

## What do you think is the biggest question on Earth?

This November at 'UnEarthed. Explore the world at your feet' about 100 NERC-funded scientists are being asked to engage the public with 'the biggest questions on Earth'. We probably all have different ideas about what these big questions are. From my office at Dynamic Earth in Edinburgh, the view takes in the extinct volcano of Arthur's Seat and often more mundane sights like traffic congestion in the Old Town and unseasonably wet weather. Each one flags up a different list of questions on a daily basis: Can we make natural disasters less disastrous? Can we make the air we breathe better for us? How can we tackle climate change and generate enough energy for the future? Some days, to be honest, it's just: What shall I have for tea? What are your big questions? I'd be willing to bet that every single question has something to do with the environment. All of mine do – even what to have for tea. Why? Because our lives are so connected to, and all our needs are ultimately dependent on, our planet. For the majority of us who live in urban areas the connection between the environment and where we live can be easy to overlook, but in every city we are reliant on the environment for the energy to power our homes, the food and water we consume and even the air we breathe. So I challenge you to get your big questions ready, to come to *UnEarthed*, and ask them. You may well think of



**Dr Hermione Cockburn, Scientific Director, Dynamic Earth.**

Dynamic Earth is the UK's only science centre dedicated to Earth and environmental science. Before joining Dynamic Earth, Hermione presented science for BBC radio and television. Her PhD was funded by NERC and examined how landscapes evolve in Africa and Antarctica.

questions that the scientists won't be able to answer and that's exactly what science is about – shaping those big questions and working collaboratively to find out the answers.

But don't just come along to ask questions – help answer them too! There has been an amazing response to our citizen science project: Operation Weather Rescue but there is still more work to be done. Thousands of people have helped digitise weather data collected by a group of Victorian scientists who spent 20 years at the top and bottom of Ben Nevis, battered by the elements collecting a precious archive that can help shed light on current weather patterns. Have a look at the project at [www.weatherrescue.org](http://www.weatherrescue.org) and join in. If the weather is not your thing, there are other ways to get involved including a photo competition called Picture It: Your Environment; shortlisted entries will be on display at *UnEarthed*.

See [unearthed.nerc.ac.uk](http://unearthed.nerc.ac.uk) for details.

This issue of *Planet Earth* covers a wonderful range of topics including energy, seals, puffins, chocolate, lizards, air, farming, the North Pole and smartphones. And that's also why I'm so pleased that Dynamic Earth is hosting *UnEarthed* because there is bound to be something there that will interest anyone who visits regardless of their age or background. I'm hoping that people from all over Scotland will come and see for themselves the broad scope of the science funded by NERC and importantly, why it's relevant to them. I also hope that many young people will leave having been inspired to become a scientist. Why do I want that? Because I know there would be an exciting career ahead of them and that many would make great scientists. And to answer the biggest questions on Earth, we need the best people in the world.

**A free science showcase for everyone**

17-19 November 2017 at Dynamic Earth, Edinburgh



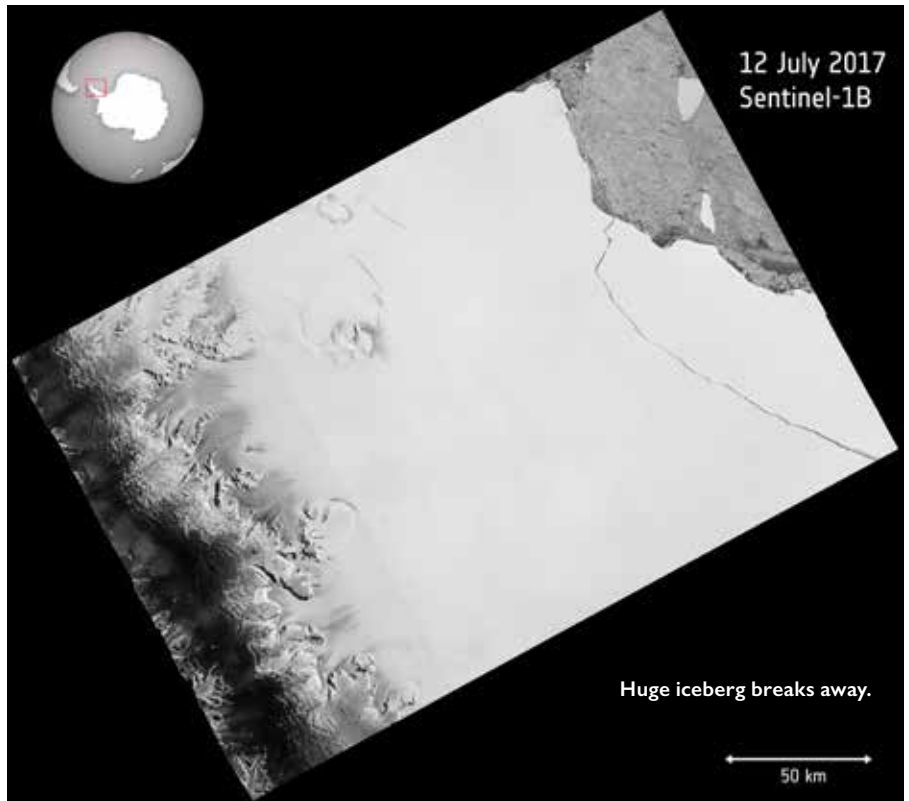
## Giant iceberg breaks free from Antarctica

An iceberg nearly as big as Aberdeenshire broke away from the Antarctic Larsen C Ice Shelf last July. A team of researchers from the University of Swansea and British Antarctic Survey (BAS) had a bird's eye view of the rift as it grew, thanks to the European Space Agency (ESA) Sentinel-1 satellites.

The research team are using Sentinel-1 to track the new iceberg, called A68, which by the middle of August had moved around three miles away from the ice shelf. A cluster of smaller icebergs has formed from the shelf and from A68 itself.

The enormous iceberg may be due to the natural growth and decay of the ice shelf, rather than climate change. However, a 2015 study showed that the Larsen-C ice shelf is thinning on its surface and underneath, suggesting that both warmer air temperatures and warmer ocean waters are having an effect.

Andrew Fleming, a BAS remote sensing



analyst, says "Our glaciologists will now be watching closely to see whether the remaining Larsen C Ice Shelf becomes less stable than before the iceberg broke

free, and our biologists will be keen to understand how new habitats formed by the loss of the ice are colonised."

Read more at <http://bit.ly/LarseA68>

## Arctic space weather radar gets 3D upgrade

The most advanced space weather radar in the world is to be built in the Arctic by an international partnership including the UK, thanks to new £6 million investment from NERC.

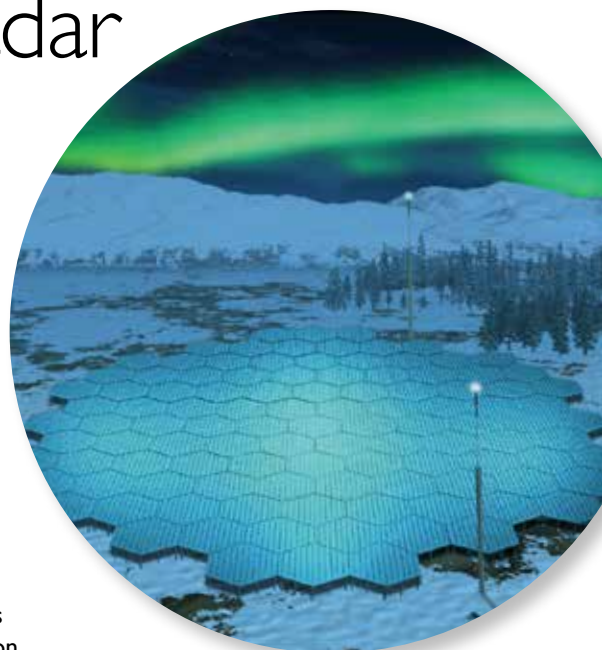
Space weather is on the UK's National Risk Register because of the potential damage it can do to satellites, communications and power grids. Solar storms drive space weather, but one of the biggest challenges in space weather science is improving our understanding of how the Earth's magnetic field and atmosphere responds to this.

The current EISCAT radars only look at one small portion of the sky at a given time but the new EISCAT\_3D radar will

provide scientists with a cutting-edge tool to probe the upper atmosphere and near-Earth space. That will help them understand the effects of space weather storms on technology, society and the environment.

Dr Andrew Kavanagh, UK EISCAT Science Support, based at the British Antarctic Survey, said: "It will be like having hundreds of radar dishes all working together, looking in different directions. This means we can easily see changes in the atmosphere, which is really important as it gives us information about how space weather effects evolve."

Read more at <http://bit.ly/EISCAT3D>



The new radar will look at 3D sections of sky. NIPR

## Climate change is a serious threat to life in the Southern Ocean

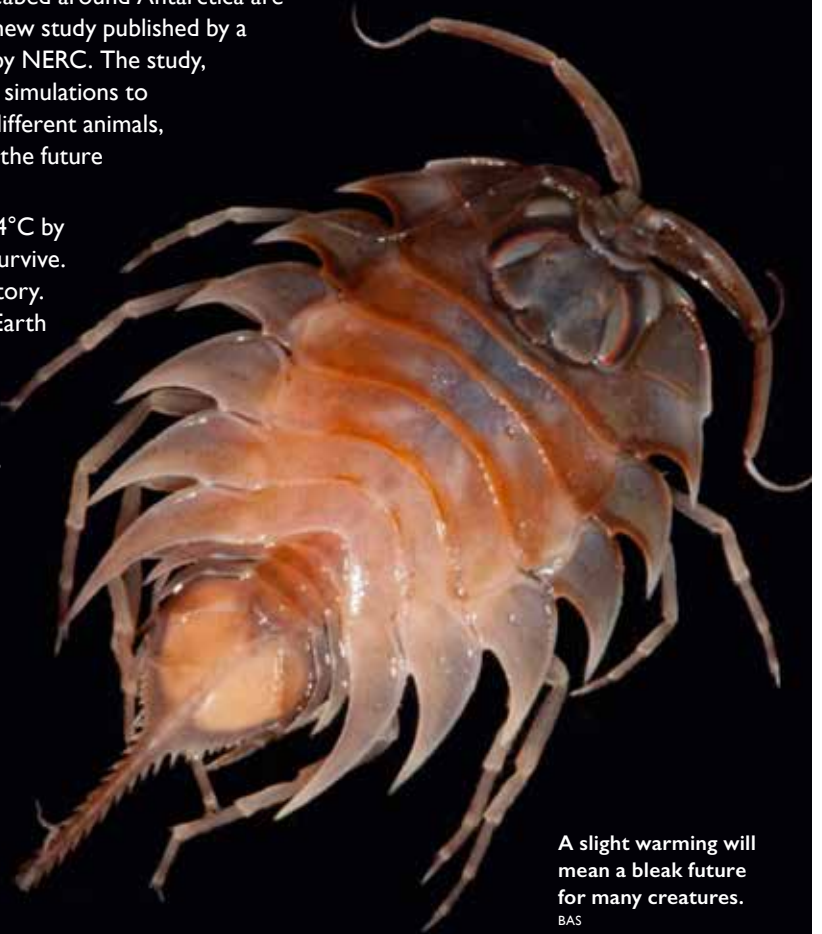
Seventy-nine percent of the animals living on the seabed around Antarctica are threatened by rising temperatures, according to a new study published by a team from British Antarctic Survey (BAS), funded by NERC. The study, published in *Nature Climate Change*, used computer simulations to study the potential distribution of more than 900 different animals, and the results suggest dramatic consequences for the future biodiversity in the region.

Research predicts that temperatures will rise by 0.4°C by 2099, and this will affect where these animals can survive. More will lose suitable habitats than gain new territory. Creatures adapted to live in the coldest water on Earth will be worst affected.

The lead author of the paper is Dr Huw Griffiths from BAS. He says: "While a few species might thrive at least during the early decades of warming, the future for a whole range of invertebrates from starfish to corals is bleak, and there's nowhere to swim to, nowhere to hide when you're sitting on the bottom of the world's coldest and most southerly ocean and it's getting warmer by the decade."

Researchers are using data collection, analyses and computer simulations to investigate the Southern Ocean and its role in the global climate. They'll be able to use the new polar research ship, RRS *Sir David Attenborough*, when it is fully operational in 2019.

Read more at  
<http://bit.ly/seafloor79>



A slight warming will mean a bleak future for many creatures.

BAS

## The coolest wedding ever?

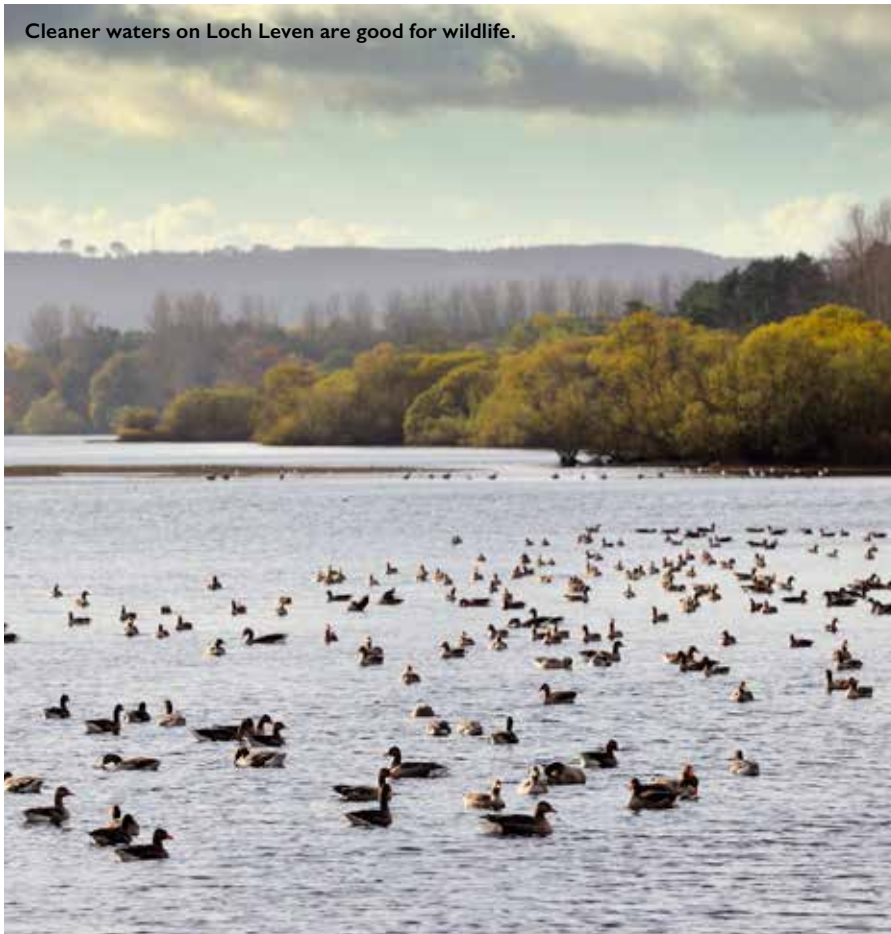
Congratulations to polar field guides Julie Baum and Tom Sylvester, who married at the British Antarctic Survey's (BAS) Rothera Research Station in July, in the first official wedding in the British Antarctic Territory. Julie's handmade wedding dress included part of an old orange tent, and the couple posed for pictures outside, in -9°C temperatures!





# 25 years of cleaner waters for Loch Leven

Cleaner waters on Loch Leven are good for wildlife.



Scottish Natural Heritage

It's 25 years since 'Scum Saturday', when a poisonous, blue-green algal bloom and murky water blighted Loch Leven and cost the local community an estimated £1 million in lost revenue. Since then, a new sewage works and upgrades to existing facilities have been combined with strict waste water treatment arrangements to improve the water quality. Local farmers and industries have made changes to ensure that pollutants aren't flowing into the loch.

NERC's Centre for Ecology & Hydrology (CEH) has been monitoring water quality in the loch for almost 50 years. For the first 20, pollution from agriculture, sewage and industry led to serious reductions in water quality. Following the management interventions, there has

been a slow and sustained recovery. CEH's Dr Linda May has led the monitoring programme for the last twenty years. She says, "The enormous improvement in water quality at Loch Leven over the last 25 years, and the associated improvements in food and habitat for wildlife, provide a world leading example of what can be achieved when scientific evidence is used to underpin restoration and management activities."

There is still work to be done, however. A recent study found that phosphorus concentrations are increasing again, and the management group is investigating possible causes.

Read more at <http://bit.ly/Leven25>

## Please fasten your seatbelt

If you're afraid of flying, look away now! A new study from the University of Reading suggests that climate change could make strong turbulence twice – or even three times – as common. Turbulence causes random up-and-down motions in planes that are stronger than gravity. During severe turbulence, food service and walking become impossible, and unsecured objects get thrown around.

The study, published in *Advances in Atmospheric Sciences*, used supercomputer simulations of the atmosphere to calculate how turbulence will change over the Atlantic Ocean when there is twice as much carbon dioxide in the atmosphere – a level that is expected to occur later this century. Its results show that the average amount of light turbulence will increase by 59%, with light-to-moderate turbulence increasing by 75%, moderate by 94%, moderate-to-severe by 127%, and severe by 149%.

Dr Paul Williams, who conducted the research, said: "My top priority now is to investigate other flight routes around the world. We also need to investigate the altitude and seasonal dependence of the changes, and to analyse different climate models and warming scenarios."

Read more at <http://bit.ly/tubulenceresearch>



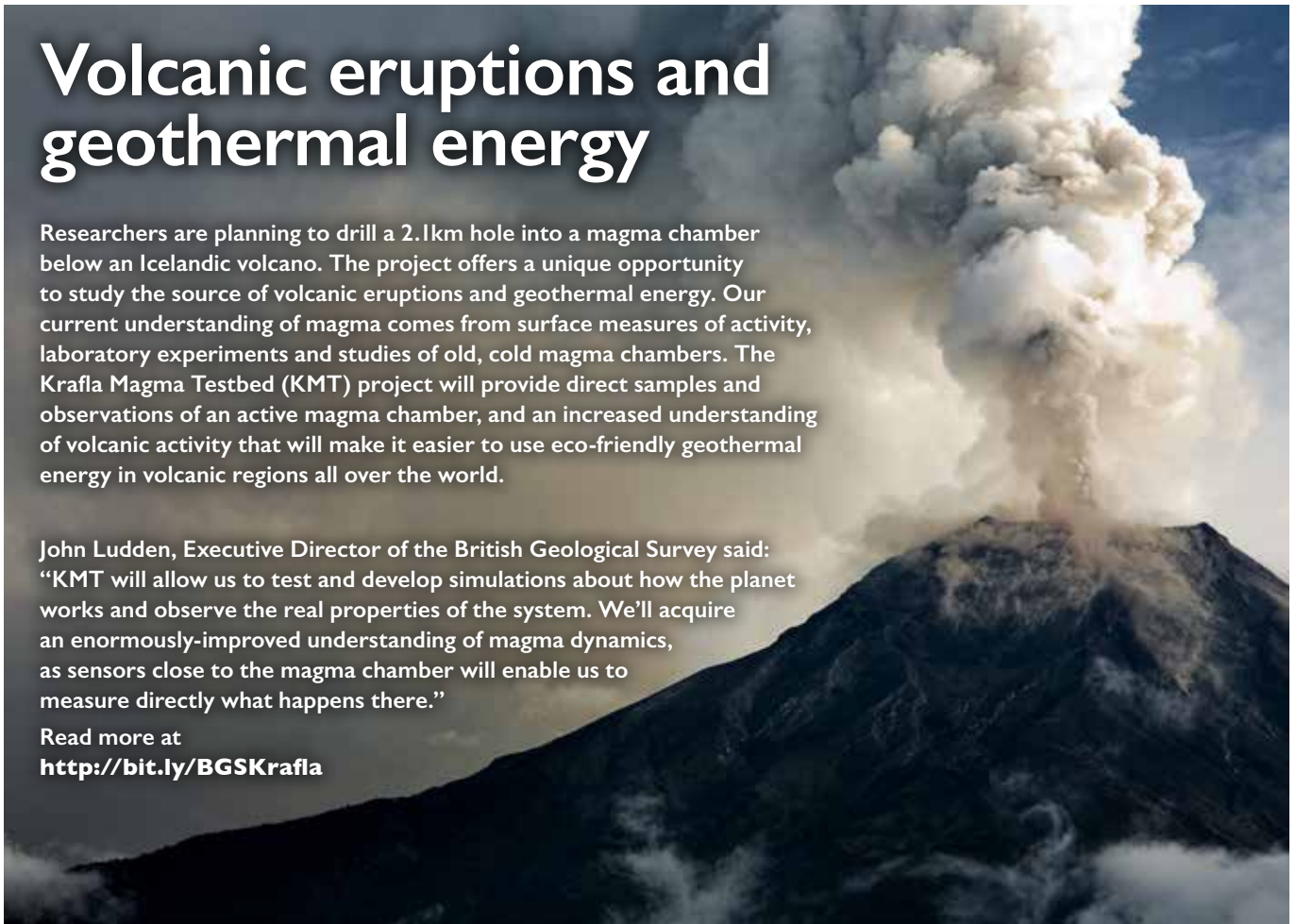
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## Volcanic eruptions and geothermal energy

Researchers are planning to drill a 2.1km hole into a magma chamber below an Icelandic volcano. The project offers a unique opportunity to study the source of volcanic eruptions and geothermal energy. Our current understanding of magma comes from surface measures of activity, laboratory experiments and studies of old, cold magma chambers. The Krafla Magma Testbed (KMT) project will provide direct samples and observations of an active magma chamber, and an increased understanding of volcanic activity that will make it easier to use eco-friendly geothermal energy in volcanic regions all over the world.

John Ludden, Executive Director of the British Geological Survey said: "KMT will allow us to test and develop simulations about how the planet works and observe the real properties of the system. We'll acquire an enormously-improved understanding of magma dynamics, as sensors close to the magma chamber will enable us to measure directly what happens there."

Read more at <http://bit.ly/BGSKrafla>



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## Microplastics in the bellies of creatures living at the bottom of the ocean



Around half of marine creatures living at depths of more than 2,000 metres in the North Atlantic could be eating microplastic material, marine scientists have discovered.

Researchers at the Scottish Association for Marine Science (SAMS) on a NERC-funded cruise sampled deep-sea starfish and sea snails and found microscopic

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traces of plastic in 48% of the deep-sea starfish and sea snails they sampled.

Winnie Coutene-Jones SAMS

traces of plastic in 48% of those sampled. The amount of plastic they'd ingested was comparable to those found in species living in shallower coastal waters.

Microplastics are small pieces of plastic less than five millimetres in size and, when ingested by sea creatures, can get passed up the food chain.

The researchers showed how even plastics that naturally float such as polyethylene used to make plastic shopping bags, could be found inside brittle stars, sea stars and sea snails.

Read more at <http://bit.ly/SAMSplastics>



# Tackling global challenges

Many of the serious challenges we face, including health and humanitarian crises, conflicts, the environment, the economy, domestic violence and the impacts of technology on society are global in nature, and can only be solved with international cooperation.

Leading experts from the UK and developing countries will work together as equal partners, with the aim of building on UK research knowledge, strengthening capacity overseas and addressing serious challenges. Work will cover areas such as the growing epidemic of diabetes and dementia that is affecting both the developing world and Western countries, and creating new technologies for solar power and to improve crop yields.

The Global Challenges Research Fund (GCRF) Research Councils UK Collective Fund is investing £225 million across 37 projects addressing global challenges. Professor Andrew Thompson, the RCUK GCRF champion, said: "These 37 projects build research capacity both here in the UK and in developing countries to address systemic development challenges, from African agriculture to sustainable cities, clean oceans and green energy, to improved healthcare, food security and gender equality. The ambition is to lay the



foundations for a sustained and targeted research effort to address the most intractable challenges faced by the world today: climate change, disease and epidemics, food insecurity, rapid urbanisation, forced displacement and protracted conflict." Here's information on two of the projects set to cover extreme weather and fisheries.

For more information visit <http://bit.ly/GCRFRCUK2017>

## • UK ocean science and robotics to help Western Indian Ocean fisheries

Over 100 million people in the Western Indian Ocean region rely on the sea for their livelihood. It can be difficult and expensive to manage marine resources sustainably, but a new international project led by NERC's National Oceanography Centre will help the area's nine nations to meet those challenges. It will combine local environmental knowledge with UK expertise in Earth observation, marine robotics and mathematical simulations of how the ocean works.

Dr Ekaterina Popova, who is leading the UK work on the project, said "This is a great example of how the UK can use its world-class expertise in oceans and technology to help deliver long-term benefits to developing regions."

Read more at <http://bit.ly/foodPE17>



## • Forecasting extreme weather events in Africa

Sahelian weather events are amongst the most explosive storms in the world, and they are just one of the severe weather effects that affect billions of people across Africa. In the last issue of *Planet Earth* we reported that climate change is responsible for tripling the number of extreme storms in the area over the last 35 years.

NERC's National Centre for Atmospheric Science is leading a £7.8 million project to improve African weather forecasting and help governments prepare for extreme storms, droughts and floods.

Advanced warning of extreme weather events could save lives. The project will give farmers and fishers tailored forecasts and weather warnings via text messages.

The project is funded by the Global Challenges Research Fund. It involves a team of 25 UK and 45 African atmospheric scientists, social scientists and operational forecasters.

Read more at <http://bit.ly/GCRFweather>

Robots can help us understand fisheries.  
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