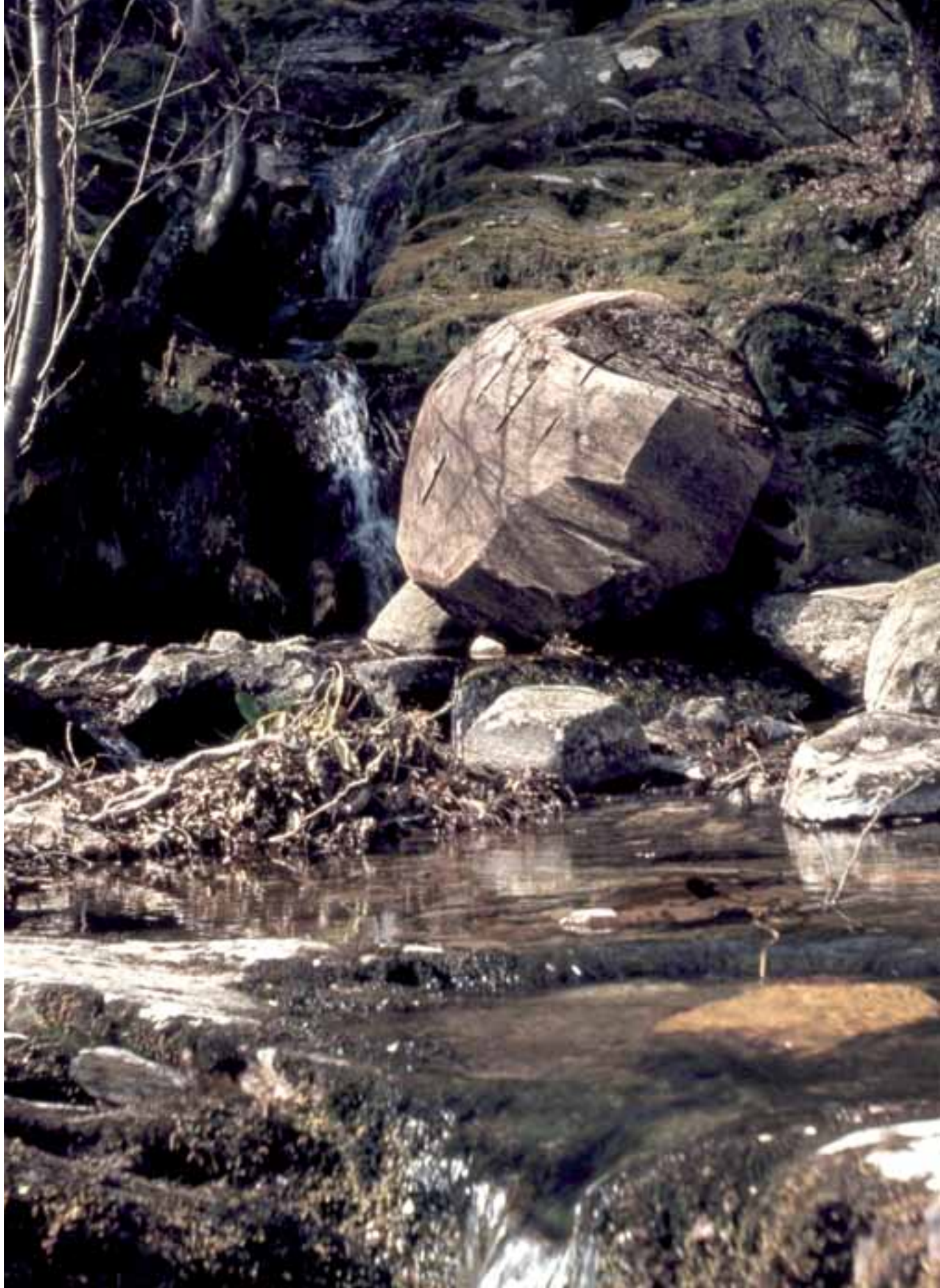
After seeing this sketch on TV, the Met Office invited Ben to their head quarters. Although Ben understood the work of the organisation, he still found the day surprising. He says, "It was a shock to see the teams at work with real weather maps, working on the basic unfolding story of the world's weather, right in front of me. I thought somehow it was all done by magic, not by real people with half-full cups of tea and photos of their kids by the monitor."

In January, Ben returned to his physicist roots to present the BBC 2 Horizon documentary 'What is One Degree?' exploring the concept of temperature. Ben says, "I think it's hard to get anywhere with the science of climate change until you get the hang of temperature. So I wanted to explore the fundamental science of how we measure temperature and what it is." It was on this show that Ben installed a Met Office weather station at his home — so he can now monitor the weather in his own back yard every day.

One of Ben's earliest primary school memories was taking measurements from the school's own weather station. "It's astonishing to think that early records — and even a sizeable chunk of today's records — are taken by amateur weather stations. I am thrilled to have made my own contribution, however small," says Ben.

The final word

This year is shaping up to be an exciting one for Ben as he turns director on his first ever film. 'Huge' hits the cinemas on 7 July and stars Noel Clarke, Johnny Harris and Thandie Newton. But don't expect laughs Ben warns, as 'Huge' is not a comedy. "It's a drama about a struggling comedy double act on the effortlessly brutal London stand-up circuit." Few comedians are better placed than Ben to deal with this kind of subject matter who's made a career out of seeing the funny side of serious issues. It makes perfect sense for Ben to now turn the tables and observe the serious side of comedy.



Left outside to weather

David Nash is known for the large wooden sculptures he carves using a chainsaw and an axe. Sometimes he uses a blowtorch to char the wood and often leaves his sculptures outside to weather.

Nash also makes land art, including Wooden Boulder. In 1978 Nash carved a large wooden sphere and left it in the North Wales landscape to weather. He followed the journey of the sphere from a Welsh mountainside to the Atlantic Ocean.

Over time, the boulder slipped, rolled and was sometime pushed through the landscape following the course of streams and rivers until it was seen in the estuary of the River Dwyryd. It was thought to have been washed out to sea but, after being missing for over five years, it reappeared in 2009 after apparently being buried under sand in the estuary. The sculptor enjoys the notion that wood which grew out of the land will finally return to it.