



ON-SITE SERVICES  
Heathrow airport  
contract

SPACE WEATHER  
Somewhere out there

GLOBAL IMPACT  
Demystifying the  
monsoon

# Barometer

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# The journey continues...

After 31 years with the Met Office, Rob Varley is the new Chief Executive. Here, Rob considers his journey and looks ahead at some key priorities for the future.



I am delighted to follow on from John Hirst as the Met Office Chief Executive. Of course it's also a huge responsibility which I feel deeply. We have enjoyed great success in improving and extending our services in recent years – and it will be my mission to continue that great work, building on that success.

Looking back over my 31 years in the Met Office, I've enjoyed a wide range of roles: I've worked as a forecaster and a College trainer. I project managed the construction of our Exeter head

office, and then led what became the Public Weather Service. I've been part of the Executive team for seven years, first as Government Services Director and for the last four and a half years as Operations and Services Director.

The scope of Met Office work has expanded dramatically since my early days. One of our most recent developments is the opening of our new Space Weather Centre (see pages 3 and 19). Advances in science, observations, and service delivery have transformed our forecasting, all fuelled by remarkable advances in computer power. We are delighted to have been supported with funding for a new supercomputer which, when combined with advances in observations and science, will further advance the precision of our advice across all timescales (see page 3).

As well as our crucial role as the UK's national weather service, our international work continues to grow in support of enabling protection of lives and livelihoods and increasing prosperity. We have been funded to work with developing countries in


equipping them to deliver improved weather services, and to understand and respond to the risks of climate change.

More than ever, doing a good job depends on partnerships and collaborations in the private and public sectors in the UK and internationally, especially working with other national weather services. We are now working on a number of major international projects such as the Newton Fund with China as well as partnerships with Australia, Singapore and the Philippines and our increasing involvement in many African states. We also work with a range of science partners around the world. For instance, in this issue we cover our work with organisations such as the Indian Institute of Tropical Meteorology (IITM) and the National Centre for Medium Range Weather Forecasting (NCMRWF) to improve forecasting of the monsoon in India (see page 17).

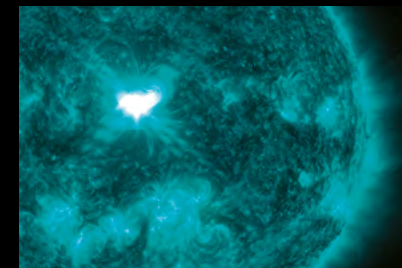
As the Met Office's Science, Technology, Engineering and Maths (STEM) Champion, education and outreach are close to my heart.

I was delighted to hear that the Met Office received the 2014 European Meteorological Society Outreach & Communication Award for our STEM programme. This award is presented for projects that demonstrate outstanding efforts to communicate knowledge on weather and climate. The award is a real testament to the efforts of volunteers from across the Met Office. Another example of our work in this area is the weather education animation project for children (see the back page).

So, for me and for the Met Office, the journey continues. We have much to be proud of and much to look forward to: exciting possibilities and partnerships, using our science, technology and operational capability to make a real difference to lives and livelihoods in the UK and around the world.

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

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## New supercomputer

**In October the Government confirmed its investment of £97 million in a new high performance computing facility for the Met Office.**

Enhanced processing power will help us protect life and property and will also enable us to turn more science into services for the benefit of government, business and the public.

Science is ready and waiting at the Met Office – the major limitation in turning it into services is supercomputing capacity.

Turning research into highly detailed operational forecasts and services will enable us to produce innovative forecasts – for example focussing high resolution models on strategically important infrastructure such as airports and flood defences.

More detailed forecasts will make it possible to predict small-scale, high impact weather features with greater skill, such as thunderstorms that have the potential to lead to flash flooding.

An element of the new computing facility will be located at Exeter Science Park, which will help create a collaborative environment where we can work with others on science and service delivery including the University of Exeter and the Natural Environment Research Council. This will enable collaborative research such as a UK-wide research project to create a next-generation climate model (known as an Earth System Model) which captures all major aspects of the Earth's climate system (oceans, atmosphere, atmospheric chemistry, terrestrial carbon cycle and ocean biogeochemistry).

## New Space Weather Centre

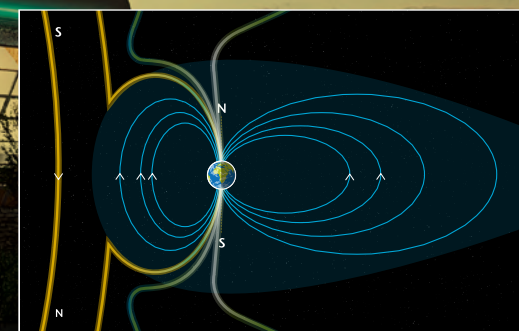
**In October, Greg Clark, Minister for Universities, Science and Cities, opened the UK's only dedicated space weather forecast centre at the Met Office.**

The new Space Weather Centre, based at the Met Office headquarters in Exeter, combines space weather resources and scientific expertise of the UK and USA.

Space weather covers the near-Earth impact of solar flares, geomagnetic storms and coronal mass ejections from the Sun. As we become more reliant on technology, the impact space weather has on Earth becomes increasingly important. Space weather is identified as the fourth most important risk listed on the UK National Risk Register. Specific areas that are exposed to space weather include electricity grids, GPS systems and satellites.

The centre will aim to protect the UK economy and infrastructure from the impacts of space weather by providing space weather forecasts and an early warning system aimed at protecting critical infrastructure. It's a new, emerging and exciting area of science where understanding is growing rapidly. Greg Clark, Minister for Universities, Science and Cities, said: "The Met Office Space Weather Centre is a clear demonstration of how the UK is a world leader in space weather. Not only will it help us to guard against the impact of space weather, but its capabilities will mean benefits for British businesses like those in the space industry and the wider economy."

➤ See page 19 for more on space weather



*Artist's impression of the purpose-designed building at Exeter Science Park where an element of the new supercomputer will be located.*

# Weather the weather

Winter can be a wonderful time of year with seasonal cheer and celebration. It can however bring difficult and sometimes extreme conditions. Cold, wet weather can disrupt our everyday lives and businesses and it makes sense to be prepared for it.

Forecasts give advanced warning of the most severe storms, and being forewarned will help to mitigate the impacts during extreme weather. Whatever setting you're in it pays to have a contingency plan to work around the worst of the weather and maintain a safe environment.

Throughout the year, different types of extreme weather can have significant impacts across the globe. All over the world, natural hazards such as floods, droughts and storms cause loss of life and contribute to increasing socio-economic and ecological instability.

Managing risks posed by extreme weather can be incredibly difficult. As weather and climate can cause extensive damage, disaster management is often viewed in negative terms. However, managing risk can deliver great benefits. Timely warnings can alert officials and the public to take appropriate action before a natural hazard. Early warnings make it possible for people to prepare or avert disaster, save lives and infrastructure. Similarly, it is essential that we prepare our homes and cities for our changing climate which brings an increased risk of flooding, drought and uncertainty.

## The science of managing risk

Helping to manage risks for the good of all, we work on climate disaster risk reduction with partners around the world including the World Meteorological Organization. Early warning is a major element of disaster risk reduction, helping to prevent loss of life and reduce the economic impact of disasters.

Although science and technology form the basis of effective early warning systems, it is essential to have a people-centred approach tailored to local conditions and involve a wide range of stakeholders. Effective communication channels are needed to involve communities that are at risk, facilitate public education and awareness of risks, effectively disseminate warnings and ensure that there is a constant state of preparedness.

Our services help authorities prepare for and respond to emergencies that are caused, or influenced, by the weather, including severe weather warnings, plume predictions, and tidal alerts. The Flood Forecasting Centre, a partnership between the Met Office

and Environment Agency, combines meteorology and hydrology expertise into a specialised service providing early flood warnings.

## Most wonderful time of the year

As well as keeping an eye on everyday weather forecasts, it is worth checking the Met Office website for severe weather warnings. The National Severe Weather Warning Service offers risk based warnings for rain, snow, wind, fog and ice. This means that they take into account impacts and the likelihood of occurrence.

Although the impact of weather is especially evident at winter it is not all bad news. To weather the weather, whatever this winter brings, the Met Office can help you keep alert to potential dangers, prepared and safe to enjoy the good things that the season brings.

Continues over the page →





## Weather the weather

Continued

### Keeping safe on the road and rails

When it comes to transport, wintry weather can cause major problems. To help the road industry reduce, mitigate and prepare for the effects of adverse weather and climate change, we now have a dedicated road forecasting team in our Scottish office. Having a team of local forecasters with detailed knowledge of the forecast area increases understanding of the localised weather environments and provide a more bespoke form of consultancy to our customers in Scotland.

We have also introduced a Quality Mark which helps independent gritting companies reassure their customers that they are getting the most accurate forecasts. By qualifying for this new mark, gritters are demonstrating that they understand the weather to make winter gritting decisions.

Meanwhile, train delays caused by leaves on the line could be avoided with a new Met Office service which predicts when leaves on the lines are most likely to hit rail schedules. The system forecasts heavy leaf falls more accurately than ever before and, for the first time, assesses the likelihood of damp rails which can exacerbate the problem caused by leaves on lines.

### Get ready for winter

Following on from last year's successful campaign we are running the Get Ready for Winter web pages to help individuals, families and communities prepare for winter. The pages combine messages from Government, the voluntary sector, local authorities and others.

We actively encourage people to prepare their properties and vehicles, take responsibility for their own safety and be aware of the latest forecasts and warnings. We provide healthcare information and advice to help the public stay warm, healthy and safe as well as energy-saving tips, and advice about how to make a difference in their communities in severe winter weather.

➔ [www.metoffice.gov.uk/get-ready-for-winter](http://www.metoffice.gov.uk/get-ready-for-winter)



### Met Office College 75th anniversary

**The Met Office College, a world leading provider of weather and climate training, celebrated its 75th Anniversary in September.**

The Met Office Training School, as the College was originally known, opened in 1939. One of its early jobs was to train forecasters for commercial flight routes across the North Atlantic. During the Second World War the school trained military personnel, especially the RAF, in the weather and its potential impacts on operations and sorties.

Since those early days, the College has been at the forefront of developing nationally recognised qualifications; ensuring standards of competence in meteorology are maintained. Former students of the Met Office College have played pivotal roles in advising and supporting the public, industry and Governments during extreme weather, helping save lives, protect property and the economy.

Tens of thousands of forecasters, defence, and air traffic control staff have been trained by the College. Famous alumni include TV and radio broadcasters, as well as Ant and Dec in 2007, and the Duke of Cambridge and Prince Harry who received training with the armed forces in 2009. Students have travelled from as far afield as Hong Kong and the Democratic Republic of Congo.

Looking back at a UK summer, perhaps we shouldn't be surprised that one minute it was wet, the next it was dry.

# Still in a summer daze



In June, working with key partners, we launched our 'Get Ready for the Great British Summer' web pages, [www.metoffice.gov.uk/get-ready-for-summer](http://www.metoffice.gov.uk/get-ready-for-summer), where everyone could discover useful tips and information to make the most of the summer months, whatever the weather.

Temperatures for July were above average across the UK, mainly due to many warm days having maximum temperatures above 25 °C, especially in the south-east. There was plenty of warm, dry, sunny weather, but the warmth led to thunderstorms and localised downpours at times with the heaviest rain generally across the South East and East Anglia.

## Nice weather for slugs

The Opening Ceremony of the Commonwealth Games in Glasgow on 23 July and first few days of

competition saw plenty of fine warm, sunny weather. Unfortunately however, the warm, humid conditions resulted in ideal conditions for slugs in gardens across the UK and for mosquitoes in and around London.

August was an often unsettled month with lots of rainfall in some areas. Ex-hurricane Bertha crossed the UK on 10 August bringing unseasonably windy and wet weather, before moving into the North Sea.

The second half of the month was notably cool with some early ground frosts, and remained unsettled resulting in a cool and wet month overall.

## Dry month in a wet year

Exceptionally low rainfall in September meant that it was the driest September across the UK since records began in 1910.

September followed on from the eighth wettest August on record and comes in a generally very wet year. This January to August is the wettest such period in the records, mainly as a result of the very wet start to the year and the wettest winter on record.

Sunshine amounts for September were close to average. The dry and warm conditions were caused by high pressure dominating which tends to block more unsettled weather heading in off the Atlantic, leaving the UK with fine, dry and fairly sunny weather.

October brought a change with unsettled weather. However, it was another warm month with temperatures well above average.

## Extreme global events influenced by climate change

Extreme weather across the globe continues to be influenced by climate change. Scientists published their work in a report by the Bulletin of the American Meteorological Society which examines how climate change could have impacted extreme events last year. The report concluded human influence on climate greatly increased the risks for extreme heatwaves in 2013, while its impact on other events was less clear – indicating natural variability likely played a larger role in these extremes.

For instance, research suggests that climate change contributed to several of the extreme weather events in 2013, including the California drought and extreme heat events. Similarly, Australian researchers found that 2013 – Australia's hottest year on record – would have been "virtually impossible" without human-caused climate change, with greenhouse gases making the record temperatures 2,000 times more likely. Although natural variability regularly causes hot years, the level of heat experienced in 2013 suggests that greenhouse gases were a critical influence.

Climate change attribution – determining what role climate change plays in specific weather events is very difficult as there are so many factors involved. Met Office Hadley Centre scientists contributed to the BAMS report on extremes with an analysis of the cold spring of 2013 in the UK – the coldest for more than 50 years. The study found that human influence on the climate had made this event at least 30 times less likely.

# On-site forecasting takes off

A five-year Met Office contract to deliver embedded weather services at Heathrow is a first for a non-military organisation in the UK. It is also a pivotal step towards Heathrow's ambition to be the world's best international airport.

Comfortable, quiet aircraft and state-of-the-art terminals are, of course, vital for keeping customers happy. But an airport's ability to deliver exceptional service – and ultimately remain commercially successful – also depends on its ability to operate within extremely tight schedules. As Ricky Oakes, Heathrow's Winter Operations Manager knows only too well – there are few things as challenging to schedules as the weather.

"The weather has a huge effect on Heathrow's operations," says Ricky. "Having a better understanding of it helps us make informed decisions for all departures and arrivals."

## Bringing forecasting home

The Met Office has provided Heathrow with weather advice for many years from our Exeter headquarters. But for the airport to have the fastest, most immediate service possible it was clear they needed a provider that was based on-site where they could have access to extremely localised weather information. After all, a single inaccurate snow-forecast could cost Heathrow over £1 million.

Heathrow put the project out to tender and the Met Office was successful in winning the contract, the ultimate aim of which was to improve operational planning, maximise efficiency and

reduce operating costs. To meet these objectives, the Met Office set up an in-house Met Office weather team of six, based at Heathrow, headed up by Operations Manager, James Shapland.

## High level support

"The Met Office has a long history of supporting aviation," explains James. "Our global model offers high resolution forecasting which we use to provide upper-air forecasts for half the world – Washington handles the rest. The centres at Exeter and Washington are known as World Area Forecast Centres, or WAFCs, and are responsible

for the production of forecasts for wind, significant weather, turbulence, thunderstorms and volcanoes. Our charts are used by pretty much every single pilot worldwide."

Met Office weather data also populates flight planning systems – helping airlines to choose the safest or most efficient route and minimise fuel consumption.

James's Heathrow team complements its global forecasting reach with local and regional weather advice, so both airport and airlines can plan ahead for as many as 45 incoming and outbound movements every hour. With the airport often operating at 98% of its maximum capacity, any unplanned reduction in that figure due to any adverse weather can have serious knock-on effects.

## Making the call

As well as ad-hoc contact around the clock, the Met Office and Heathrow have scheduled conference calls at 04:00, 09:00, 13.30 and 20:30 every day. Tailored forecasts target specific 'cut-off' conditions such as minimum visibility and cloud base height.

"The evening call is usually all about the next day," explains James. "So our view on wind can help our Heathrow colleagues think about runway usage. And if fog is forecast – we aim to flag it 18-24 hours ahead – we may have to recommend flow reductions and higher separation stacks."



"The weather has a huge effect on Heathrow's operations. Having a better understanding of it helps us make informed decisions for all departures and arrivals."

Accuracy in fog forecasting is vital for informing airlines how much fuel to build into the flight plan. Too pessimistic a view will result in unnecessarily heavy aircraft and higher fuel consumption. But if the forecast is over optimistic, under fuelled planes will be forced to divert, unable to hold in the stacks.

The Met Office team also keeps a close eye on US east coast weather – a key factor affecting early morning inbound traffic. At 4am in winter we advise on de-icing in the critical early morning hours.

But it's about more than saving airlines money. It's also about ensuring passengers fly as closely to schedule as possible – and can be made aware of

programme cancellations and changes before they arrive at Heathrow and check in.

#### Tapping into technology

If fog is the event offering the most potential for disruption, it's also one of the most difficult to forecast. Heathrow's heavily concreted 4 km site has various microclimates that can see fog form in one place but not another. Snow coverage on the airfield can vary hugely too.

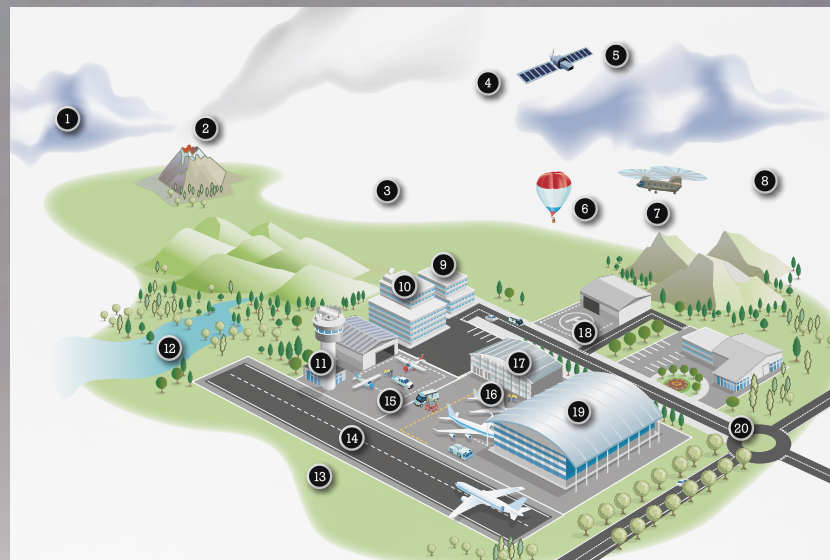
Thankfully, computing power continues to evolve exponentially, enabling the Met Office to offer the greater certainty of 1.5 km grid forecasting – a resolution we now deliver UK-wide.

"The Met Office is always pushing the boundaries of technology," say James Shapland. "We are testing in research mode a very high-detail model of just a few hundred metres resolution. This is specifically being tested and developed to help us enhance our forecast skill for Heathrow airport."

At the same time, the Met Office is improving the data it feeds into its models, by expanding the observation network around Heathrow and creating better vertical atmospheric profiles using balloons and aircraft sensors.

#### Seeing is believing

Embedding weather services at Heathrow has not only revolutionised Met Office meteorologists' understanding of operating one of the world's busiest airports. It's also



→ To find out more about the range of solutions we provide for the aviation industry see the interactive infographic at [www.metoffice.gov.uk/aviation](http://www.metoffice.gov.uk/aviation)

opened the airport's eyes to the challenges of getting the forecast right.

"We can now understand the operational implications of our forecast, as well as get to know our customer and the intricacies of the airport environment," says the Met Office's James Shapland. "We're no longer just a voice on the phone."

"Knowing what's likely to happen weather-wise sooner means we can communicate in advance to affected passengers," adds Heathrow's Ricky Oakes, "as well as to local communities about flight path changes – and the government."

"Above all, the Met Office offers us both credibility and confidence. We wanted a partner who could tell us the things 'we didn't know we didn't know'. What we now have is a very good partnership with people who are not just hungry for knowledge – they're dedicated to continuous improvement."



After gaining his forecasting qualifications John went to Aberdeen to start work as a marine forecaster. He remembers the day he joined the vessel he would be onboard during its work servicing the oil rigs in the Shetland Basin. It was February, the vessel was scheduled to be away for about a week – but that all depended on completion of its tasks.

John saw at firsthand the challenges that workers experience offshore. It gave him an understanding of how seas impact work offshore – and a high respect for the workers operating in that challenging environment. A significant wave was no longer just a forecasting term that described a sea-state on a forecast. The term had come alive. Never mind the academic degree, qualifications and training – this was the most important lesson he had ever received.

That was over thirty years ago – and he's been serving the offshore marine industries ever since. As a Metocean Scientist, John provides marine forecasting services primarily to the oil and gas industries, and offshore renewable industry. His work focuses around understanding what the industries' needs are – both now and in the future – and establishing how the Met Office can best meet those needs.

A glance at his diary demonstrates just how varied his role is. One week he may be on-site providing forecasting for the safe exit of a nuclear submarine from shore to sea; another week he may be helping an oil and gas provider devise a strategy that allows them to continue operating an oil rig through the hostile weather of the winter months.

Based in Aberdeen, much of John's work focuses around the North Sea – widely regarded as one of the most challenging working environments in the world. Precise, accurate forecasting is critical to making sure operations are both safe and cost effective.

Take helicopter flights to and from an oil rig, for example. Flying regulations stipulate that helicopters can only fly when wave heights are below 6 metres – so accurately predicting sea-state is essential to enable companies to plan their helicopter logistics safely and efficiently.

Minimising downtime on an offshore operation is also paramount: access to real-time weather forecasts allows engineers to identify a weather window when they can carry out maintenance and other essential tasks. Not only does this ensure the health and safety of engineers, it also minimises the costs involved.

Whether oil and gas or renewables, offshore operations are hugely expensive to run. John explains, "Resources such as oil and gas are becoming increasingly scarce and located in more hostile environments so there's ever greater pressure on making sure that operations are efficient." As this pressure drives the Met Office to deliver more and more accurate forecasting for the industry, "we need to make sure the science we have is continually made available to that market in a relevant form."

#### Extreme measures – the 2012 storm

The weather in the North Sea is always variable, often inhospitable. Most winters, wave heights can reach ten metres, and conditions can change rapidly. The last two winters, however, have been particularly severe. Extreme conditions forced oil and gas production shutdowns as wave heights breached safety thresholds; some platforms ran low on water, and restricted helicopter travel made it difficult to move staff on and off the platforms.

In December 2012, a fierce storm struck the north-east of Scotland. It caused considerable damage – but it also offered Met Office scientists an opportunity to study the rate at which waves build in the North Sea, and how they build in a significant storm event. Using existing data to evaluate this extreme event, Met Office research teams were able to identify and test a new set of wave growth physics. This has now been implemented in regional wave models. The teams also recalculated over 30 years' of data using the revised models, and this new homogenous dataset provides information on wind speed and direction, as well as 48 different wave elements. This makes it possible to describe sea-states in fine detail, giving the marine offshore industries a deeper knowledge of the environments in which they'll be working.



**John Mitchell** has been a Metocean Scientist with the Met Office for 25 years – but his work with the offshore marine industry goes back even further.

# Weathering the wilds of the North Sea

## It's all in the planning

Much of John's work involves supporting customers in the planning stages of a new offshore operation. Understanding the wind, wave, current and weather patterns – and the huge variability from month to month as well as year to year – allows customers to assess the viability of a proposed new operation. For a new wind farm to be viable, for example, there needs to be enough wind over its lifetime to generate sufficient electricity and achieve a return on investment. Using data stretching back over 30 years, the Met Office is able to deliver a long-term forecast for the proposed wind farm's location. Met Office information also assists in wind farm design and informs the most cost-effective operations and maintenance strategies helping achieve the necessary return on investment.

The industry's reliance on accurate forecasting is continually increasing, particularly as offshore operations move out into deeper waters where the weather is even more changeable. Boats regularly take maintenance teams to offshore wind turbines. These boats find access difficult if waves are above 1.5 metres. Such waves are common in open water so accurate wave forecasting is crucial.

The marine industry is also becoming increasingly interested in the impacts of climate change: "We have done some work recently within the oil and gas sector, looking at climate change to see if any mitigating actions might be appropriate," explains John.

With more accurate predictions come higher expectations: "When I started forecasting I wrote forecasts going three days ahead. Today's data has improved to the extent that people are surprised if the weather is different to what was forecast. I try to make sure people understand the uncertainties involved in providing this forecasting so they can plan for the weather better."

Today's customers want the reassurance that the data being generated is of a high standard – and that there's quality control. "I think the Met Office has integrity and world-leading science in the provision of metocean data. One of its strengths is the quality management of the forecasting process, from data inputs, computer resource and modelling through to forecaster input and the provision of guidance."

As the offshore industries demand ever more accurate forecasting, the Met Office is rising to the challenge – something John is immensely proud of: "I love that my work is useful. I never cease to be amazed and impressed by the potential that the Met Office's technology and science can offer. It is as important to ensure that such development is relevant and focussed on the industry's future needs. This means I have frequent contact with various areas of the industry, and it's exciting to help draw those things together."

"I love that my work is useful. I never cease to be amazed and impressed by the potential that the Met Office's technology and science can offer. It is as important to ensure that such development is relevant and focussed on the industry's future needs."



# Putting the **GREAT** in Great Britain

A chance conversation between the Met Office's Head of Communications, and the Head of the GREAT Britain Campaign has led to our involvement in an exciting new initiative that is spreading awareness of our capabilities worldwide.

The GREAT Britain Campaign is a marketing initiative that is showcasing the heritage, creativity and innovation of Britain around the world to encourage investment and growth. Some of the country's most successful companies and iconic personalities are working with the campaign to inspire the world to do business, visit and study here.

The campaign was originally launched in 2012, when the eyes of the world were on the country for the London Olympics and the Diamond Jubilee. With cross-party support and the backing of 10 Downing Street, the campaign ranges across Governmental Departments including the Foreign Office, the British Council, the Department for Environment, Food and Rural Affairs and UK Trade and Investment, Visit Britain and the Department for Business, Innovation and Skills. Rather than having different

Governmental departments promoting solely their own particular areas of expertise, the campaign drives home the message that unites them all – that Britain is a great place to do business, study and visit.

## The best of Britain

The campaign has a presence in 144 countries around the world, and has secured funding up until 2016. It has already seen some impressive results. "We measure our success against our objectives ruthlessly," explains Conrad Bird, Director of the Campaign, "And so far we have seen a return on investment of more than £1 billion." Indeed, the campaign is so successful that it has become a valuable brand in its own right, on a trajectory that would put it in the top 50 UK brands within the next five years.

The campaign is working with 150 leading businesses across Great Britain, as well as celebrities including David Beckham and Richard Branson, not to mention the Royal Family. "We're looking for the best Britain has to offer," explains Conrad, "and we're proud to promote it." The campaign has a number of key pillars – such as creativity, innovation, heritage and the countryside – and tailors the message for specific local markets. "For instance in China we know that we're not considered particularly innovative or creative," says Conrad, "So we focus on the innovation and creativity pillars in that market to change perceptions and showcase our strengths."



The Met Office's posters and messaging sit under the campaign's pillar of 'Knowledge is GREAT', with a compelling proposition to partners across the world: **"The UK's university sector is a research power house, creating innovative, timely solutions to the world's most pressing problems."**

The three posters created for the campaign include the following messages:

**FORECASTING** Met Office weather and climate services are delivering millions of forecasts every day – helping save time, money and lives across the world.

Research shows that the message is coming across loud and clear, as people who have seen the campaign are much more likely to study, visit and do business over here. “The messages are strongest when they work together,” explains Conrad. “So for example we might promote investing in the UK to businesses overseas but also highlight the benefits of sending your children to study here. All in all that

makes for a strong and compelling message that people are responding to.”

#### The Met Office gets involved

With such a strong and influential message across international markets, it’s no surprise that the Met Office’s Executive Head of Communications, Dee Cotgrove, was inspired to get involved after having had a conversation with Conrad Bird. The Met Office has always had a presence overseas, working with

partners in national meteorological services, for instance, but the GREAT Britain campaign gives us a formal and structured opportunity to make our message abroad even stronger, and support the promotion of weather and climate services overseas.

“The campaign enables us to showcase our work in a professional business sense and in a slightly quirky way too,” explains Dee. Dee cites the recent opening of the Met Office Space Weather Centre, when Greg Clark, Minister for Universities and Science, referred to the Met Office and British weather in general as both being ‘Icons of Britishness.’ “People overseas tend to joke about our obsession with talking about the weather, but this gives us the opportunity to show the value of forecasting and how we can help partners and businesses around the world.”

Once the Met Office and GREAT Britain had agreed to work together, there was a period of evaluation and discussion as the two bodies pinpointed the messages to get out to the market. “Conrad suggested we develop some examples of what could be used,” says Andy Yeatman, Deputy Head of Communications “And there was some to-ing and fro-ing as we fine-tuned the messages.”. Three areas in particular were chosen to progress: forecasting, training and aviation. The in-house Met Office graphic designers then created three concepts to highlight key messages about each of these areas.

#### Showcasing expertise

The posters can appear in a number of different formats, ranging across everything from traditional billboards to digital campaigns and online banner adverts. “What we are working on now is where we will use them,” says Andy. The collateral is there, which we can use at international exhibitions and email campaigns around the world.

“It’s great to showcase the value of weather information, and now we can raise awareness outside of the UK of what the Met Office does,” explains Dee. The organisation already has an excellent reputation across other national meteorological services and academic institutions. Now the GREAT Britain campaign can amplify our message to a wider business audience.



**TRAINING** Met Office experts are delivering world-renowned meteorological training in over 30 countries across the world.

**AVIATION** Met Office is a World Area Forecast Centre, helping two thirds of global air traffic fly safely and efficiently.



# Grape

## expectations

The vineyards of England had bumper harvests this year. We look into what created the perfect conditions for this growing industry.

Fermentation, acidity, soil, there are so many elements involved in winemaking but one is much more vital than the rest. As Geoff Bowen, Winemaker at Devon's Pebblebed Vineyards, says, "A good wine is made in the vineyard." And that means weather.

"Over the last two years you couldn't have written a better script," says Geoff. Tuscany and France have had wet summers, but England and in particular the South West has had the perfect combination of an early spring, good weather in June and a sunny September. "It's been the best weather in the whole of Europe for the type of grapes we are growing," enthuses Geoff.

Being on the edge of the wine-growing region, vineyards like Pebblebed are very dependent on the weather and winemakers like Geoff will keep their eyes on a number of forecasts to plan ahead. Geoff is a big fan of the Met Office website, which he checks every day throughout the growing season. The respect is mutual. Pebblebed is just a few miles from Exeter, and every year a number of Met Office employees volunteer to help with the grape harvest.

### **Doubling the yield**

Thirty or so miles south of Pebblebed is the Sharpham Estate, where ten acres of vines stretch along south-facing slopes next to the river Dart. In an average year the vineyard produces 60,000 bottles of

red, white and sparkling, but this year that number is set to double to 120,000 bottles. And it's all down to the weather.

For a bumper harvest like this, the weather has to be favourable not just during the summer months but during crucial periods throughout the year. Head Winemaker at Sharpham, Duncan Schwab explains: "Everything starts with the pruning. We need cold days to keep the disease levels down." The cold kills off spores, which otherwise would attack the new shoots on the vines. An early spring encourages the buds to start bursting earlier, which means that the grapes have longer to ripen. However, this can be a

precarious time for wine growers, as there could still be a frost to kill off the delicate new growth.

The next critical stage takes place in early July, when the flowers pollinate. Ideally the weather needs to be warm and dry for successful pollination, happening over as short a time frame as possible. "If pollination is prolonged then the grapes ripen at different stages," explains Duncan, "And we might have to have two harvests."

The grapes should be ready to pick by about 20 September onwards, through into October. Weather is just as crucial during the harvest period. If it rains during the harvest, the vine roots will suck up moisture from the soil and that will be apparent in the grapes. Duncan and his team will check the forecast closely to aim to pick after there has been a dry spell.

Meanwhile, for Geoff at Pebblebed, good weather during harvest is crucial for another reason too. As volunteers always come and help with the picking, Geoff checks the forecasts to make sure visitors will have an enjoyable day in the sun.



Average yield  
x60,000 bottles



2014 predicted yield  
x120,000 bottles  
(Thanks to the weather)

### Fermentation and beyond

Even once the grapes are picked and in the winery, the weather still plays a crucial part. The liquid created from the crushed grapes needs to be fermented cool to lock in the wonderful fruit flavours in the grape. The best way to do that is simply leave the barn doors open and expose the mixture to cooler temperatures.

Once the wine is fermenting, wine makers may want to create a second fermentation, for which they rely on warm temperatures. Yet again, the weather can play a part here, with a warm spring kick-starting the fermentation.

This year all of these factors came into place to create the perfect conditions for wine growers like Geoff and Duncan. "I've been here 22 years," Duncan says, "And this is one of the best harvests I've ever known."

So does the weather affect the taste of the wine too? Duncan's short answer is "Yes, yes, yes!" A warm summer means ripe grapes and big fruity flavours. Duncan gives the example of a red wine they sold one year that, due to conditions, didn't have the strength of flavours of previous years. "We couldn't market it under the same name as the taste was just too different, so we called it a Summer Red, which worked for us." Customers expected the wine to be lighter.

### Microclimates and forecasting

Both Sharpham and Pebblebed also have unique microclimates that help with the growing process. "The Haldon Hills seem to create a microclimate with more sun and lower rainfall," says Geoff, and it's a similar picture in Sharpham, as the river helps to eliminate frosts during the winter months, while reflecting heat and light from the sun up onto the slopes during the summer. Both vineyards also have rows of carefully planted windbreaks to hold the temperatures in while allowing for some breeze to flow across the landscape.

For winemakers like Geoff and Duncan, accurate forecasting is absolutely vital. "Forecasts seem to have got better and more accurate over the past decade," says Geoff, "And frost forecasts in particular are useful in April and May." Ever more precise forecasting can play a part in making English winemaking even more successful. Duncan gives the example of the tourist industry, something that Sharpham relies on a great deal. When potential visitors see a pessimistic forecast they are less likely to come and visit the vineyard, even though the microclimate means it can be very different at Sharpham. With precise and pinpointed forecasting, vineyards like Pebblebed and Sharpham can welcome more tourists, plan ahead more effectively, and continue to produce award-winning wines.



From sheer mountain slopes to Arctic ice fields, Martin Hartley specialises in photographing expeditions to some of the most challenging and remote environments on earth. Environments where knowing what the weather's up to is essential for a safe return – and getting some fantastic pictures along the way.

Today, expeditions to remote corners of the globe are less likely to be made purely for exploration, but also for reasons that have a scientific or social value. It's adventure with a purpose that attracts Martin Hartley, a world-leading expedition and adventure travel photographer who has completed over 20 polar assignments and won numerous awards.

"Nowadays, I think it's irresponsible to travel and not share knowledge of where you've been," says Martin. "Technology has made that so easy, that it's an integral part of any expedition."

Sharing knowledge, whether through documenting life in unique communities, remote landscapes or scientific expeditions, is just what Martin achieves through his photography.

"...if you're standing still at minus 40 degrees, no amount of warm clothing will stop you getting cold."

# Behind the camera



### A changing world

Martin's heroes include polar explorer and artist Sir Wally Herbert and Herbert Ponting, the photographer who documented Captain Scott's expedition to the Antarctic between 1910 and 1911. But as he points out, polar expeditions today are a little different than they were for the great polar explorers – which is in no small part due to climate change.

"There's definitely more open water to cross than there used to be," says Martin, explaining how his team has to carry inflatable devices and drysuits to cross channels that open up in the ice. A possible reason for this is the thinning sea ice that is known to have decreased in some areas from between 3 and 4 metres thick to 1.7 metres over the course of just 100 years.

While studying the possible effects of climate change has been the driving force behind many of the expeditions that Martin has been part of – it can be incredibly hard to convey these environmental changes visually. "The problem with the Arctic Ocean is that while the ice is getting thinner, it looks almost completely the same on the surface," says Martin.

But, having travelled in the high Arctic many times over the past 12 years, Martin's first-hand experience leaves him in no doubt. "I know that the ice is moving a lot faster with the winds than it used to," he says, "and that it's breaking up more easily."

### Looking ahead

Whether it's Arctic winds or heavy snow, knowing what's coming next can make all the difference when travelling in such remote locations. Martin points to an upcoming project with top British climber Andy Kirkpatrick to climb Mount McKinley in Alaska – also known by its native name Denali – the highest peak in North America. Denali is also the third highest topographical prominence peak in the world. This is based on the distance of the peak's summit above the lowest contour line encircling it with no higher summit.



Having detailed weather information will help the team know when they can move forwards. "It's the weather that will allow us to summit and return safely."

Weather conditions have a different impact altogether on his Arctic travels, where the expedition must keep moving come wind, storm or snow. Besides allowing them to prepare mentally for the journey ahead and plan routes across drifting ice fields, knowing what the weather has in store can help Martin visualise the photos he wants to take.

"When the weather's at its best is a very boring time to take photos," he says. "But when there's lots of clouds or snow, or there's big dark skies – it's not that good for the expedition, but it's great for the pictures."

### Getting a great shot

At times when the temperature sits far below zero degrees, it's a challenge to focus on anything but keeping moving, let alone compose and capture remarkable photographs. For Martin, it's a talent that takes complete dedication – and some careful planning.

"It helps to have an ongoing shopping list in your head of the types of images you want to get each day." This is because when taking a photograph, speed is of the essence to protect fingers, feet and core body temperature from the Arctic chill.

"If you're taking pictures or video you obviously have to stand still," Martin says. "And if you're standing still at minus 40 degrees, no amount of warm clothing will stop you getting cold."

"...when there's lots of clouds or snow, or there's big dark skies – it's not that good for the expedition, but it's great for the pictures"

### The right tools

The cold can also take its toll on the cameras – something Martin's learned from experience.

"I had six film cameras on my first polar expedition, and by the end of day one, they had all stopped working," says Martin. In extreme cold, the mechanical components in a camera can shrink and become too tight to operate, and batteries die. "I had to put two cameras inside my jacket and run around to warm them up again."

Since then, Martin's gone on to use cutting-edge digital cameras including a Nikon D3X, which is much more resilient to the cold. He also carries a Leica MP – a completely mechanical film camera that was made especially for him and put through rigorous cold weather testing. This means he always comes home with something to show and gets his work placed everywhere from books and newspapers to exhibitions at the Royal Geographic Society.

Besides having the right camera and a few spare rolls of film, there's one thing Martin couldn't do his work without:

"A smile. That's the only thing you should always travel with, which will help you in more ways than you could possibly imagine."

➡ You can read more about Martin and view his work at [www.martinhartley.com](http://www.martinhartley.com). You can also follow Martin on Twitter @MartinRHartley

# Demystifying the monsoon



Over one billion people depend on the South Asian Monsoon for water. But the very complexity of this yearly weather event makes it notoriously difficult to predict, placing innumerable lives at risk. Fortunately this is changing, thanks to the on-going collaboration between scientists in India and other organisations around the world, including the Met Office.

For many years, the Met Office has been working with organisations such as the Indian Institute of Tropical Meteorology (IITM) and the National Centre for Medium Range Weather Forecasting (NCMRWF). The primary focus of recent collaboration has been with NCMRWF on the evaluation and development of the Met Office Unified Model (UM) – a single model that can be used across a range of spatial and temporal scales for forecasting weather through to climate change.

The relationship has paid dividends over the years and is now set to become even stronger with significant commitment from India dedicated to developing the technical capability of the UM as part of the Unified Modelling core partnership team.

Understanding monsoon dynamics has always been central to the Met Office's work in India and was given even greater focus in 2012 when India's Ministry of Earth Sciences (MoES) launched the National Monsoon

Mission (NMM). The aim of NMM is to develop state of the art predictive capabilities around the South Asian monsoon and it has brought about several collaborative projects with the Met Office.

One such project involves building a coupled model system around the UM, and conducting a regional reanalysis over India. But one of the most exciting NMM projects launches next year and will demonstrate collaboration at its best.

## A lasting legacy

When it comes to tracking monsoons, the level of detail obtained from observations makes all the difference. So in 2013, the National Environment Research Council (NERC) brought together scientists from the Met Office, MoES, Indian universities and several Met Office Academic Partners, to examine how their joint expertise could be put to best use when working with the NMM.



The summer monsoon provides 80 per cent of annual rainfall to around one billion people in India.

"We could have more of a lasting legacy if we made a decent targeted observational campaign, focusing modelling efforts and observations together," says Jim Haywood, Research Fellow at the Met Office.

The resulting Drivers of Variability Programme is designed to do just that. The programme involves a large-scale observational campaign for the South Asian monsoon over the next three to five years. Researchers will use the UK's BAe-146 atmospheric research aircraft and ocean gliders, Indian research ships and other ground-based instruments to gather fresh data on the region in more detail than ever before.

"This model of having an extended observation period on the ground and an intense observational period provided by aircraft works very well," explains Haywood.

The programme will improve understanding of the physical processes of the South Asian monsoon, with far-reaching implications.



सत्यमेव जयते  
Ministry of  
Earth Sciences



NERC  
SCIENCE OF THE  
ENVIRONMENT



## Why does the monsoon matter?

The summer monsoon provides 80 per cent of annual rainfall to around one billion people in India. Forecasting the precise timing and location of the rains is vital to the region's economy, which is dominated by farming, and for managing its increasingly pressured water resources.

Last year, the monsoon advanced particularly rapidly over northern India, causing devastating damage while, in 2009, prolonged breaks led to a severe shortage of rainfall and poor harvests. Of all monsoons, the South Asian is the biggest, with the largest global influence.

## What makes it so hard to forecast?

All monsoons have a wide range of variability across timescales – over days, within the season itself, and over years – making them very difficult to predict. To complicate things further, they interact with other parts of the world – not just within the tropics but with the middle latitudes as well. The South Asian monsoon is particularly complex for several reasons, such as the way the land is arranged, the height of the Himalayas and the Tibetan plateau.

So much variability presents significant challenges, particularly in developing general climate models. This variability is also why it's so important to carry out observations over extended periods – which is why the Drivers of Variability Programme has a range over several years.

## A global impact

"One of the things we really want to do with this programme is to push forward very high resolution modelling over the region," explains Gill Martin, Manager of the Met Office's Global Water Cycle Group. "This will involve some model development but once it's done, we'll be able to apply it to other tropical regions."

The monsoon is a central element of the climate system – so if it is better represented within the UM as a result of this programme, the benefits won't just be local or regional, they'll be global too.

The spirit of collaboration runs through every aspect of this programme. Each of the science projects within the programme will be led by one British and one Indian researcher. And both the Met Office and its Indian counterparts will benefit from each other's expertise and operational assets. For example, while the Met Office is training Indian scientists on the use of observational aircraft, it is also benefiting from the Indian scientists' local expertise and gaining unprecedented access to Indian instrumentation.

"Together you can always do more than you can on your own," explains Jon Petch, Head of Science Partnerships at the Met Office, "and that's true of all of our collaborations."





# Somewhere out there

Space weather encompasses conditions on the Sun, and its impact on the near-Earth environment that can affect space-borne and ground-based technological systems and endanger human life and health. That description doesn't convey how spectacular space weather phenomena are: millions of tons of plasma erupt out of the Sun at millions of kilometres per hour; solar flares are sudden releases of energy across the entire electromagnetic spectrum that arrive at Earth at the speed of light; the Sun is also a source of fast-moving streams of energetic charged particles. So how on Earth can the Met Office forecast all that?

If a large eruption of plasma from the Sun, known as a Coronal Mass Ejection (CME), is headed for Earth and its internal magnetic field has the correct orientation to penetrate Earth's magnetic shield, it can generate a geomagnetic storm. This induces large ground currents which can disrupt electricity grids – a major concern of the National Grid and the UK Government. Space weather also affects satellites, radio communications, GPS navigation, aircraft digital systems and cause health impacts for astronauts and airline crew and passengers.

With our experience in operational numerical weather prediction, the Met Office is well placed to provide operational space weather forecasts. Observation reception and processing, and delivery of forecasts

and alerts in near real-time are highly relevant to space weather forecasts. We also have relevant expertise in numerical modelling, data assimilation and ensemble prediction.

## Partnerships are vital

Where we have less expertise, we aim to progress through collaboration. Through the new Met Office Space Weather Centre we are transitioning research to operations with partners in the UK and abroad, notably the National Oceanic and Atmospheric Administration (NOAA) Space Weather Prediction Center in the US.

Currently we monitor the Sun, the radiation belts, the ionosphere and the geomagnetic field using real-time observations. Solar observations are

used to analyse solar active regions which may be the source of space weather events. In addition, the WSA Enlil model forecasts solar wind, including CMEs via an analysis of observations from the SOHO and STEREO solar-observing spacecraft. The model predicts the arrival of CMEs at Earth to within six hours (at best), with a lead time of close to the 1-3 days it takes for the CME to arrive. Other models forecast high energy electron flux at geostationary satellite altitudes and the impact on radio communications in the ionosphere. We are working on real-time ionospheric mapping which will be useful to radio and GPS users.

## Challenges and research goals

Developing models will make the CME arrival time predictions more accurate and consistent. CME forecasts provide no information on the orientation of the CME's magnetic field, and we currently rely on observations which give a lead time of around 30 minutes. We are developing more accurate representations of the coronal magnetic field which will lead to more detailed, accurate forecasts. Associated research will improve our currently limited ability to predict solar flares and radiation storms.

We are also challenged by a lack of data. The STEREO data used to identify CMEs are largely unavailable. Many spacecraft like SOHO are past their planned lifetimes. Important ground-based observations are often sparse, and thermospheric observations (important for satellite orbital tracking and ionospheric forecasts) almost non-existent. International and national efforts are required for new satellite missions, ground-based networks, and improved data access and sharing.

## 'Sun to Earth' prediction system

Many models currently have limited forecast skill. This is partly due to limited understanding of the relevant physics, but also because models often only cover a restricted part of the Sun to Earth domain. Similarly, models also do not often adequately incorporate predictive information of space weather activity at the Sun – which highly enhances overall forecast skill.

Our long-term research goal is to join solar, magnetosphere, thermosphere / ionosphere and troposphere / middle atmosphere models into a data-driven 'Sun to Earth' prediction system, underpinned by near real-time forecast verification. Combining models will provide a fuller picture and significantly enhance ability to forecast the amazing assortment of space weather.

# 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 David Jackson**  
Manager of Space Weather Research

From flooding to falling trees, we're all familiar with the damage that can be caused by storms. But what's less well known is that about 100 to 600 km above the clouds – in a layer of the Earth's atmosphere called the ionosphere – storms and disturbances also frequently occur. While these are very different to the weather we experience on Earth, they still have the power to cause massive disruptions to our technology and infrastructure.

Professor David Jackson leads the Met Office's research into 'space weather' – studying variations in solar activity and how they affect the Earth. The team's ultimate goal is to improve the UK's space weather forecast service.

"There's currently a gap in what we can do compared to weather forecasts," says David, "so there's a huge potential for development and to understand more about the Sun's impact on Earth."

## Sunny spells ahead

The Earth is constantly bombarded by a stream of charged particles from the Sun – the solar wind. While the solar wind is largely blocked by the Earth's magnetic shield, some finds its way into the ionosphere – a layer made up of positive and negatively charged particles that is essential for radio communications. Solar activity can cause massive changes in the solar wind known as coronal mass ejections (CMEs). These are explosions of magnetised plasma that can cause geomagnetic storms in the ionosphere, leading to electrical currents on the ground that can disrupt power grids. Sudden bursts of solar radiation, such as solar flares, are another spectacular manifestation of space weather. In addition to the power grid impacts, space weather can disrupt radio and GPS communications – a phenomenon that is of particular concern for the airline industry.

It's events like this that the Met Office's space weather service forecasts. As David explains, predictions are especially important to key infrastructure such as the National Grid, where "knowing when a CME will arrive on Earth means they can take preventative action against potential impacts."

**"If we can predict how a coronal mass ejection will move through the magnetic field and affect the ionosphere, we can better forecast the impact of space weather."**

## Creating a forecast

For David and the team, creating a forecast is a step-by-step process that uses a number of different models. First, using observations from three solar satellites, they can identify CMEs as they leave the Sun's surface. This information is then fed into a two-part model, called WSA-Enlil that can be used to forecast when the CME will hit the Earth's atmosphere.

Collaboration with organisations worldwide has made this forecast system possible. WSA-Enlil was created by the National Oceanic and Atmospheric Administration (NOAA) in the US, which continues to run it in parallel with the Met Office. David's team can use the model to produce forecasts twelve times a day that can predict CMEs up to three days in advance.

As well as predicting when space weather will strike, David's team is working towards forecasting "the fine effects". This means not only studying the Sun, but also

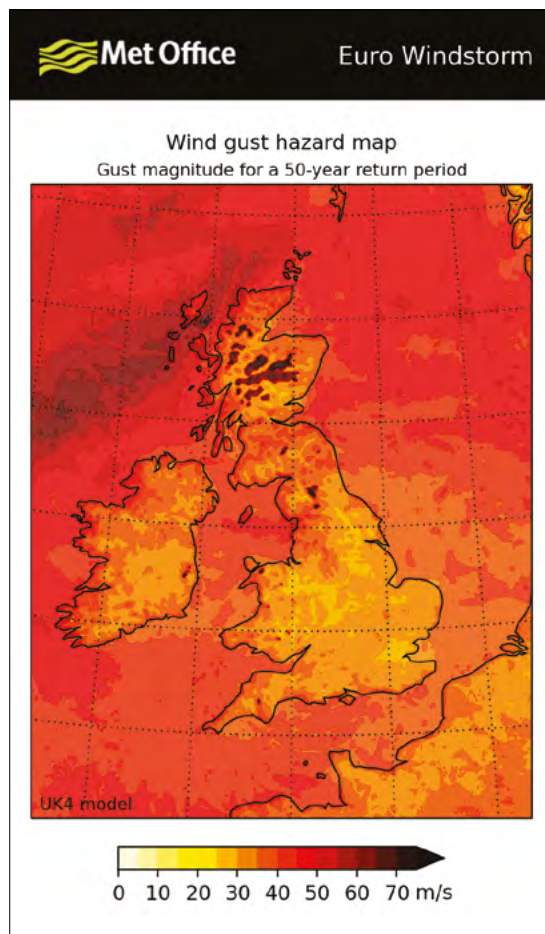
developing a more detailed view of the Earth's upper atmosphere. David explains that this involves linking a model of the Earth's magnetosphere with a model of the ionosphere. "If we can predict how a CME will move through the magnetic field and affect the ionosphere, we can better forecast the impact of space weather."

## Bridging the gap

There's still much to do. As David points out, space weather forecasting is in roughly the same state as weather forecasting was over 30 years ago – a gap that the research team is working hard to close. This means their day-to-day tasks involve what David terms "applied research", constantly running experiments on models to test their reliability, and assessing how they could work as part of an operational forecasting system.

David takes a very strategic role. "A lot of my work takes me out of the office, to build collaborations with universities and other organisations," he says. At the moment, this includes working with the World Meteorological Organization to define how to improve the observations that play such a crucial part in space weather services.

The more they know, David explains, the more detail they can put into forecasts. "In future we'll move towards not just warning about when a severe space weather event could happen, but also providing more detailed forecasts of "everyday space weather" for users".



Mention insurance and most people will express mixed feelings; at best, a payout on a motor or travel claim, at worst, pushy sales techniques or expensive premiums. Despite these mixed emotions, insurance fulfils an important social function. In the event of a natural catastrophe it's what gets families back in homes and businesses back up and running.

It may come as a surprise that, last winter, windstorms caused greater insured losses across Europe than flooding. So it is just as well that the Met Office's Insurance and Capital Markets Applied Science team has developed Euro Windstorm, a suite of products released in time for winter, which includes a catalogue of historical storm footprints for aggregate risk management, hazard maps for understanding local risk, and a near real-time alert and forecasting service.

#### Modelling risk

Property insurers cannot meet their obligations without modelling the probability, severity and location of a natural hazard. Many in the industry invest large sums in catastrophe models and the scientific capability to use them. This is partly to balance portfolio risk across domains and product lines, but also to calculate the amount of capital insurers must hold to avoid business failure.

We're all aware of bank crashes in recent years, but regulators have always tried to ensure the adequacy of insurers' capital reserves. This is so that they cannot fail to pay out – even in the event of a 1 in 200 years storm. It's not enough just to

have an industry catastrophe model (a complex model including hazard, vulnerability and financial components) insurers must demonstrate that they understand them and have verified the output. This is where third party expertise can add value, such as the Met Office's understanding of hazards.

The Met Office's Euro Windstorm catalogue offers modelled footprints and tracks of more than 6,000 real storms. "Exposure managers and researchers can compare these modelled storms with their loss records to better understand the impact of future storms," says Nick Moody, Met Office Marketing Manager for Insurance and Capital Markets. But with climate change research showing a higher probability of severe events in future, observed history is not enough to represent all likely outcomes. So the Met Office is developing an event set based on dynamic starting conditions which will show the probability, location and severity of events over much longer time periods.

#### Putting a price on risk

Individual policies relate to risk at a local level. Not all insurers work with multi-million pound catastrophe models and so the Met Office has developed hazard maps to show locations of the most extreme winds for different return periods. Using gridded extreme values analysis, adjusted for the nature of the land surface, underwriters can quickly score areas of higher and lower risk and price policies accordingly.

"To create these products, we've used our computing resource to downscale a model reanalysis to optimise the length and granularity of the dataset", states Paul Maisey, Met Office Science Manager for Insurance and Capital Markets.

#### Responding to storms

When a major Atlantic storm makes landfall, policyholders have a higher than ever expectation of help. Insurers must deploy staff on the ground, boost call centres and call forward capital for early settlement of claims. To do this they need early alerts and the best possible view of the storm size, track and severity. The Euro Windstorm Event Response service is designed to do exactly this. It not only provides daily updated models, but it matches the storm's footprint to the closest historical storm so insurers can compare it with previous losses and anticipate what's coming.

"These are early days for us in this industry" says Nick "but industry feedback suggests Met Office Euro Windstorm services will be well received and will help insurers anticipate and adjust with early alerts and increased understanding of long-term risk."

# Windstorm insight for insurance

The Met Office has always helped society to avoid or mitigate loss from natural hazards. Now, with a new product, Euro Windstorm, we are helping the insurance industry increase their understanding of risk.

# Bringing astronomy down to earth

Mark Thompson

Mark Thompson was just ten years old when he first looked through a telescope. Standing in the Norwich Astronomical Society and staring at the vivid colours of Saturn's rings nearly a billion miles away is a moment that has stayed with him ever since. It was also an experience that sparked the hugely varied and successful career that followed.

Contrary to expectations, Mark didn't go down the conventional academic path to becoming an observational astronomer. Instead he left school at sixteen after his GCSEs to work in photography, IT and Project Management. While he later went on to start an Open University degree in astrophysics he soon got distracted by flying lessons. "At the time they were infinitely more exciting to me – so I decided to train as a commercial airline pilot," says Mark.

But his interest in the cosmos never left him and he began writing books on space and lecturing on everything from dying stars to black holes in distant galaxies. His refreshingly fun and engaging approach to communicating science made him a natural for television and radio and led to roles on Sky at Night and The Culture Show. He currently co-presents Stargazing LIVE on BBC2, as well as regularly appearing on The One Show and This Morning.

With astronomy being so dependent on the weather, Mark considers the

Met Office website an invaluable tool. "The main difficulty", he says, "is accurately predicting – and then putting on Twitter – when the sky will be completely cloud-free."

## Space weather matters


But it's not just the weather in our atmosphere that impacts on Mark's work as space weather also plays its part. In fact, he became more involved in studying this phenomenon while making a series of short films for the Yahoo Extreme Weather at the Met Office Space Weather Centre. "The way it affects astronomers is chiefly around the beautiful display of the Northern Lights," Mark explains "when outbursts of charged particles from the sun cause atoms in our atmosphere to glow. It's the same principle that causes a fluorescent lighting tube to glow – where electrically charged atoms cause the gas inside to light up."

As the world becomes increasingly reliant on electronic data, Mark is keen to point out that space weather often has negative consequences too, especially for satellites – knocking out their ability to communicate. Astronauts conducting experiments on the International Space Station (ISS) bear the brunt of this problem. For most us, however, our first-hand experience of space weather will be when the sat nav in our car stops working.

"At its source," Mark says, "space weather looks like 'hairs' stretching out from the surface of the sun. As it rushes towards us at 400 to 800 kms per second, it's invisible. But because it disturbs the magnetic field of the Earth, scientists are able to analyse any atmospheric changes using very sensitive magnets. Right now, our best line of defence is to design better satellites and technology that resists the impact of radiation and electromagnetic interference."

## Making science simple

Overall, Mark's mission is to get the average person as inspired about the universe as he is – something he does naturally by explaining complex science in down-to-earth language. His new book, due out in March 2015, is a perfect example of this. Titled – A Space Traveller's Guide to the Solar System, it explores whether it's possible for one person to visit all the planets in a human lifetime. It's ideas like these – along with plenty of other media projects – that will be keeping him busy in the future. As Mark concludes, "My work involves a pretty random selection of things. I often have to pinch myself that I'm doing my dream job."

 The new series of Stargazing LIVE begins March 2015.

Look out for the next issue of Barometer when readers will have the chance to win Mark Thompson's new book.

[www.markthompsonastronomy.com](http://www.markthompsonastronomy.com)





### Weather animations for kids

A series of informative and educational video animations for children have been developed by the Met Office and Drive Creative Studio.

Covering everything from snow, sleet and hail, to how rainbows form, the videos show in a simple yet engaging way how weather conditions develop.

The quality of the animations earned Drive Creative Studio a Gold award at the 44th Creativity International Awards – one of the longest running, independent design competitions which recognises great design from around the world. The winning entries are selected for their creativity, quality of execution and impact.

➔ The videos are available as an educational resource on our website and YouTube channel <https://www.youtube.com/user/TheMetOffice/>