Met Office

GLOBAL GOOD
Helping developing countries

INTERNATIONAL RELATIONS
Working worldwide

BETTER TOGETHER
Collaborating in research

Barometer

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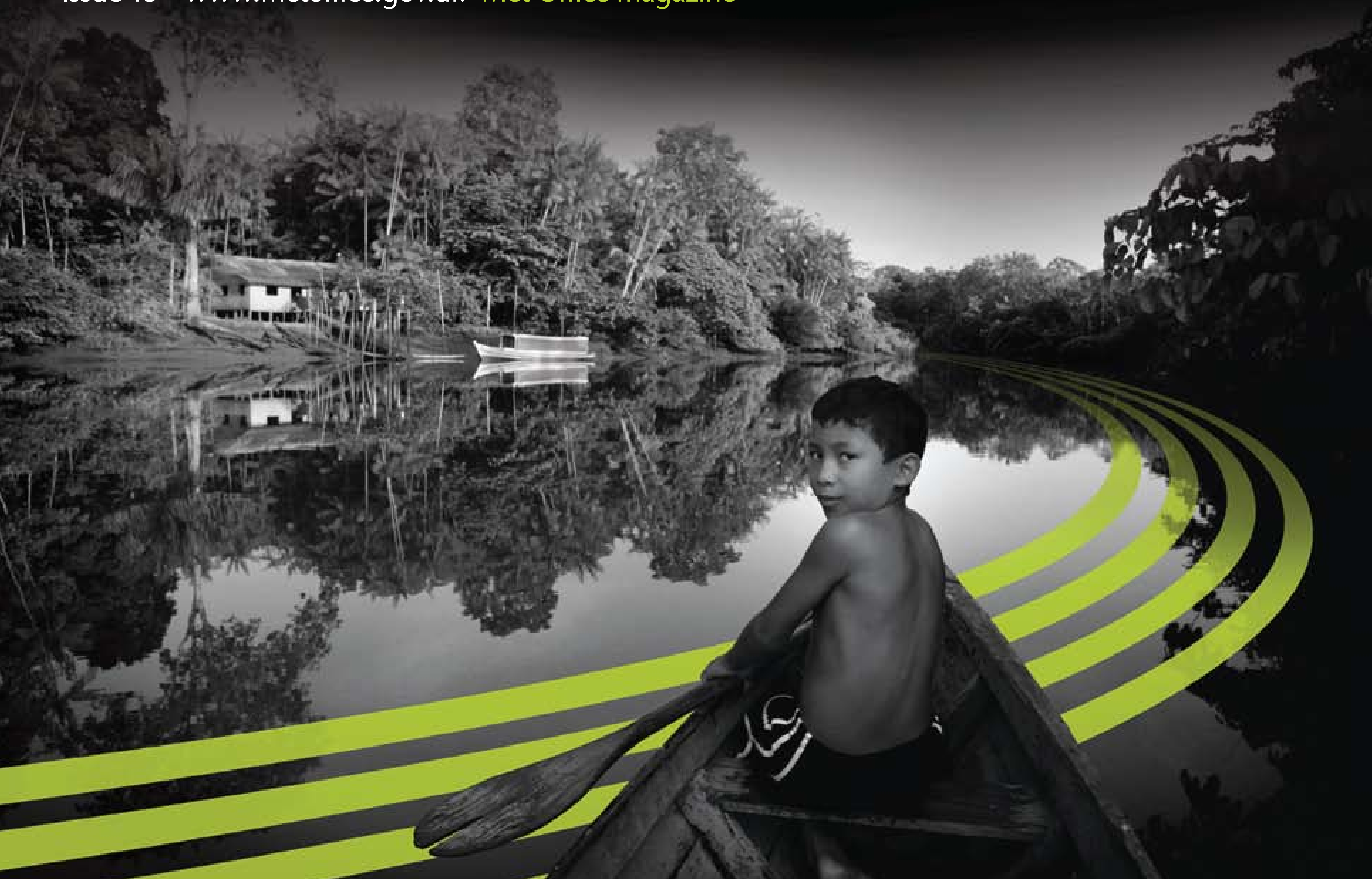

Accurate weather forecasts rely on collecting careful observations from all over the world. In the same way, **Alan Shepherd**, Met Office Strategic Marketing and Product Director, believes it's important to keep a close eye on the horizon for new business and collaborative opportunities beyond the UK.

Horizon scanning

Welcome to the summer issue of *Barometer*. As Strategic Marketing and Product Director, I'm always looking for new opportunities to help people with our services and solutions. At the Met Office, this involves looking at opportunities to work with, and for, others in the UK and globally. This issue of *Barometer* focuses on our global relationships.

During my career, I've been involved in many international collaborative efforts. Successfully marketing products in different countries and cultures relies on people working together well. Understanding each other's differences is a must. A successful product in one country often needs to be marketed differently elsewhere, so local knowledge and experience are both essential ingredients for success.

This issue of *Barometer* looks at Met Office collaborations with people across the world and the benefits of working together. An interview with Steve Noyes, previously the Met Office's Operations and Customer Service Director, provides an insight into the importance of our relationship with EUMETNET, the Network of 26 European National Meteorological Services that looks at ways national weather organisations can combine efforts to provide the best possible services (page 6).

The Met Office's new Chief Scientist, Professor Julia Slingo OBE, underlines the significance of working with people and scientists worldwide — particularly when it comes to the critical issue of dealing with climate change (page 7). An interesting mix of international projects (page 9) illustrates how we are working with a variety of organisations and businesses around the world.

A few examples of the Met Office's work as part of the World Meteorological Organization's Voluntary Co-operation Programme show just how important our work is overseas. It's good to know that we are helping people in the developing world achieve their goals — from climatological databases to national televised weather forecasts (page 11).

It's also good to see that we are continually developing our capabilities, as shown by the trial of the 1.5 km model (page 13). Made possible as a result of the installation of our new supercomputer, the new 1.5 km model will enable us to better predict small scale weather events like thunderstorms and heavy rain. Alongside clear benefits for the public, this also has enormous value for both commercial and international operations.

As ever, it is our science and research that is the foundation of all that we do. This time, *Barometer's* science focus is on the Met Office Unified Model (UM™) collaboration. This model is now being used and enhanced by other centres around the world for both weather and climate prediction. Our work with the Norwegian Met Institute is a particular example of this (page 15).

We need to get even better at horizon scanning — looking beyond our existing products to offer new and innovative weather and climate services across the globe. It is with this global perspective that we can help many others realise their goals and improve our services to our current valued customers.

In this issue

Cover image: 10 year-old Ribeirinho (river person) paddling his dug-out canoe, along the Picano River on the Amazon estuary, Brazil
Photo: Gary Calton/Panos Pictures

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International climate conferences

The need for early action to reduce greenhouse gas emissions and avoid the worst effects of climate change was highlighted by Met Office scientists at an international conference in March 2009. More than 2,000 scientists from around the world joined in Copenhagen for the Climate Change: Global Risks, Challenges and Decisions Congress.

Met Office research played a vital role at the event, including evidence of the need to take early action on climate change to limit temperature rises to 2 °C. Dr Vicky Pope, Head of Climate Change Advice at the Met Office, said, “Even with drastic cuts in emissions over the next 10 years our results project there will only be around a 50% chance of keeping global temperature rises below 2 °C. Any delay will only see temperatures rise further.”

The congress allowed experts to discuss and update climate science. This will underpin vital negotiations at the United Nations Climate Change Conference, again being held in Copenhagen, in December 2009, when it is hoped that a new international treaty to tackle carbon emissions will be set.

Photo: Global Warming Images

High spring tides and gale force winds cause flooding at Sandside near Arnside, Cumbria.

Climate projections

The most comprehensive UK climate projections ever produced have been released to help the UK prepare for the challenges of climate change. The UK Climate Projections (known as UKCP09) feature in-depth projections based on the latest Met Office science.

Funded by the Department for Environment, Food and Rural Affairs, UKCP09 will help governments, businesses and organisations take a risk-based approach to tackling the implications of our changing climate. This includes preparing for likely changes such as hotter, drier summers and milder, wetter winters, as well as a higher frequency of extreme weather events such as flooding, heatwaves, and droughts.

The projections are underpinned by Met Office expertise, using results from our climate model. These have been combined with output from 12 of the world’s other leading models to build a comprehensive picture of how our climate may change. The range of results is presented in terms of probability. With careful interpretation, the climate projections are a useful planning resource.

As we provided the science behind the climate projections, we intimately understand its uses and limitations. Our climate science consultants are on hand to give advice on how to best use and apply the projections.

To find out more, or sign up for our free seminars in the autumn, visit our website or speak to a Met Office science consultant.

Building on our knowledge

GRAND DESIGNS LIVE LONDON
EXCEL • 25 APRIL–4 MAY
Sponsored by British Gas

Secretary of State for Energy and Climate Change, Ed Miliband, was among thousands of visitors to the Met Office’s stand at the Grand Designs Live event in London. About 100,000 people flocked to the award-winning show at the ExCeL centre in Docklands to see a huge range of displays, many based around the show’s main theme of sustainability.

We were there to offer advice on how climate change must be considered when designing and building homes. Mark McCarthy, urban climate specialist at the Met Office, said, “We are already committed to some warming here in the UK so it’s very important to start building new homes with climate change in mind. We need to design homes that reduce greenhouse gas emissions to combat global warming, and that are future-proofed to be comfortable places to live, both now and in the future.”

Visitors to the stand also got the chance to enter our ‘TV studio’ to present the weather, with a twist — looking at an average summer and winter day both now, and in 2050. This showed how, in the future, UK summers will be hotter and drier, while our winters will be milder and wetter — bringing home the effects climate change will have on our lives and buildings.

Voyage of discovery

The Met Office has always been involved in the world's premier collaborations. When Charles Darwin and Robert Fitzroy met in 1831 they changed the course of history forever.

This year, we celebrate 200 years since Charles Darwin, one of the most influential scientists of all time, was born. In 1859, Darwin unveiled his theory of natural selection, the driving force behind evolution. Now 150 years since Darwin published the Origin of Species, sending shockwaves across the globe, his revolutionary theory has completely changed our understanding of the world.

In 1831 Darwin set off on a five-year expedition on the ship HMS Beagle as an unpaid naturalist. It was on that South American journey that he observed the behaviour of various plant and animal species. The forgotten part of the story behind the Darwinian revolution is Robert FitzRoy, founding father of the Met Office.

Today, the voyage of the Beagle is synonymous with Darwin, however as the ship's captain, FitzRoy was a crucial part of the equation. Far from being just the captain of the Beagle, FitzRoy was an outstanding mariner, nautical surveyor and meteorologist, and a surprisingly accomplished geologist and natural historian. Joining the Navy when he was just 12 years old, by the time he was 23, FitzRoy was in command of a 90-foot sailing ship, surveying the southern tip of South America. He returned to Cape Horn three years later, deciding to bring with him a young naturalist, Charles Darwin.

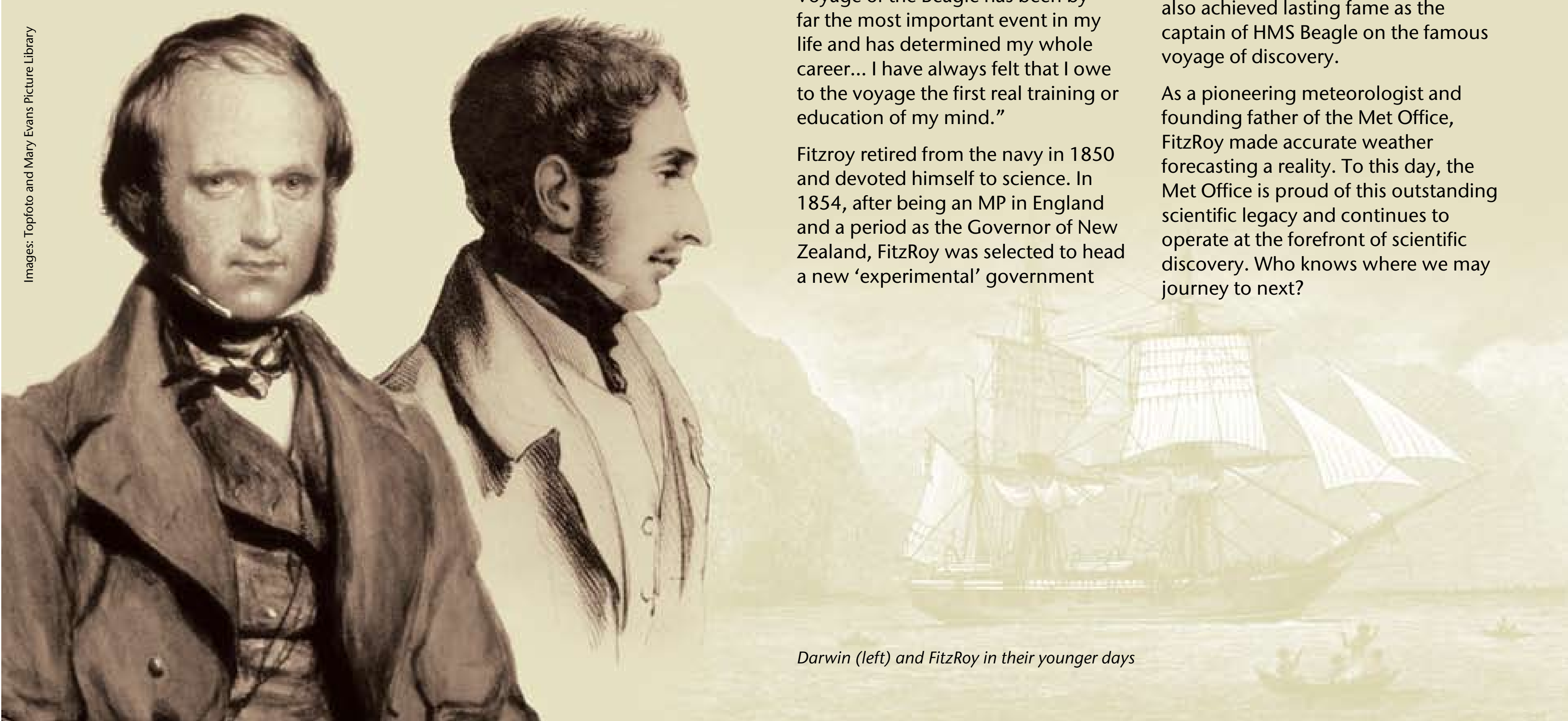
If it wasn't for FitzRoy, it is doubtful that Darwin would be the household name that he is today. It was FitzRoy that appointed Darwin to the Beagle. If that hadn't happened, Darwin would not have had the chance to observe and collect the plant and animal species that led to his ground-breaking publications. Darwin was carefully selected by FitzRoy, to be his messmate and companion. In his autobiography Darwin wrote, "The Voyage of the Beagle has been by far the most important event in my life and has determined my whole career... I have always felt that I owe to the voyage the first real training or education of my mind."

Fitzroy retired from the navy in 1850 and devoted himself to science. In 1854, after being an MP in England and a period as the Governor of New Zealand, FitzRoy was selected to head a new 'experimental' government department within the Board of Trade — what is now the Met Office. FitzRoy's interest in the weather was to save lives and his main concern was for the safety of all those at sea. (See page 17 for modern maritime safety using satellite technology).

In 2002, the weather forecasting sea area Finisterre was renamed FitzRoy to recognise his valuable work. He was the world's first full-time weather forecaster, and is even credited as having invented the term 'weather forecast'. It is not by chance that the Met Office headquarters in Exeter is on FitzRoy Road, named in his honour.

Did FitzRoy and Darwin have any idea that their voyage would change the world so significantly? Darwin is one of the most eminent scientists the world has ever known, but FitzRoy also achieved lasting fame as the captain of HMS Beagle on the famous voyage of discovery.

As a pioneering meteorologist and founding father of the Met Office, FitzRoy made accurate weather forecasting a reality. To this day, the Met Office is proud of this outstanding scientific legacy and continues to operate at the forefront of scientific discovery. Who knows where we may journey to next?



Darwin (left) and FitzRoy in their younger days

Photos: Gettyimages

Enjoying the sun in 1948

Soaking up the rays in 2009

Sunny spring

After enduring the coldest winter in a decade, spring made a pleasant change. With temperatures mostly above average across the UK, it was also the sunniest spring since 1948. However, spring often produces a mixed bag of weather, so we continued to keep the public and our customers informed of any changes to the UK's variable climate.

Spring frequently offers a wide variety of weather, and this year was no exception. Except that this spring was the sunniest for over 60 years — with a mean temperature about 1 °C warmer than average.

March temperatures were also mostly about 1 °C above normal, partly because of some warmer than average daytime temperatures, particularly in central and eastern areas. Rainfall was close to or below normal almost everywhere, with only around half the average in parts of north-east England, the Midlands and Wales. Indeed, it was the driest March since 2003 over England and Northern Ireland and the driest since 2002 over Wales. However, in contrast, northern Scotland had above-average rainfall.

There was plenty of sunshine almost everywhere, particularly in the Midlands, southern England and northern England. In England, it was the second-sunniest March ever and the third-sunniest for the UK, since records began in 1929. It was the fifth-sunniest March over Scotland, with a maximum temperature of 18.5 °C recorded in the Highlands on 20 March. However, Braemar in Aberdeenshire recorded a chilly minimum temperature of –9.6 °C on 5 March. There were strong gusts in the Northern Isles on 8 March, with 81 mph recorded at Lerwick on the Shetland Islands.

As the first holiday of the season, many people made the most of the weather over the long Easter weekend. With some rain and showers, sheltered locations in the south and east had the best of any dry and bright conditions. Temperatures ranged from 11 °C in Scotland to 16 °C in south-east England, which felt pleasantly warm in the spring sunshine.

In April, mean temperatures were above average across the whole UK — about 1.3 °C above average in south-west England and south Wales, and about 2.3 °C above in East Anglia, south-east England and northern Scotland. It was actually the third warmest April over Scotland and equal third over England, since records began in 1914, but not as warm as the warmest in April 2007. Sunshine ranged from close to normal over Northern Ireland, Wales, south-west England and southern and eastern Scotland to over 130% of average over East Anglia and parts of north-west England and north-west Scotland. A maximum temperature of 22.1 °C was recorded at East Malling in Kent on 15 April.

April was the third consecutive month to be noticeably drier than average over much of England and Wales. However, rainfall was above normal in Northern Ireland and the western fringes of Scotland, Wales and south-west England. A large amount of rain fell in a short period of time over western Cornwall on 24 and 25 April, with 56.8 mm recorded at St Mary's on the Isles of Scilly. Tragically, three people were killed after a car was swept into a swollen river. Northern Ireland also had a lot of rain, with the wettest April since 1996.

There was the chance to bask in some hot weather at the end of May, with the late spring bank holiday weekend having the highest temperatures of the year up to that point, nearly reaching 26 °C in London. People on holiday during the half-term week had more dry and bright weather, especially in the south where temperatures remained warm into early June.

As for summer, our long-range forecast suggests that temperatures across the UK are likely to be warmer than average and rainfall near or below average. However, there will still be some heavy downpours, but thankfully we won't have another wet summer like the last two years.

Euro-Vision

Image: EUMETNET

EUMETNET — a network of 26 European National Meteorological Services is pivotal in coordinating meteorology across Europe. In a newly created role, the Met Office's Steve Noyes joined EUMETNET as Executive Director. Here, he tells Barometer about the challenges of helping to shape meteorology in Europe.

Back in the early 90s, when the EU was becoming increasingly involved with environmental policy, there was a growing concern at the lack of understanding in what the various meteorological organisations around Europe could do. The fear was that there could be a large amount of duplication of their work and, as a consequence, EUMETNET was born. Its remit was to enable its members to work more collaboratively — and create a single, unified, voice for communicating meteorological issues to the EU.

Membership grew steadily as more and more European meteorological services joined and, today, the organisation of 26 National Met Services has a significant influence on policymaking within the EU. It also helps the EU understand how to make the most of the vast meteorological resources and knowledge around the continent as a whole.

Formerly the Met Office's Operations and Customer Service Director, Steve Noyes' role at EUMETNET focuses on improving the benefits that Members get from being part of EUMETNET, for example, by doing more together rather than separately, or by helping to increase their collective influence in Europe. It is a challenging role that requires subtle diplomacy.

"When 26 different countries work closely together, there are inevitable challenges. Agreeing actions, for example, can take a while. But it's part of my job to understand what each Member wants EUMETNET to do — and try to find a common ground."

Since he started this role 18 months ago, much of Steve's time has been taken up with travelling to meet the different Members and understanding how the meteorological services in their countries work. "It's surprising just how much common ground there is between the organisations," says Steve. He has also been leading the development of a new business model and strategy for EUMETNET and its Members that "can begin to deliver a vision to bring even more benefits than before."

EUMETNET
The Network of European Meteorological Services

Project by project

EUMETNET takes specific projects to task that are of benefit to people and organisations around Europe. These are usually identified by members of the wider meteorological or political community. Projects last for three to four years, or even longer, and their impact can be felt right across Europe.

One of EUMETNET's highest profile projects for example, has resulted in a website called Meteo Alarm (www.meteoalarm.eu) which produces a European weather warning service. It draws on national warnings from different member countries around Europe to create a mosaic based on geographical boundaries. To the public, the result is a valuable service that can forewarn them about difficult weather conditions if they are travelling across Europe.

"It would be difficult for an individual meteorological service to deliver this kind of information on its own. It is a prime example of the power of collaboration," says Steve.

EUMETNET is also running a project that focuses on climatology and the observations that have been stored by many different European countries over the years.

"Historically these climate records are produced and held at a national level, so it's been hard to get a Europe-wide vision of what's been happening to the European climate. But through a number of EUMETNET programmes we now have data for the whole of Europe that can be put together to offer a single, comprehensive view."

What next?

Thanks, in part, to the work of EUMETNET, the meteorological community is increasingly at the heart of policymaking in Europe; but Steve sees even greater scope for the organisation in future.

Vision of the future

Climate change and the weather have very real — and sometime catastrophic — effects on peoples' lives around the world. The Met Office's new Chief Scientist, **Julia Slingo**, is taking vital steps to understand and help tackle the challenges we all face today, tomorrow and decades into the future.

Photo: Science Photo Library

"My role is to make sure we're always looking ahead to the big, upcoming global challenges five and ten years away, and beyond. The Met Office will be very much at the forefront of these climate issues."

From childhood, Julia has been fascinated by the way things work. But it wasn't until her Physics Degree at Bristol University that she became interested in more than just the theoretical side of science. She wanted to see the actual results as they happened. "I'd always been fascinated by the weather and why it follows certain patterns," she explains, "so I looked to meteorology, where I could go outdoors to see Physics in action."

Julia joined the Met Office 35 years ago, working on the very first climate models. "I was about to start a postgraduate degree at Imperial College when the Met Office offered me a post" says Julia. "The College's advice was to 'go for it' — which I did. It has been a truly fascinating career from day one and I've never regretted my choice."

Fresh beginnings

For an up-and-coming scientist, the Met Office was the place to be. Julia joined the Dynamical Climatology Branch and began to work on the very early phases of climate modelling, writing the first fully interactive cloud and radiation codes, and doing some of the first studies in the Met Office on climate change. "30 years ago we had virtually no satellite information and much slower computers, so we were very limited in what we could do. And there were lots of processes in weather and climate systems that we now take for granted, but that we didn't appreciate then."

But with advances in technology, weather and climate research has been completely transformed. "Now, very powerful supercomputers allow us to run enormously detailed and complex models," she explains. "And with the amazing array of earth observation data, we can work with a level of detail that was simply inconceivable 30 years ago."

Vast experience in modelling, and in-depth research in atmospheric physics — including convection and cloud-radiation interactions — have helped Julia forge a career as a world-leading scientist. Today, she's getting to grips with her role as Chief Scientist. "At the moment, it's meeting after meeting. But getting to know people is very important to me — after all, teamwork helps us achieve some really great things at the Met Office."

Making plans

To Julia, the most valuable thing about research isn't purely finding out what makes things tick — it's also about taking that knowledge and turning it into powerful and reliable information that people can use. "We're increasingly being asked for more and more detailed predictions," says Julia, "from the weather conditions a building will need to withstand fifty years from now, to what sort of crops a farmer should be planting this coming summer to make the most of the prevailing weather patterns, and to the risks of hazardous weather locally in the next few hours."

Tropical weather systems are of particular interest to Julia and an area of vital research that helps protect many lives around the world. The effects of storms and droughts can be dramatic, and often devastating — particularly in heavily populated countries vulnerable to climate change, such as China and India. Julia's work over the years has not only been instrumental to the Met Office's understanding of these systems — and the role the ocean plays in creating them — it has also been a major focus for her role as Professor of Meteorology at Reading University, a link that she still keeps.

The global debate

Now that climate change is recognised as a global issue, forging links with scientists and academic institutions worldwide is vital if effective action is to be taken. As the founding Director of Reading University's Walker Institute for Climate System Research, and having been a key player in the Natural Environment Research Council (NERC), no one understands this more than Julia. "The reason initiatives such as the recently launched Met Office/NERC Joint Climate Research Programme are so important, is because they formally set partnerships in place. We have some big challenges ahead, and we will need to draw on the best multidisciplinary research in the UK and with our international partners if we are to achieve our goal of being the best weather and climate service in the world," says Julia.

Later this year, the third World Climate Conference will convene in Geneva to agree what services need to be set in place to provide the climate predictions and information for decision-making, so that we can adapt to and mitigate climate variability and change most effectively. Julia and the Met Office will be engaging with this with great interest. Julia explains, "My role is to make sure we're always looking ahead to the big, upcoming global challenges five and ten years away, and beyond. The Met Office will be very much at the forefront of these issues."

➔ To find out about the Copenhagen Climate Conference, turn to page 3

➔ For more about Met Office Unified Model collaborations, turn to page 15

World focus

Around the world, the Met Office works for a wide range of customers, developing strong relationships built on understanding their needs, sharing their passions and delivering consistently high results. In return, customers trust the Met Office to take them to the cutting edge of climate science and weather advice so they can make the most informed decisions possible.

Well trained

Met Office Consulting, in partnership with the Danish Hydrological Institute (DHI), has been commissioned by the Egyptian government to look at how climate change could impact the Nile, its primary water source. Travelling through eight different countries and various different climates, the river experiences both tropical downpours and intense evaporation. This makes understanding the impacts that climate change could have a complex challenge. However, using the Met Office Hadley Centre's PRECIS (Providing REgional Climates for Impacts Studies) model, the Met Office team, led by Business Manager Helen Bye, has come up with a solution.

Sponsored by the Department for International Development (DFID), PRECIS is a freely available, high resolution modelling system that developing countries can use to build climate change scenarios, drawing on local climatological experience. The Met Office has been using PRECIS to produce scenarios about the future availability of water in Egypt — the results of which will enable the Egyptian government to see how climate change could affect the amount of water reaching the Aswan Dam.

But the project is about more than simply delivering these results. Met Office consultants are also working closely with the PRECIS team to offer Egyptian scientists tailored training in how to run the PRECIS model. "We want to enable our customers to build their capacity in climate change research," explains Senior Climate Change Consultant Carlo Buontempo, "to equip them with the skills to continue to run the model once the consultancy project has been completed."

The Met Office has also introduced PRECIS to the Bangladesh University of Engineering Technology and helped to establish a Numerical Weather Prediction Facility at the Bangladesh Meteorological Department. Met Office Climate Scientists James Dent and Bhaski Bhaskaran visited Bangladesh in April to develop awareness of the Met Office's role. A seminar was hosted in Dhaka by the Met Office, to explore how we can contribute to the success of DFID-funded programmes in Bangladesh. Met Office Climate Services Manager Bhaski Bhaskaran says, "The seminar identified stakeholder requirements and helped to match them with Met Office capabilities and skills. We look forward to working with our Bangladesh colleagues in the near future."

Meanwhile, the Met Office has also joined a knowledge exchange programme with a number of humanitarian relief charities. The exchange aims to identify how developing countries affected by climate impacts and severe weather events could benefit from improved scientific capability. The Met Office is reviewing its current contact with non-governmental organisations to enhance collaboration.

Lay of the land

Met Office Consulting and research teams are currently working together on a project for an international mining company looking to develop a new mine in the Tropics. This large-scale development could affect the climate of the region because of the significant role of topography in the cycle of tropical rainfall. “Our customer wants to fully understand the potential effects the mine development could have,” explains Business Manager Tom Butcher, “not only to satisfy themselves but also to demonstrate due diligence to environmental stakeholders including potential financiers and the country’s government.”

With the customer’s needs in mind, the team has developed an innovative way of calculating the potential effects of a change to the mountain’s landscape, using the Met Office’s Numerical Weather Prediction model. When run at a high resolution, to show maximum detail, the model can resolve fine detail topographical features and small-scale weather features such as localised tropical rain. Using historical data, scientists can run the model for case studies firstly with the mountain unchanged and then a second time with altered topography to show the difference with the proposed mine in place.

The project involves the Met Office’s work being applied to vegetation modelling and hydrology to consider the potential impacts that a shift in weather patterns could have on biodiversity in the area. “Our customer is undertaking a thorough assessment of environmental impacts and we are playing a pivotal role in that process,” Tom concludes, “my job is to make sure that we deliver what they need, every step of the way, living up to the trust that they place in us.”

Working together

Focused on building a better understanding of climate change worldwide, the British Foreign and Commonwealth Office (FCO) has commissioned the Met Office to deliver two pieces of collaborative research on opposite sides of the globe.

In northern Russia, climate impacts scientist Rutger Dankers is working with Russian scientists to look at the relationship between potential agricultural expansion and climate change. Currently covered by forests and permanently frozen soil — permafrost — northern Russia is one of the world’s most important

carbon stores and turning it into farmland could release that store, with serious ramifications. “We want to get a clearer picture of the carbon balance of the area so we can understand what effect any changes could have,” explains Rutger, “and by bringing different sets of expertise together on this project we can better represent permafrost in our prediction model, improving our overall understanding of global climate change as a result.”

Met Office Climate Impacts Scientist Gillian Kay places similar value on collaboration. She is working closely with the Brazilian National Institute for Space Research (INPE) to enhance existing climate change projection capacity within Brazil and improve understanding of how Amazon deforestation and dieback may affect the regional climate. “INPE, which is leading the way in climate research in South America, wanted to improve its modelling capacity, and we wanted to develop our own models with its knowledge of the region’s climate, so the project grew from a desire to cross fertilise,” she explains. “On top of that, the work we are collaborating on in Brazil, looking at interactive vegetation schemes, can be applied to other regions and fed into work being done by the Met Office across the board.”

Improving in the

Getting to grips with the weather and climate can be a complicated and costly process, but for many developing countries around the world, the Met Office is on hand to help.

As part of the World Meteorological Organization's (WMO) Voluntary Cooperation Programme (VCP), the Met Office helps developing countries prepare for the future. Put simply, this means protecting the lives and property of citizens by building a better understanding of their weather and climate.

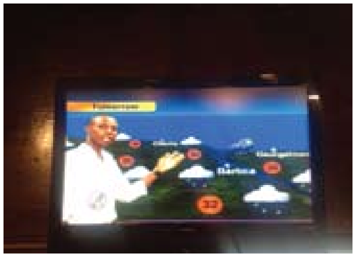
Accurately recording and storing local weather observations is a key part of this process, and something the Met Office's Technical Cooperation Manager, Steve Palmer, has spent years helping developing countries do. "By putting computers in at station level and providing the appropriate software, countries' meteorological services can record and input observational data." Steve explains, "They can then use these observations to make products like bulletins, television forecasts or data products for use locally, so the population is better prepared for what the weather has in store."

Tools of the trade

Software that's both advanced and compatible with widely-used computer programmes is vital to help achieve this. Introduced most recently in Malawi, CLIMSOFT is a scaleable database package that was developed in Africa and runs with commonly available software and hardware. "Most climatology databases are expensive and rely on complex computer systems to function," Steve continues, "but with CLIMSOFT all you need is a computer that can run Microsoft Office. The set up is cheap and the licence is free, which makes it far more suitable for countries like Malawi."

Steve's team has provided numerous countries with access and training to run CLIMSOFT, partnering with Computer Aid International to supply second-user computers that make the system affordable and sustainable. But recording observations is just a small part of the equation. The Met Office VCP team also

“The forecast will connect better with its viewers and get more people tuning in, which could ultimately improve the country’s productivity — and in some instances save lives.”



South

helps countries use that information effectively — which is where people like Dave Robinson come in.

Design for life

As the Met Office’s Media Designer, Dave has been creating and designing weather forecasts for 20 years. His work can be seen every day on GMTV, ITV and Channel 4. Dave joined the VCP team four years ago to help developing countries design superior graphics for their own weather forecasts. He’s currently introducing many of them to new design software based on the same programme used by the Met Office — WeatherEye.

“It’s a complicated programme, but with a simple user interface.” Dave explains. “The idea is that, by introducing professional quality and locally based visuals, the forecast will connect better with its viewers and get more people tuning in, which could ultimately improve the country’s productivity — and in some instances save lives.”

Nowhere is this more apparent than Guyana, South America. As a country with low-lying coastal regions, high tides and storms have a direct and often disastrous effect on the population. However, getting a national weather broadcast on TV has proven difficult — until now. In late April, Dave arrived in Guyana to introduce the country’s Hydrometeorological Office to WeatherEye and train the Hydromet staff to produce TV weather broadcasts. The second stage involved training staff from Hydromet and NCN, the state national television network, to present, for the first time in Guyana, their brand new TV weather forecasts.

A brighter future

The results have been impressive. It’s taken a lot of enthusiasm and hard work to get the new WeatherEye TV broadcasts up and running in just three weeks. “They’ve gone down a storm. It’s big news in Guyana,” says Dave, “one stranger came and shook my hand in the airport as I was leaving because he recognised my face from my television interview about the programme launch. He was very excited about what we’d been doing. Our work as part of the VCP has made a big difference to the people of Guyana and will continue to do so in the months and years to come.”

Improving weather information and communication in developing countries also achieves a wider aim. By observing, recording and using locally generated weather data, each country is contributing to a central database, which will help develop a greater understanding of weather and climate worldwide.

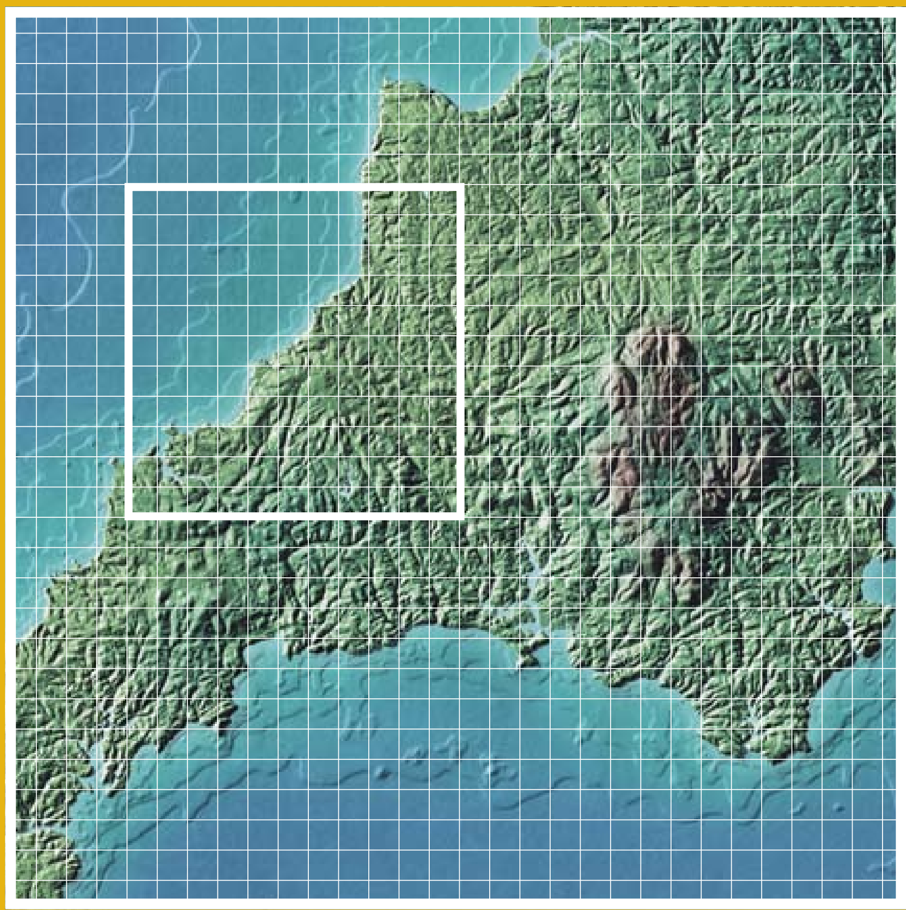
“It’s all about building assets for the future.” Steve concludes. “Observations taken 30 years ago are invaluable to us now, just as today’s observations will be used well into the future, providing we can store and use them effectively.”

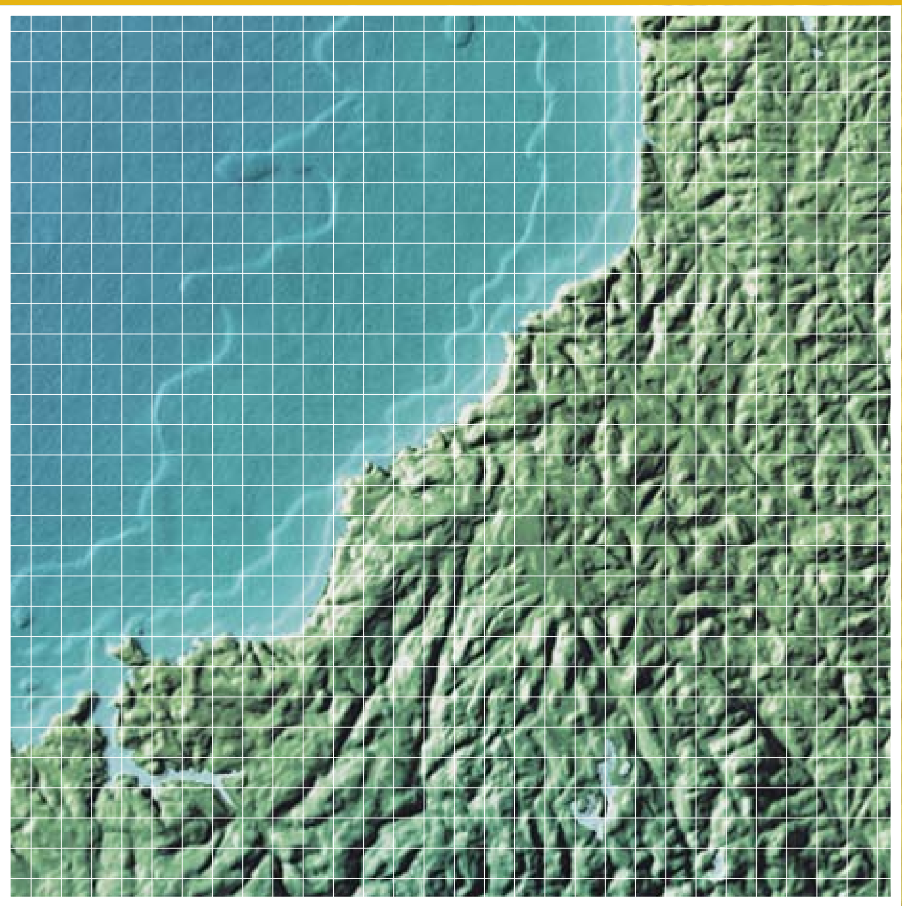
A model performer

With the arrival of the Met Office's new supercomputer, the UK's forecast model will be given a major upgrade. This should enable a more accurate and localised picture of the weather than was ever before possible.

To see what the weather might do in two hours, twenty-four hours or even several days' time, the Met Office needs to create detailed simulations of future weather conditions — a process called atmospheric modelling. While this system forms the bedrock of Met Office forecasting, it has, until now, relied on a model with a maximum resolution of four kilometres. Or, put another way, it uses a four-kilometre grid to study and predict UK weather. But with the extra processing power of the new supercomputer, a 1.5 kilometre grid will be possible. As Peter Clark, Head of Joint Research Centres, explains, "We were aware that the 4 km model had its limitations, and this new 1.5 km model is a major jump in resolution."

Each square = 4 km





Each square = 1.5 km

"The new 1.5 km model will give more accurate and localised predictions providing earlier warning of events like the Boscastle flood in 2004."

Quicker, clearer, closer

Using the 1.5 km model, the Met Office should be able to forecast weather conditions that had previously been hard to predict. Nick Grahame, Chief Forecaster for the Met Office, puts it this way, "The higher resolution allows us to nail down small scale, severe weather effects that can have a big impact on the public — such as thunderstorms and heavy rain. And, because it's better at representing land surfaces like hills and mountains, we're hoping to get more detail on where fog and localised winds form."

Potentially, the benefits for the public are huge — especially when it comes to severe weather warnings for local authorities and the emergency services, which should be greatly improved. "When we spot things like heavy rain in potential flooding areas, for example, we can warn the relevant authorities earlier, with more specific information about when and where it may happen," Nick says. "So emergency services can be better prepared — and respond faster."

A flood of information

Since 2007's severe summer flooding, the joint Flood Forecasting Centre — composed of Met Office and Environment Agency staff — has been working to develop a better flood warning system, especially for events like the Boscastle flood in August 2004. "Previously, this sort of flooding was seen as so dependent on the detail of the rainfall forecast, that accurate flood predictions were viewed as near impossible," explains Peter. "But the joint Flood Forecasting Centre is now able to issue flooding alerts on a much more localised level." With the 1.5 km model, predictions are more accurate and localised. For example, the model was tested for the flooding in Carlisle in January 2007 that was caused by heavy rain over the Lake District. "We showed that predicting the river flows using this higher resolution, the 1.5 km model is much more accurate — and really can enhance the lead times of warnings," Pete says.

The future of forecasting

The new 1.5 km model aims to be fully up and running on the new supercomputer this summer and should be the main input to short-range forecasts for the UK from next year. If all goes well, the potential for future forecasting is huge. "Although we're currently looking at public safety and high impact weather in particular, there'll be benefits for a whole range of people who use forecasts," Nick says. "People like mountaineers and hill walkers who need to know what the weather will be doing in very specific areas. Or airports that need to put contingency plans in place for fog."

Peter also sees how the model could be applied in the future. "Many customers need detailed forecasts — for example, as wind power grows as a sustainable energy form, this model could help provide valuable forecasts for the power from wind turbines. It could also be used anywhere on the globe, opening up the possibility to truly predict local weather."

Photo: John Cleare/Mountain Camera Picture Library

By collaborating with scientists at the Norwegian Met Institute, we have been able to significantly improve forecasts of near-surface temperatures in cold, wintry conditions. Here, John Edwards and Gabriel Rooney of the Atmospheric Processes and Parametrizations team explain how working together has made things better.

Better together

Norwegian Meteorological Institute
met.no

The icy cold of Norway seems a world away in warm summertime but, whether it's warm or cold outside, the temperature affects our everyday lives in many ways — influencing, among other things, what we wear, what we drink, and crucially whether driving in potentially icy conditions is worth the risk.

Accurate forecasts of the temperature in the lowest couple of metres of the atmosphere are of great benefit to individuals, businesses and society as a whole. However, these near-surface temperatures present a significant weather-forecasting challenge because they are determined by the interactions of, and delicate balance between, several physical processes.

With its complicated mountainous terrain, extensive tree cover and snowy winters, forecasting for Norway is an exacting test for the Met Office Unified Model™ (UM™). Thanks to the joint efforts of scientists at the Norwegian Met Institute and the Met Office, the UM™ has given an excellent performance over Norway and has been used for operational forecasting by the Norwegians since 2008. Improving forecasts of near-surface temperature was a crucial part of it being used operationally.

Norwegian wood

Our first challenge was the coniferous forests of Norway at the start of the spring melting season. If snow is on the trees, sunlight is reflected and the atmosphere warms up slowly. However, if the snow has fallen to the understorey, the area underneath the forest canopy, and the trees are not covered in snow, they absorb more of the sun's energy, warming the atmosphere more quickly. Therefore, near-surface temperatures and the location of the snow are closely linked. So, to forecast temperatures accurately, we need to precisely model the physical processes that determine the interaction between the snow and forest canopy.

The UM™ is able to account for the forest canopy intercepting falling snow and its subsequent unloading to the ground, rather than just assuming that all the snow remains on the canopy until it melts. By default, model forecasts begin with all the snow on the trees. As a result, the Norwegian Met Institute found that near-surface temperature forecasts were consistently too cold. By improving the representation of the snow canopy in the model, allowing snow to fall off the trees before the start of the forecast, warmer near-surface temperatures were forecast.

Reinforcing our findings

But snow on the canopy was not the only modelling issue. The experience of the Norwegians reinforced what we have learned by looking at data from our own field-site at Cardington in Bedfordshire, where detailed measurements of near-surface data are made on a continuous basis. In light winds, under clear-skies, when the surface is cooling rapidly, the model tends to link the near-surface air temperatures too closely to the surface temperature; this also makes the forecasts too cold.

This can be a significant problem in Norway because the snow surface can cool very quickly after sunset. Analysis of the Cardington observations enabled us to understand the problem and to devise a simplified scheme for operational use that allowed the air temperatures to become more separated from the surface temperature. The Norwegian Met Institute confirmed that implementing this improvement reduced their forecast errors considerably. On the basis of their experience we're working on a similar change to our own operational forecasting system to give better forecasts of near-surface temperature, especially during winter months.

Through this close collaboration, both the Norwegian Met Institute and the Met Office will ultimately reap significant rewards. Indeed, by working together, the forecasts issued by the Norwegian Met Institute have already improved. The changes are also to be included in the operational UM™ here, improving a range of our forecasts — from short-range wintertime forecasts of near-surface temperatures for the UK, through to long-term climate forecasts for the whole globe.

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...

George Pankiewicz
Manager of External Collaboration

For George Pankiewicz, taking on astronomical challenges comes naturally. After completing a PhD on the modelling of comet Halley's dust distribution, George joined an international team to undertake the first all-sky survey of extreme ultraviolet light with the ROSAT orbiting telescope. Then in 1993, he joined the satellite applications area of the Met Office. His role was initially to improve the way satellite images are used in nowcasting and in the Unified Model™ (UM™) — the Met Office's flagship numerical modelling system and weather and climate prediction software.

A model example

Taking his interest in numerical weather prediction, George moved to International Relations to manage activities with National Meteorological Services and the European Centre for Medium-Range Weather Forecasts. It became clear that other Numerical Weather Prediction (NWP) centres around the world wanted to use the Met Office UM™ for their own forecast production. Together with the Met Office's Science and Technology Director Alan Dickinson, George and others developed a new licence agreement enabling collaborating NWP centres to use the UM™ in return for at least one scientist's effort per year to make valuable improvements to the UM™, which can be fed back to bring improvements for the UK.

"We wanted to incorporate our collaborators' NWP expertise into the research and development work we do here at the Met Office. If we're able to agree a science plan and their work contributes to our programme plans, collaborators can expect to get their annual licence fee returned."

George now leads a team, managing 40 scientific projects with six operational users. While some organisations he works with may have 30 NWP scientists, when they pool their resources with the Met Office, the result is a team of over 400. George plays a vital role in overseeing the work at hand. "My job is to support the model's use, oversee the scientific contributions and improve communication through webpages, workshops and tutorials."

International collaborations

George deals with projects that span both short range NWP and climate prediction — and works with countries around the globe, learning from them and helping with specific issues they face. For example, when wildfires swept through south-east Australia in February 2009, the UM™ contributed to the job of predicting the high temperatures and wind patterns that contributed to the devastation. "The UM™ based model set up by the Australian Bureau of Meteorology was able to predict the synoptic situation with the same level of accuracy, but 24 hours earlier than their current global model."

Photo: Gettyimages

The UM™ helped to predict the high temperatures and wind patterns that led to the devastating wildfires in Australia in February.

In the US, a data and software exchange between the Department of Defence and Britain's MoD has led to George's team negotiating with the US Navy about a similar project. "Whilst in the UK we've made incredible use of US polar meteorological satellites over the years, the Met Office's UM™ is seen as offering a world-class modelling system for the future."

The UM™ is being installed in Delhi, allowing the combined efforts of Indian and UK scientists to more accurately model the Asian monsoon, and huge computing power in Korea offers the opportunity to run half the Met Office's global ensemble forecasts.

Collaboration is critical for improving the performance of the UM™ around the world. The Norwegian Met Institute for instance, helped discover that the model gave a cold bias in snow-covered needle-leaf forested areas — which ultimately led to improved temperature forecasts in these areas (see opposite page).

With the large investment made by the Met Office every year in developing the UM™, currently around £15 million, it seems fair to George that other organisations around the world that benefit from the service, should contribute to its development.

Ultimately, George views the situation quite simply. "There are other systems out there, but what we are offering is a high quality, stable model, a 24/7 support team and the best performance in the world."

Marine safety has to be an international effort and is heavily dependent on accurate weather observations at sea — in particular, the meteorological reports supplied by Voluntary Observing Ships. To ensure the safe delivery of this vital data, and to transmit our high seas forecasts and warnings to ships, we use the satellite communication systems provided by the international telecommunications company, Inmarsat.

High seas safety

Image courtesy of Inmarsat

The high seas can be an unpredictable and dangerous environment — but just imagine how difficult it would be to safely navigate an ocean-going ship without access to marine forecasts and warnings.

Across the globe, a fleet of around 4,000 Voluntary Observing Ships makes a significant contribution to Met Office weather prediction in the form of surface marine meteorological and oceanographic observations. Observers on traditional Voluntary Observing Ships typically make observations every six hours, while an increasing number of ships are now equipped with Automatic Weather Stations (AWS) that generate hourly observations.

Safety at sea certainly is an international collaborative endeavour, and Admiral Robert FitzRoy would be proud that the maritime tradition has continued at the Met Office to this day (see page 4 for more on Admiral Robert FitzRoy, founding father of the Met Office). These days, almost all ocean-going ships are required to be equipped with Inmarsat systems for maritime distress and safety purposes. This system is also used by the majority of our voluntary observing fleet, which currently numbers around 360 ships, to transmit their observations back to the Met Office.

Inmarsat was founded in 1979 so that ships could stay in constant touch by telephone. Originally started as an intergovernmental organisation, Inmarsat is now an international telecommunications company providing telephony and data services to people across the globe. It operates a global satellite network offering mobile satellite communications services to a wide variety of people, including land and aeronautical users, as well as the maritime community.

Seafarers also rely upon Inmarsat's SafetyNET services to receive their maritime safety information broadcasts. Free at the point of use, these vital services provide storm and gale warnings and routine weather bulletins from meteorological offices, together with urgent navigational warnings from hydrographic offices around the globe.

For the past 10 years, Brian Mullan has headed Inmarsat's maritime safety services, ensuring that satellite and network operations have at all times exceeded the minimum 99.9% availability required by the International Maritime Organisation. Although Brian will soon hand over the reins to his successor, he is confident that Inmarsat will continue to deliver the 'gold standard' services upon which lives depend.

"The maritime community is well familiar with Inmarsat's communication and safety services, as the lives and livelihoods of seafarers have depended on them for more than 25 years", says Brian. "Not only that, but the services provided by Inmarsat have also helped to ensure the continued success of the Met Office's voluntary observing fleet.

"Without the vital combination of work carried out by the Met Office, the Voluntary Observing Ships and Inmarsat, it is certain that the high seas would be even more dangerous, and many more lives would have been lost at sea."

➔ For more information on Inmarsat safety services see **www.inmarsat.com/maritimesafety**

Natural high Alan Hinkes

Alan Hinkes OBE is the first and only Briton to have reached the top of the world's 14 highest peaks above 8,000 metres. Yet, despite the magnitude of this achievement, it was the natural lure of the mountains, rather than breaking records, that pushed him forward.

They call it the death zone: the treacherous section of a mountain above 7,000 metres. At that altitude, survival is measured in hours rather than days as the human body must endure incredible stress from lack of oxygen, extreme exposure, the cold and the severe weather that ravages the mountainside.

While it's this kind of environment that shaped Alan's career, his love of the outdoors started on much lower ground. At school in North Yorkshire, Alan acquired a taste for hill walking, "I loved finding my way through the thick hill fog with just a compass and a map," he says. From the fells of northern England to the peaks of Scotland and mountains of the Alps — Alan's experience increased and he set his sights on the Himalayas.

High hopes

It wasn't until Alan had completed his eighth 'Eight-thousander' — which included K2 in 1995 and Everest in 1996 — that it even occurred to him to attempt all 14 mountains. But it wasn't all easy going. K2 took Alan three attempts on consecutive years and he is unequivocal about the strains such expeditions put on the body and mind.

"At 8,000 metres and above, you're climbing at the cruising altitude for jumbo jets. Up there, every move is an effort and you're gasping in the rarefied air. The feeling is a little like having the flu and a really bad hangover at the same time — and you still have to push your body through something like a marathon. And of course, there are no rescue services up there as it's too high for helicopters."

At altitude, the tiniest mistake can be life threatening. In wind chill as low as –100 °C, even a dropped glove or lost sunglasses could spell disaster. Alan has personally known highly experienced — even world-famous climbers — perish on routes he has completed, sometimes while in his own climbing party. It is not just the intense cold and altitude that claim so many lives — the extreme and changeable weather is a constant threat.

"Up that high, you're basically in the jet stream and can have to avoid winds of 200 km an hour. But you also get katabatic winds that accelerate down the mountainside — you can literally hear them coming like an express train. Ironically, once they pass, the conditions can be perfect for climbing. But ascent is impossible if your camp has been flattened."

Calculated risk

It is, arguably, Alan's measured approach to climbing that underpins his success. While others focus on world records — Alan climbs simply for the challenge and to enjoy the mountains.

But in 2005, when he was on the last of the 14 peaks, Kangchenjunga in Nepal, he had to push himself to his absolute limits. His climbing partner had been forced to turn back and Alan went on alone, eventually reaching the summit just before nightfall. On the descent, the weather took a turn for the worse.

"There I was, alone in the darkness on the world's third highest mountain when a blizzard whipped up. I was thinking about three friends that had perished on the same mountain and I started to have a panic attack — shaking and hyperventilating. Experience told me I was going to die."

Alan felt he had no choice but to accept his fate — and, with that realisation, he was determined to enjoy the last few minutes of his life. "At that point I went beyond fear and my feelings turned into sheer joy, euphoria even." Somehow Alan caught up with his partner in the early hours of the morning and they descended the rest of the way together.

Despite these experiences — or perhaps because of them — Alan's love for the mountains remains strong. And while he can't pinpoint exactly what drives him, there's little doubt that climbing is in his blood. "Some people like golf or tennis. I like climbing. Cut me in half and it would say 'mountain climber'."

Instability index

This image is derived using data from Meteosat-9, a meteorological satellite operated by the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT).

EUMETSAT is an intergovernmental organisation that launches and operates meteorological satellites, delivering weather and climate satellite data, images and products to a variety of users. The Met Office represents the UK as one of EUMETSAT's largest Member States.

Developed in collaboration by Met Office and EUMETSAT scientists, the image identifies unstable air masses, which have the potential to produce rain and thunderstorms.

Observations from satellites are essential for Numerical Weather Prediction. As well as helping forecasters identify potentially hazardous weather, satellites also gather long-term data to support climate change research.