



Met Office

Unlocking potential  
Met Office College

Inspiring learning  
Building bright futures

Encouraging development  
Working in partnership

# Barometer

Issue 25 [www.metoffice.gov.uk](http://www.metoffice.gov.uk) Met Office magazine





After 30 years at the Met Office, **Rob Varley**, Met Office Operations and Services Director, remains passionate about weather and learning.

# Excited to learn

Like many others, I was excited to learn of the Government's decision to invest in a major upgrade to the Met Office's supercomputers. It will undoubtedly improve and extend our weather forecast capability and further progress climate science at a time when there are important policy questions to be answered.

We are ready and looking forward to doing something remarkable, working with others around the world to put science that is ready to apply into action (page 3). Central to our scientific collaborations is the Met Office Academic Partnership (page 3), and I'm delighted to welcome the University of Oxford as the latest member to join us in this.

The first part of the Fifth Assessment Report, published in September 2013 by the Intergovernmental Panel on Climate Change, is a major milestone for the Met Office. Not only have Met Office scientists made an important contribution (page 19), it is also a highly significant statement from the scientific community which reminds us all of the seriousness of the risks we

face and the need for the nations of the world to take action.

As a world centre of excellence, we have a duty and passion to share our science with the next generation, and we use every opportunity for encouraging young people to see science as exciting and fulfilling. As well as helping to safeguard the Met Office's future, this is an important national priority; our owners, the Department of Business, Innovation and Skills is encouraging businesses and government agencies to help build a nation which is strong in science, bringing vital economic benefits.

Nationally and locally, we engage, educate and build excitement in what we do. Many Met Office staff are now STEM (Science, Technology, Engineering and Maths) ambassadors, and are working to share their passion with the young. It's a great motivator for our staff as well as giving many opportunities for personal development; someone who starts out presenting to a classroom of children, could one day end up delivering a talk at the Royal Society.

One of the many Met Office STEM ambassadors is Climate Consultant, Felicity Liggins (page 9) who is also responsible for co-ordinating our STEM work, recruiting and enthusing others to get involved.

Providing educational resources is part of our mission as the national weather service, sharing our expertise and inspiring the next generation of scientists. We can educate young people about matters of day to day relevance and matters of global importance. I'm a huge fan of our work experience programme (page 4). Young people often have little idea of the different types of jobs available. By offering them a week with us, we can give them a direct glimpse of many of the different possibilities.

Our latest initiative to introduce children to weather science is the Met Office Science Camp. Over the past few months we have had over 100 children camping overnight at the Met Office, and taking part in engaging activities to learn about weather and climate science. I went along to one of the Science Camps and it was incredible to

see all the kids wide-eyed and excited while learning about physics.

As a former Chief instructor of the Met Office College I was interested to read how its work has expanded and diversified in recent years (page 12). The College is a vital resource to equip our own people to do their jobs. But it's also impressive to see the worldwide reputation that the college has built as an international centre of excellence for training and meteorology.

The College now attracts students from many nations, helping share best practice and build capacity in the developing world. A media systems training workshop in Kenya (page 21) is an extension of the training we offer at our headquarters and an example of how we are actively equipping countries to ensure their citizens are warned and informed.

Finally, I'm delighted to welcome Dr Liz Bentley as the new Chief Executive of the Royal Meteorological Society (RMetS). The Met Office has always been a strong supporter of the RMetS, and as a Vice President of the society I know just how important it is to provide clear leadership for this national institution, with its dual functions of both championing professional science and encouraging amateur engagement in meteorology.

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

# In this issue



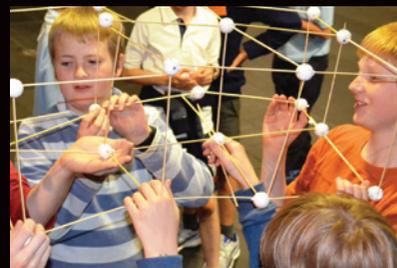
## News and updates

- 03 In brief**  
Forecasting demand  
Unlocking potential  
On top of the mountain
- 04 Learning of the future**
- 21 Media savvy**



## Features

- 05 Key weather events**  
Summer cheer
- 07 Working in partnership**  
Collaboration with universities
- 12 Met Office College**  
World leader in meteorological training
- 15 Building bright futures**  
Met Office free educational resources
- 17 Society matters**  
Spotlight on the Royal Meteorological Society



## People

- 09 Our people**  
Felicity Liggins
- 20 Science profile**  
Chris Jones, Manager of the Earth System and Mitigation Science Group
- 22 Celebrity weather**  
Kathy Sykes



## Science

- 19 Science focus**  
Climate science in context

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

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

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

**Tel: 0870 900 0100**

Fax: 0870 900 5050

From outside the UK:

**Tel: +44 (0)1392 885680**

Fax: +44 (0)1392 885681

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## Forecasting demand

A new contract is helping Sainsbury's to make operational stock ordering decisions.

Predicting consumer behaviour based on weather is nothing new. It's common sense that during hot weather people will eat more ice cream and salad for example. However, the extent will vary depending on the actual conditions. In retail it is essential to have exactly the right goods when people want them and, as usual, the devil is in the detail.

Under ordering won't meet demand. Over ordering results in waste, particularly when it comes to perishable foods. That's why we're now helping Sainsbury's understand our view of the weather, which in turn helps them inform their ordering decisions. By ordering wisely, Sainsbury's can reduce waste and save money.

At the Met Office, we forecast across a range of timescales which means Sainsbury's can understand how weather affects sales in the short- and long-term. We have also been working

**Sainsbury's**  
*live well for less*

hard to learn the intricacies of Sainsbury's business and its supply chain. Met Office forecasters have spent time with teams from Sainsbury's listening to their requirements and running workshops to fully understand the nuances of the types of decisions they have to make.

Through this detailed understanding, we are developing bespoke services such as helping Sainsbury's to easily visualise weather trends through maps of forecasts 11 days ahead.

Karen Whitworth, Director of Supply Chain at Sainsbury's said: "We really appreciate the value-added services the Met Office provides. Their forecasting services have given us the confidence that we need to make better ordering decisions."

## Unlocking potential

As part of Government's Spending Review earlier this year, the Treasury announced its intention to invest in a new High Performance Computer at the Met Office, enabling science to realise its full potential.

Funds for the upgrade will come from the Department for Business, Innovation and Skills (BIS) agreed capital budget of £2.2 billion in 2015-2016 and 2016-2017.

The announcement comes at a critical time in the UK's economic recovery and represents endorsement from BIS and wider government of what we do — and the potential for our science and service to help the UK to be more resilient, competitive and sustainable.

Science is in place to deliver a step change in forecasting for the nation, enabling increased prosperity, safety and well-being. Investing in a major supercomputing facility at the Met Office, targeted at multi-disciplinary collaborative environmental science, prediction and services, is the key to unlock this potential.

First indications show that the investment will be significant, enhancing supercomputing capability at the Met Office in line with the Science and Technology Committee's recommendations in its March 2012 report on 'Science at the Met Office'.

In a tough economic climate this announcement acknowledges the vital work of the Met Office in enabling protection, well being and prosperity and so provides a robust platform for our future plans.



## On top of the mountain

Our mountain weather forecasts have been enhanced following consultation with members of the public.

Even the most experienced and well-prepared hill walkers and mountaineers should not underestimate the weather. Mountain areas can experience weather of a ferocity seldom seen elsewhere so we've improved our mountain weather forecasts to help keep you safe.

The refreshed mountain forecast web pages are now easier to read, providing forecasts for a selection of the main mountain areas. Forecasts are issued twice each day and, as a direct result of feedback, these now cover the full 24-hour period where previously only daylight hours were provided.

You can simply click on the region where you are planning your expedition to see indispensable planning information. Details include a weather overview, warnings and weather hazards, maps and links to useful information services.

So the latest forecast can easily be taken on expeditions, or displayed in local youth hostels and climbing clubs, mountain forecast web pages are now printable. Ensuring that as many people as possible are made aware of weather conditions is crucial, especially considering the unforgiving nature of mountain weather.

 [www.metoffice.gov.uk/public/weather/mountain-forecast/](http://www.metoffice.gov.uk/public/weather/mountain-forecast/)



At the Met Office we work hard to predict what it will be like tomorrow. That means we are making full use of the emerging technologies that are transforming education.

# Learning of the future



It is often said that we all learn something new every day — and that's certainly true at the Met Office. As a centre of scientific excellence and learning, our research and development teams are at the forefront of the research which underpins all of our products and services.

For hundreds of years, classrooms have retained a familiar setting. These days however, learning in the digital age means that more classrooms are online. Few industries have been untouched by the digital revolution, and education is no exception. Interactive webinars can be broadcast live online in a virtual version of face-to-face courses. The convenience of being able to train from afar can't be underestimated — all you need is an internet connection.

At the Met Office, we embrace various ways of teaching and learning, but we haven't forgotten the importance of face to face interaction. One-on-one tuition and classroom learning each offer something different. Similarly, e-learning, if used appropriately, can enhance classroom courses and is a useful tool for both Met Office staff and customers. This approach, of blended learning, is one that the Met Office strives to provide by offering a carefully balanced learning experience (see page 12 for an article about the Met Office College).

The rapid growth of internet use is giving people access to more and more information and it is having a major impact on how people get information — not least about science and technology. We are committed to communicating science to help to broaden the public's understanding of science.

We help many others, including young people, discover the importance of Science, Technology, Engineering and Mathematics (STEM) subjects (see page 9). We enable learning inside as well as outside the Office, for example, Met Office scientists who do not already have PhDs often work towards attaining them while carrying out research at the Met Office.

Learning is integral to everything we do. Each day we push boundaries at the Met Office, furthering understanding of weather and climate science. It's exciting to think of how people will be learning in the future. One thing's for sure, the Met Office will be always be at the forefront of learning and education, passionate for knowledge.

## Importance of experience

We host students across the Met Office throughout the year. Students find it a rewarding experience and a useful way to test out what they might like to do in the future.

Although individual students can be hosted at any time, the Met Office Human Resources team co-ordinates one week a year for a larger group of young people. This year's week in July saw 43 students visit different areas of the Office. For the first time, students based in Exeter took part in group work which gave a new dimension to their experience.

We also provide longer-term summer placements for students of college and university age. This year's scheme once again proved to be a great success, attracting over 500 applications, with 44 students from all over the country chosen to work at our Exeter headquarters and other locations around the UK.

An intensive 12 week placement offered the opportunity to experience the excitement of working on projects in all areas of our organisation from science, technology and information services, forecasting and observations right through to business, which includes placements in marketing, finance, legal and human resources.

Not only are work placements the ultimate in blended learning, it's how we find the scientist and technologists of tomorrow. As Albert Einstein said, "The only source of knowledge is experience." Our growth depends on recruiting the best and brightest graduates. We focus significant energy on showing placement students the opportunities we have to offer after they finish their studies. Indeed, many summer placement students return to work at the Met Office once they graduate.

# Summer cheer

After the warmest, driest and sunniest summer since 2006, many of us had the feel good factor.

It's possibly a distant memory now, but this summer, the UK enjoyed the best weather we've seen for a number of years. Now, just as there's a danger of getting the winter blues we can, at least, sit back and enjoy the view of summer in hindsight.

For those who were lucky enough to get out and about, gardens, parks and beaches were packed from Blackpool to Brighton. Not only that; the good weather was accompanied by good news. Andy Murray won Wimbledon — the first male Briton to win the Championship since 1936. The Ashes were also retained in style with rain coming to stop play just a few times.

Farmers were happy too, with warm, dry conditions for the harvest. Animals were able to stay outside for longer and there were bumper harvests of soft fruits. One slight annoyance was in the last few weeks of August we were plagued by wasps as the soft fruit gave them plenty to eat. Meanwhile, a small boost to the economy in July was attributed to increased retail sales, perhaps a reflection of the nation's good mood or people getting ready for barbecues.

The summer was not a record breaker — regardless of a prolonged heatwave experienced across the UK from the 3rd to 22nd July. Despite the feel good factor, July's heatwave was more notable for its duration than its intensity, although it was not

particularly unusual in a historical context. The last year in which 30 °C was not recorded anywhere was in 1993.

July was one of the top three sunniest and warmest on record. With a mean temperature of 17 °C, July 2013 was the third warmest in the national record going back to 1910, behind 2006 (17.8 °C) and 1983 (17.3 °C).

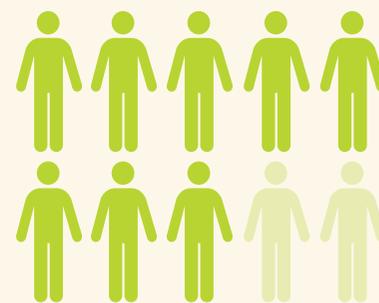
This summer stands out in contrast to the run of unsettled summers from 2007 to 2012, and was the most significant UK heatwave since July 2006. During the hot weather, we worked with Public Health England providing them with heat-health warnings. We also put lots of summer safety tips on our 'Get ready for the Great British summer' website, including advice on skin care, summer swimming and wild fires.

The summer wasn't wall to wall sunshine however; there were also some very wet days in parts of the UK. Torrential rain on 23 July caused flash flooding in Nottinghamshire and in other parts of Northern England and Scotland. Heavy rain also caused some flooding in Essex on 24 August.

Although there was some rain, in the main it was fine and sunny. The hot weather wasn't confined to July as there were also spells of warm and settled weather in June and August. The highest temperature of the year was 34.1 °C recorded on 1 August at Heathrow, the highest UK temperature since July 2006.

The golden haze of summer is now long gone. So, for now it's head down until Christmas when there's always plenty of winter cheer to go around. Anyway, there's always next year.

In the summer...



Eight out of ten Brits check the weather forecast before planning a summer activity.



82%

of women change their wardrobe



64%

of men choose different clothes



The Met Office Academic Partnership (MOAP) has been encouraging collaboration between Exeter, Leeds and Reading universities and the Met Office since 2010. The involvement of new partner the University of Oxford now opens up more exciting possibilities.

# Working in partnership



## In 2012:

**5**

new studentships at the University of Leeds

**2**

Met Office staff studying for the MSc in Climate Change Impacts and Feedbacks at the University of Exeter

**2**

Met Office staff studying for PhDs at the University of Exeter

It's undisputed that Britain is home to many of the world's finest meteorological minds. MOAP was set up by the Met Office to bring this research expertise together. The goal is to enable UK academic scientists to better tackle today's challenges in weather, climate science and prediction.

The Met Office funds an academic chair based in each MOAP partner university and each appointee liaises with a counterpart Met Office co-chair. Lead representatives from partners and the Met Office then link up to take topics forward, streamline communications and ensure the partnership remains focussed.

The result is innovative, cost-effective collaboration that doesn't just make the most of resources to maximise

research impact, but also plays a vital role in developing the science leaders of tomorrow.

### Bottom-up philosophy places scientists centre stage

“One of the partnership’s biggest strengths is its ‘bottom up’ approach,” explains MOAP manager Chiara Piccolo, who also works in Data Assimilation and Ensembles research. “Usually, partnerships involve universities setting the research agenda. But our route brings together world-class scientists to answer their own questions.”

One of the partnership’s original objectives was to encourage new thinking in areas that played to each university’s strengths. These included earth sciences at Exeter, atmospheric observation/chemistry and process research at Leeds, and high-resolution regional and local forecasting modelling at Reading.

“However, there’s more subject overlap now than when we began,” says Chiara. “So we’re encouraging more collaboration on cross-partnership projects — especially through events such as our annual ‘Super RAP’ research advisory panel.”

For example, Super RAP 2012 saw partner scientists agree to collaborate on an initiative termed the Forecast Evaluation for Water and Agriculture in Sub-Saharan Africa. The pioneering ‘FEWAS’ project (see more on partner achievements opposite) will see a full proposal for providing end-to-end studies of forecast impact in Africa published in November 2013.

### Newest partner already reaping benefits

While existing MOAP members continue to find new ways to pool expertise through the Met Office, the addition of four departments from the University of Oxford now significantly boosts the partnership’s capabilities. Coordinated through Oxford climate physicist Professor Peter Read and Met Office lead John Eyre, it brings

together experts specialising in atmospheric pollution and planetary physics, earth sciences, geography and maths.

“The Oxford departments are already doing some exceptional work — made possible through new lines of communication,” adds Chiara. “They conduct groundbreaking research representing uncertainty in weather and climate models — and have an especially strong ocean modelling group.”

Other pioneering Oxford research explores climate risks, decisions and services, plus remote sensing and composition interactions.

### Developing careers, expanding knowledge

As well as increasing scientific understanding, MOAP promotes training and exchanges. For example, 2012 saw five new studentships at Leeds, two Met Office staff undertake the Exeter MSc in Climate Change Impacts and Feedbacks, and a further two staff study for PhDs through Exeter. Other educational successes include funding for a new post-doctoral research assistant plus Met Office staff secondments at Leeds.

So where next for MOAP? Coordinator Chiara Piccolo describes a policy of consolidation and managed evolution.

“It takes a lot of time and work to get a new university on board,” she says. “So we’ll now be putting all our efforts into encouraging the newly expanded partnership to work with each other — to provide really focussed science benefits.”

“This route brings together world-class scientists to answer their own questions.”

## Bright ideas: MOAP achievements to date

### ENDGame

ENDGame improves the dynamical core of the Met Office Unified Model — strengthening its accuracy, robustness and scalability.

Scheduled to be operational in 2013/14, the improvement draws on the University of Exeter’s expertise using environmental statistics to quantify uncertainty with an emphasis on rare and extreme events.

### The Forecast Evaluation for Water and Agriculture in Sub-Saharan Africa (FEWAS)

FEWAS aims to provide end-to-end studies of forecast impact in Africa, on daily to seasonal timescales.

The Africa College at the University of Leeds is providing administrative support for the proposal’s development; the University of Reading is contributing with seasonal to sub-seasonal predictions.

### Modelling high impact, convective storms

The University of Reading continues to stretch the boundaries of what can be modelled reliably, with a special focus on representing complex turbulent flows such as thunderstorms.

The Dynamical and Microphysical Evolution of Convective Storms (DYMECS) project uses the Chilbolton high-resolution radar to make tens of thousands of measurements of the 3D structure of convective storms over many events. These are then analysed and statistically compared against equivalent data and the operational model, to test improvements to the treatment of cloud, precipitation and turbulence.

How do you inspire the next generation to pursue a science or maths-based career?

# Inspiring young hearts and minds



**Felicity Liggins** is a Met Office Climate Consultant, but she's also one of a growing body of Met Office staff who volunteer as Science, Technology, Engineering and Mathematics (STEM) ambassadors – inspiring young people to study STEM subjects.

When Felicity first joined the Met Office five and a half years ago, there were just ten Met Office STEM ambassadors. Today, there are over 120. For the last two years, Felicity has been coordinating this volunteer army, and working with colleagues to ensure that STEM volunteering becomes ever more embedded and part of the culture of the Met Office.

The work of the Met Office STEM ambassadors varies hugely: from outreach visits in local schools, to taking part in national events such as The Big Bang – an annual science event that hosts over 65,000 young

people. While there's an emphasis on events in the local region, the Met Office has STEM ambassadors across the UK and is looking to participate in more nationwide events. Every event is an opportunity to interact with young people and encourage them to study STEM subjects.

#### **Making STEM accessible**

Gone are the days of simply giving a talk. Today's STEM ambassadors are armed with experiments and hands-on activities that capture the attention and imagination of their audience. "Kids love it when you take experiments in – like making clouds or tornados in bottles," explains Felicity. At events such as the Cheltenham Science Festival, the STEM Ambassadors also bring green screen technology so that young people can try their hand at presenting the weather. ➡

“Kids love it when you take experiments in — like making clouds or tornados in bottles.”



“It’s all about making the science and maths relevant,” explains Felicity. “I would have loved, when I was about to choose my A-levels, if someone had actually shown me how statistics were relevant. Now I have to learn statistics on the job and that’s much more difficult.”

As well as engaging young people with the science, it showcases the breadth and depth of what the Met Office does — and the sheer diversity of people who work there. The Met Office also holds STEM events for school teachers, including Continued Professional Development courses to help teachers keep up to date with the science. “If we can help teachers understand the basics of weather or climate, and where the exciting science is going, they’re able to go out and inspire their students.”

### Reaping the rewards

For Felicity, the benefits of being a STEM ambassador are clear: “I love interacting with young people when they’re as excited about what we do as we are. I don’t mind if they don’t remember the details of the science — if they’re just excited about it, that’s wonderful.”

The benefits are two-way: every STEM event is an opportunity for the ambassadors to work with fellow Met Office staff they wouldn’t otherwise meet — and to learn from each other, too. As Felicity explains, “Suddenly you’re meeting new people from across the organisation and finding out what they do. And because our work is so dynamic and the science is always progressing, it’s amazing what you learn at STEM events.”

Being a STEM ambassador is also an affirmation of what it means to be part of the Met Office — and nowhere has this been more evident than in the recent pilot series of Science Camps.

### Science Camp 2013

Launched in April this year, the Science Camps offered 11 and 12 year olds the opportunity to camp out at the Met Office overnight. When they arrived on the Friday evening, they were set a challenge, to provide a weather forecast for a fictional celebrity who wanted to know whether he’d get his perfectly-styled hair wet at an upcoming gig. They learnt directly from Met Office staff about temperature, wind, how clouds form and so on. They then applied what they had learnt and presented their forecast in front of a green screen the following morning.

Science Camps will be held again in 2014. Besides the overwhelmingly positive feedback from participants, the events drew tremendous support from Met Office staff. Over 100 staff members volunteered and many later commented on how the event made them proud to be part of the Met Office. This is one of the great benefits of being a STEM ambassador: “It’s really rewarding and a big part of inspiring you to do a good job at work,” says Felicity.

Now, the Met Office is looking to develop partnerships with other STEM organisations, such as Bloodhound SSC, the makers of the supersonic car. This has a very popular STEM programme and the Met Office has just installed a weather station on the flats where they’re going to try to break the land speed record.

It’s just the kind of project that will capture the interest of young people. And as Felicity says, “If you’ve inspired even one kid then that makes it all worthwhile.”

➔ Contact Met Office STEM ambassadors at [stem@metoffice.gov.uk](mailto:stem@metoffice.gov.uk)

## Where to find Met Office STEM ambassadors

### School visits

STEM ambassadors visit schools throughout the year, with some events hosted at the Met Office or around the UK.

### Cheltenham Science Festival

In partnership with EDF, the Met Office hosted a stand this year where children could have a go with green screen technology and try being a weather presenter.

### The Big Bang Fair

After several years of participating in Big Bang South West, the Met Office attended its first national Big Bang this year. Over 65,000 visitors attended.

### Careers days

A regional careers event called “What’s My Line?” challenges the audience to guess a STEM ambassador’s career. The idea is to break down stereotypes: young people are sometimes surprised to meet female coders, technologists and scientists from the Met Office.

### Science Uncovered

This evening event at the Natural History Museum showcases the latest science and research. About 8,000 people attend these events and this year, the Met Office was represented for the first time.

### Green Man Festival

Another first for the Met Office, this four-day festival in the summer of 2013 presented the challenge of having no available power on which to run the team’s usual kit. Instead, children could play with tornado tubes and make their own clouds, and it was an opportunity for the STEM ambassadors to talk in-depth with a broader audience, understand some of the misconceptions about weather and climate science and help people understand more about what the Met Office does.

Forecasting

→ Feature 12

Understanding  
the  
weather

Accessibility

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Jobs

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# Met Office College

Developing skills in forecasting, science and technology has been part of our mission from the beginning and the Met Office College has provided meteorological tuition for more than 70 years. Today's students are as likely to be distance learning from an offshore oil rig as sitting in a classroom.

## Who learns with the Met Office College?

### Met Office staff

Every forecaster starts their career at the Met Office by taking an initial forecasting course. Running twice a year, the course is consistently at full capacity to meet demand. The College also offers a full programme of Continuing Professional Development courses for forecasting staff.

### Air Traffic Services

The Met Office is contracted by the Civil Aviation Authority to train all airfield observers. The training enables them to make weather reports that ensure the safety of aircraft.

### Commercial customers

Traditionally the College has served road, rail and aviation customers, training staff in basic weather to help them better understand and interpret the forecast information they receive. This also helps them have greater confidence in their weather related decision-making. The College is now also delivering courses for the utilities sectors, specifically energy and water companies.

### Government staff

The Met Office works with the UK's Ministry of Defence to train members of the Army and the RAF. The College also offers a variety of courses to a wide range of other government departments, such as the Environment Agency, helping staff understand meteorology, climate and key Met Office products.

### Masters students at the University of Reading

Two years ago, the College launched a two-week module for the University of Reading's Masters in Meteorology. Students learn about forecasting and get an idea of what working at the Met Office might involve.

### Meteorological services in other countries

Students come from across the globe to study with the Met Office College. Some of the courses are aimed exclusively at overseas customers, such as the new Foundation Meteorological Technician Course for weather observers. The new Severe Weather Event — Effective Planning modular course has been developed for staff in meteorological services as well as key responders and decision makers. The course aims to build on national resilience, response and communication before, during and after severe weather.



The Met Office College is widely regarded as a world leader in meteorological training. This is, in part, thanks to the calibre of its trainers and other staff — but also because it is highly responsive to the needs of the customers it serves.

A new course for air traffic control personnel is a case in point. The Met Office College already offers a well-established two-week classroom course for this sector but after consultation with the Civil Aviation Authority — it has now launched a

new course, a one-week alternative, specifically for personnel using semi-automated weather reporting equipment, which meets another type of users' needs.

The College has also developed new courses for the utilities and energy markets. For example, there is a growing demand for training from professionals in the renewable energy sector who want to better understand and interpret meteorological information so they can optimise operations and site safety.

### Going online

Traditionally, the Met Office College has offered exclusively classroom-based courses — but that's beginning to change. In September last year the College launched an e-learning site — Met Office College Online — opening up a whole new dimension of learning.

With e-learning comes the ability to reach many more people, including international students. The College's online courses also enable industry users to learn at their own pace from their own home or workplace which can complement or provide an alternative to classroom learning. For example, the College has recently launched an e-learning course specifically for a niche segment of the road industry.

The College is also developing distance learning courses for Met Office staff based at outstations around the UK and overseas — such as the Falkland and Ascension Islands. The beauty of these courses is that they enable all staff, whether they are at outstations or not, to undertake self-paced learning when it suits.

### Getting the right blend

The College sees the e-learning platform as a way to enhance its classroom courses. As Aileen Semple, Head of the Met Office College, explains, "This 'blended learning' offers the best of both worlds: posting resources online can free-up some classroom time that can be better used interacting with the trainer."

"This 'blended learning' offers the best of both worlds: posting resources online can free-up some classroom time that can be better used interacting with the trainer."

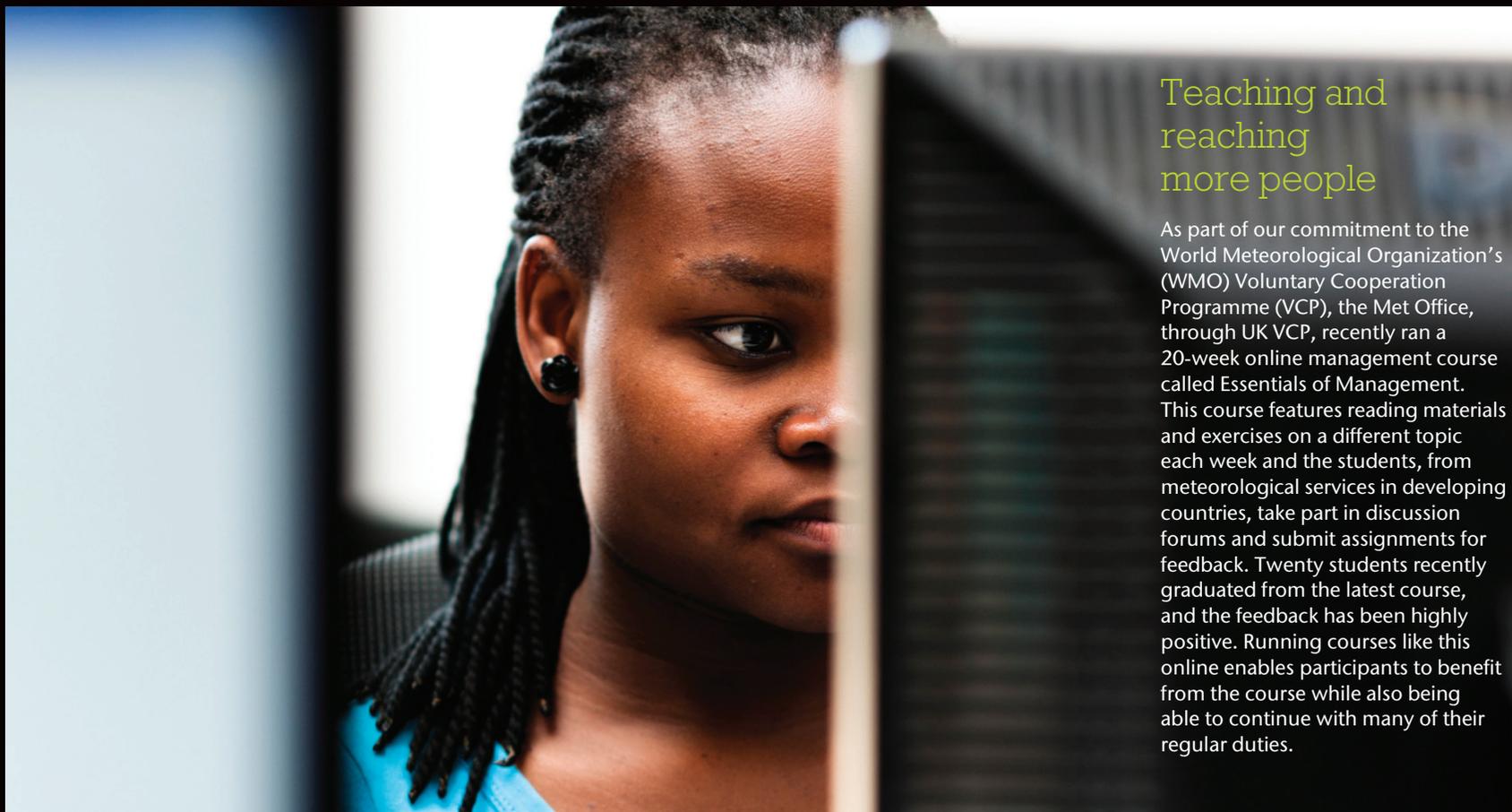
It can also be used to deliver follow-ups to classroom-based courses. For example, the College provides an initial classroom course for the offshore oil and gas market, but participants are now required to take a refresher e-learning course every two years to maintain their certificate.

The Met Office College is actively investing in the future, and has recently recruited an e-learning specialist to develop this side of the business. As Aileen explains, "As well as developing further courses, plans include introducing web conferencing, which would enable real-time online discussions, study groups and webinars."

➤ To download the latest prospectus, visit [www.metoffice.gov.uk/training](http://www.metoffice.gov.uk/training)

### Teaching and reaching more people

As part of our commitment to the World Meteorological Organization's (WMO) Voluntary Cooperation Programme (VCP), the Met Office, through UK VCP, recently ran a 20-week online management course called Essentials of Management. This course features reading materials and exercises on a different topic each week and the students, from meteorological services in developing countries, take part in discussion forums and submit assignments for feedback. Twenty students recently graduated from the latest course, and the feedback has been highly positive. Running courses like this online enables participants to benefit from the course while also being able to continue with many of their regular duties.



From predicting puddles at playtime to coding computers that connect you with the global weather network — the Met Office’s free educational resources help learners of all ages discover a whole new world of weather.

# Building bright futures

When it comes to inspiring the next generation of scientists, engineers and mathematicians, the Met Office has a huge pool of experience and enthusiasm to draw on. “There’s a great culture of education here,” says Mat Richardson, Account Manager for the Met Office’s work funded by the Department for Education. “Ideas can come from anywhere in the organisation — our people love their subject and really want to share it. That’s why we’ve been able to extend our great resources beyond just weather and climate.”

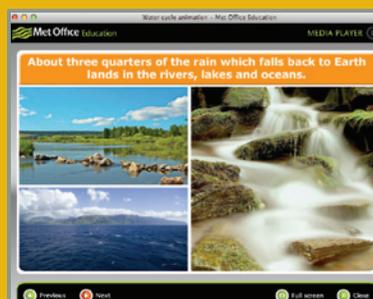
Working closely with the Science, Technology, Engineering and Maths (STEM) section of the Department for Education, the Met Office develops educational resources for primary and secondary school students and teachers, aligned with the National

Curriculum across all of the STEM subjects. Now, alongside more traditional learning aids such as lesson plans and weather event case studies, a whole raft of initiatives are on offer to help fire students’ imaginations.

## Rain or shine

How do you get primary school children to take an interest in something they might only associate with TV weather forecasts after the news? Rain or Shine, the Met Office’s daily children’s weather forecast currently hosted on its YouTube and TeacherTube channels, is aimed at 5 to 11 years olds and is supported by further online resources such as colouring sheets, puzzles and more educational videos.

“When we went into schools to get feedback on Rain or Shine, one pupil



suggested the presenters should be superheroes,” says Mat, “another said how about a puppet!” For the time being Rain or Shine doesn’t plan on employing Superman or Kermit the Frog, but it’s still a great way for kids to start picking up weather vocabulary while deciding if they’ll need their wellington boots.

## Build your own weather station and WOW

For older school pupils, whose science and technology interests have outgrown plastic bottle rain gauges and weather vanes, the Met Office Observations team and engineers are developing resources that will help them build their own fully functional weather stations.

Using demonstration videos and teaching plans aligned with the Design & Technology curriculum, teachers can set projects to build workable equipment from wood, metal or plastic. Adding sensors and electronics will enable students to link their stations to the Met Office’s Weather Observation Website (WOW) and automatically upload their observations to the map. WOW also enables students to compare their findings with the nearest observation station or with other schools around the world.

## Raspberry Pi weather

Thousands of small, single-board computers, known as Raspberry Pi, specially designed to help increase pupils’ coding skills will be put into schools around the UK over the next year or so, thanks to Google and the Raspberry Pi Foundation. Founded in 2009, the Foundation is a charity that works in collaboration with specialist computing education organisations to promote the study of basic computer science in schools.

Spotting a fantastic opportunity to share our vast experience of coding, the Met Office is producing weather-themed resources to help teachers and pupils get to grips with the Raspberry Pi’s capabilities, and develop essential

STEM skills at the same time. “Coding is central to all the models that we develop and run to forecast the weather,” Mat explains, “so we’re perfectly placed to be one of the first organisations to provide these type of resources. We’re talking to Code Club and Computing at Schools to help connect up with work already being done.”

### Learning outside the classroom

Bringing science and technology to life for students is a key part of the Met Office’s educational work, and our Learning Outside the Classroom activities are often a real eye opener. “We’ve got a really enthusiastic STEM community amongst our employees,” explains Mat, “around 120 ambassadors who are keen to get everyone learning about science, and maybe inspire a few future employees, too.”

We do this through hosting school visits to the Met Office’s Exeter headquarters, attending careers fairs, going out to schools and running mentoring schemes. The video conferencing season, which runs from autumn to spring each year, is also a hugely popular way of connecting the Met Office with schools around the country and giving teachers and students the opportunity to get answers straight from the experts. “Video conferencing facilities are becoming more and more common in schools,” says Mat, “so we can even offer our exciting learning experiences to pupils that are too far away to visit us for a day trip.”

### Enquiry and data services

While the majority of the Met Office’s educational projects are developed with schools and teachers in mind, the good news is that you don’t necessarily have to be in school to benefit from their expertise. Anyone with a burning educational or curriculum related question can get in touch by phone, email or post (details below). The query gets passed to the relevant expert and they aim to get back to you within five working days.

### Collaborations

Further afield, the Met Office is busy teaming up with various companies and organisations to bring resources to a wider audience and inspire even more learners. The Pod, in collaboration with EDF Energy, is a practical programme that’s been up and running since 2008 to help pupils learn about basic weather and climate science in the context of sustainable energy. New partnerships are in development with the Science Learning Centres network, which manages the national STEM e-library, and EUMETSAT, which operates Europe’s satellites for monitoring weather, climate and the environment.

So keep an eye on the Met Office education web pages for the latest news on all these and other future projects. And if you’ve got a question or an idea, get in touch.

## Discover

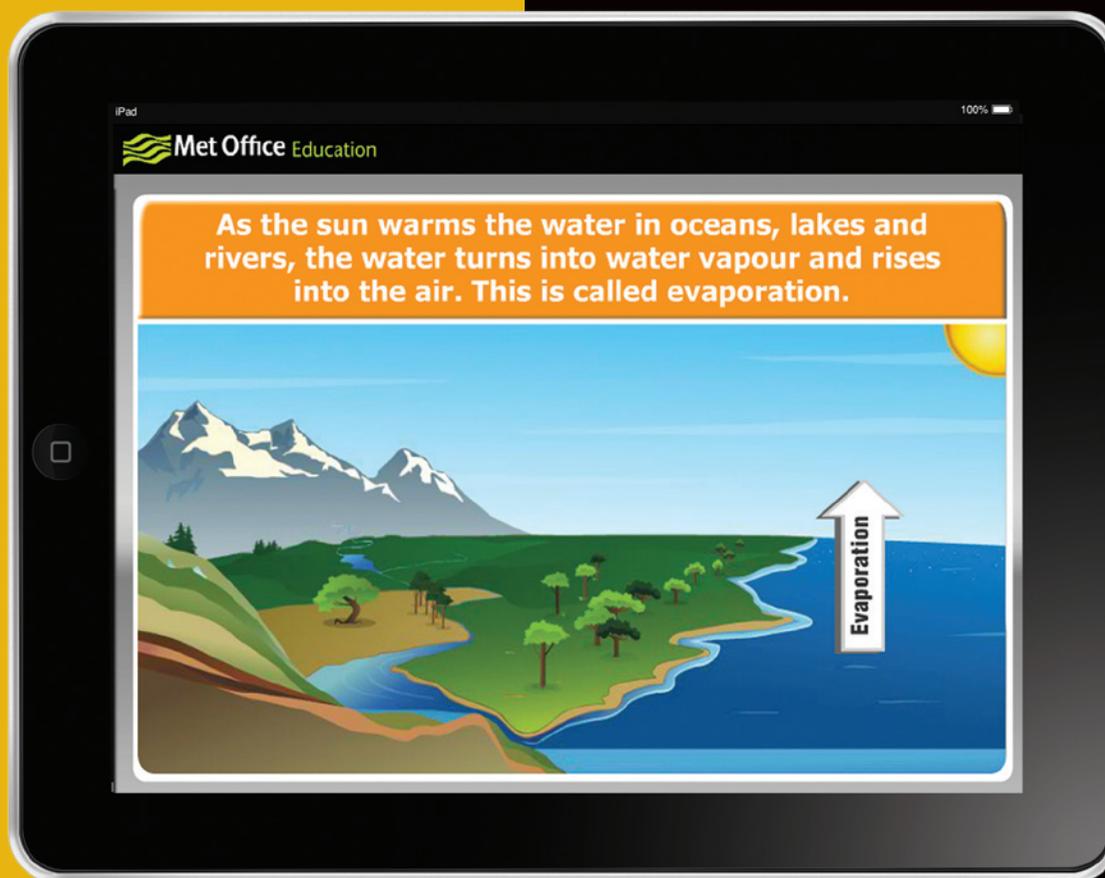
Visit the Met Office education web pages [www.metoffice.gov.uk/education](http://www.metoffice.gov.uk/education) to browse the resources, which are themed for kids, teens and teachers.

Watch Rain or Shine at [www.metoffice.gov.uk/education/kids/rain-or-shine](http://www.metoffice.gov.uk/education/kids/rain-or-shine)

Find lots of other video resources on the Met Office YouTube channel [www.youtube.com/metofficelearning](http://www.youtube.com/metofficelearning)

Share and analyse weather observations on the Met Office Weather Observation Website (WOW) <http://wow.metoffice.gov.uk>

Explore The Pod, EDF Energy’s programme for greener schools, at [www.jointhepod.org](http://www.jointhepod.org)



# Society matters

The British Meteorological Society was formed in 1850, becoming the Royal Meteorological Society in 1883. While the activities of the Society have grown and diversified, the focus on advancing the science of meteorology has stayed consistent since the early days.

Spotlight on:



With over 3,000 members across the globe, the Royal Meteorological Society is one of the world's largest organisations of its kind, and works tirelessly to promote meteorology and the understanding of weather and climate. "We get a lot of media exposure," explains the Society's new Chief Executive Liz Bentley, "Particularly when the weather is extreme and some of the tabloids are getting excited!"

The Society's dynamic website and social networking channels deliver news and information to people every day of the year, while its portfolio of journals and online newsletters caters for just about everyone — from the specialist scientist through to the general public.

Encouraging the next generation of meteorologists is particularly important to the Society. Every year, it loans meteorological instruments to schools for classroom activities and trains several hundred student primary teachers in how to bring meteorology into the classroom.

Thanks to its heritage and reputation, the Society is able to get the ear of public policymakers on weather and climate matters. It plays an international role too, working closely with the European Meteorological Society, the International Forum of Meteorological Societies and the World Meteorological Organization.

#### **Promoting high quality science**

The Society has strong links with academia and in recent years set up an annual meteorological conference specifically for students and young

scientists. The conference gives students a platform for their own work, as well as the chance to network and meet potential future employers.

As the science of meteorology involves pooling knowledge from a wide range of fields, the Society is working with specialists from a growing range of disciplines. By bringing experts together, the Society is encouraging collaboration and disseminating knowledge on weather and climate matters to the wider community.

#### **Working closely with the Met Office**

The links between the Society and the Met Office are very strong and well developed. "I would define our relationship as complementary," explains Liz, "Both parties benefit from it and are respectively stronger in their roles as a result."

One example of how the two organisations work together is the Met Office's Weather Observations Website (WOW). Developed with support from the Royal Meteorological Society and the Department for Education, the site provides an online hub for UK weather observations, helping to educate people about weather and encourage growth in the UK's amateur weather observing community. The site hit 100 million observations in April this year.

The Society runs the RMetS Chartered Meteorologist (CMet) Scheme which is a professional chartership, like that available in other disciplines. Anyone

who has an RMetS Fellowship, as well as the right type of academic qualifications and professional experience, can apply to become a Chartered Meteorologist. Met Office staff have applied for and gained CMet status. Applicants have to provide supporting evidence and references, and are interviewed by a panel of other professional meteorologists. The qualification is highly regarded and is a great credit to those who achieve it.

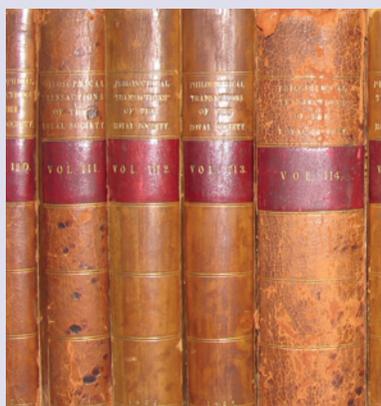
Another link between the two organisations comes from the fact that Rob Varley, the Met Office Operations and Services Director, is Vice President of the Royal Meteorological Society and a Chartered Meteorologist. “The Society is delighted to welcome Rob into this role,” adds Liz.



Left: The new Chief Executive of the Royal Meteorological Society, Dr Liz Bentley.

## A cultural custodian

The Society owns a number of historical artefacts and rare books, including valuable weather sketches and paintings. Some of them are cared for in the National Meteorological Archive at the Met Office. From the personal papers of George James Symons, to original copies of the Beaufort Wind and Weather Scales, the Society holds some of the most important and fascinating documents in the history of meteorological science.



## The seven strategic aims of the Society

- Sharing enthusiasm with all**  
 Through a range of activities to keep people interested in meteorology, involving everything from running successful websites such as theWeatherClub, to regularly informing public policymakers on, for example, climate and meteorological education issues.
- Enhancing understanding and awareness**  
 By getting across subjects and issues that matter in an understandable and approachable way.
- Raising professional standards**  
 By focusing on the standards for meteorological practitioners, ensuring they are rigorous, popular and aligned with the needs of employees and employers.
- Promoting careers in meteorology**  
 By helping people understand what a fascinating and important area of work meteorology is, and where the opportunities lie.
- Advancing high-quality science**  
 From running topical scientific meetings to publishing scientific journals, the Society is the custodian of meteorological science.
- Recognising excellence**  
 Through annual awards, research and travel grants, and professional qualifications.
- Informing evidence-based policy**  
 By engaging with policymakers on issues such as climate change and its impacts, as well as communicating climate science and developing educational resources and teaching skills.

The Intergovernmental Panel on Climate Change (IPCC) published the first part of its Fifth Assessment Report (AR5) in September 2013. As one of the world's leading climate research centres, the Met Office has been a central contributor to AR5 and is a key adviser to the IPCC.

# Climate science in context

The eagerly awaited report is a comprehensive assessment of the state of scientific, technical and socio-economic knowledge on climate change, its causes, potential impacts and response strategies. The report, which forms the evidence basis for policymakers over coming years, revealed that on the ground, in the air and in the oceans, global warming is without doubt.

Temperatures have risen by about 0.8 °C since pre-industrial times; Arctic sea ice extent has declined by 4% per decade since records began in 1979, and summer extent has declined at an even faster rate; sea levels have been rising by about 3 mm a year since the early 1990s.

Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. In the Northern Hemisphere, 1983-2012 was 'likely' the warmest 30-year period of the last 1,400 years. Scientists are 95% certain that humans have been the dominant cause of the rise in temperatures since the 1950s.

Thousands of scientists from all over the world voluntarily contribute to the work of the IPCC. The assessment reports are published around every five years with the Met Office Hadley Centre's work influential in forming the content of the reports. The Met Office has a long history of involvement in the IPCC, becoming a key adviser soon after it was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1988. The Met Office contributes in a variety of ways throughout the process — including from contributing authors, use of our datasets, modelling efforts and scientific paper outputs.

Co-ordinating the global research effort of the IPCC process is a complex task. There are three working groups which will all report separately before the final synthesis report is published. With around 200 authors involved in each working group, co-ordination and arranging meetings and interaction is challenging.

In trying to draw a consensus, the working groups carry out reviews of the published work from the peer-reviewed scientific journals all over the world. The published work is carefully analysed using a matrix which assesses and measures the amount of evidence and the level of agreement on certain aspects of climate change.

The reports use consistent, calibrated language, such as it 'is likely' or 'very likely'. Throughout the process, the co-Chair of Working Group I, Professor Thomas Stocker, has stressed the importance of being rigorous, robust, transparent and comprehensive.

Scientists at the Met Office have been closely involved in Working Group I which is concerned with The Physical Science Basis of Climate Change. For the first time we have lead authors in Working Group II which looks at Impacts, Adaptation and Vulnerability. Met Office research also contributes to Working Group III which is examining the Mitigation of Climate Change.

Met Office Earth System and Mitigation Science Manager, Chris Jones, was a lead author on the carbon cycle chapter of Working Group I (see the profile on Chris opposite). Chris's main focus is on analysing feedbacks between climate and the carbon cycle and looking at the long-term commitments of ecosystem changes to climate change and their implications for setting policy targets such as reducing carbon emissions.

Publication of each working group's report will attract global media interest, as well as the final synthesis report, which will be published next December. The Met Office is helping to carefully communicate the key messages from the report throughout its publication process.

Next December's final synthesis report will be a summary of all three of the working group, but it's important to realise that's not the end of the story. The Met Office and research institutes around the world will continue to drive science forward to provide in-depth information and advice to help governments, businesses and individuals make informed decisions.

➔ For more on IPCC see:  
[www.ipcc.ch](http://www.ipcc.ch) and [www.climatechange2013.org](http://www.climatechange2013.org)

➔ For regular updates on some of the latest Met Office research activities and developments see:  
[www.metoffice.gov.uk/research/news](http://www.metoffice.gov.uk/research/news)



# 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...



**Chris Jones**

Manager of the Earth System  
and Mitigation Science  
Group

“Without detailed understanding of our changing climate, any policies that are made might not have the intended consequences.”

In order to provide climate advice to our customers, it's essential that every prediction is as accurate and useful as possible. That means not just mapping how climate may change, but also taking into account how it interacts with ecosystems. Chris Jones leads the Met Office research into Earth System modelling and climate, providing a crucial link between human activity and climate response — essential for policymaking across all timescales.

As part of this role, Chris led the HadGEM2-ES development and testing, the Met Office's most complex model to date used for input to the latest Intergovernmental Panel on Climate Change (IPCC) assessment. The 'ES' tag in the name stands for 'Earth System' and reflects how the project goes beyond the physical atmospheric and oceanic processes commonly included in climate simulations and focuses on a much wider range of factors. It includes representations of the global carbon cycle, dynamic vegetation, atmospheric chemistry and aerosols, and ocean biology. Instead of using pre-determined inputs of atmospheric composition such as aerosols and greenhouse gases, the model can show how these components will alter over time as they respond to a changing climate.

### The fine detail

The interaction between climate and ecosystems is crucial. Climate affects how ecosystems function and grow — but ecosystems also affect climate. For instance, as an ecosystem grows it will absorb more and more carbon dioxide — but, conversely, climate change affects how this works. Chris and his team collaborate with scientists from a wide range of different fields to ensure that factors such as vegetation, aerosols or ocean biology are taken into account in the climate simulations. The greater level of detail that can be included, the more possibility for accuracy in climate modelling.

Much of the team's day-to-day work is spent at the computer, splitting the world into ever-finer distinctions and trying to understand how the different components fit together. The model takes into account the temperature, rainfall and wind speed at each point, and can map how each evolves through time. The team can then set other

parameters, for instance, what is the impact if an area is deforested or changes in technology affect our emissions? The results are analysed and tested wherever possible against observations, to ascertain the accuracy and to continually enhance the model.

### Collaboration across Europe

Chris and his team are also involved in many exciting pan-European research collaboration projects, co-leading work in COMBINE and EMBRACE and playing a key role in CARBONES. The projects are incorporating new components into climate models, for instance carbon stored in permafrost that may thaw under climate change and looking at risks of abrupt changes.

Pan-European projects like these pool the expertise of climate experts across the continent to rise to an international challenge. They also encourage continual improvement. As Chris points out, even though another country may be using the same techniques to tackle the same questions, they may have different outcomes. This encourages both parties to interrogate the simulation and pinpoint the vital elements, in order to improve the model and confidence in its predictions.

Ever increasing accuracy like this is crucial for Chris and the team. “The big challenge is to understand which parts of the model to enhance in order to improve our confidence in the future,” he explains. “We are constantly trying to improve the faithfulness of the model.”

Chris and his team are also looking at how ecosystems are 'committed' to change for decades after climate has stabilised, much as an ice cube is 'committed' to melt after it has been taken out of the freezer; not instantly, but over a few minutes. Is this a depressing thought? Not necessarily, points out Chris.

“Without detailed understanding of our changing climate, any policies that are made might not have the intended consequences. But now we have enough knowledge to know the consequences of action — or inaction — it is in our hands to decide what to do...”



# Media savvy

A media systems training workshop in Kenya has helped national weather services in developing countries to communicate weather and climate information.

Earlier this year, we ran a successful media systems training workshop in partnership with the Kenya Meteorological Department's Institute of Meteorological Training and Research (IMTR).

Participants from 15 developing country national weather services across Africa attended the workshop, organised through our UK Voluntary Cooperation Programme (VCP). The workshop was a two-week 'train-the-trainers' style course delivered by Dave Robinson from the Met Office Media and Communications team.

The Voluntary Cooperation Programme (VCP) is run by the World Meteorological Organization (WMO) in cooperation with donors across the

world. The Met Office delivers the UK component of the VCP programme, working in partnership with national weather services in developing countries to build their capacity, ultimately enhancing the protection of life and property not just in the UK, but also overseas.

A key aspect of the UK VCP strategy is working in partnership with national weather services in developing countries to help effectively communicate weather and climate information to their government, stakeholders, and the public. In cooperation with WMO, we have supported the installation of TV studios, and associated training, in over 40 developing countries, mainly

in Africa. The workshop complements our previous work, for example, earlier this year Met Office experts travelled to Ethiopia to upgrade the Ethiopia National Met. Agency (NMA) media studio (as featured in *Barometer 24*).

## Developing media capability

As VCP Projects Manager at the Met Office, Cathy Moore, explains: "Weather forecast bulletins provide warnings of high-impact weather, often in local language, to a significant proportion of the population, helping to make communities safer. A key benefit of developing media capability is that the TV weather forecasts are very high-profile and therefore increase the visibility of national meteorological services among government and other key decision makers, with the potential to ultimately increase funding to the national meteorological services."

The workshop in Kenya focused on using a media graphics software package, Weather Eye, which we provide free-of-charge to developing countries. Participants could develop their skills to create noticeably improved presentations and will be able to train their colleagues when they return home. Practical training

was also given in the setup and use of the studio equipment through hands-on work in the Kenya media studio.

Workshop participants came from a variety of African countries including Burkina Faso, Ethiopia, Gambia, Guinea Conakry, Kenya, Madagascar, Malawi, Mauritania, Niger, Rwanda, Senegal, Seychelles, Swaziland, Tanzania and Zambia.

There was good feedback from the participants, for example, Kebba Jawo from The Gambia commented: "It was two weeks of real interaction, sharing of knowledge, skills and experience both in class and in the hostel. We should try to share with each other and apply all learnt during the training to make our work better."

## Tuning in to radio

UK VCP also provided digital audio recording equipment to each of the participating countries. This means weather forecasts or warnings can be recorded as small electronic files, which can be easily distributed, for example by email to community radio stations. Potentially this can vastly increase the reach of the severe weather warnings so they are received by a much greater proportion of the population. The importance and reach of radio was also highlighted by invited guest speakers at the workshop from BBC Media Action, the BBC's International Development Charity, which is currently working on 'radio for resilience' projects in Kenya and Tanzania.

But development doesn't stop now the workshop has ended, as Cathy describes: "Expanding the pool of expert users through this workshop means that participants can help provide peer-to-peer support to other developing countries, either through contributions to our online support website and forums or even, through agreement with their national weather services, assisting directly in future VCP media projects."

# Scientist for the people

Professor of Physics. TV presenter. Co-director of the Cheltenham Science Festival. Talent spotter for new scientists. It's easy to see why Kathy Sykes' multi-faceted career has earned her the title of the 'people's scientist'.

She credits an A-level physics project for first getting her hooked on the creative aspect of research. A degree in polymer physics followed, culminating in a PhD in biodegradable plastics, both at the University of Bristol. This is where Kathy became Professor of Sciences and Society in 2002 — the UK's youngest professor at that time and where she is currently based.

Her increasingly high-profile role has put her in a leading advisory capacity, whether she's chairing public platforms or presenting BBC programmes. As Kathy says, "I was unbelievably chuffed to be labelled the 'people's scientist'. A lot of my work revolves around encouraging scientists to be more human, communicate better and make research more relevant. From nanotechnology to nuclear energy, I try to promote public dialogue with people of different backgrounds and ages. This results in a diverse range of perspectives which I pass on to the governmental policymakers."

## Two-way listening

Her ability to communicate research and understand different points of view comes to the fore in her broadcasting roles such as BBC1's 'Hot Planet' in 2010. On this, she joined geologist Professor Iain Stewart to look at global warming, based on the findings of over 4,000 climate scientists. While Iain described how global temperatures are rising, Kathy examined positive, technological inventions such as artificial trees that absorb CO<sub>2</sub> from the atmosphere and release it as oxygen.

Kathy has also gone on to initiate groundbreaking projects for promoting science communication and engagement. One of the most well known is the Cheltenham Science Festival. It began in 2002 when she became a co-founding director with fellow science communication guru, Professor Frank Burnet. Right from the start, their goal was to attract adult audiences — not just school kids.

The Met Office exhibited at this year's festival in June. Along with showcasing our work on climate science with EDF Energy, people had fun presenting the weather and doing hands-on experiments such as making a cloud in a bubble or tornado in a bottle.

## Entertaining science

As Kathy says, "Unlike some science festivals that consisted of dull lectures held in dusty, grey university rooms, we wanted Cheltenham to be edgy, playful and challenging — with the festive feel hitting you the moment you walked in. It's a fantastic mix of the serious and the frivolous, with comedians like Marcus Brigstocke and Dara O'Briain performing alongside chefs and scientists such as Dr Brian Cox and space scientist Dr Maggie Alderin-Pocock."

## Opening new minds

These days, rather than battling to shift the mindset of an older generation of scientists, Kathy concentrates on nurturing and training the next generation of young scientists. One of the ways she has helped launch budding careers is through FameLab, also held at the Cheltenham Science Festival. Running across 23 countries, it's a unique opportunity for any scientist or engineer to present to judges in just three minutes how relevant and exciting their piece of research is.

Looking to the future, Kathy believes the public's engagement with science is undoubtedly brighter. As she says, "When I got a female engineer coming up to me saying she became an engineer because she saw me on BBC2's Rough Science, it blows your mind knowing that as an individual you can make such a positive impact."



### Ask the experts

Now young people are able to pose their climate questions directly to Met Office climate scientists through a new website, *My Climate & Me*.

Youngsters can upload questions directly to the site and vote for the ones that they would most like to see answered by a climate scientist. The film content is already proving popular, and as it grows will hopefully develop into a 'beginner's channel' for climate science.

Scientists answer questions from well-known household names such as River Cottage, the Royal National Lifeboat Institution (RNLI) and Ben Fogle.

*My Climate & Me* is in association with the Met Office and uses social networks such as Twitter, Facebook and YouTube to share its films.

This close-up of a reptile was taken while filming at Newquay Zoo for the website.

 To find out more visit  
[www.myclimateandme.com](http://www.myclimateandme.com)

