



Success stories
Making a difference

Creative culture
Doing things differently

Worldwide weather
Another busy year

Barometer

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After a busy and challenging year, **Robert Napier**, Met Office Chairman, praises the work and forecasts of the Met Office

Success story

This issue of *Barometer* looks back on another eventful year for the Met Office. Throughout the last twelve months, the Met Office has been at the forefront of providing critical safety advice to the public. Through snow, flooding and volcanoes the Met Office has been vital. As I write, work continues on monitoring the spread of the ash plume from the eruption of the Eyjafjallajökull volcano in Iceland, keeping everyone up to date with the latest information (pages 9–10).

We are rightly proud of our UK and international safety role. Last November, accurate forecasts of floods in Cumbria, Durham and Scotland served our customers well (page 5–6). Extensive flooding was much easier to deal with because of warnings from our new joint Flood Forecasting Centre (pages 21–22). The new supercomputer and the 1.5 km model (page 27) performed especially well during these floods.

Progress and change

This year, the Met Office has pushed ahead with new mobile applications to keep the public informed wherever they are. Various examples of innovation, such as our iPhone application, can be found on pages 19–20.

The challenge of communicating the science of climate change is considerable (pages 17–18) but we're at the forefront of building public confidence in climate science. Now, more than ever, it is the reputable source of the science which matters. The Met Office is very thorough in the way it considers and peer reviews its science; ensuring its advice is transparent and trusted. As well as publishing station records and explaining new science, we've communicated through our *Warming* brochure, our website and briefings across all sectors.

Despite some criticism from the media, 82% of the public have moderate to high trust in the Met Office. We've

listened to public feedback and replaced our seasonal forecasts with a monthly outlook. See pages 9–10 to discover how we manage customer feedback and find out what people really think about us.

Delivering with integrity

Consistent delivery is something that John Hirst, Met Office Chief Executive, insists on (pages 7–8). It is clear that the good work we do as an organisation depends on the dedication and hard work of our people (pages 11–12).

The Met Office prides itself on its peer reviewed science and, earlier this year, the Met Office Hadley Centre was named as the top geosciences institution in the world by the Times Higher Educational Supplement. This *Barometer* also reveals some of our other international successes on pages 15–16.

Rightly being praised for its high quality output, the Met Office Hadley Centre celebrated its 20th Birthday this

year and is a great institution on a global scale and a jewel in the UK's crown. We continue to help people across the world with our expertise, advising a range of clients on the opportunities and challenges of a changing climate (pages 23–24).

Again this year we've demonstrated our integrity in both a technical and personal sense. As Chairman, I'm particularly grateful for the commitment and spirit of Met Office staff. Let's hope that this success story continues.

➔ This *Barometer* is a review of the year. To find out more about what we do, take a look at this year's Annual Report and our new Corporate Responsibility brochure on our website at www.metoffice.gov.uk/publications

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Climate Service

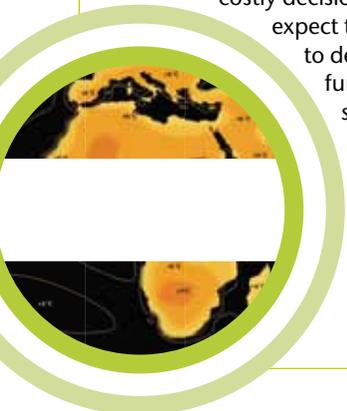
The Met Office is developing a Climate Service as a natural extension of its weather service, in response to growing user interest and evolving scientific capability.

We are building on our existing expertise, for example, the world-renowned Met Office Hadley Centre and Met Office Consulting are both well established in providing climate advice to a variety of customers. With growing emphasis on forecasting on timescales from months to seasons to years, the development of the Climate Service is an expansion of our weather service role.

Our intention is to improve our current global capability and reach by working in partnership with others, such as the Natural Environment Research Council, academia and customers. The Climate Service encompasses observations, research, operational predictions and delivery of products and services for all sectors that depend on climate information, both within the UK and abroad.

This work has already involved a Climate Science Research Programme for the UK Department for International Development in Africa, and new climate services for reinsurance. These are long-term relationships built on close interaction to help shape critical and costly decisions. We

expect to be asked to develop further such strategic climate services over the coming years.



Empowering

From weather forecaster training to understanding the likely impacts of climate change on your organisation, the Met Office College offers training specially tailored for you.

The world-renowned and highly respected Met Office College provides a wide range of professional weather and climate training – incorporating related science, maths and information technology. A team of highly skilled staff deliver training at the Met Office College in Exeter or at locations worldwide as chosen by our customers.

We have earned an excellent reputation for delivering globally recognised professional weather observing and forecasting training to national National Vocational Qualification (NVQ) and international World Meteorological Organization (WMO)/International Civil Aviation Organization (ICAO) guidelines. We also offer essential high-quality weather training to a wide range of government departments and industries, including aviation, road, water and broadcasting.

Climate change seminars are also available that combine the most up to date research and specialist know-how from the Met Office Hadley Centre. Our scientific excellence and hands-on experience can benefit your organisation at operational or strategic level. We can help you unravel the myths and scepticism surrounding climate change, supporting you in discovering how your organisation may be affected and preparing you for the possible opportunities and threats ahead.

To find out more see www.metoffice.gov.uk/training

A new synergy

The Met Office Research and Development (R&D) section is to be restructured.

Forecasting R&D and Climate Science will be unified under a single Science Directorate to reflect the synergy between weather and climate that is driving the research agenda.

The new structure will allow us to make full use of our unique position of having weather forecasting and climate prediction in the same organisation. This will enable us to respond better to the changing and increasing requirements of our customers.

The Science Directorate will be led by Met Office Chief Scientist, Professor Julia Slingo who enters the new post of Director of Science. New areas have been created to make the Met Office even more efficient and flexible: Foundation Science will draw on those parts of Forecasting R&D and Climate Research which are fundamental to all our science and prediction activities, while two other areas, Weather Science and Climate Science, will cover the main activities of Forecasting R&D and Climate Research. We have also created a new Head of Science Partnerships, which recognises the increasingly important role that the Natural Environment Research Council (NERC), UK universities and our international partners play in our science base.

This is an exciting step for Met Office science and forms part of our long-term strategy to maintain our position as a world-leader in science, forecasting and climate services.



Professor Julia Slingo, Met Office Director of Science

It pays to know

The Met Office is a vital part of British life. On duty 24 hours a day, providing essential services to protect people and property at home and abroad, ultimately delivering exceptional value for money.

For over 150 years we've pioneered the science that makes today's advanced weather and climate forecasting possible. Today, however, we all live in an increasingly challenging climate – both in terms of the weather and the economy. We provide real value for money to the taxpayer.



In fact, for every £1.40 invested in our Public Weather Service, there is a £10 return. In 2008/9 we produced a £17.2 million dividend for the Ministry of Defence. Here, we take a look at some of the ways we've played our vital role over the past year.

The UK experiences some of the most variable weather in the world, recently suffering several extreme events. Across the nation, people's lives were affected by the harshest winter for more than 30 years and floods in Scotland, Durham and Cumbria. Our forecasts of heavy rain in November and snowfall in January made these events easier to deal with.

Natural hazards

Damage caused by natural hazards is predicted to increase to £2.25 billion per year by 2040–60, compared to £1.5 billion today. We already use the latest techniques and technology to deliver our warnings, and efficiency savings. Science forms the foundation of our role as a national weather service, the climate advice we provide, and our applications used to tackle environmental hazards.

We support emergency services, public health organisations, local councils and other public bodies. Health forecasts let people know when, and where, there is a risk of illness so they can take action quickly. Our Public Weather Service Advisors are always on hand to help people make crucial decisions. We also manage RIMNET, the national radiation monitoring network and emergency response system, in partnership with the Department of Energy and Climate Change and the Department for Environment, Food and Rural Affairs.

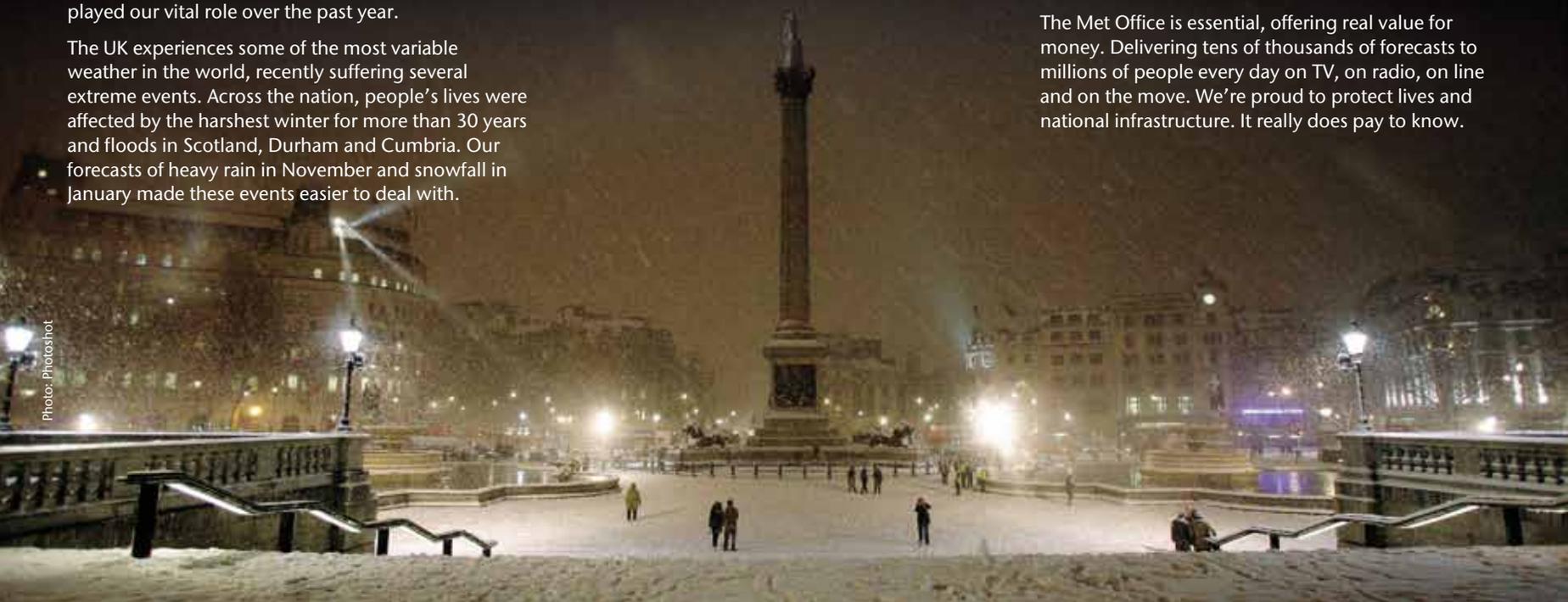
We help to tackle inefficiency by pooling key public sector resources. For example, our support to the Emergency Response community has been enhanced with our new Hazard Manager web portal providing access to a variety of services in one location.

Supporting role

The Met Office Mobile Met Unit (MMU) supports UK and allied forces helping to keep people safe and provide a tactical advantage where possible. Our dust forecasts can have a significant impact on military operations – particularly in environments like Afghanistan. This year we set up a Joint Operational Meteorological and Oceanographic Centre (JOMOC) with the Royal Navy to further support the Armed Forces. We've also secured a contract to provide a weather visualisation system to the Air Force Weather Agency, the lead weather centre of the United States Air Force.

All over the world, we're helping people prepare for climate change. Together with the World Meteorological Organization and partners like the Department for International Development and the Foreign and Commonwealth Office, we work with national weather services in climate vulnerable countries, helping prepare for and respond to natural disasters.

The Met Office is essential, offering real value for money. Delivering tens of thousands of forecasts to millions of people every day on TV, on radio, on line and on the move. We're proud to protect lives and national infrastructure. It really does pay to know.



Demanding days

All in all, this year has been a busy one. With a quick glance back at the year's weather and environmental events, you can see we've been critical to keeping the UK informed. Confronted with snow, gales, heavy rain, floods and international disasters – the UK has kept calm and carried on.

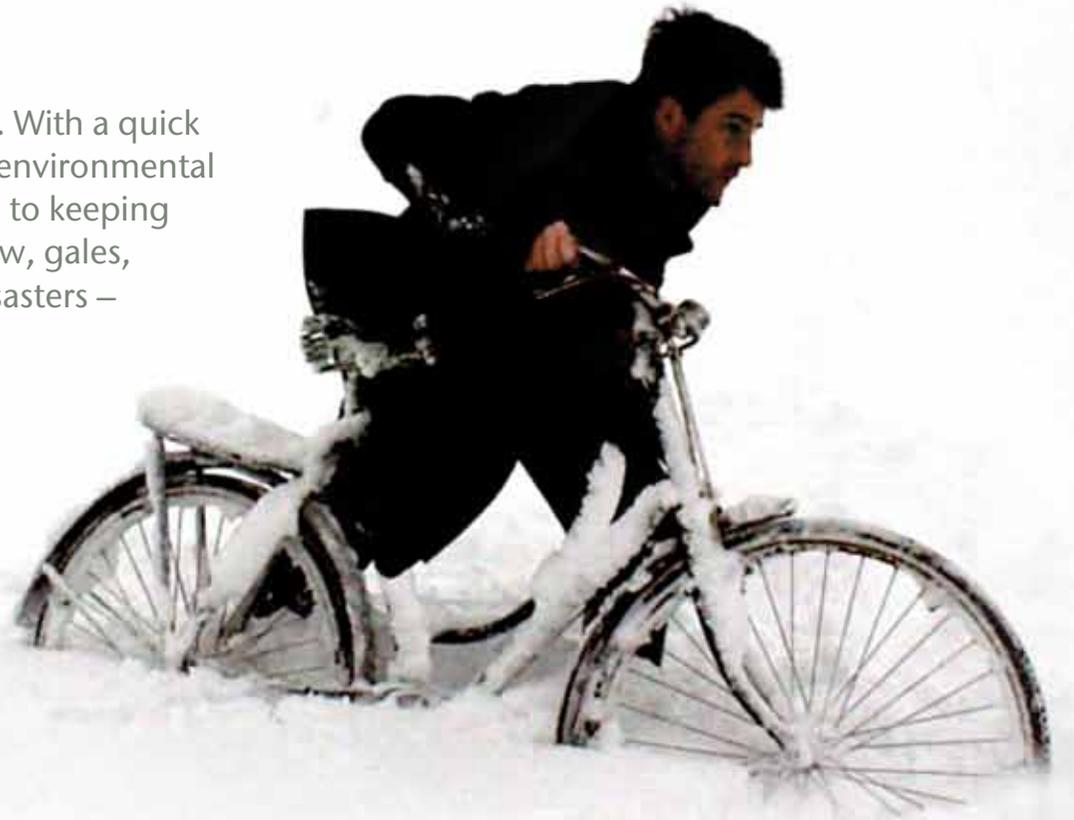




Photo: Photoshot

"The Met Office had predicted when the snow was coming. Therefore, there was a window of opportunity for getting gritters out on the roads."
Edmund King, President of The AA

While the environment has placed differing demands on all of us, our early warnings have contributed to saving lives and property. Here's a round-up of how we were involved in some of the most important weather and environmental events of the past twelve months.

In our own backyard

Coldest winter for decades

This winter we experienced the most severe weather we've had in the UK for over 30 years — the coldest since 1978/79. Since mid-December cold weather dominated much of the country, with snow and very low temperatures. The mean UK temperature over the entire winter was 1.5 °C, the lowest since 1978/79 when it was 1.2 °C.

From tip to toe of the UK, travel was disrupted, flights were cancelled and schools closed. Despite the challenges, our forecasters accurately predicted the wintry weather before it arrived. We had around 100 million hits on our website during the cold spell, with 15 million hits during the snow on 5/6 January when up to 40 cm of snow fell in places.

Through the season, the accuracy of our forecasts and warnings was widely acknowledged as we helped the emergency services, our customers and the public to cope with the adverse conditions.

Extensive flooding

Rising to the challenge of the wettest November in the UK involved strong teamwork and consistent messages from the Flood Forecasting Centre (FFC) —



Photo: PAFotos

a partnership between the Met Office and the Environment Agency.

In Cumbria, over 1,300 homes were affected and many more were left without power and water. There was severe travel disruption — several bridges collapsed and others were closed. Cockermouth was the worst affected town where water levels reached 2.5m. There was also flooding in Scotland with some property flooded and travel disruption in Dumfries and Galloway and the Borders. There was also some flooding and travel disruption in parts of north Wales.

It was a real highlight that the FFC's joined-up approach was so successful. Rainfall estimates from our forecasters and interpretations of impact and early warnings from the FFC helped emergency responders to save lives and property. To find out more about how the FFC has improved flood forecasting guidance and alerts see pages 21–22.

"We are delighted to support the invaluable work that the Met Office performs. The extreme weather events we now experience and the very real threat of rapid climate change make the work provided by the Met Office invaluable and vital to the UK and the rest of the world. The Flood Forecasting Centre performed to an exceptionally high standard in its prediction and response to the recent events in Cumbria. Without its sterling work, the situation in Cumbria could have been a great deal more traumatic for all involved."

The then Secretary of State for Environment, Food and Rural Affairs, the Right Honourable Hilary Benn MP, December 2009

Severe weather in Scotland and Northern Ireland

Snow, gales and heavy rain hit Scotland and Northern Ireland in March, causing transport and power problems. Rail services were disrupted, ferry crossings between Scotland and Northern Ireland were cancelled and Belfast International Airport was closed for a few hours. Snow, ice and strong winds led to accidents including a bus crash in South Lanarkshire that sadly resulted in the death of a 17-year-old girl.

Our Public Weather Service Advisors were in close contact with emergency responders and we kept the Scottish and Northern Ireland government departments and the Cabinet Office briefed throughout. We issued Emergency Flash Warnings for Scotland and Northern Ireland. As the highest level of warning for severe weather these are issued rarely. They were also issued for the Cumbrian floods in November and the unusually heavy snow in January.

Global support

Haiti earthquake

Internationally, we were able to help in the response to the earthquake in Haiti, providing daily forecasts to UK non-governmental organisations working in the worst hit areas.

Flash floods in Madeira

We were proud to offer support to the Portuguese weather service after the island of Madeira suffered flash floods on 20 February.



Photo: PAFotos

Volcanic ash from Iceland

To top it off, it was an eventful week or so in April while we monitored the spread of ash from the eruption of the volcano in Iceland (see pages 9–10).

In a year that witnessed floods and the coldest winter for three decades, our work has rarely been more important — or come under closer scrutiny. Here, Met Office Chief Executive, **John Hirst** talks about the highs and lows of the year.

Moving closer to our goals

Q. How well did the Met Office perform this year?

A. We performed very well and met all our Key Performance Targets. There's no denying that some of the weather we were forecasting was quite tricky, so it wasn't always clear if we were going to hit all our short-term targets. But actually the quality of the forecasting has been excellent throughout the year. Our performance during the Cumbrian floods, for example, was exceptional and the short term forecasts during the very severe winter were outstanding. But our less obvious successes have been just as important to us. Our Finance Team, for example, are leading the way for other government organisations in bringing in new international financial reporting standards. And we are now used as a role model by the National Archive — which looks after government data — on how public data should be separated from commercial activities. So we are leading the way in many areas of our work.





Images: John Frost Newspapers

Q. Has the Met Office moved closer to its goal of being the best weather and climate service in the world?

A. Meeting our Key Performance Indicators is vital, of course, but it's the bigger things that really move us towards being the best in the world — such as the enhancements made to our supercomputer. This year's upgrade means we can now apply more sophisticated science to our forecasting models — and we also increased the resolution of our UK forecasts from 4 km² to 1.5 km². This leap forward has had a huge impact on our forecasts. (See page 27 for more detail.)

While we moved closer to our goals, we were also very pleased to be recognised by the Times Higher Educational Supplement as the best geosciences research institute in the world, out of 43,200 candidates.

Q. What were the year's low points?

A. We came under severe attack from the press for some of our seasonal forecasting. While I don't think all the criticism was necessarily justified, we have learned some important lessons from it. One such lesson is it's easy to underestimate how complicated some of our messages are — and there is a need to communicate our science in the right way. There's been a realisation that, because we work in the world

of meteorology, it all seems relatively straightforward to us — but it's not necessarily so straightforward to people outside our field. Our research with the public showed that they would prefer a monthly update rather than a seasonal forecast.

Q. The Met Office has 1,850 employees worldwide. Were any significant HR measures put in place last year?

A. We put a lot of time and effort into leadership training last year. This organisation has fantastic potential — some of which, we recognise, is still untapped. Now we're focusing on creating good leaders to release it. Of course, we continue with our training of forecasters — we have started rebuilding the Met Office College. New classrooms are helping us deliver an extended range of courses to Met Office staff as well as meteorologists from around the world.

Q. The Met Office relies heavily on IT. What progress has been made in this field?

A. Our supercomputer aside, we have really begun to sort out our back office IT systems and increase our capability in web and multimedia. Today, our website capability is really much improved. During the particularly extreme weather this winter, for example, we had 19,000,000 hits on our website in a single day. That was the highest number of hits we've ever had, and the system coped.

I'm also very proud of the iPhone app. we released at the beginning of January. This is the kind of thing a lot of organisations talk about but never do. I feel that, as a government organisation, we're really beginning to break boundaries. We haven't just created an app. that works; we've created one that works really well. So well in fact, that it went to number three in the app. charts with 74,000 downloads in the first three weeks — figures usually only achieved by games. Now we've even got advertising and sponsorship on our website — another boundary broken for a public sector organisation.

Q. What are the plans for next year?

A. We've got more upgrades to our computer coming; new streams of products coming out; and new collaborations with key universities in the UK and institutions around the world — to name just a few of our plans. As I often say, this is a fantastic organisation with so much capability. Next year we hope to tap further into that capability and take more steps towards being recognised as the best weather and climate service in the world.

Q. And finally, how would you summarise the past year?

A. Busy.

As the Eyjafjallajökull volcano in Iceland erupted, weather conditions meant that the volcanic ash covered a large proportion of Europe, causing widespread disruption to aviation. Here, we take a look at our role in predicting the spread of the ash and advising the aviation industry.

As the dust settles



Low-level volcanic eruptions in Iceland occurring since 20 March 2010 increased significantly on 14 April. On 15 April the bright orange plume of the highest concentrations of volcanic ash extended across Scandinavia, and the Met Office observer at Lerwick in the Shetland Islands reported a reduction in visibility and a slight yellow hue in the sky.

The Met Office's responsibility is to monitor and forecast the spread of ash from the volcano. Weather patterns meant that the volcanic ash spread towards the UK so, in our role as a Volcanic Ash Advisory Centre (VAAC), we issued a Volcanic Ash Advisory.

Safety thresholds

Volcanic ash can have a major impact on aircraft, potentially causing their engines to fail. The International Civil Aviation Organisation (ICAO), the UK Civil Aviation Authority (CAA) and aircraft engine manufacturers set safety thresholds for flying planes through volcanic ash. Our forecasts of the ash plume trajectories are based on these thresholds.

We advise the CAA and National Air Traffic Services (NATS) where the ash will be. They have responsibility for safety within UK airspace and decide whether airspace is open or closed. Airspace was closed on 15 April which meant that many people across Europe had their travel plans disrupted.

Monitoring the spread

To forecast the spread of ash we use dispersion models that have been tested and proven during events such as Chernobyl, Bunccefield and the outbreak of the animal disease Bluetongue. Our capability to predict the spread of airborne pollution is delivered by our world-leading atmospheric dispersion model, NAME (Numerical Atmospheric-dispersion Modelling Environment). In addition to being used as an emergency response guidance tool, the model is used for routine air quality forecasting and meteorological research activities.

From the moment the volcano erupted, we used our models to forecast how the ash cloud would move. We have also used satellite imagery, scientific balloons, research aircraft and ground-based radar systems to observe the ash cloud and verify the forecasts. As the Facility for Airborne Atmospheric Measurements (FAAM) and Natural Environment Research Council (NERC) research aircraft were called into action, the importance of research flights when monitoring ash plumes was highlighted.

A comparison of five Volcanic Ash Advisory Centre dispersion models was conducted based on the Grimsvötn volcanic eruption in Iceland in 2004. This concluded that the models all produced very similar results. Locations of the eruption plume simulated by the different models were almost identical to those predicted by the Met Office during the eruption and agreed with the satellite observations.

Guidance

Until 20 April, ICAO guidance was that aircraft should not fly through any volcanic ash or dust, and our predictions were based on this 'zero tolerance' rule. Subsequently, the CAA changed the guidelines, setting new safety thresholds based on information from engine manufacturers and airlines. In support of the regulator, our guidance displayed the areas where ash concentrations were below the new threshold, as well as airspace affected by the 'zero tolerance' rule.

Hot on the heels of the new guidance, a change to weather patterns on 23 April meant that most of the ash moved away from the UK for a week. This was good news for everyone as it gave a significant window for airlines to get people and goods to the right places. However, there were still some traces of ash and aircraft still avoided areas where ash concentrations were above the new threshold. Regulators instructed airlines to conduct a risk assessment before flying and engine inspections before and after each flight.



Volcanic ash chart – the red zones represent the standard safety threshold, while the black represents ash concentrations that are 20 times higher than the standard (red) threshold. The black zone is the area within which aircraft engine manufacturer tolerances are exceeded.

“We very much appreciated the collaborative approach and responsiveness of all your team who worked very effectively with NATS, airlines, airports and the Civil Aviation Authority to bring matters to a close.”

Richard Deakin, Chief Executive Officer, National Air Traffic Services (NATS)

Support network

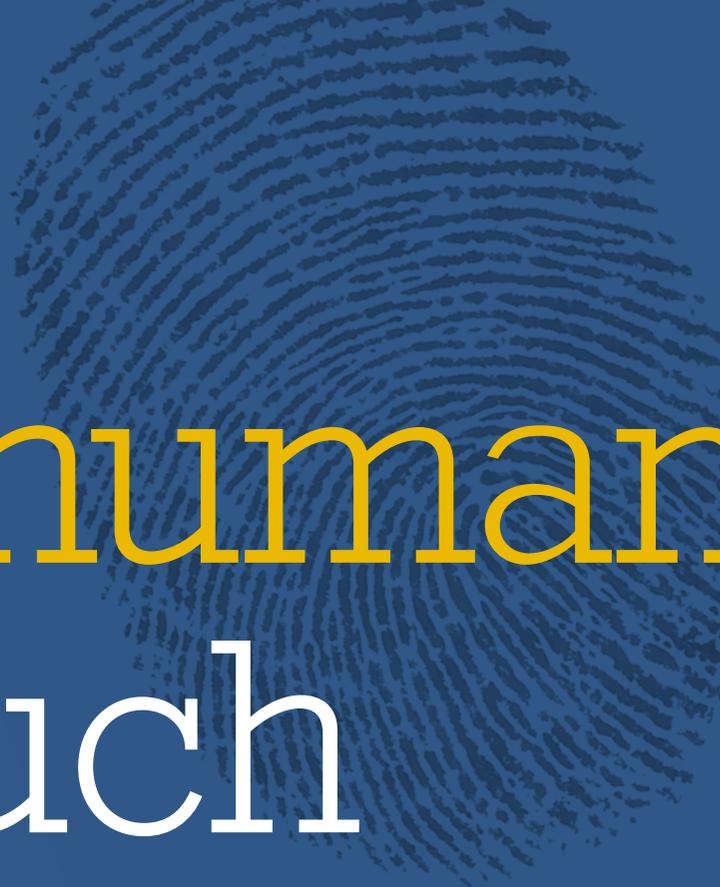
Many people were involved from across the Met Office, with different teams working together to deliver a world-class service. Collaboration with NERC and the Universities of Reading and Hertfordshire worked well, while research aircraft and research communities provided us with observations and measurements of the volcanic ash plume. Working closely with the Icelandic Meteorological Service, we also had the full support of the European and global VAAC meteorological community throughout. We maintained close contact with aviation authorities who supported us in discussions with the wider aviation community.

Our advice and hard work has been recognised as exemplary at the highest

levels of Government and by the agencies we have supported during the eruption. The Cabinet Office, the then Transport Secretary Lord Adonis and previous Business Secretary Peter Mandelson all praised and thanked the Met Office. So too have NATS, CAA and ICAO.

As a Volcanic Ash Advisory Centre we are very proud to provide advice to inform critical safety decisions. Our Volcanic Ash Advisory Centre is an operational service, on watch around the clock, so as the volcanic activity and weather changes we continue to provide timely advice.

➔ For more information on Volcanic Ash Advisory Centres (VAAC) see www.metoffice.gov.uk/aviation/vaac/



A human touch

“If people aren’t motivated to deliver, then they won’t deliver their best — and the business will suffer as a result. That’s why we have a whole framework of processes in place to make sure all staff are working together in their own departments and across the Met Office in the most effective way possible.”

It’s no secret that a happy workforce means a more productive business — not to mention a more stimulating working environment for everyone. Today, the Met Office invests extensively in strategies and initiatives to give people the support and guidance they need to succeed.

It’s easy to assume that in a large, multi-faceted government organisation like the Met Office, the needs of individuals might take second place to any number of business priorities. But, in reality, this couldn’t be further from the truth. In fact, Diana Chaloner, Director of Human Resources, believes business success and staff satisfaction are inextricably linked.

“If people aren’t motivated to deliver, then they won’t deliver their best — and the business will suffer as a result. That’s why we have a whole framework of processes in place to make sure all staff are working together in their own departments and across the Met Office in the most effective way possible.”

Investing in people

The Met Office invests in people. As a national government standard, the Investors in People accreditation focuses on a chosen area of business — for example, engaging employees or developing management skills — that’s then regularly retested. It’s a reliable framework to help organisations chart

their progress. “We were only just meeting the standard last time we were tested,” says Diana. “This time round, however, we met it by a huge margin which is really encouraging. And we’re going to carry on retesting across even more areas of the business.”

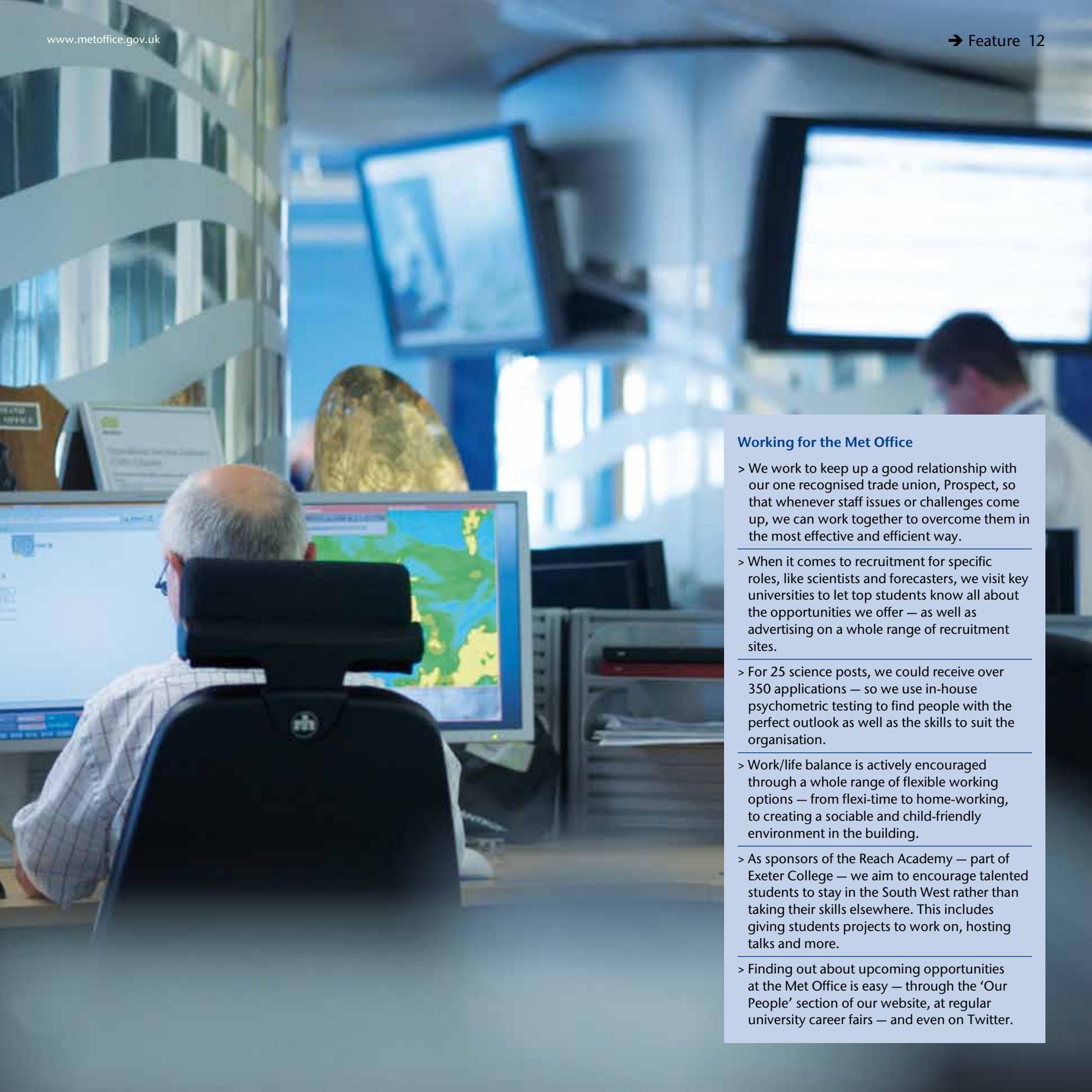
The Met Office keeps investing in its people and improving the satisfaction of its staff in a range of ways. Using a ‘professional skills framework’, for example, the Met Office makes it easy for individuals to see exactly what they need to do to further their careers. As Diana says, “For every type of job there’s a clear, transparent framework that staff can see on our intranet. And for extra support, they can also speak to a team of learning and development advisers.”

Setting sights high

Crucially, contentment in the workplace also comes down to how people feel they’re being managed — and where they think the organisation is going as a whole. The Met Office tackles this head on, with a Leadership Development Programme that helps train managers in best practice. “First, we put sixty

of our top managers through the programme,” says Diana. “Then, we reviewed how the organisation feels it’s being led, the effect of the leadership style and whether staff feel they’re being inspired. Our recent retest shows a real improvement. We are now planning to roll the programme out to managers throughout the organisation, which is crucial to ensuring standards of leadership are maintained and continuously improved.”

But for Diana, an understanding among staff of the business direction is absolutely critical — and all for one important principle. “I believe that if everybody understands our long term direction — and feels they have a part to play in it — then they’ll deliver it,” she explains. “In essence, it’s that simple.”



Working for the Met Office

- > We work to keep up a good relationship with our one recognised trade union, Prospect, so that whenever staff issues or challenges come up, we can work together to overcome them in the most effective and efficient way.
- > When it comes to recruitment for specific roles, like scientists and forecasters, we visit key universities to let top students know all about the opportunities we offer — as well as advertising on a whole range of recruitment sites.
- > For 25 science posts, we could receive over 350 applications — so we use in-house psychometric testing to find people with the perfect outlook as well as the skills to suit the organisation.
- > Work/life balance is actively encouraged through a whole range of flexible working options — from flexi-time to home-working, to creating a sociable and child-friendly environment in the building.
- > As sponsors of the Reach Academy — part of Exeter College — we aim to encourage talented students to stay in the South West rather than taking their skills elsewhere. This includes giving students projects to work on, hosting talks and more.
- > Finding out about upcoming opportunities at the Met Office is easy — through the 'Our People' section of our website, at regular university career fairs — and even on Twitter.

It's who you know...

Understanding the needs and wants of your customers is crucial to business success. This is no different for the Met Office. Here, we look at how today's customer feedback is shaping the future of the organisation.

Over the last few years, we've been carrying out annual and special surveys to gain insight into our government, commercial and public customers' requirements.

We have a wide variety of customers who have differing relationships with us. We reflect this in the different approaches we take to gathering their feedback; from face to face interviews through to fully automated email surveys. For instance, we target public surveys around severe weather incidents to gain insight into the usefulness of our warnings.

All customer feedback is fed into an overall action plan so that we regularly review and improve our products and services.

Surveying the scene

In October 2009, we conducted the third wave of our Customer Attitude Survey, carrying out telephone interviews with over 270 customers and stakeholders, from commercial, government and research institutions. The aim of the survey was to gain a clear understanding of our customers' opinions on a range of issues, including their perception of our reputation, our value for money and our customer service.

Met Office Brand Manager, Helen Ticehurst, says, "Our brand positions us as a world-leading provider of weather and climate services, and our customers are the best people to tell us if we're achieving this. This research measures how our customers perceive us and what they want us to be, and helps us

understand how we can improve the services we offer them."

The research showed that our reputation among our customers is very high and within the top 10% of all European business-to-business organisations. Over 70% said that 'trusted' was one of the most applicable words to describe the Met Office. Knowledge and expertise were also highlighted as key strengths. 'Being innovative' was one of the things customers wanted us to demonstrate more. See pages 19 and 20 to find out more about innovation at the Met Office.

One of the biggest shifts for the Met Office has been to draw together findings from a variety of surveys to look at the whole customer experience rather than just one aspect for one particular customer group. This customer-focused approach ensures that actions are taken as a result of what customers are telling us as opposed to what we think customers want.

One new element to the mix is the MetPS (Met Promoter Score).

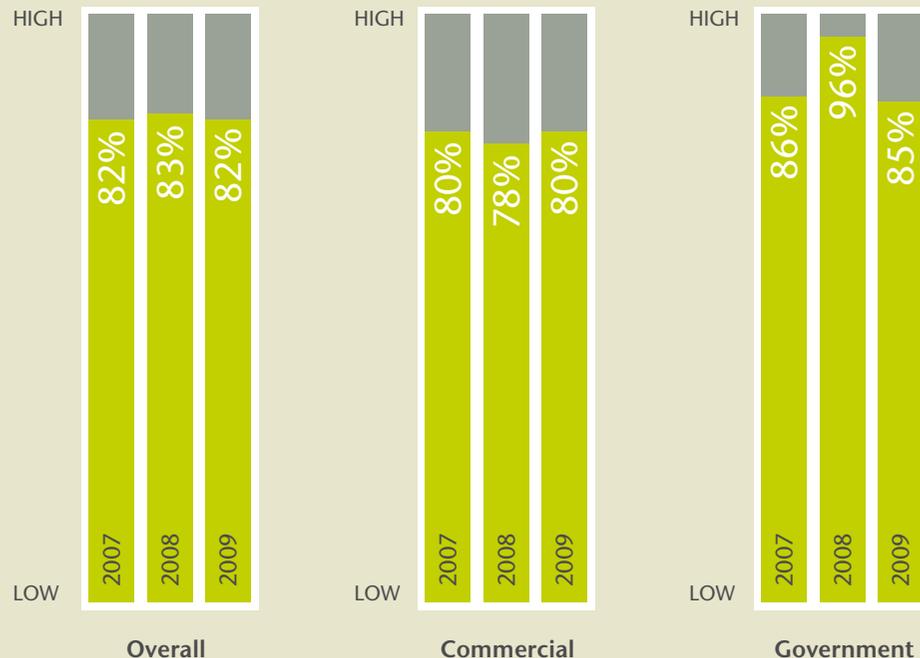
The MetPS

Part of our Corporate Plan is to establish an ongoing user feedback mechanism so we can keep up to



Our reputation

Our Customer Attitude Survey showed that the Met Office's reputation among our customers is very high and within the top 10% of all European business-to-business organisations.



date with what our customers think. The MetPS was launched in November 2009 with the objective of obtaining ongoing feedback from customers who have a transactional relationship with us. For those who have a more in-depth relationship, the key questions are embedded into a more detailed survey.

Customer Experience Manager, Chris Stephens, says, “MetPS is a user-friendly, easy way to understand our customers’ experience when they deal with the Met Office and receive our products.”

It currently works via email and it’s integrated into other Met Office systems. When a customer buys a product, the transaction is recorded on a database, which then triggers the MetPS software to send out an email. This links to a mini-questionnaire requesting feedback.

Short and sweet

Consisting of just three questions, it can be completed in just over 30 seconds. The first question asks customers to rate their satisfaction with the Met Office, from 1–5. The second question, known as the promoter question, asks how likely the customer is to recommend the organisation to a friend or colleague, on a scale from 1–10.

As Chris explains, “This question taps into the idea of word-of-mouth and whether people will talk positively or negatively about your product or service. It’s an indicator of loyalty — but it also gives us information about our detractors, the unhappy customers.”

The third question asks how the organisation can improve, with a text box for customers to make suggestions.

In January 2010, 95% of customers said they were either satisfied or very satisfied with the Met Office. The MetPS rating was 49%, a figure well above the general industry level, calculated by taking the percentage of Promoters (ratings of 9 or 10) and subtracting the percentage of Detractors (ratings of 1–6).

Feedback from MetPS is being fed into the overall Corporate Action Plan and used to continuously improve our products and services, and enhance the customers’ experience.

Forewarned is forearmed

We constantly review ways of improving our public weather service. Heavy snow, frosts... weather-wise,

the start of 2010 was tumultuous, disrupting travel, schools, work and home life. We worked hard to make sure the public — and the emergency services — were made aware of any potential severe weather. But how were our warnings received?

Public Weather Service Marketing Manager, Adele Beswick, says, “We conducted independently run ad-hoc surveys in specific areas affected by the Early Warnings. We asked if people saw the warnings, if they thought they were useful and whether they acted on them.” The public surveys were extremely positive, confirming the expertise of our forecasters and the way the Early Warning information is presented.

Shaping up

One thing the surveys have shown is that there’s always room for improvement. Importantly, we’re not only willing to ask the questions, we’re also prepared to take the necessary steps to make sure we provide the best service possible.

Many thanks to all of you who took part in the surveys.



Photo: PA/Photos

The stats

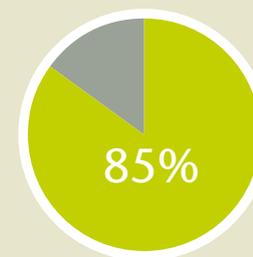
The ad-hoc surveys carried out in January 2010 following the issue of heavy snow warnings has given an insight into the way the warnings are received — and what action, if any, people took.



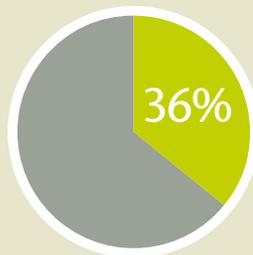
90% said they saw or heard the warnings



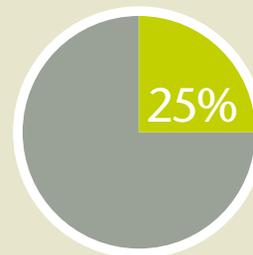
90% thought the warnings were fairly or very useful



85% saw the warnings on the TV



36% via radio



25% via the internet



55% took some form of action

Global



thinking

The Met Office represents the UK Government on most global meteorological matters and attends and influences some of the most important conferences and programmes around the world. 2009 was a particularly busy year that saw the Met Office at the forefront of international climate science.

Within the last six months, the World Meteorological Organization (WMO) — a UN specialised agency and voice on the state and behaviour of the Earth’s atmosphere, oceans, climate and water resources — has hosted two key climate and weather science conferences: the World Climate Conference 3 in Geneva, and the Commission for Climatology meeting in Turkey.

One voice

In September 2009, the Met Office attended the World Climate Conference 3. The aim of the conference was to endorse the establishment of a Global Framework for Climate Services, which would help the international community better adapt to the challenges of climate change and variability.

Simon Gilbert, Deputy WMO Manager at the Met Office, says, “All 189 member states and territories that attended the event agreed that the Global Framework was a great idea and gave the go ahead to make it happen.”

A High-Level Taskforce is currently investigating what already exists globally, and will make recommendations to the WMO about how the future of climate services should be structured.

Simon explains, “Effective climate forecasting relies on producing and having access to good observations. This will be one of the key elements of the framework.” See pages 25 and 26 for more on observations.

Looking good

The subject of good observations was also addressed at the WMO Commission for Climatology (CCI) meeting, held in Turkey in February 2010. The CCI is one of the WMO’s eight technical commissions responsible for a specific area of interest.

Here, the Met Office achieved a particular success by proposing a new international effort to analyse land-surface air temperature data. This new dataset will provide enhanced information, particularly about climate extremes.

As Simon puts it, “We’ve been looking at this idea for quite a while and decided to put together a proposal in time for the meeting. So there was a lot of engagement with our stakeholders in government and the scientific community both in the UK and abroad. At the meeting itself, the initiative was very warmly received with lots of messages of support and backing.”

From land to ocean

Another important indicator of climate change is sea-surface height. However, there’s only one way to do this with precision across the globe — by satellite. Currently, a sole satellite performs this function — the Jason series.

The future of the Jason series looked in doubt earlier this year but the continuation of the programme was made possible through the commitment of the Met Office together with substantial support from the British National Space Centre (BNSC) — now known as the UK Space Agency.

Met Office Space Programme Manager, Stewart Turner, says, “This was a big success against the odds. BNSC helped us raise Jason’s profile by speaking to other governmental departments and putting together detailed proposals about why, as a country, we needed the Jason data. As a high profile organisation on climate change issues, it would have been damaging if we hadn’t managed to get the necessary funding that we needed.” See the opposite page for more information.

High flyers

In February 2010, the Met Office's WMO Manager, Ian Lisk, was elected as Vice President of the WMO's Commission of Aeronautical Meteorology (CAeM). One of the eight WMO Technical Commissions, CAeM is responsible for helping to ensure the provision of safe, efficient and high-quality aeronautical meteorological services by responding to WMO Members' needs in line with the requirements of the International Civil Aviation Organisation (ICAO).

As Ian says, "It's all about making sure that aircraft can fly safely wherever they are on the globe. You just don't want to fly through thunder clouds, or for the aircraft to encounter severe turbulence or icing. Volcanic ash, low cloud and poor visibility are amongst the other aviation hazards that can be potentially dangerous and disruptive to flight operations." See pages 9 and 10 for the volcanic ash feature.

The Met Office is one of two designated World Area Forecast Centres (WAFc) — the other is in the United States. The two WAFcs share responsibility for providing global en route aviation weather forecasts for all civil aviation above 25,000 feet.

According to Ian, "To be elected Vice President of this Commission sends out a very strong message that we take our global aviation responsibilities very seriously. It is also an important strategic role for the UK because it enables us to continue to play a leading part in helping to shape and maintain worldwide professional flight safety and service delivery standards for aviation meteorology."

Copenhagen Climate Convention

In the run up to the United Nations Framework Convention on Climate Change meeting in Copenhagen last December, we worked closely with the Department for Energy and Climate Change (DECC), providing scientific evidence to inform its negotiations.

During the meeting, through an exhibition stand and presentations, we showcased our latest scientific research, including the latest observations of climate, potential climate impacts and mitigation options. We also undertook numerous interviews with the print and television media.

The path to success

At the forefront of international meteorology, we take our power of representation very seriously, and continue to maintain the highest of standards in everything we do.



Image: CNES/ILL/David Ducros

An eye in the sky

As well as representing the country at WMO conferences, the Met Office also has responsibility for the UK's part in many other international programmes.

EUMETSAT

EUMETSAT is an intergovernmental organisation created in 1986 to provide weather satellites. One of 24 members, the UK joined at the start and is the second largest in terms of contributions to core missions and optional programmes.

The Jason-3 Programme — part of a series of satellites that measure the sea surface height to a great level of accuracy — is classed as an optional mission. Yet its importance in the study of climate change is invaluable. Jason is made possible by the international collaboration between the National Oceanic and Atmospheric Administration (NOAA), NASA, the French space agency CNES, and EUMETSAT.

The Met Office worked closely with the BNSC for nearly two years to acquire the necessary funding from a number of interested parties in the UK, including Defra, the Department of Energy and Climate Change (DECC), the Department for International Development (DFID) and the Department for Business, Innovation and Skills (BIS). Thanks to this effort, the UK's contribution to the Jason-3 Programme will be around £9 million over nine years and will help continue the otherwise unbroken chain of climate data for the foreseeable future.



Photo: Hassan Bipul/DFID

Adapting to climate change — building to avoid flooding

Helping the developing world

Opened in 1990, the Met Office's Hadley Centre undertakes scientific research on climate change. One of its key successes has been the development of a regional climate modelling system — PRECIS (Providing Regional Climates for Impact Studies).

PRECIS

David Hein, PRECIS Technical Coordinator, explains, "Unlike our supercomputer-based climate models, we've developed a regional climate modelling system (PRECIS) that runs on a standard computer. This means developing countries can independently generate high resolution climate scenarios for their region of interest. Such scenarios are an important component in assessing a country's vulnerability to the impacts of climate change and how it can adapt to these impacts."

Countries that want to use PRECIS attend a workshop to gain the necessary scientific and technical knowledge to run it and make best use of its output. PRECIS has proven to be incredibly popular — it's now being run by over 300 users from over 95 countries.

Developing countries can independently generate high resolution climate scenarios for their region of interest.

Getting the message across

Whether it's the press, the public or the government, a multitude of people rely on the Met Office as a source for the latest information on climate change.

The science behind our changing climate is complex, which means that communicating in a way everyone can understand is vital. We've provided a range of predictions for government, businesses and the public using cutting-edge scientific evidence in the UK Climate Projections 2009 (UKCP09). Developed by the Met Office Hadley Centre, UKCP09 uses probabilities when talking about climate change making it possible to take a 'risk-based' approach for the first time in planning for an unsure future.

As the Met Office's Director of Science, Julia Slingo, explains, "Through UKCP09, the Met Office has provided the world's most comprehensive regional climate projections to date. These give a unique assessment of the possible changes to our climate for the rest of this century."

Talking probabilities

Working with other research centres, the Met Office is investigating probabilities of exceeding given thresholds of global temperature rise. The AVOID programme, which researches dangerous climate change and how to avoid it, looks at possible greenhouse gas emissions pathways when emissions will peak and the rate at which they reduce to examine the likely temperature outcome.

To arrive at these projections, Met Office scientists run a number of simulations based on a range of different emissions. They may take one possibility of CO₂ production peaking in, say 2016, and another that peaks in, say 2020 and see what the effects would be on the global temperature in each case.

The programme looks at the impacts of climate change on everything from crop production to water availability, but as the Met Office Hadley Centre Communication Manager, Fiona Carroll, explains, "It's our job to work out how greenhouse gas emissions may affect climate, and how changes in climate may impact various sectors. But it's the job of policymakers to make informed decisions, based on this information how and when emission cuts should be made, and what the appropriate steps should be to adapt to change."

While scientists are certain about some areas of climate change such as the fact the world has warmed over the last century they're very confident, although some uncertainty remains, on some key aspects like whether humans are the major cause. The same applies to attributing causes to extreme weather events. That's why we're always careful to talk in terms of probability. Fiona puts it this

Our talks at the Copenhagen conference pulled in our biggest audiences yet, and over the course of the conference we had coverage in many of the UK's national newspapers and across global news channels.

way, "A good analogy would be smoking and its link to certain cancers. There's hard evidence connecting the two, and though we can never be 100% certain that smoking caused a particular cancer, most people would agree that smoking increases the risk. It's the same with climate change. If we pump CO₂ into the atmosphere, it's likely to increase the risk of certain extreme weather events."

A global audience

Because the Met Office Hadley Centre is one of the main climate centres in the world, we play a critical role globally. At the December annual United Nations Conference of the Parties (COP) in Copenhagen we distributed literature and hosted talks on our latest research, presenting evidence for current and future change to inform decision-makers on the challenges of a warming world. "We communicated with all kinds of people, from the press and charities to those who are trying to set emissions targets worldwide," says Fiona. "Our talks at the conference pulled in our biggest audiences yet, and over the course of the conference we had coverage in many of the UK's national newspapers and across global news channels."



Talking it over: the Met Office Conference

To start a meaningful conversation about the work of the Met Office and how this can be used, the Met Office Conference, 'The Big Conversation', was held in London to tackle the big issues. Here are some of the highlights:

- > Held at the Commonwealth Club in January, 'The Big Conversation' featured a range of speakers, including politicians, environmental journalists, Met Office staff and even a mountaineer.
- > Using presentations, panel discussions and breakout sessions, the conference focused on issues such as the best way to communicate climate science, how to harness the science to help businesses, and how the government is dealing with the reality of a warming climate.
- > The event not only showcased the Met Office's world-leading science in weather and climate change, but also showed how its services could save lives and inform strategies for the future.
- > Lord Selborne, Chair of Living with Environmental Change, said, "[The Met Office] is playing a central role in the scientific community in developing climate modelling because, unless we can understand the risks involved, we can't make the right decisions or strategies for a sustainable future."

- > We hope that this will be the first in a series of similar events, to open up the discussion on weather and climate in an informed forum.



Climate change affects us all, and it's not just policymakers that we have a duty to inform – but the public as well. Our Customer Centre alone gets over a quarter of a million direct queries a year, many of which relate to climate change. So to help address a growing need for public information, we produced the *Warming* brochure – a guide to climate change – with ACT ON CO₂ and the Department of Energy and Climate Change (DECC), distributing over 200,000 copies of the *Warming* brochure alone in the Independent newspaper.

Speaking on how the Met Office aims to communicate the issues of climate change effectively, Fiona says, "It's about taking complex science and transforming it into something everyone can understand – the public and policymakers alike. It's very clear communication is so vital."

 To find out more about the expert advice provided by the Met Office, turn to Met Office Consulting success stories on pages 23 and 24.



There's a quiet revolution taking place at the Met Office. Over the last 18 months, different teams have been working to develop new initiatives that will enhance the way the organisation delivers its weather products and services to the public, its customers and stakeholders.

Doing things differently

A smart choice

On 29 January 2010, the Met Office launched its free iPhone weather app. — providing accurate and reliable five-day forecasts and severe weather warnings.

Since its launch, it's become the top free weather app. in the UK, with over 500,000 downloads. Not only that, it now ranks in the top 100 free apps — an impressive achievement especially considering there are more than 50,000 free apps available. With such resounding success, there are now plans to roll out similar applications for other smart phones and devices.

As Mona Lukha, Manager of Met Office Media, explains, "The iPhone has proved to be a fantastic opportunity to understand the mobile market. Users can leave feedback and rate the service — which has been invaluable and helped us to direct and steer new services."

As well as providing general weather forecasts, we're planning to introduce service-specific apps for groups such as surfers, sailors or mountain climbers. As Mona points out, "Where there are weather related activities, there's an opportunity for an app. in its own right."

Online and on the move

The Met Office has also developed content for other web-enabled phones. Designed with fewer graphics, it gives the user essential information that loads faster than a standard website. It's not just new services for mobiles — we're expanding our online presence too.

Eighteen months ago we launched our first Twitter feed, featuring weather warning services. Today, the service has expanded to include job vacancies, general news alerts and links to sources of information on subjects such as climate change. There are also a number of regional Twitter feeds that users can subscribe to.

Have your say

Heading up the Met Office's Web Team is Charlie Ewen, Head of Web and Online Content. He says, "We've recently launched the first step of a project that will use Twitter to gather user-generated observations. Our plan is to use the internet as a conversational medium, rather than just to broadcast information." This new project is inspired by another hot topic at the Met Office — contextual weather.

Come rain or shine

Charlie says, "Different weather scenarios are good or bad for different people. Contextual weather aims to provide a picture of certain activities such as sailing, cutting grass, hanging out the washing, operating a

crane... and how the weather will affect them." This contextual understanding can be applied to make the weather more meaningful to people with specific requirements — which is why Invent was set up.

Currently under development, Invent is a showcase of plans to present web-based contextual weather forecasts, products and information. Designed to give customers what they want, Invent gathers feedback from users, which is then used to shape and refine the future technology.

From the inside out

Generating new ideas for products and services can be difficult. Creativity needs to be nurtured, given the right environment and time to blossom. No one appreciates this more than members of the Met Office ThinkUP Team.

Team member, Gary Holpin says, "In 2008, a few of us realised we didn't have enough ideas for new products in our markets. So we asked ourselves, how can we come up with better ideas? There are all these innovative companies out there — what are they doing that puts them ahead of the rest?" This small group became known as the ThinkUp Team.

Over the first few months, the team met with senior people from Google, innocent and Shell and asked what made them innovative. Armed with inspiration, they adapted some of the methods used by these companies and are trying a few out at the Met Office.

As Claire Hooper, another team member explains, "One of the most important things we've learnt as a team is that creativity isn't some elusive trait that only special people have. Creativity can be nurtured using some simple tools and techniques or simply being prepared to try and do things differently, and more creativity leads to more innovation."

To help make the Met Office an even more innovative place, the ThinkUp Team has applied its research on innovative companies to deliver a whole range of activities, including facilitating creative sessions to generate new product ideas, and running one-day courses for staff where they can learn to be more creative in their day jobs. They have also created a website to share what they've learnt about creativity, and offer a 'ThinkTank' room equipped with tools to help all Met Office staff to be more innovative.

As Gary says, "Our goal for this is if, in ten years' time, you ask people to name a company that's really innovative one of the first things they say is the Met Office."

Latest innovations

We're keen to take a more creative look at the way we can use all available technology to provide our customers and the public with the very best weather service possible. Here are just a few of our recent endeavours:

iPhone application

Released at the end of January 2010, it fast became the top free weather app. download. The app. provides clear, five-day forecasts and weather warnings.

Twitter

The main Twitter feed provides corporate information, press releases and job vacancies. There are also five national feeds and 14 regional feeds for users to view weather warnings for specific areas.

Weather widgets

Users can tailor a Met Office weather widget to sit within their own website.

Mobile phones

The Met Office has developed content for web-enabled mobile phones with fewer graphics, to speed up loading time.

Invent

A web-innovation being used to trial and develop new ways to communicate weather and climate information, so that it is more meaningful to people who are planning specific activities.

ThinkUp Team

An internal team established to boost creativity in the workplace, to maximise the creative potential of the Met Office capabilities and staff.

 For another example of our innovation, find out about the new generation of weather radar on pages 25–26.



Photo: PAFotos



Photo: Global Warming Images



Flooding in Cockermouth, November 2009

Joining forces

As the UK floods of recent years have proved — water can be a hugely destructive force. But floods can be incredibly difficult to predict, principally because they are usually dependent on a combination of factors. Which is precisely why the Met Office and Environment Agency have combined their expertise to form the Flood Forecasting Centre.

FLOOD FORECASTING CENTRE

a working partnership between



“We’re combining the Met Office’s rainfall and weather knowledge with the Environment Agency’s hydrology and response skills to provide better flooding information and longer lead-time advice to emergency responders.”

Over the last few years, flooding has become increasingly common in England and Wales. But thanks to the Flood Forecasting Centre (FFC), more and more disasters have been avoided. Set up in April 2009 by the Met Office and Environment Agency, the FFC was formed in response to the Pitt Review’s recommendations for the two organisations to work more closely together — itself a response to the summer floods of 2007. The Centre, where Met Office and Environment Agency staff work under one roof, has three key objectives: One — to provide emergency services and other responder organisations with flooding advice. Two — to communicate more effectively and deliver a clear message about flooding. And three — to bring new flood forecasting into operation as quickly as possible.

“The philosophy of the centre revolves around closer collaboration,” explains Paul Davies, Chief Hydrometeorologist at the FFC. “We’re combining the Met Office’s rainfall and weather knowledge with the Environment Agency’s hydrology and response skills to provide better flooding information and longer lead-time advice to emergency responders.”

The Cumbrian Floods of November 2009 are an excellent example of this united approach. Working together, the team at the FFC was able to predict extreme rainfall early, work out its impact and issue the highest level alerts well in advance. This gave the emergency services and other parties enough chance to prepare for the floods before they happened. The relevant information was issued through Flood Guidance Statements, which cover coastal

flooding, tidal flooding and extreme rainfall. They offer responders a clear five-day outlook of the risk of flooding. “We’ve really focused on getting the communication right,” Paul explains, “it’s no good just telling responders there’s going to be 250 mm of rainfall in an hour, they need to know what this means and what effect it is going to have.”

Another important tool provided by the FFC is the Extreme Rainfall Alert, or ERA. The alerts look at factors that could lead to surface water flooding such as the capacity of drains, rainfall thresholds and the probability of extreme rainfall breaching those thresholds. Surface water flooding is notoriously hard to predict — especially in urban areas where heavy rainfall can saturate the ground and form pools of water. The FFC has reduced the time between predicting rainfall and identifying when surface water flooding is a risk — leading to more timely Flood Guidance Statements. But there is still a long way to go before a full surface-water flood warning service is set up. “With this sort of flooding we’re dealing with minute lead-times and very specific variations in location — right down to individual streets and even houses,” Paul explains. “Offering predictions accurate enough for people to really take action on the ground is a huge challenge.”

But the FCC is working on it — developing its skills, science and communication. They’re training FFC staff in both Met Office and Environment Agency disciplines to create a workforce of hydrometeorologists, equipped with a thorough understanding of the entire water cycle. They’re developing a new grid-to-grid model — a forecasting tool that shows the risk of flooding on a national level. And they’re working closely with the responder community to make sure they are providing the right information in the best way possible.

What’s more, the successful development of the FFC has triggered discussions about further collaboration between the two agencies. “We’ve learnt from each others’ ways of working and improved the flood warning service in England and Wales, which is great. But the FFC has also made people in both organisations think, ‘If we can build this brilliant centre what else can we do?’” Paul concludes. “For me, it’s a hugely exciting place to work right now. The possibilities are endless.”



Did you know?

- > Over 5 million people in England and Wales live and work in properties that are at risk of flooding from rivers or the sea.
- > The Flood Forecasting Centre (FFC) is a joint Met Office and Environment Agency service to provide early, integrated flood warnings.
- > In the summer floods of 2007, two-thirds of properties suffered from surface water flooding, not river flooding.
- > The summer floods of 2007 saw over 55,000 homes and businesses flooded, over 1,000 people rescued and the cumulative claims to insurance companies estimated at £3 billion.
- > In its first three months of operation, the FFC received more than 200 requests from responder organisations to sign up for the daily Flood Guidance Statement and around 1,000 registrations for the web service.
- > The FFC also provides a number of weather services to the Environment Agency including heavy rainfall and strong-wind warnings as well as the UK coastal monitoring and forecasting service.

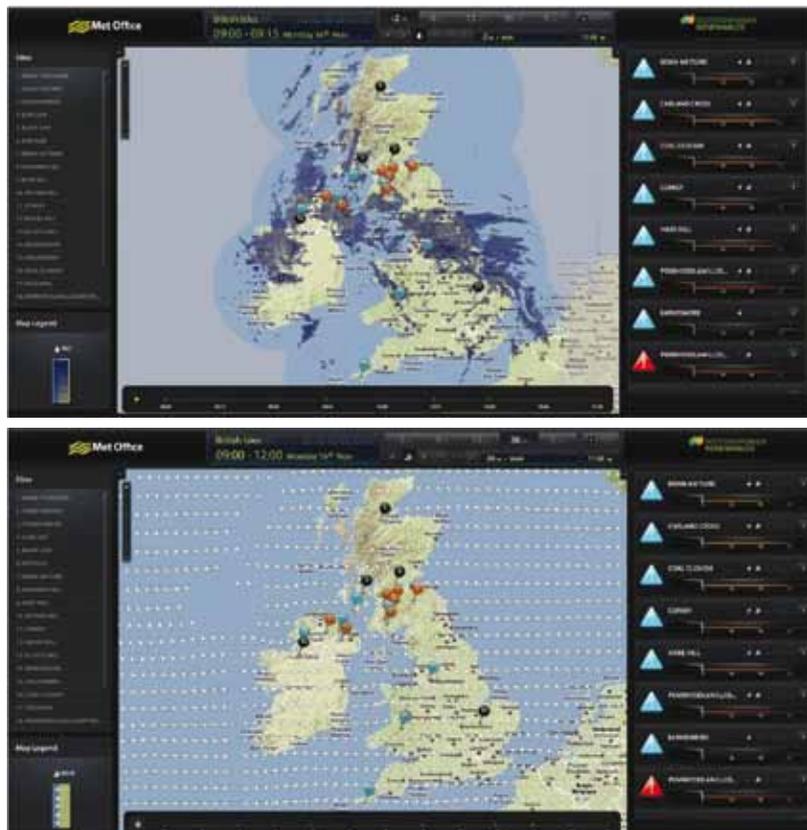
Providing expert advice

Photo courtesy of Elsam

The UK's changing climate has a significant impact on our trade and industry. In sectors as diverse as health, transport, insurance, and energy, understanding how future weather patterns might change could be critical for business success. Which is why Met Office Consulting was created.

The Met Office Consulting team works with organisations across a wide range of sectors, offering everything from detailed scientific analysis to top level strategic advice. As Cathy Durston, Head of the Met Office Consulting explains, "The key to everything we do is collaboration. We work closely with our customers' own experts to make sure we get the best outcomes possible."

This approach has a proven track record. In a recent project, a group of 11 energy companies asked Met Office Consulting to study the impact of climate change on their sector as a whole. By working closely with experts from all 11 companies, the Consulting team was able to provide a very specific set of recommendations, right down to details such as altering the design of transformers to cope with the temperatures a changing climate could bring.



VisualEyes™ — an online forecasting system for onshore and offshore wind farms

Collaboration has also yielded excellent results in the health sector. The Met Office has worked closely with a number of Primary Care Trusts (PCT) to provide an early alert system for Chronic Obstructive Pulmonary Disease (COPD). The service, called Healthy Outlook® is based on a close analysis of weather patterns and the conditions that trigger respiratory problems, and offers COPD sufferers an automated support and advice service in their own homes. “Thanks to the way we worked with industry experts, Healthy Outlook® has proved incredibly successful,” Cathy explains, “the PCTs that have invested in the service have seen a 20% decrease in hospital admissions from patients suffering with the condition and 97% of sufferers have found the service very useful.”

The Met Office Consulting team has also collaborated with private sector organisations to develop specific products. For example, led by Tom McIlwaine, Senior Account Manager, the Consulting team worked with ScottishPower Renewables to develop VisualEyes™, a forecasting tool that helps wind farm owners improve their operations and maintenance. “There are two critical elements when it comes to operating a wind farm,” Tom explains, “keeping people safe and scheduling maintenance at the most effective time to ensure a wind farm continues to operate at maximum efficiency. Working with ScottishPower Renewables helped us understand the requirements of a company that operates a number of wind farms; enabling us to build VisualEyes™ and further develop the spectrum

of services we offer the wind energy industry.”

In a separate project, the Consulting Team is working as part of a consortium, commissioned by Defra — with a task to deliver the first ever climate change risk assessment for the whole of the UK. Project leader, Helen Bye, and her team are currently piloting the process — looking at the underlying climate risk for the water industry. They are studying whether the scenarios that the water industry believes to be of greatest risk to them are, indeed, the most likely to cause them challenges in the future. The results from this pilot will then form the basis of a larger risk assessment across all the sectors in the UK, due for completion in 2014.

“We have all been working together to guarantee that what we’re doing meets all the needs of the UK,” Helen explains, adding that there are many sectors relying on the work of the consortium. “Our aim is to give these organisations the tools they need to get to grips with the climate-change risk for their sector. We are using our knowledge of current weather risk in the UK to build a picture of what challenges we could face as the climate changes.”

Ultimately, this combination of weather and climate knowledge — married with the team’s collaborative approach — is what Cathy Durston believes sets Met Office Consulting apart from its competitors. “Organisations are not necessarily interested in how the climate is changing — but how the changes will affect their operations,” she concludes. “The Met Office is unique in its ability to combine its own expertise in weather and climate change with customers’ specific sector knowledge. It’s something no other organisation in the world can do — and something we are immensely proud of.”

Time to decide

For customers who want to add scientific expertise and analysis to their own sector knowledge, a new tool is available from the Met Office.

Decider® is a brand new tool we’ve developed to let utilities, hedge funds and energy traders analyse future weather conditions and work out the probabilities of various scenarios. By using Decider®, customers are able to make an objective evaluation of the risks associated with each scenario and prepare accordingly. This puts traders, utilities — and other businesses that buy and sell energy — in a better position to hedge risk or make the most of less likely weather conditions.

Decider® works by condensing large volumes of information into 29 weather regimes across Europe. Data on temperature, pressure, rainfall, cloud cover and wind speed and direction is gathered and then the tool’s unique analysis deciphers it. Ultimately, Decider® provides percentage probabilities that lay the foundations for local weather patterns within each of the 29 regimes. “Decider® has revolutionised the way we interpret the weather,” explains Dave Parker, Head of Meteorology at EDF Energy. “Its value stretches across the entire business and has applications as diverse as forecasting our customers’ energy demand to understanding weather risks affecting our network.”



Good observation

Torrential rains, heavy snowfall, fledgling tornadoes... Observations are fundamental to the work of the Met Office. They tell us what's happening in real-time on the ground and in the skies — and make sure we're all prepared for high-impact weather events.

"Observations perform three key roles for the Met Office; they allow us to initialise environmental prediction models, corroborate the data from these models, and make sure we're ready for any emergencies," explains Gill Ryall, Head of Observations. "It's a system that's always evolving and improving."

Over the past year and into 2010, we have continued our move towards an Integrated Observing System (IOS). It's a three-pronged approach, with more surface observations, a new upper air network design project and a next-generation weather radar.

Together, these are helping us create more accurate, detailed forecasts, predict high-impact events and meet wider business objectives too.

On the ground

Since the 1970s, we have been collecting data from automatic weather stations — drawing together a range of measurements and using them to support our forecasts. Over the past two years this system has been replaced by a new, more modern surface observing system: the Meteorological Monitoring System (MMS).

While previously data was fed back on an hourly basis, the MMS receives per minute readings from all sensors at all MMS weather stations. As Aidan Green, Surface Networks Manager, explains, "Even though we can now get per minute data from many sites, we may still collect this on an hourly basis. But when there's a severe event we now have the capability to turn up the frequency — for example, bringing back data every minute from the South West if the rain gauges are going crazy."



This additional data also gives greater insights into the realities of the weather — especially in areas where there is significant regional variation, such as snowfall. With MMS, the Met Office can now see where snow is falling in real-time and discover if a front is moving more quickly or slowly than expected.

“Of course, more data means more information, so we have been developing algorithms and techniques to make processing this mass of data easier, pulling out key areas for forecasters to focus on,” says Gill.

In the skies

Alongside these land developments, we are creating new ways of enhancing the upper air network. “More accurate boundary air readings will enable us to better initialise our weather models — which in turn leads to more accurate forecasts,” Gill continues.

Currently in a testing phase, we have set up a number of sites around London with different air sensors at each location. With this knowledge, forecasters will be able to determine which kind of sensors will create the best operational network.

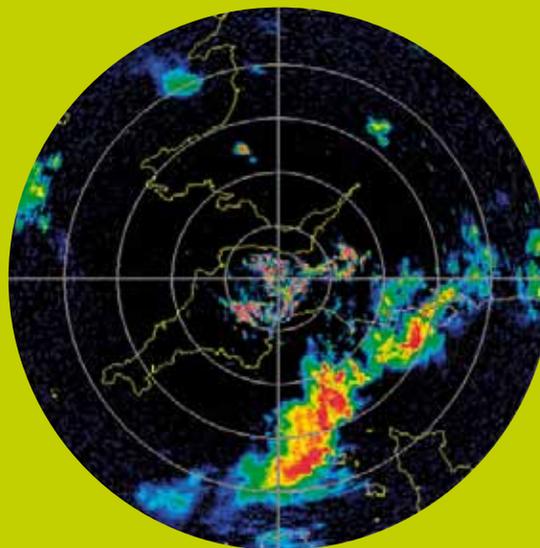
Upgrading our radars

Throughout 2011, 2012 and 2013, we will be rolling out a new network of state-of-the-art weather radars across the UK. The radar is already a vital tool — showing forecasters where and how much rain is falling. But the new system, largely developed in-house, will bring numerous new benefits including:

Doppler capabilities: measures how fast something is moving, providing valuable wind-speed information and greater awareness of high-impact weather events.

Dual-polarisation: transmits and receives energy in horizontal and vertical planes, giving forecasters more data about the kind of target, identifying drop shape and size (sleet, snow, hail, drizzle) as well as location.

Radar refractivity: because our facilities are developed in-house, we’re able to maximise the value from the data we receive. For example, while some would



discard clutter from ground readings, we can use this data to produce a map of changes in the atmospheric refractive index around each radar site. Refractivity is a strong function of relative humidity, so the new data will enable small-scale moisture convergence in the boundary layer to be located. Moisture convergence can be a critical factor in the timing and location of storm initiation.

More readings, more knowledge

With observations, the more data available, the better. But even with the planned enhancements, we’re unable to monitor the weather on every stretch of coast or street corner. Which is why, during 2010 and 2011, we plan to launch a new website to collect weather observations from the general public.

This data will be compiled into an online database and will supplement the other forecasting tools.

With more observations to hand, the Met Office will be able to create a more detailed picture of what’s happening across the country.

Making sense of data

More data presents another major challenge: how to interpret the information. To aid interpretation, we’ve been working on the appropriate data management infrastructure and visualisation capabilities, giving forecasters information that makes their job easier, not harder.

These advances in creating a stronger, Integrated Observing System (IOS) will soon bring tangible benefits, especially when it comes to high-impact weather events. But there are other benefits too. By developing our weather monitoring capabilities we’re able to monitor other environmental factors, such as air quality. By meeting these goals, we can provide more accurate data and records to meet climate needs and commercial demands.

The fact is that by observing more, the Met Office can achieve more.

➤ For more information on observations see www.metoffice.gov.uk/science/creating/first_steps/

Why invest in a new radar system?

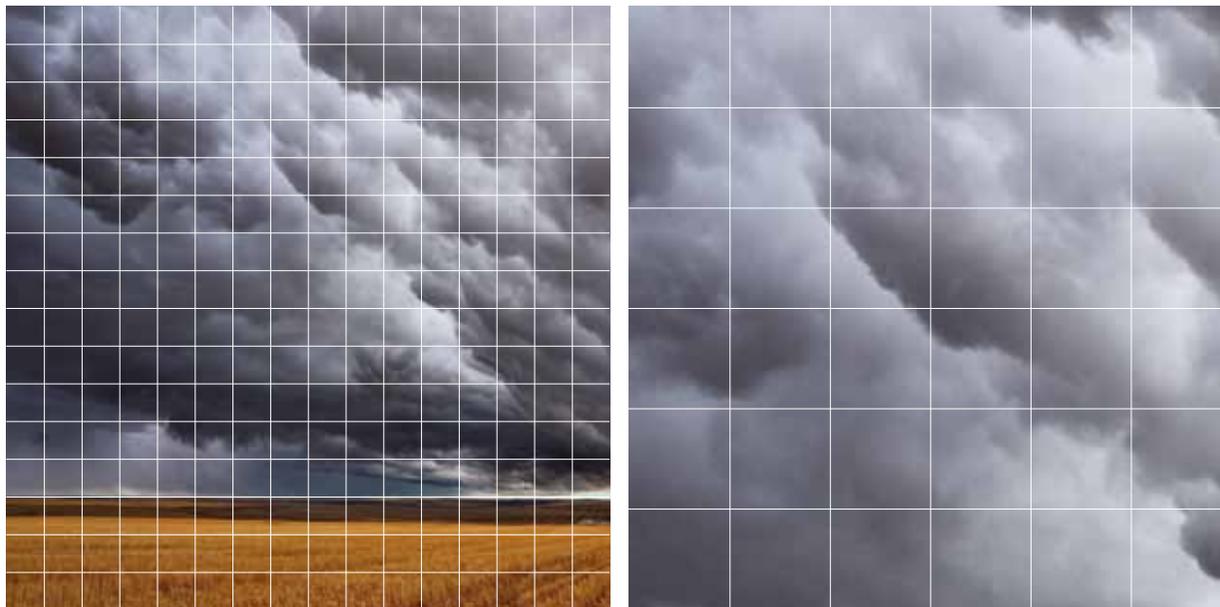
Longevity: many of our current radars are over 30 years old and it’s beginning to show — Hameldon Hill radar is 33 years old and has completed over 14 million scans.

Capabilities: the new radars will feature enhanced capabilities, enabling us to monitor snow, sleet, hail and drizzle, as well as rain, wind and relative humidity.

Emergencies: we can monitor and respond more quickly to high-impact weather events such as flash floods and heavy snowfall.

Efficiency: the new radars make use of the latest technologies, improving efficiency and reducing carbon emissions.





Rare opportunity

Our new IBM supercomputer has enabled our scientists to implement a number of major advances in forecasting science. However, as Professor Brian Golding, Head of Forecasting Research & Development explains, it has also presented a major challenge to maintain the quality and integrity of our existing capabilities.

Preparations for the migration of existing code were set in motion as soon as the contract was awarded to IBM. The software developers in IBM and our own code owners kept in very close contact to ensure that the migrated code had the necessary reliability, accuracy and speed to take over the operational tasks. At the same time, scientists and code owners have been working together to bring many years of scientific research to fruition in new versions of our forecasting systems so that the expected performance gains could be achieved at the earliest opportunity.

Our new flagship capability is a 1.5 km mesh size model for the UK, which for the first time provides routine forecasts of typical sized thunderstorms. The science behind this capability has been under development for almost a decade by a dedicated team of scientists under Professor Peter Clark at the Met Office Joint Centre for Mesoscale Meteorology based at the University of Reading. It is a world-leading capability and has already

provided impressive demonstrations of its capacity to give realistic rainfall forecasts. For instance, it forecast a peak of 269 mm of rain over the Cumbrian mountains during the November floods (see page 5), substantially closer to observations than the operational guidance available from existing models.

The second major advance was to increase the number of atmospheric layers in several of our forecasting models from 38 to 70. It is difficult to make changes to the representation of the vertical structure of the atmosphere because they impact on many aspects of model formulation that interact in complex ways, and have to be adjusted for consistency. The benefits of this advance have been most dramatic in our short-range regional models — both for the UK and elsewhere. This has shown some spectacular improvements in the accuracy of cloud, and therefore of surface-temperature, forecasts during some of the cold, dry spells of the past winter. The source of these improvements comes from better resolution of the shallow layer of the atmosphere about 1 kilometre above the ground, which marks the normal upper limit of direct mixing of air from the surface.

The last of the major upgrades was to refine the spatial mesh size of the global model from about 40x40 km to about 25x25 km at UK latitudes. This enables the model to represent the influence of small weather systems on future weather anywhere in the world; particularly energetic weather systems like hurricanes. This has led to significant improvements in the accuracy of UK forecasts up to several days ahead, continuing the steady rate of increase in predictability of the weather, and enabling the Met Office to hold its leading position amongst global forecasting centres.

➔ See the opposite page for a profile on Professor Brian Golding, Head of Forecasting R&D.

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...



Professor Brian Golding
Head of Forecasting
Research & Development

Brian Golding's career at the Met Office spans 38 years. Yet it was as early as age 14 when he first became interested in meteorology while recording the weather before school for a monthly magazine about the local environment.

After reading Maths at the University of Leeds, Brian spent a summer vacation at the Met Office in Bracknell in 1972 before joining permanently in 1973. He soon became involved in a groundbreaking project designing the Ocean Wave Prediction System to support forecasters in the burgeoning North Sea offshore industry.

Five years later and Brian started a 1.5 year post, helping provide the 24-hour, seven days a week forecast service for public, government and commercial customers. The experience proved invaluable. He remembers in particular, an enquiry in the middle of the night from a ship in the Atlantic requesting a forecast and how he enjoyed helping them out of their predicament.

"I realised at that point that I'm driven by solving problems. It's good to know that your specific expertise can directly save properties and lives."

World-recognised expert

After becoming manager and scientific leader in Numerical Weather Prediction, he developed a new forecasting capability based on a mesoscale model. "This system paved the way for us to move from simply forecasting for the whole of England, to a more regional scale."

Short- and long-term goals

On his return from a two-year secondment in Australia he took on work to develop a nowcasting system forecasts for just a few hours ahead, particularly of dangerous weather. This led to new hydrometeorology research feeding into flood forecasting.

As Brian says, "Very short-range forecasting is particularly useful for rainfall that, due to its variability, is very difficult to predict a long way ahead. Flooding is usually a combination of rain and river. Rain is the remit of the Met Office, while the Environment Agency specialises in rivers. So combined with the fact that our radar network is jointly funded it was a natural progression for us to work together and eventually the combined Flood Forecasting Centre was born." (See pages 21 and 22 for more on the Flood Forecasting Centre).

Brian was busy throughout the nineties as he helped design extensions to the main forecast model including tactical decision aids for the Ministry of Defence. There were also high-profile international consultancy projects incorporating applied meteorology for road and rail transport, civil aviation and the offshore industry.

Pushing the mesoscale boundaries

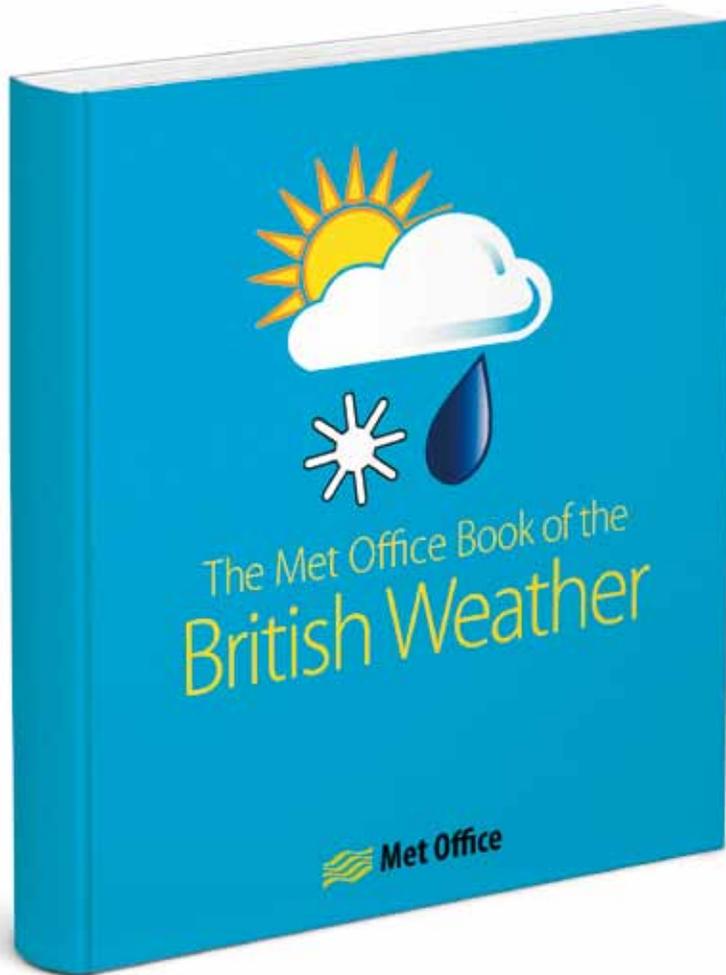
In recent years, Brian has focused on delivering accurate, automated forecasts along with achieving even finer resolution than the mesoscale. The result implemented this year is the convective scale model. It produces forecasts for severe weather, pinning down where floods will occur to 20–30 km. Ultimately, using ensemble predictions that produce multiple forecasts by making small alterations to either the starting conditions or the forecast model, or both, this will enable the chance of a flood in a specific location to be forecast. As Brian puts it, "This is breakthrough science. You can calculate a 60% chance of a flood, pinning down the location to within 5–10 km."

Brian's career has certainly been varied, including everything from working on a location finder app for mobile phones to discussing on the BBC News 2008's 'Typical British Summer' from a deckchair in London's Green Park.

Now, after a long and groundbreaking career, he is due to retire in a couple of years, but is keen to remain in meteorology. He plans to continue his links with the universities of Exeter and Bristol, to stay involved in advisory bodies and take on educational roles in schools. Perhaps the latter is his chance to share his teenage passion for the subject forged years ago while measuring the weather with a rudimentary thermometer, barometer and wind anemometer.

"It's good to know that your specific expertise can directly save properties and lives."

Best of British



The Met Office has teamed up with publishers, David and Charles, for 'The Met Office Book of the British Weather' to provide a fascinating and detailed look at the British weather and the effects of climate change.

Everyone likes to talk about the weather. It's a national pastime — one of the most talked about subjects in daily life. This new book is both a look back — and forwards, at British weather, using authoritative statistics and data from Met Office experts. A unique and entertaining reference, The Met Office Book of the British Weather shows the British weather over a 30 year period from 1971–2000 and how it could change in the future.

Weather and climate are represented in colourful maps showing every aspect of local and national weather over the years. The maps chart sunshine hours, rainfall, temperature, wind and many other aspects of the weather. Split into sections — the Weather Month By Month, Sunshine and Temperature by Season, Wind and Rain by Season, Extreme Weather by Season, and the Future of British Weather — the book covers the past and future of British weather in detail.

Want to know what the weather could be like in 2040? The Future of British Weather chapter can tell you using the most up to date information. The data comes from the UK Climate Projections released in 2009 (UKCP09) which are the most comprehensive projections ever published to provide information on how Britain's climate is likely to change in the 21st century, as it responds to rising levels of greenhouse

“It is commonly observed, that when two Englishmen meet, their first talk is of the weather.”

18th century writer, Samuel Johnson

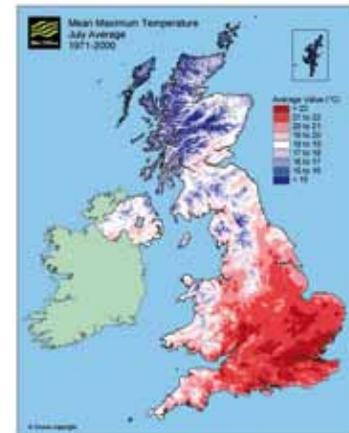
gases in the atmosphere. The projections were produced from multiple runs of a global climate model developed by the Met Office Hadley Centre and runs of 12 of the world's other leading climate models.

Authored by John Prior, manager of the National Climate Information Centre at the Met Office, the book is the fourth in a line of books over the last two years that have been successfully produced in association with the Met Office. It follows 'Weather' published by Dorling Kindersley along with 'Extraordinary Clouds' and 'The Cloud Book' also published by David and Charles. John Prior describes the book as, “an original, interesting and usable volume that makes Met Office science more accessible.”

The Met Office Book of the British Weather is a great book for you, or to give away as a gift — because everyone likes to talk about the weather.

➔ For your chance to win a copy of The Met Office Book of the British Weather simply complete the pre-paid card opposite.

➔ The Met Office Book of the British Weather is published by David and Charles. Readers can order a copy for the special price of £5.99 (rrp £9.99) with free p&p (UK only). To order please call 0844 880 5851 or visit www.rubooks.co.uk and quote code RS2164.



The July mean maximum temperature map. July is the warmest month, with mean values in the London area around 22 °C, some 8 °C above those in Shetland.

Sliding fortunes Shelley Rudman

Hurting down an icy track on a sled with no brakes or steering may not be everyone's idea of fun. But for Shelley Rudman, it's all in a day's work. Here, we talk to the Olympic athlete about her career in the bob skeleton.

From a young age, Shelley Rudman wanted to represent her country in sport. But she never imagined it would be in the skeleton bobsleigh, sliding along ice at breakneck speeds. Today, she has some impressive titles to her name, including Olympic silver medallist Turin 2006, European Champion 2009, British number one, and overall World Cup silver medallist 2008/9. All this, from a career that started just seven years ago.

"I got into sliding after visiting a friend who was already part of the GB Skeleton squad. He was training at the push-start track in Bath and I asked if I could have a go. I liked the sensation and the quest to try and get faster and faster." Shelley then paid to join a military ice camp in Norway and soon became hooked.

Adrenaline rush

Skeleton riders lie face-down on a stripped-down sled with metal runners. It has no brakes or steering. Instead, the athletes use their body weight and rakes in their boots to make turns and slow down. They often experience speeds of up to 95 miles per hour and forces up to 5G.

As Shelley says, "You never know what speed you've reached at the time. On some tracks you have a fair idea as the g-force becomes quite intense. You're either willing everything to go faster, or

hoping you can keep the correct line at such speed."

A true love affair

Shelley's whole life revolves around the sport. Not long after she got into skeleton, she met her now-fiancé and fellow slider Kristan Bromley, whose company also designs and makes her sled.

"Having a fiancé in the sport is great, as we both understand what the other is going through. And as the season can last between five and six months, we can travel round the world and compete together."

When she's not jet-setting to cooler climes for the winter season, Shelley's summer training is very similar to that of a sprinter, with a stronger emphasis on core strengthening. While the UK has specialist training facilities where athletes can practice their push-starts, the main ice and competition tracks are abroad, in places across Europe, the USA, Canada — and even in Japan. As most of these are built on mountainsides, they are exposed to all sorts of weather conditions, which can have a major impact on performance.

"The weather can change race results so quickly."

Every second counts

"The weather can change race results so quickly," Shelley explains. "A very slight scattering of snow over five minutes can slow the track down by half a second — in a race, this could literally be between three sliders."

The athletes and their teams are continuously checking the weather conditions, including the ice, air

and humidity, to try and predict incoming changes and adapt the settings of their equipment accordingly.

"Wind can blow grit onto the track, which can damage our highly polished runners. So we have to keep a close eye on conditions, as this will determine the choice of runners and the settings we use."

The future of skeleton

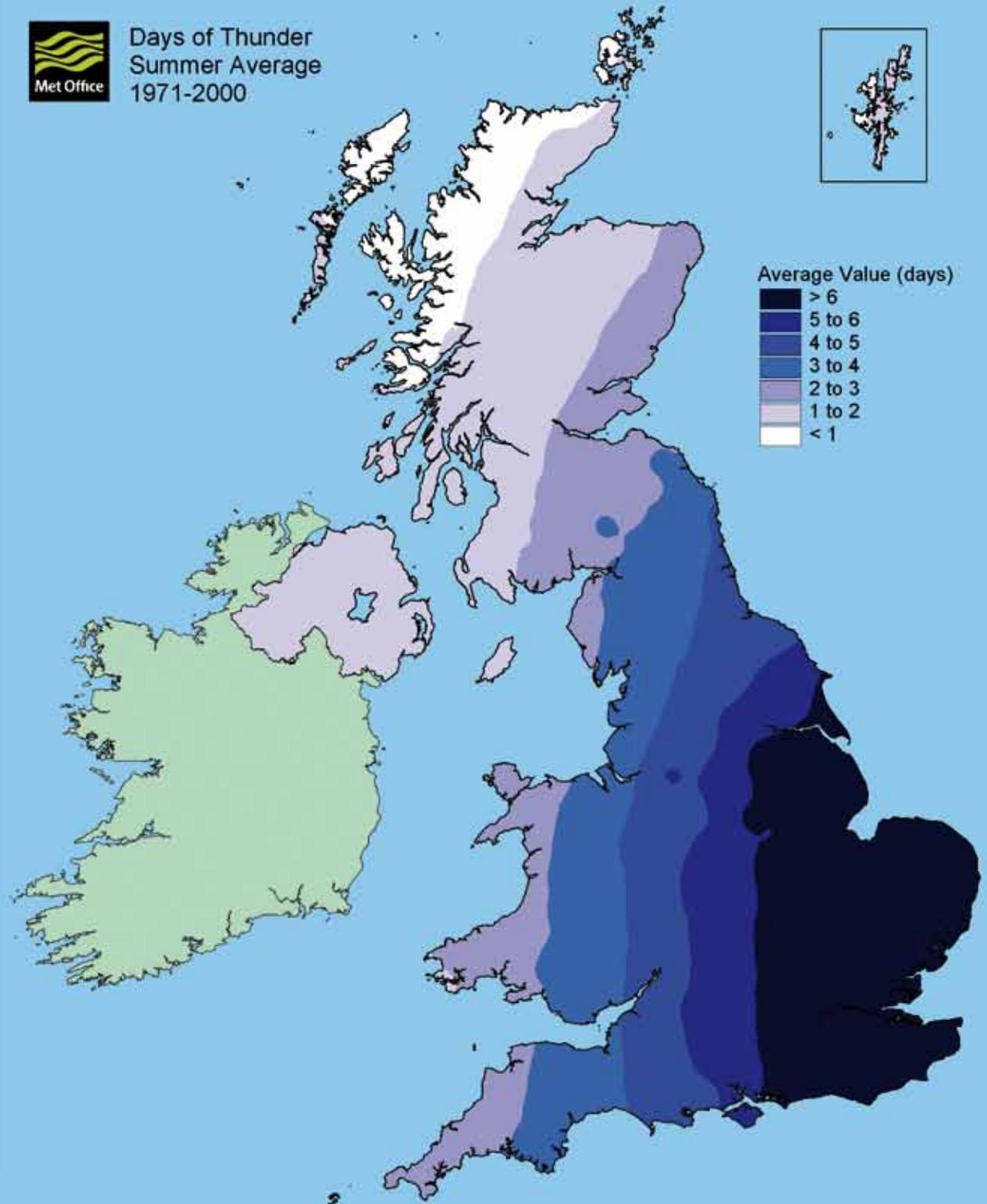
With Shelley's continued success and the recent Olympic win for Bath-based athlete Amy Williams in Vancouver, the future of skeleton looks promising. For the UK — a non-winter sport nation — this is particularly impressive.

"As a sport we are being taken more seriously which I hope will have a hugely positive effect on young people who want to take up skeleton bobsleigh," says Shelley. With the medal winning performance from our athletes, and if Shelley's track record is one to go by, we can expect great things from Britain's future sliders.





Days of Thunder Summer Average 1971-2000



Days of thunder

The summer thunder map shows the average number of days in summer (June to August) when thunder is heard across the UK. Thunderstorms are most frequent in the summer, with the warmer areas of eastern England most prone.

The image is from The Met Office Book of the British Weather. A selection of maps from the book show the seasonal variation in the number of days when thunder can be heard. For your chance to win a copy, simply complete and return the pre-paid card in this issue of *Barometer*.

Timing the gap between seeing a lightning strike and hearing thunder can help to estimate how far away a storm is, with every five seconds representing a mile. Thunder is often heard up to about 10 miles away and occasionally as far as 20 miles.