



KNOWN AND TRUSTED
Behind the
household name

MANAGING RISKS
Contributing to
economic growth

REACHING OUT
Award-winning
media

Barometer

Issue 20 www.metoffice.gov.uk Met Office magazine





The Met Office puts its experience and know-how to good use, says **Arwel Griffiths**, Met Office Director of Business Development.

Applying expertise

2012 is a big year, with the Olympic Games and Queen's Diamond Jubilee giving us extra reasons to (hopefully) enjoy the weather.

The Met Office will be forecasting for the Diamond Jubilee, when many people hope to be holding street parties — weather permitting! We will also be providing forecast advice to the Olympic event organisers, for the competing athletes and their coaches and, importantly, for visitors and those responsible for the massive logistical exercise of transporting and ensuring the safety of huge numbers of visitors and tourists from overseas.

And while all this is going on, we will be supporting the everyday weather decisions that affect people's lives and livelihoods across the nation. This issue of *Barometer* is full of examples of how

we support UK business growth by applying our expertise across a range of industries, helping businesses understand the impacts of weather and climate on their operations.

One example of how our expert knowledge is critical to the nation is our wind power forecasts. Wind power will be a key source of energy in the future with the National Grid already making increased use of electricity generated by the wind. Wind power supplied an average of 5.3% of the UK's demand for electricity coming into this year and reached a record share of 12.2% in December 2011. We're also supporting the development of wind energy opportunities around the world (see page 17).

Many people are astounded by the extensive services we offer beyond the daily weather forecast (see page 5). Using social media, we're now getting our messages across to an even wider audience than we reached traditionally (see page 14). By communicating in a new way, different people are now seeking out our forecasts and becoming aware of our trusted warnings and services.

To understand our customers, the Customer Attitude Survey asked our government and private sector business customers what's important to them. Although over three quarters of respondents trust the Met Office — and think that we are the best weather and climate service in the world — we know we can't stand still. We'll continue to adapt to help our customers achieve their goals.

The appointment of Professor Stephen Belcher as the new Head of the Met Office Hadley Centre (see page 9) helps us to build upon our world reputation in climate science. Our Climate Service is a global offering and it is vital for the UK to have a strong voice that can inform the world economy and achieve a sustainable balance. Another example of our international reach is the work of Dr Richard Graham, who received an OBE in the New Year's Honours list for his contribution to longer range forecasting in the developing world, especially Africa (see page 3).

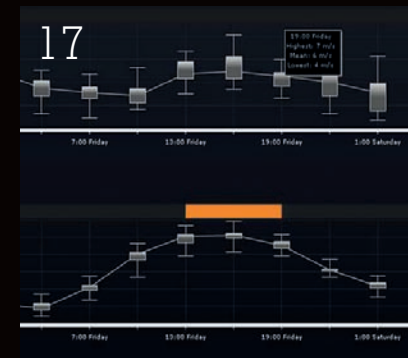
Through our collaboration with the US National Oceanic and Atmospheric Administration (NOAA) we're now recognised as having our own capability in space weather forecasting (see page 11). Incorporating our capability into the Hazard Centre in partnership with others is a significant contribution to national resilience by helping to protect infrastructure such as telecommunications and satellites.

World-class science underpins all that the Met Office delivers. Specific developments, such as advances in forecast modelling, are fascinating. It's essential for us to continue to develop our science to provide even more reliable predictions, such as our seasonal to decadal forecasting (see page 19).

We have the necessary knowledge, experience and flexibility to be able to apply our science in relevant ways. Often working in partnership, we're contributing to economic growth by helping businesses manage risks and opportunities from our weather which, ultimately, is good for everyone.

➔ **Barometer** is now available online at www.metoffice.gov.uk/barometer

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OBE for Met Office scientist

Dr Richard Graham, Climate Applications Development Manager at the Met Office Hadley Centre, was the proud recipient of an OBE in the New Year's Honours list.

The award was for Richard's outstanding contribution to seasonal weather forecasting in the developing world, especially in Africa.

Richard works with climate organisations in Africa who are pioneering the application of long-range forecasts to help alleviate poverty, and run sustainable development projects. As a world expert in long-range weather forecasting, Richard is central to international collaborative efforts to advance this complex and developing science.

Richard said: "Without the dedicated hard work of Met Office colleagues, the contribution I have made to the delivery of our long-range forecast services and capacity building in Africa would not have been possible."

→ See the Science Focus on page 19 where Dr Adam Scaife, Head of Monthly to Decadal Prediction at the Met Office, talks about piecing together the puzzle of UK climate.

Working with EDF on education

We've teamed up with EDF Energy to educate young people on climate science.

Our collaboration with EDF is the latest development in our engagement with young people. EDF has created 'The Pod' — a website where registered schools can access free teaching resources, download activities, blog and share ideas on sustainability.

We've launched a climate science topic on the Pod, explaining the science behind phrases like 'the greenhouse effect' and 'climate adaptation'. This helps give children using the Pod a good understanding of the climate science underpinning the other sustainability topics they study.

Peter Thorn, EDF Energy's Head of Education, said: "We are really excited about this new collaboration. We are keen that children become interested in science related subjects from an early age and working with the Met Office will ensure that we provide interesting, high quality, and factual climate-science resources to Pod schools."



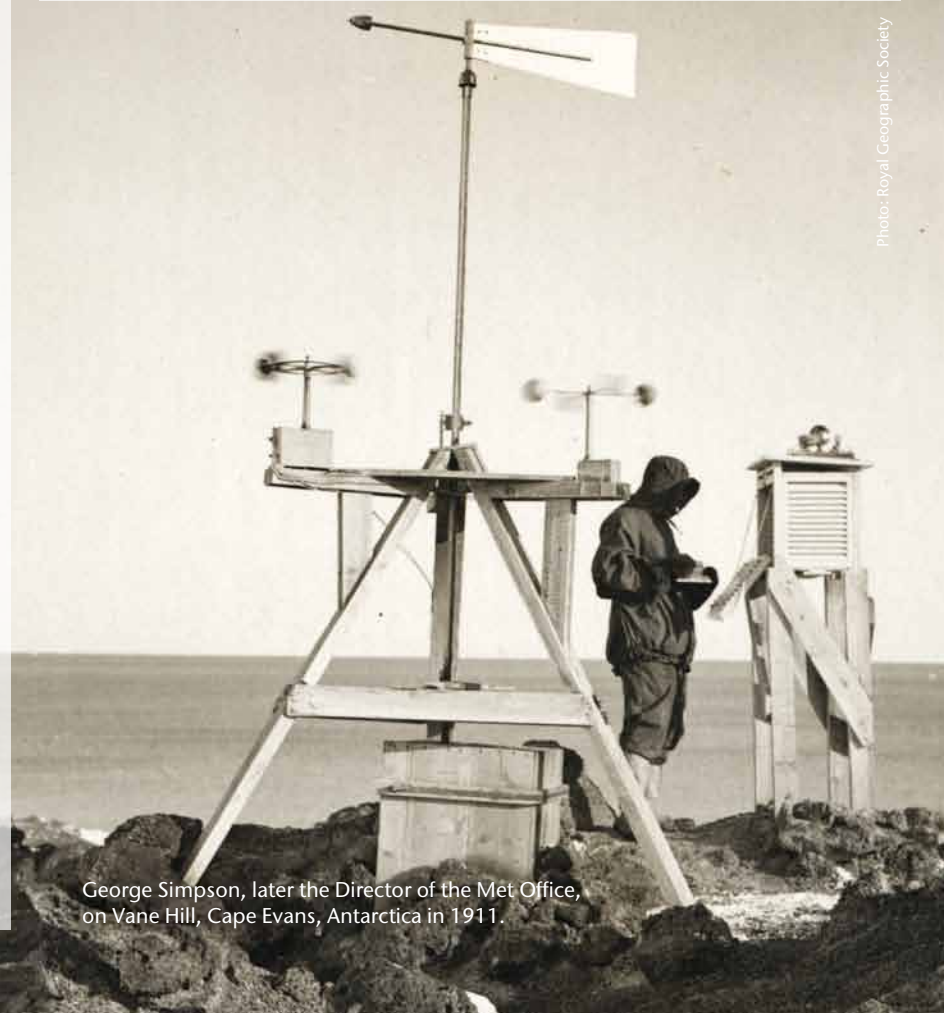
→ Find more at www.metoffice.gov.uk/education/collaboration/edf

100th anniversary of the British Antarctic Expedition

Captain Scott's brave but ill-fated adventure still fascinates and inspires today, with 2012 marking the 100th anniversary of the death of Scott and his four companions. Faced with extreme and unusually cold temperatures they perished on their return journey from the Pole.

Although the main aim was to reach the South Pole, the expedition also established a long tradition of scientific research on the continent. The Met Office provided the instrumentation used to conduct the meteorological observations and Scott's team of meteorologists included George Simpson — later the Director of the Met Office from 1920 to 1938.

Records from the expedition are among the most historically significant items in the Met Office's National Meteorological Archive. Other material from the expedition in the archive includes letters, photographs and diagrams. An exhibition in the Met Office's Library is showcasing some of the items until mid-May.



George Simpson, later the Director of the Met Office, on Vane Hill, Cape Evans, Antarctica in 1911.

Photo: Royal Geographic Society

Risky business of weather forecasting

Weather forecasting is not just a hugely complex process — it's actually impossible to get it completely right all of the time, says **Dee Cotgrove**, Met Office Head of Communications.

It's not the case that science cannot predict what the atmosphere (and weather) is going to do next, it's rather that the atmosphere itself doesn't know what it is going to do next. Here in the UK, for example, we often see finely balanced situations where the weather could go in many different directions. Therefore all forecasters deal in risk — looking at the chances of many different outcomes happening and deciding which is the most likely.

The Met Office is regarded as one of the most accurate forecasters in the world and research shows our forecasts are right six days out of seven. It's because we're trusted to give the best possible guidance that government agencies, the UK's resilience community and businesses across a range of industries act on our advice.

We saw this in action during the first major snowfall of the winter across England on February 4–5 2012. Well in advance of the event, we gave guidance to the UK public and our customers and issued Severe Weather Warnings. Many people rely on our advice for everything from deciding whether to grit roads to stepping up operations at hospitals to deal with those affected by cold weather.

Based on our forecasts for 10 cm of snow, planners at Heathrow moved a well planned operation into action — which included cancelling 30% of flights in advance. A spokesman for BAA said: "Heathrow runs at 99.2% of capacity with a plane taking off every 45 seconds, so treating the runway or sending out snow ploughs will immediately have an impact on flights.

"We can pre-empt issues by cancelling flights ahead of time to avoid passengers having wasted journeys and to keep operations running smoothly despite challenging weather conditions.

"We can only make these decision based on the risk as it's presented to us by the experts — the forecasters. In this case, the forecast was spot on — snow arrived exactly when the Met Office said it would."

In early December 2011 we issued a red Severe Weather Warning, the highest possible, as we forecast a powerful Atlantic storm would affect Scotland. Police and the resilience community there took a series of preventative decisions based on our forecast — including closing schools and vulnerable transport links.

A gust of 106 mph was recorded on the Tay Bridge, with Scotland's Deputy First Minister Nicola Sturgeon saying at the time: "The conditions are exactly as predicted when the Met Office issued its red warning."

Central Scotland Police Emergency Planning said Met Office forecasts and updates: "are vitally important to us and are a great source of detail for warning and informing our communities."

These are two examples of success stories in the daily challenge of dealing with risk. However, whenever dealing with risk rather than certainty, there will inevitably come a time when the most likely outcome does not happen. If schools are closed for a storm that does not materialise (say, it narrowly missed the UK), or flights are cancelled for snow that never arrives (say, it falls harmlessly over the Channel instead) there will inevitably be criticism.

But it's important to realise that if a forecast appears to be incorrect, it doesn't mean it wasn't the best guidance or that decision-makers were wrong to take action based on the advice. Our forecasts are right six days out of seven, so in the long-run relying on those forecasts is the best way to make decisions to minimise the impacts of the weather.

What our customers say:

“Very focused on working with us in partnership to achieve beneficial outcomes.”

Media



More

than just a household name

The Met Office is known and trusted by millions of people across the UK. For over 150 years we have pioneered the science that makes today's advanced weather and climate forecasting possible. But to stay at the front, we know we can't rest on our laurels. That's why the findings of a recent Customer Attitude Survey are helping to shape our services.

From the first legendary public weather forecast in The Times newspaper in 1861 to our first ever iPhone app last year, the Met Office has come a long way. Today, almost everyone in the UK uses the Met Office's Public Weather Service to help make informed decisions about their daily activities — from planning a weekend away, to knowing when to hang the washing out.

But world-class weather broadcasts aside, the Met Office does so much more to help a huge range of sectors function safely and efficiently — from UK and overseas governments to airlines and energy companies.

To provide the best services to these sectors, we are making a real effort to understand their needs

and each year we conduct a Customer Attitude Survey. This year's survey asked commercial and government business customers across every sector what was important to them and what they thought of the current service.

Overall, more than three quarters of respondents said they not only trusted the Met Office but also considered it to be the best weather and climate service in the world. The feedback, in general, was incredibly encouraging, acknowledging significant improvements made by the Met Office in recent years.



However, the research also uncovered some key areas for development. Specifically, these were based around being more proactive, communicating the capabilities we can offer more effectively and improving how problems are resolved when they arise. Tackling these three areas head on, the Met Office has resolved to:

- continue to unearth what our customers want, and adapt our services accordingly.
- work to emphasise the breadth of our services so organisations have a clear idea of what's available to them.
- make sure problems are satisfactorily resolved and improve follow-up contact.

Developments are already underway to help our customers — in business and government — succeed and achieve their goals.

Constantly evolving

While the survey has prompted the Met Office to act in certain areas, we are constantly looking for ways to sharpen our offering. The recent move to the Department for Business, Innovation and Skills (BIS), for example, has helped the Met Office reinforce the links between science, services and business. By understanding the direct impact weather and climate have on the economy, the Met Office is perfectly placed to support BIS' long-term objective to drive UK growth.

Many of the improvements at the Met Office go on quietly behind the scenes. At the moment, for

instance, we are helping the National Health Service manage workloads by providing information on how the weather affects hospital admissions. We also work closely with government departments, and UK public sector bodies to help them improve the effectiveness of their services. And for defence, our work is vital to help military operations succeed around the world. Climate research too is becoming an increasingly important business sector for the Met Office.

Even though the Met Office is consistently one of the top two operational weather forecasting services in the world, we understand there's no room for complacency. And that's precisely why we're always striving to build on the strengths and successes of our world-class reputation.



Climate
security



We get people talking

The weather is well known for breaking the ice in conversations, and we've decided to get people talking in a series of critical debates.

As a world-leader in weather and climate science, it's our job to provide expert advice and information wherever the weather and climate change make their presence felt. Thanks to the recognition and the strength of the Met Office brand, we're also able to start dialogues with our customers and work together with them to make the most of changes, and avoid the potential dangers, to come.

Met Office Conversations is a set of roundtable discussions designed to encourage key stakeholders to talk about shared issues. The events bring together thought-leaders in different industries — significantly from both the government and business sectors — to share their views on a variety of topics.

By giving people the chance to talk freely these discussions bring out ideas from different perspectives, experiences and areas of expertise. Where there is consensus, attendees might meet within their own industries to take work forward. Some ideas might also be developed in working groups hosted by the Met Office.

Climate security

At this event the group recognised that using a common language was key to formulating joined-up and meaningful climate change adaptation strategies for the UK and other countries. They also felt that maximum benefit would be achieved by bringing in experts from other areas such as social science, economics and global security.

Natural hazards

Attendees agreed to meet more often in future to share information and join-up initiatives around hazard management and national resilience. As natural hazards do not respect geographic boundaries, it was also important not to look at the UK in isolation but to consider the impacts of international events. A working group is being set up by the Met Office to look at shared communication issues.

Aviation

Here, the group recognised that staying one step ahead of the weather could make airports more resilient, airlines more efficient, and improve services for passengers. But more should be done first to

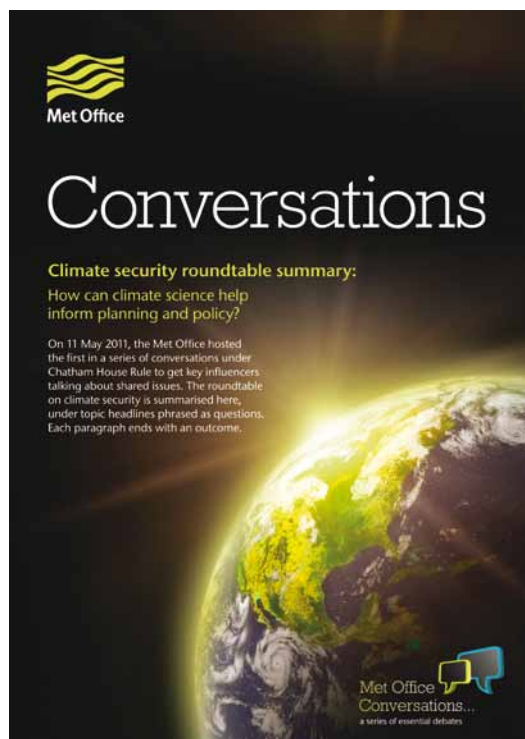
Renewable energy



Met Office Conversations

So far, this series of debates has covered:

- **Climate security** and what it means in the UK and globally.
- **Natural hazards** and how the UK can better prepare for and manage them.
- **Airport-Collaborative Decision Making** and how sharing information in real-time — including the latest weather forecast — can make airports more resilient, airlines more efficient and improve services for passengers.
- **Renewable energy** and how to maximise its potential so that it continues to play a significant role in meeting the energy demands of the future.



make sure weather information was used more fully and widely across the industry as part of Airport-Collaborative Decision Making.

Renewables

At our next discussion, attendees will look at what can be done to maximise renewable energy, given its variable nature, and how it can continue to play a significant role in meeting the energy demands of the future. (For more on wind power, see pages 17–18).

In addition to Met Office Conversations, we regularly go out to customers to better understand their needs. For example, our transport customers were invited to take part in a symposium in February, while a workshop for emergency responders is planned for

the summer. Together with our Customer Attitude Survey, these activities are critical for getting feedback on how to improve our services.

At the Met Office, we know that talking about the weather does more than break the ice in conversations. It brings people together, fosters new ideas and leads to new ways of working. Importantly, events like Met Office Conversations help different industries to develop shared strategies on the impacts of the weather and climate change, and identify new opportunities for development and growth.

Practical science



On 1 January, the Met Office Hadley Centre — a world-leading centre for climate science research — welcomed Professor **Stephen Belcher** as its new Head. Here, the award-winning scientist talks about what first drew him to meteorology, his plans for the climate programme and how he sees the Met Office Hadley Centre evolving, in a constantly changing environment.

Professor Stephen Belcher has always been fascinated by the idea that maths relates to the real world. “The fact that maths can predict what an experiment can produce is a pretty mind-boggling concept,” he enthuses. It was this fascination that led him from a Bachelors and PhD in Applied Mathematics at Cambridge, to his current role as Head of the Met Office Hadley Centre.

Throughout his career Professor Belcher has held key research posts at Cambridge, Stanford in the US and, most recently, the University of Reading, where he was both Head of Department and Head of the School of Mathematical and Physical Sciences. His research at Reading encompassed a range of meteorological phenomena including atmospheric and oceanic turbulence, boundary layer meteorology, urban meteorology and the impact of climate change on urban areas, and the role of oceans in climate. His research into these last two subjects will continue at Reading, alongside his new role as Head of the Met Office Hadley Centre.

Adding to an already illustrious list of titles, Professor Belcher was also the Joint Met Office Chair in Weather Systems for the University of Reading through the Met Office’s Academic Partnership with the universities of Exeter, Leeds and Reading that launched in 2010. Although he had worked with Met Office scientists for some time, it was through the Joint Met Office Chair role that he was able to get a closer look.

“I thought that John Hirst, the Chief Executive, and Professor Julia Slingo, the Chief Scientist, were taking the Met Office to interesting places,” he says, “so when the position came up at Hadley it was a fantastic opportunity. And of course the Met Office Hadley Centre is a world-leader in climate research. So to be related to it in any way is the most fantastic privilege. To be its Head is the most immense honour.”

Leading Met Office Hadley Centre

Now there is persuasive evidence that human activity is changing the earth’s climate (demonstrated by the Intergovernmental Panel for Climate Change (IPCC)) Professor Belcher sees the Met Office Hadley Centre’s role as helping society adapt to these changes by using cutting-edge science. But, for him, this raises more questions than the original matter of humanity’s impact. “This is what the Met Office Hadley Centre has to tackle head on,” says Professor Belcher.

And as the Met Office enters a new three year contract with the Department of Energy and Climate Change (DECC) and the Department for Environment, Food and Rural Affairs (Defra) Professor Belcher feels the emphasis of the Met Office Hadley Centre’s Climate Programme is shifting into three areas: detection and attribution, seasonal to decadal forecasting, and developing the next generation of climate models. All of these will enable the Met Office to establish the causal relationship between a climate event and human activity, produce more accurate forecasts looking between three months to 30 years in the future, and understand how the various elements that create our climate work together.

“...when the position came up at Hadley it was a fantastic opportunity. And of course the Met Office Hadley Centre is a world-leader in climate research. So to be related to it in any way is the most fantastic privilege. To be its Head is the most immense honour.”

This last area goes under the “glorious name,” as Professor Belcher affectionately calls it, of HadGEM3-ES. But putting together the next generation climate model is a huge endeavour that requires multi-party cooperation with the UK academic community.

The reason for this? “The complexity of these climate models continues to increase enormously,” explains Professor Belcher. “We’re trying to include things like aspects of the terrestrial carbon cycle (plants on land-surfaces), the ocean’s biogeochemical cycles, and even the effects of wetlands on the climate.” If the Academic Partnership achieves what it sets out to, “the next logical step,” says Professor Belcher, “would be to seek out European academic partnerships”.

Creative science

Professor Belcher set out to apply his maths skills to the real world — and he’s certainly achieved this. The work he’ll be doing as the new Head of the Met Office Hadley Centre will help DECC and Defra, other government agencies and wider industries plan for the future. “Part of our core mission is to provide quantitative estimates of climate change and its impact on different sectors,” says Professor Belcher.

What’s more, he sees the potential for the technologies developed at the Met Office Hadley Centre to create new climate services. “This is using the output from our climate simulations and tailoring them as products in creative ways for a type of real-time decision management,” he comments. One thing is for certain, science couldn’t get more practical than this.



“The goal is to develop a UK-based space weather forecasting service that will monitor the way the Sun’s matter and energy changes and predict how these changes are likely to affect the Earth’s environment.”

Although the Sun is over 90 million miles away from Earth, life on this planet simply couldn't exist without it. But what's often overlooked is that the Sun is in constant flux and that this change – or solar activity – has a direct effect on Earth. The phenomenon is known as space weather and it's the reason why the Met Office has been working in partnership with the US National Oceanic and Atmospheric Administration (NOAA) since February 2011 – sharing valuable knowledge and developing the UK's space weather forecasting capabilities.

Forecasting space weather



The Met Office is most commonly associated with producing terrestrial weather forecasts. But recently we have been looking further afield, way beyond our atmosphere. The goal is to develop a UK-based space weather forecasting service that will monitor the way the Sun's matter and energy changes and predict how these changes are likely to affect the Earth's environment.

Helping make this a reality is Mark Gibbs who is in charge of the Met Office's space weather strategy and development.

"Mostly we see the Sun as never-changing," says Mark, "but in reality it's like any dynamic system. Constantly shifting and changing the energy and matter it emits. And that can have profound influences on the Earth and its inhabitants"

The impact of space weather

Solar events have been happening for millions of years, but their effect has been more apparent as people have become more reliant on technology. Solar flares and the solar wind affect our technology and systems such as satellites, GPS, power grids and radio communications. Today, the impact – and potential risk to humans – is greater than ever before.

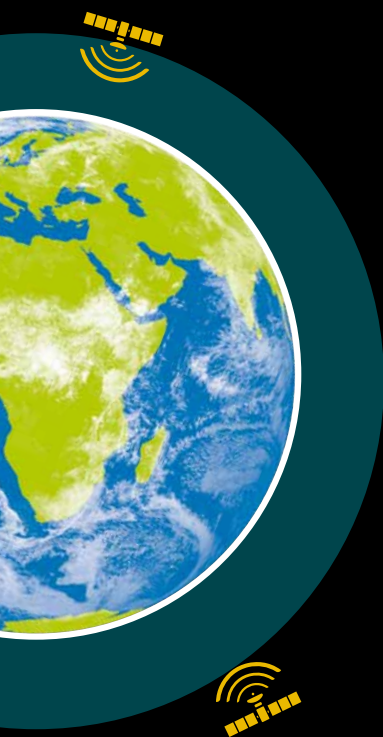
"Coronal Mass Ejections, large eruptions of plasma from the Sun which travel across space at high speed, can cause geomagnetic storms and send currents through power lines if they track towards and reach the Earth. These can then damage transformers and entire power grids," says Mark.

While this might sound like science fiction, it is a very real occurrence that can cause widespread

issues. In fact, in Quebec, Canada, on 13 March 1989, fluctuations caused by a geomagnetic storm plunged six million people into darkness when the power grid failed. But the potential impact on power grids depends on many factors.

As Mark adds, "In the UK we're probably better prepared than most nations. The engineering design of our network makes it quite resilient to this sort of geomagnetic storms and the geology and geography of the UK helps us as well. We are collaborating with the British Geological Survey who are the experts in the UK on how these geomagnetic storms interact with the natural environment in the UK to produce these currents."

However, the affects of solar activity aren't limited to power failure. Solar flares can cause disturbances in the ionosphere, part of our atmosphere – the area



that high-frequency radio communications bounce off before returning to Earth. This can cause high-frequency radio and GPS to perform erratically. For most people driving along in their car, incorrect directions wouldn't cause too much upset. But for high-precision users such as the military, being tens of metres out could cause critical problems. It's for these reasons that space weather forecasts are very important to a wide range of organisations including the Armed Forces, electricity industry, satellite operators and the aviation industry.



The Met Office–NOAA partnership

Since February 2011 the Met Office and NOAA have been working together very closely. "We're collaborating to improve forecasting techniques and develop services that users need," says Mark. In practise, this has seen several Met Office forecasters getting on-the-job space weather forecasting training at NOAA's centre in Boulder, Colorado — benefiting from the many decades of experience the US has in this field.

But NOAA will also benefit from the Met Office's expertise. "We bring a lot of skills from terrestrial weather forecasting that we can take into space weather forecasting," says Mark. For instance, Mark and his team are sharing their extensive knowledge of ensemble modelling — a technique used to understand uncertainty — and data assimilation, which helps forecasters analyse information. Both of these techniques aren't currently being used by NOAA in space weather forecasting. As Mark says, "It's a two-way relationship — and we're making good progress."

The Met Office and NOAA are also joining forces in their attempt to create the world's first combined space / terrestrial weather model to help improve space weather forecasts. The ultimate aim is to take all the various models used for space and weather forecasting, and bringing them together — which is no small task. The main challenge is the number of different models currently used. Firstly, there

are models of the Sun plus geospace models that look at the area between the Sun and the Earth's environment. Then there are models of the different parts of the Earth's atmosphere.

As Mark explains, "What we're trying to do is pull all these together into a seamless line. So from the Sun you pass from one model tier into another, all the way to the surface of the Earth. It's a grand challenge."

Delivering space weather forecasts in the UK

When it comes to delivering space weather forecasts in the UK, one of the main hurdles the Met Office faces is a lack of awareness. But Mark and his team are meeting with people from different industry sectors to make them aware of their potential vulnerability or — if they're already aware of it — find out how the Met Office can help them mitigate the risks.

If all goes to plan, by later this spring there will always be a trained space weather forecaster on duty at the Met Office's normal forecasting centre. And with the Sun about to reach its solar maximum in 2013 — the period of greatest solar activity in the Sun's cycle — the Met Office capability will be well placed to help UK industries prepare and deal with any possible effects.

Met Office partnership with the International Space Innovation Centre (ISIC)

In developing a UK-based space weather forecasting service the Met Office has become a member and partner of ISIC. ISIC's aim is to support and facilitate innovation in the space sector.

For the Met Office, becoming a member and partner brings great benefits. "It gives us immediate access to a community of users and industries that are specifically focused on space," says Mark Gibbs, who is heading up the Met Office's space weather forecasting programme. What's more, as designated space weather prediction experts to ISIC, this access will allow Mark and his team to better understand the needs of industries impacted by space weather — and help the Met Office tailor its alert service to meet members' requirements.

Award-winning media

We're also using our social media channels for customer service and support, with the Met Office Weather Desk team available to respond to queries on Twitter 24 hours a day, 7 days a week the world is only one tweet away from the very latest information from the Met Office. "Our team of weather experts build engagement with our followers, making sure that they know everything from if they can hang their washing out, go walking on the moors to if there is severe weather expected," says Chalky Langley, who manages the Met Office Weather Desk.

Retweets per month

January
2011



30



Understanding your customers — and finding new, fresh ways to engage with them — is key to a thriving business. This is something the Met Office understands all too well. With our innovative use of new media, we are leading the way within the public sector — and picking up awards along the way.

Last year the Met Office won 'Best Use of Social Media in the Public Sector' at Computer Weekly's 2011 Social Media Awards. This was a real coup for the organisation and was just one of many awards won and numerous short-listings gained — against competition in both the private and public sectors. "We've only been doing social media for a few years which makes the awards we've won even more impressive," says Dave Britton, Communications Manager at the Met Office.

As Dave says: "This award is a reflection of the work we've put into growing these channels over the past few years and the impact that they now have. As well as growing reach, we've also increased levels of engagement and advocacy. One example is retweets — at the start of 2011 we were getting around 30 retweets a month, this has now grown to thousands".

January
2012

3,000+

Twitter followers

January
2011

60,000+



Monthly
growth

800 approx.

The rise of social media has given organisations the chance to have a more direct relationship with the general public and today makes up a large part of many companies’ communications strategies. The Met Office now reaches more than 100,000 people every month through social media, including blogs, Twitter, Facebook, YouTube and Google+. The Met Office has over 60,000 Twitter followers — growing by an average of 800 each week — one of the largest followings of a public sector organisation.

Chalky says, “During times of severe or unusual weather, social media is a useful tool for communicating messages quickly and raising awareness.” For instance, when Hurricane Katia crossed the Atlantic, reaching the UK as a post-tropical storm in September, the Met Office kept people up to date, day and night, through Twitter, Facebook, YouTube and our blog. We produced a YouTube forecast that was rapidly shared around the world and watched over 65,000 times.

Reaching out

The Met Office uses a range of methods to help people access weather forecasts — and we work to defined targets — not only for the number of people we reach but also the type of people we reach. There are many groups of people that have very specific needs from weather forecasts, whether for leisure purposes, such as hill walkers, or for business reasons, such as farmers. The Met Office has always used the tools at its disposal to communicate effectively, from radio to television and, more recently, our website. But today new technologies are becoming increasingly important.

Twitter for example, is highly valuable because it can reach thousands of people at once. But to get to specific-need groups, you have to find a platform that’s common to that group. For example, LinkedIn could be the best platform to contact business leaders. Social media will play an important part in identifying — and getting to — these specific-need groups in the future. And, interestingly, we’re also finding that Facebook in particular is helping us to reach a much younger demographic.

Hurricane Katia forecasts
65,000+ views



iPhone app



More locations, sharper accuracy, harnessing technology

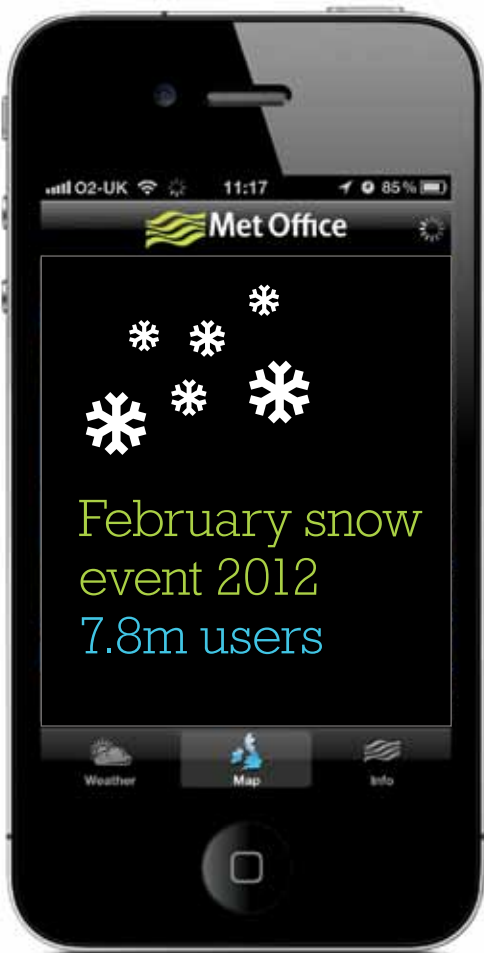
Through social media and new technologies, the Met Office is starting an exciting journey, engaging with — and improving its services to — the public in a very new way.

In October 2010, the Met Office fundamentally changed its forecasts by increasing the number of UK locations from around 480 to 5,000. “This presented tremendous benefits to the public as it gave them a weather forecast that’s more local, and therefore more accurate,” says Charlie Ewen, Head of Data and Applications. We also recently upgraded our technology to make best use of these extra locations — developing our first ever Android app, updating the hugely successful iPhone app and creating a new website.



Our website already receives around 4.5 million visitors each month but is now more interactive than ever before. The site gives organisations the opportunity to download a ‘weather widget’ for use on their own website. And the public can make use of an events calendar, which has been a particularly good way to target groups at events such as the Glastonbury Festival. Last year, the Met Office’s Glastonbury event page alone received 146,000 visits.

At the beginning of February, snow and cold temperatures meant that, for the first time ever, traffic to our mobile apps exceeded traffic to our main website. Charlie goes on to say, “5.6 million people visited the website and an extraordinary 7.8 million used the mobile apps. It proved just how invaluable forecasts on the move really are.”



On a winning roll...

Here’s a line-up of the Met Office’s new media accolades since 2011, against both private and public sector competition.



Winner

GovDelivery’s 2011 Excellence in Communications Award for Central Government

GovDelivery celebrates agencies that take an innovative approach to improving service to the public through effective communication channels, cross-promotion, and compelling content.

Winner

Best use of social media in the public sector at the Computer Weekly Social Media Awards

Recognises innovative uses of social media and the impact it’s had.



Shortlisted

Best SEO campaign at the 2011 UK Search Awards

This recognises campaigns that have achieved outstanding results in search engines in natural, free or organic listings.

Shortlisted

Best in-house team at the 2011 UK Search Awards

This recognises outstanding in-house teams or practitioners that demonstrate consistently great understanding and use of search.

Shortlisted

Innovation in SEO at the 2012 Econsultancy’s Innovation Awards

These awards shine a light on the finest creative thinking across the digital industry.

As world supplies of coal, oil and gas dwindle, energy markets around the world are looking to renewable sources of power to fill the gaps. Which is why the Met Office has developed a new suite of innovations to help shape the renewables industry.

Setting the standards for wind power

Renewable sources of power in the UK are big news at the moment, as the industry grows rapidly to meet the country's commitment to a lower carbon economy. Dominated by wind power, its growth over the last year is partly down to Government incentives.

But all renewable energy sources in the UK — whether wind, wave, hydro or solar — are highly sensitive to the vagaries of our weather. And this means the Met Office's forecasts are crucial to the success of renewable developments. They help increase confidence in the industry and enable a wide range of interested parties to make informed decisions — from developers and operators to turbine manufacturers, investment bodies and consultants.

"We provide the very best weather and climate information at every stage of the renewable energy lifecycle, from identifying sites to looking at the effects of climate variability and risk in the future," says Rob Harrison, Business Manager, responsible for the development of the Met Office's renewable services.

The wind lifecycle

Today, nearly half of all renewable electricity comes from wind alone. The challenge facing developers is accurately assessing how much wind they can rely on over the life of the turbine — and whether this can generate enough electricity to make the investment worthwhile. Using the Met Office's new modelling technology, Virtual Met Mast™, the Met Office can assess wind conditions at the early





“We provide the very best weather and climate information at every stage of the renewable energy lifecycle, from identifying sites to looking at the effects of climate variability and risk in the future.”

stages of a wind project, without having to take real wind measurements that can be very expensive and time-consuming.

“Virtual Met Mast™ is highly accurate, cost-effective and innovative. And we’ve seen our business grow in line with developing this great new capability and the growth of small wind projects,” says Rob.

Wind assessments using Virtual Met Mast™ take into account topography and land use which gives a more accurate long-term wind climatology and therefore a more accurate prediction of revenue. All this information can then be used to help fund the project.

Onshore and offshore winds

When potential sites have been planned and funded, the next step is development. The Met Office can optimise a site’s potential, reduce risks and harness wind energy using our range of innovations, both on and offshore. As Rob says, “We work with every type of project, from single turbine wind-farms to the largest, most complex offshore projects.”

To help wind farms with their ongoing operations and maintenance, the Met Office has created intuitive, web-based weather alert systems that provide real-time and forecast weather conditions. The Met Office helps operators identify optimum times for power generation in both the onshore and offshore environments.

For onshore wind-farms, VisualEyes™ provides health and safety alerts, for example, warning of lightning, and identifies low wind periods when maintenance work can be carried out.

The equivalent platform for offshore projects is called SafeSee™. It is designed to meet the challenges of working in the marine environment where projects are particularly sensitive to weather and marine conditions. For access to turbines, SafeSee™ presents hourly updated site-specific forecast information.

“We’ve got more than 30 years’ experience of delivering marine forecasts to the oil and gas industries and we’re now doing the same for the renewables sector,” says Rob.

Once a wind farm is up and running there could be the potential for trading some of the power it produces — as long as it generates an excess of energy. The Met Office can even help in this area, by providing site-specific forecasts to help predict power output and trading opportunities.

Looking to the future, the Met Office is actively working to make the industry much more predictable to help businesses and governments plan effectively, and this will take into account the risk posed by climate variability.

“At the moment, we’re making assumptions based on the past, but everyone knows that’s not

necessarily the best basis to plan for the next ten or 20 years. To make the industry more predictable, we need to make plans based on what the weather, climate — and the industry — are going to be like in the future,” says Rob.

More than just wind

Although the main service area for the Met Office is wind energy, we are also exploring and developing services for other emerging renewable sources. We are already providing information on river hydro where precipitation in catchment areas is important. And demand for solar is growing within this business sector, especially in Europe. Wave and tidal services are the least developed areas, but they’re certainly getting off the ground.

“We have big aspirations for the future. The renewables industry is flourishing and we’re always striving to be one step ahead, providing each sector with the very best, most accurate forecasts available. We’ve done it for wind and it’s only a matter of time before we provide the same innovations for solar, wave and tidal energy too,” says Rob.

➤ The future of renewables will be the focus of one of our upcoming roundtable discussions — find out more about Met Office Conversations on page 7.

Climate jigsaw puzzle

Dr Adam Scaife, Head of Monthly to Decadal Prediction at the Met Office, talks about piecing together the UK climate puzzle.

In 2011, we had the warmest spring and the second warmest autumn in records that go back for more than a century. In 2010, the UK's coldest start to winter on record, with heavy snowfalls causing disruption, cost the economy up to £130 million a day. This followed 2009/10 which was another very cold winter. Similarly, our recent summers seem to have been out of sorts, with the last five in a row being wetter than average.

We expect to see fluctuations in our weather and climate from one week, month or year to the next. This is natural variability — chaotic processes that govern our climate which mean we don't get consistency, especially in the UK. But several seasons in a row with similar non-average traits demands a closer look, because the longer it goes on, the more statistically significant that becomes.

It's like tossing a coin and getting several heads in a row — not impossible but you might wonder whether the odds are even. The question for climatologists is whether the last few years are an unlikely series of natural variability events or a trend in our regional climate. If it's a trend, how long will it last? What's causing it? Can we predict it? These are questions at the heart of our work. Working alongside researchers all over the world, we've made huge progress in understanding the processes at work in the Earth's climate system.

Understanding El Niño and La Niña is one example of that progress. This long-term cycle sees variations in tropical Pacific Ocean sea-surface temperatures. Our research helped show that this cycle has impacts all over the world. We now better understand these impacts and reproduce them in our climate models. El Niño years — when Pacific sea-surface temperatures are warmer — tend to drive colder winters in the UK.

This is just one factor affecting regional climate in the UK. Another is Arctic sea-ice, which recently reached its second lowest minimum extent since records began. When sea-ice is at low levels, it may produce more easterly winds over the UK in winter — bringing colder air from the cold Eurasian winter continent and causing freezing temperatures. However, again this is just one factor and it can't explain the past or predict the future in isolation.

Our latest research shows how variations in solar output may affect winters in the UK. If new satellite measurements are correct, periods of low solar activity can also drive more easterly winter flow. Other factors also influence winter climate, such as Atlantic sea-surface temperatures, a cycle in high-altitude equatorial winds called the Quasi-Biennial Oscillation, and volcanic activity.

Greenhouse gases must also be considered to explain European and global climate variations. While in the long-term we expect increasing carbon

dioxide to warm all our seasons, it's possible there could be short-term feedbacks from changes these gases are causing. The reduction in Arctic sea-ice extent is one example of a feedback from increasing greenhouse gases that may cause an effect which is opposite to what we might expect.

Each factor exerts its own influence and potentially conflicts with others, so no single factor controls the season ahead in the UK. Unpredictable variability due to chaos in the climate system also has to be thrown into the mix and this makes definitive forecasts impossible. You can't simply look at the indicators and tot up those in favour of, say, a colder winter and those against. Instead, all of these impacts and cycles interact with each other in the equivalent of a global climate jigsaw puzzle.

It's this puzzle that we're piecing together through our research. Some climate cycles are understood well enough to be reproduced in our climate models, so impacts can be included in our forecasting. But they're not all there yet. Our long-term predictions are among the best in the world but we continue to work with the ultimate aim of providing more reliable and skilful forecasts as we already do for our shorter-term forecasts — recognised around the world for their accuracy.



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...

Dr Adam Scaife Head of Seasonal to Decadal Prediction

In 2011, Dr Adam Scaife was awarded the Lloyd's of London annual prize for the Science of Risk in Climate Change. The prestigious award is given for ground-breaking research that helps the insurance industry manage risk caused by a changing climate. But, two years ago, when Adam began work on the study that would eventually win him the prize, he merely set out to prove — or disprove — a hypothesis.

Adam is Head of Seasonal to Decadal Prediction at the Met Office Hadley Centre. His team effectively bridges the gap between short-term weather forecasts and long-term climate predictions. The award-winning study drew on his expertise but focused specifically on how the upper atmosphere — or stratosphere — might

affect surface climate and winter rainfall in Europe, over the next 100 years.

While other studies of this kind already existed, Adam felt they didn't give an accurate picture. "In the past," Adam explains, "climate models were limited because of computing power and vertical resolution (that depicts weather patterns, both close to the Earth and high into the upper atmosphere) was particularly restricted."

Previous simulations suggested the jet stream would get stronger and move northwards as the climate changes. This would, effectively, take a lot of stormy, wet weather away from Europe, potentially resulting in less flooding. But with recent advances in computer capacity — and therefore vertical resolution — Adam decided it was time to take a fresh look at the possible scenarios, and he began his study in earnest.

A moment of truth

After approximately two years of work, running climate simulations and analysing data, there was a real 'moment of truth':

"You work for months and months on something like this, then there's a single make or break moment when you press the button and the results pop up on screen. At that instant you find out whether all your hard work was worthwhile or not."

The results proved Adam's suspicions that previous studies were correct. His simulation showed a clear difference from previous estimates of winter

climate change, with up to twice as many additional heavy winter rainfall events (those most likely to produce flooding) in Europe over the next 100 years than previously thought.

Each year, flooding and storms cause billions of pounds worth of damage in Europe alone, which make Adam's findings particularly significant for the insurance industry.

Richard Ward, Chief Executive of Lloyd's said: "The record catastrophe losses facing the industry this year are a reminder of the importance of understanding risk."

Eye on the future

Adam conducted his study at the Met Office Hadley Centre. Over the last three years, he also led a large project team to build our new high-resolution climate model HadGEM3-H. Its completion marks the first time the Met Office global climate model has achieved an atmospheric resolution below one degree, giving it the potential to make significant improvements in climate simulation. With this, and other advances in computing and expertise, what does Adam think the future of seasonal and decadal forecasting holds?

"While we will never have seasonal or decadal forecasts like weather forecasts — where you can say 'tomorrow it will snow' — we will be able to make increasingly accurate forecasts of the risk of extreme events. And this will be of huge benefit to governments, business and people all around the world."

"...there's a single make or break moment when you press the button and the results pop up on screen. At that instant you find out whether all your hard work was worthwhile or not."



Met Office data helps student win award

Abi Davies, a student from Thomas Hardy School in Dorset, used Met Office data for a project that won a prestigious prize from the Institute of Physics.

Using a seismometer (a device for measuring the movement of the Earth's surface), in partnership with the British Geological Survey's UK School Seismology project, Abi looked at the relationship between sea state and seismic noise. The project involved analysing sea state and wave height data from the Met Office to prove that local wave height does affect background seismic noise.

The project was carried out in Abi's final year at Thomas Hardy School (THS). She was mentored by Jim Nicholson, a Science, Technology, Engineering and Mathematics (STEM) Ambassador from Atlas Elektronik, and Tom Hearing also of THS who was named UK Young Scientist of the Year at the 2010 Big Bang Fair.

Judith Wardlaw, Industry Partnership Development Manager at THS, said: "Abi and Tom visited the Met Office in 2009 as part of our Maths/Physics

enrichment programme and that gave them the opportunity to negotiate the use of the data — a school visit can bring unexpected bonuses!"

Abi received her Prize for Physics from Professor Jocelyn Bell Burnell, DBE, FRS, FRAS and Professor Brian Cox OBE at the Big Bang 2011. Now studying geophysics at the University of Liverpool, Abi said: "It was a huge honour to win the Institute of Physics prize and especially to be presented it by Professors Brian Cox and Jocelyn Bell Burnell. The Met Office provided sea state data for three locations around South West England. Without the data, my project would not have been possible and I would not have won the Institute of Physics prize."

➔ This year, we're supporting the Big Bang South West awards ceremony and the science shows in June at the University of Exeter. We'll have a stand at the event too. For more on the Big Bang Fair see www.thebigbangfair.co.uk

Making waves



Abi Davies (second from left) receives her prize from Professor Jocelyn Bell Burnell, DBE, FRS, FRAS and Professor Brian Cox OBE at the Big Bang 2011.

Scientists of tomorrow

STEMNET is a national organisation which creates opportunities to inspire young people in Science, Technology, Engineering and Mathematics (STEM).

STEM Ambassadors are people from STEM backgrounds who volunteer as inspiring role models for young people. They can contribute both to regular lessons or participate in extracurricular activities. STEM Ambassadors open the door to a whole new world for young people, helping them to see STEM subjects and careers with a fresh perspective and engage their interest and imagination in new ways.

The Met Office fully supports employees becoming STEM

Ambassadors. One of our Sustainability objectives for 2011/12 was to increase the number and we have achieved this with 45 staff now registered as STEM Ambassadors. As well as encouraging more staff to join the scheme, our aim in 2012/13 is for our Ambassadors to attend a greater number of STEM events so more young people have the opportunity to benefit from their skills and enthusiasm.

➔ For more information see the STEM website www.stemnet.org.uk

Kate Humble

Open to the elements

“It’s fantastic to know that we have such an incredible resource, not just for programme makers, but for all of us. Because even if we can’t change the weather, we can at least learn how to adapt and work with it.”

Photo: BBC Press Office



As a presenter on *Springwatch*, the president of the Royal Society for the Protection of Birds (RSPB) and a Welsh farm owner, Kate Humble is no stranger to the weather. In fact, it plays just as much a part in her wildlife and science programmes, as it does in her everyday life.

Whether filming the Hottest Place on Earth in Ethiopia in 2007 or surviving howling gales last March for *Lambing Live*, with her predominantly outdoor career, Kate regularly makes good use of Met Office forecasts. But it wasn’t until October 2011 that she gained first-hand experience of the organisation when researching BBC2’s *Will it Snow?*

The show, which aired last November, was prompted by the two previous harsh winters and put forecasters to the test, asking whether another was on its way. As part of their research, Kate and the editor of *Nature* magazine, Adam Rutherford, visited the Met Office. By her own admission, Kate was staggered by the level of technology at the Met Office and the sheer amount of data that pours into its supercomputers.

“The information is not only coming from Earth, but from under the sea and even out in space. And then it’s analysed by the latest modern technology and by the Met Office’s incredibly experienced scientists.”

Lights, camera, weather

While bad weather can really disrupt a filming schedule, good weather can sometimes turn an ordinary shoot into something special, which, at times, is well worth waiting for. For the *Springwatch* Christmas Special, for example, Kate and her team deliberately delayed filming by two days, based on the forecast, so they

had the best possible light to capture a seasonal delight: mistletoe in an apple orchard.

And sometimes the weather can, itself, even become a feature of a programme. “*Lambing Live* really brought home the reality of what our farmers go through. And although filming was gruelling at times, we were glad to be in a landscape that truly reflected what was going on weather-wise,” Kate says.

Fortunately for the team, the weather turned for the last few days of filming and they had bright sun and blue skies to finish the programme.

Extreme science

One of Kate’s latest projects is even more intimately concerned with the weather and, specifically, the climate. *Orbit: Earth’s Extraordinary Journey*, which airs on 4 March 2012 on BBC2. It explores how the Earth’s orbit around the sun and the physical pattern of the land and sea on this planet affect the way we live.

Kate co-presents with Helen Czerski, a bubble physicist and oceanographer from the University of Rhode Island. Helen also worked closely with the Met Office on the series which helped further Kate’s experience of the organisation.

“It’s fantastic to know that we have such an incredible resource, not just for programme makers, but for all of us. Because even if we can’t change the weather, we can at least learn how to adapt and work with it.”

Despite having worked in some challenging weather — or perhaps because of this — Kate’s favourite conditions are, in her words, “when it gets really exciting and dramatic”. Although she says this is in many ways prompted by her rural home life on a smallholding in Wales:

“You may not want to be carrying hay over to feed your sheep in severe weather. But being in the middle of a thunder storm is what makes me feel alive.”

Transience by Julia Rogers

The artist, Julia Rogers, has created an installation inspired by the wind. Made from tracing paper, the installation takes its inspiration from an everyday phenomenon that cannot be seen, only felt. Julia has interpreted the feeling of the wind, how its tendrils find their way into, through and around every object it encounters, bringing to life what we all experience but rarely give a second thought.

Julia's and other artists' work will feature prominently in the inaugural Reading Festival of Weather, Art and Music later this year. Held over the Jubilee weekend of 1–3 June a full programme of events will provide a fascinating and unique collaboration between scientists, musicians and artists where you can explore all things weather-related in ways you never dreamt of.

Find out more about the festival at www.wamfest.co.uk or [@wamfestival](https://twitter.com/wamfestival)

