ICAS Newsletter

Institute for Climate and Atmospheric Science

SCHOOL OF EARTH & ENVIRONMENT   http://www.see.leeds.ac.uk/research/icas/

ICAS PROFESSOR ELECTED OF AMERICAN GEOPHYSICAL UNION

Professor John Plane, an ICAS Associate from the School of Chemistry, has been elected as a Fellow of the American Geophysical Union for his work in space physics and aeronomy.

When announcing the nomination, the American Geophysical Union stated: "Professor Plane has made fundamental discoveries and breakthroughs in several fields of importance to aeronomy and atmospheric chemistry. He is best known for his study of the metal layers in the upper atmosphere that result from the ablation of cosmic dust particles, but he has in fact made substantial contributions to understanding the chemistry of all regions of the Earth's atmosphere. His work has had sustained scientific impact since the early 1980s. His citation would read 'for his outstanding contributions to understanding the chemistry of the Earth's upper atmosphere.'"

Full details on page 4.

Editors: Martyn Chipperfield & Mollie Van der Gucht

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FEATURED PAPER:
INSIGHT INTO OUR CLIMATE FUTURE

New research has shown that limiting the increase in global average temperatures to 1.5°C above pre-industrial levels is still geophysically possible, but requires more ambitious emission reductions than those pledged so far.

An international team of scientists, including ICAS Professor Piers Forster, Director of the Priestley International Centre for Climate, have re-evaluated the current outstanding carbon budget, which is the tolerable amount of greenhouse gas emissions that can be emitted before causing significant changes to global warming.

Their analysis, published in Nature Geoscience, found that the carbon budget is four times larger than estimates stated in the last report from the Intergovernmental Panel on Climate Change (IPCC) in 2014. They conclude that limiting emissions after 2015 to 240 billion tonnes of carbon would


Photo: Emissions at sunset over Leeds. Credit: Pablo Munoz Rodriguez.

still be likely to achieve the goal of limiting warming to 1.5°C. The IPCC estimate was only 70 billion tonnes. Piers Forster, also a lead author of the IPCC report said "Using the latest observations and understanding has allowed us to find a bigger carbon allowance hiding under the carpet. I would say to citizens of the Earth, don't spend it all at once, but they probably already have."

The study cautions that despite a slightly more optimistic outlook on the overall carbon budget, the 1.5°C goal cannot be achieved without continued commitment to ambitious emission reduction targets.

Co-author Professor Michael Grubb, from University College London, said: "Sticking to these budgets will require historically unprecedented rates of emission reductions, and we are already seeing strong political resistance even to the relatively modest cuts proposed so far. The sooner global emissions start to fall, the less the risk that the required reduction rates will become technically, economically or politically unfeasible in future."
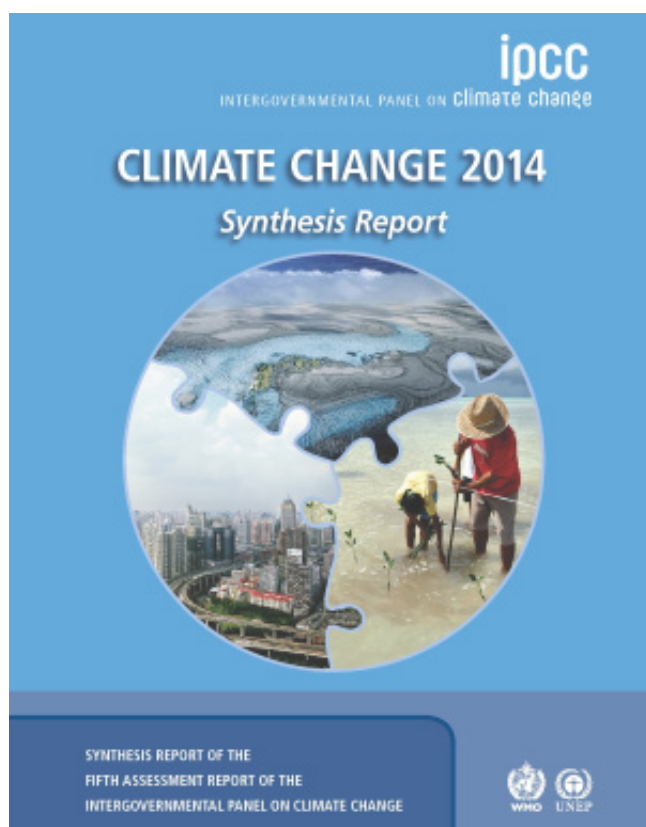
FEATURED PAPER: INSIGHT INTO OUR CLIMATE FUTURE ...continued

Photos: Traffic pollution. Credit: plherrera-iStockphoto

Recent research also highlights that the carbon budget is not the only factor in predicting the rise of global temperatures and its effect on climate change. The doubling of atmospheric CO_2 concentrations has become a standard experiment in climate science, and a convenient way of comparing the sensitivity of different climate models. Early simulations charted a timeline of predicted warming effects on the path to reaching double the amount of CO_2 concentrations in the atmosphere.

In their Nature Geoscience Correspondence, Piers Forster and colleagues warn that we have now gone beyond the warming effects expected at the halfway point on the doubling timeline, before the simulated CO_2 concentrations have actually reached the halfway point. This brings the hypothetical changes to climate calculated by previous researchers' CO_2 doubling simulations closer to becoming a reality such as widespread changes to global temperatures and series effects on ecosystems. Piers explains: "This is because of the way CO_2 absorbs radiation – tonnes of CO_2 emitted earlier in the timeline have a stronger warming effect than tonnes emitted today. This effect of CO_2 warming slowly saturating may sound like a good thing but it alone will not save us as it takes a very long time to naturally remove CO_2 from the atmosphere and every tonne we emit adds to the warming effect."

Richard J. Millar, Jan S. Fuglestvedt, Pierre Friedlingstein, Joeri Rogelj, Michael J. Grubb, H. Damon Matthews, Ragnhild B. Skeie, Piers M. Forster, David J. Frame & Myles R. Allen. Emission budgets and pathways consistent with limiting warming to 1.5°C. Nature Geoscience 10, 741–747 (2017).

RECENT ICAS PRIZES AND AWARDS:

ICAS Professor elected Fellow of American Geophysical Union

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Established in 1962, the Fellows programme recognises American Geophysical Union members who have made exceptional contributions to Earth and space sciences as valued by their peers and vetted by a committee of Fellows. The Fellows programme serves to meet the need for identified authorities who could advise, upon request, the various government agencies and other organisations outside the Earth and space sciences.

The American Geophysical Union (AGU) is the world's pre-eminent organisation of geophysicists, consisting of over 62,000 members from 144 countries. The Fellows programme recognises AGU members who have made exceptional contributions to Earth and space sciences as valued by their peers and vetted by a committee of Fellows. A maximum of 0.1% of the membership of the AGU can be elected as Fellows each year.

Photo: Professor John Plane.

Fellowship and Committee Post for Anna Hogg

Congratulations to ICAS Early Career Researcher Dr Anna Hogg who has been accepted onto the UK Space Agency's (UKSA) Earth Observation Advisory Committee (EOAC).

The aim of the EOAC is to provide advice to the Agency on the strategic direction for the UK's involvement in Earth observation programmes and projects.

Anna has also recently been awarded a 2-year NERC Knowledge Exchange Fellowship linked to the Satellite Applications Catapult.

Royal Meteorological Society Prize for Richard Johnson

BSc Meteorology student Richard Johnson won the 2017 departmental Royal Meteorological Society undergraduate prize for his dissertation and best overall grade.

His research project analysed the meteorological factors which control UK air quality and was supervised in ICAS by **Richard Pope** and **Martyn Chipperfield**.

Photo: Dr Anna Hogg at University of Leeds Alumni event.

SUCCESS: KEN CARSLAW ON HIGHLY CITED RESEARCHERS LIST 2017

Professor Ken Carslaw is on the Clarivate 2017 list of highly cited researchers – the 4th successive year that he has made this list. The Clarivate Analytics Highly Cited Researchers Award is given to those researchers ranking among the top 1% most cited for their subject field and publication year, earning him the mark of exceptional impact. The list is derived from highly cited papers in journals indexed in the Web of Science during an 11-year period, and in the latest listing from 2005 to 2015.

This year's list included only 14 Geoscientists in the UK. To see the full 2017 list, please visit https://clarivate.com/hcr/.

Some examples of Ken's most highly cited papers include:

Kirkby, J; Curtius, J; Almeida, J; et al. Role of sulphuric acid, ammonia and galactic cosmic rays in atmospheric aerosol nucleation. Nature, 476, Issue: 7361 Pages: 429-433. doi:10.1038/nature10343, 2011. Times Cited: 442.

Carslaw, KS; Harrison, RG; Kirkby, J. Cosmic rays, clouds, and climate. Science, 298, Issue: 5599 Pages: 1732-1737. doi:10.1126/science.1076964, 2002. Times Cited: 322

Monks, PS; Granier, C; Fuzzi, S; et al. Atmospheric composition change - global and regional air quality, Atmospheric Environment, 43, Issue: 33 Pages: 5268-5350. doi:10.1016/j.atmosenv.2009.08.021 2009. Times Cited: 302

Merikanto, J; Spracklen, DV; Mann, GW; et al. Impact of nucleation on global CCN. Atmospheric Chemistry and Physics, 9, Issue: 21 Pages: 8601-8616, doi:10.5194/acp-9-8601-2009, 2009. Times Cited: 294

FUNDING SUCCESS

HyTPP for Lake Victoria

The HyCristal Transport Pilot Project (HyTPP) has been funded by UK Aid from the UK Department for International Development (DFID) through the Corridors for Growth Trust Fund (C4G TF), administered by the World Bank (£150k). HyTPP builds on HyCRISTAL and is led by John Marsham. Lake Victoria is Africa's largest lake by area, and the world's largest tropical lake, and is unusual in that its water balance is dominated by on-lake rainfall and evaporation, rather than river in and out flows. The Lake is shared between three countries (Kenya, Uganda and Tanzania), is an area of rapid population growth and has been described as the "nerve centre" of East Africa. Lake Victoria has undergone substantial variations in lake-level over the past 100 years and HyTPP investigates the role of possible changes of Lake Victoria water levels under climate change and the implications for development of the regions transport infrastructure.

Colombian Beans

Andy Challinor is leading a new £170k project funded by Newton Colombia "Bean breeding and adoption in changing climates in post-conflict Colombia".

The project is for one year working with Prefessor of Rural Resource Economics Andrew Barnes at Scotland's Rural College and International Center for Tropical Agriculture (CIAT).

PROJECT NEWS: GCRF AFRICAN SWIFT

Global Challenges Research Fund African Science for Weather Information and Forecasting Techniques

Professor Alan Blyth (National Centre for Atmospheric Science and ICAS) and **Professor Doug Parker** will lead a major new £7.8m Global Challenges Research Fund project called GCRF African Science for Weather Information and Forecasting Techniques (GCRF African SWIFT). The ambition of GCRF African SWIFT is that African forecasting capabilities will improve on hourly and seasonal timescales, and that a lasting research infrastructure will be put in place that translates benefits to the wider developing world.

Accurate weather forecasting is an essential tool of modern society, which brings benefit to people's safety and livelihoods, along with country-wide economic development and prosperity. The GCRF African Science for Weather Information and Forecasting Techniques (GCRF African-SWIFT) programme will develop sustainable African weather forecasting capability, to enhance the livelihood of African populations and improve the economies of their countries.

In the UK we benefit from some of the best forecasting in the world and the UK Met Office is estimated to bring £3 billion of benefit to the UK economy every year. In Africa, the impacts of weather are much higher due to the severity of weather extremes such as storms, droughts and floods, and to the vulnerability of poor people. Comparable benefits to those seen in the UK are not yet possible in Africa without significant improvements in the skill and capability of the forecasts.

GCRF African-SWIFT is a programme of research and capability building funded by Research Councils UK that aims to tackle this problem by delivering a step change in African weather forecasting capability from hourly to seasonal timescales, and by building the research capability to continue those improvements into the future.

The GCRF African-SWIFT consortium, led by the National Centre for Atmospheric Science (NCAS), builds upon existing partnerships between forecasting centres and universities in four African partner countries – Senegal, Ghana, Nigeria and Kenya – bringing together 5 UK partners (NCAS, University of Leeds, University of Reading, CEH, UK Met Office), 10 African Partners (ACMAD, ICPAC, ANACIM, UCAD, GMet, KNUST, NiMet, FUTA, KMet and University of Nairobi) and, as an advisory partner, the UN World Meteorological Organisation (WMO).

Over the 4-year programme, the team of 25 UK and 45 African atmospheric scientists, social scientists and operational forecasters will undertake fundamental scientific research into the physics of tropical weather systems; evaluation and presentation of complex model and satellite data; and communication and exploitation of forecasts.

The GCRF African-SWIFT team will work with forecast users across sectors from aviation to agriculture, energy, water and emergency response to understand how to tailor the provision and delivery of weather forecasts and to ensure improved response to high-impact events (e.g. onset of rains, heat-waves, dry spells, strong winds); rapid emergency response to extreme events, such as urban flooding and prolonged droughts; and increased resilience, through integration of weather prediction into strategies for response to climate change.

GCRF African-SWIFT will-

- Make fundamental research advances to significantly improve weather forecasts in Africa, and the tropics more generally, from the hourly to the seasonal timescale.
- Build the operational capability of the African forecast agencies; deliver state-of-the-art forecasting tools; and improve links and communication with forecast users.
- Assist African partners in developing capacity for sustained training of forecasters, in partnership with African academic institutions and international agencies to yield ongoing forecasting improvements in the coming decades.

- Ensure results are translatable beyond the partner countries to other nations of Africa and the developing world more widely.
- Deliver an impact felt by many millions of ordinary African people, and by large public and private organisations across sectors from aviation to agriculture, energy, water and emergency response.

SWIFT launch meeting DAKAR

The NCAS – led Global Challenges Research Fund African Science for Weather Information and Forecasting Techniques (GCRF African SWIFT) project began with a kick-off meeting held in Dakar, Senegal from 13 – 17 November, 2017. The team aims to improve tropical forecasting ability on hourly to seasonal timescales, build capacity within African forecasting agencies, and improve communication links to forecast users – all of which have the potential to bring benefits to African populations and the wider developing world.

Photos: Above: SWIFT Launch in Dakar. Previous page - Presenter at SWIFT launch in Dakar. Credit: Sinead McSweeney.

GCRF African-SWIFT key facts:

- **Funded by a £7.8m award over 4 years from the Global Challenges Research Fund Research Council (GCRF) UK (RCUK) Collective Fund.**
- **The programme will fund 25 UK researchers and 45 African researchers from 5 UK and 10 African institutions.**
- **Activities will take place in 4 African countries – Senegal, Ghana, Nigeria and Kenya – and results will be translatable beyond the partner countries to other nations of Africa and the developing world more widely.**

WELCOME TO OUR NEW PHD COHORT

In October ICAS welcomed the following 11 new PhD students.

| Student	Project	Supervisor	Funding
Martin Daily	From clouds to cells: Fundamental studies of ice nucleation applied to the atmospheric sciences and cryopreservation	Murray/Morris (Asymptote Ltd.)	NERC DTP 2017 CASE Asympote
Joshua Hampton	Novel ways to see more: Using dual-polarisation Doppler weather radar observations to improve our understanding of winter weather	Neely/Blyth	NERC DTP 2017
Peter Joyce	How will Northern ecosystems respond to global environmental change	Buermann/ Brienen (Geog)/Gloor (Geog)	NERC DTP 2017
Freya Lumb	Exploration of the melting layer using multiple frequency Doppler dual-polarmetric radar techniques	Blyth/Neely	NERC DTP 2017
Felicity Monger	The impacts of semi-natural woodland on flooding in the UK	Spracklen/Forster	School and United Bank of Carbon
James Norman	Wind and solar energy industry	Maycock/Dessai	NERC Industrial CASE World Energy Meteorology Council
Amy Peace	Aerosol pollution impacts on climate projections	Carslaw/Lee/Booth (Met Office)	NERC Industrial CASE Met Office
Ben Silver	The co-benefits of low carbon cities to Asian air quality	Spracklen/Arnold/ Gouldson	AIA (Pan-Asian Life Insurance Group)
William Torgerson	The role of diabatic processes during the intensification of tropical cyclones	Schwendike/Ross/ Short (Met Office)	NERC DTP 2017 CASE Met Office
Meghan Bickle	Interactions of environmental wind-shear and deep moist convection in the tropics	Marsham/Griffiths/ Ross	EPSRC Centre for Doctoral Training in Fluid Dynamics
Andrew Price-Allison	Small-scale domestic combustion and associated emissions	Spracklen	EPSRC Doctoral Centre for Bioenergy

UNIVERSITY OF LEEDS LIVING LAB FOR AIR QUALITY + CLIMATHON

ICAS researchers are collaborating with the Sustainability Service and the Institute for Transport Studies to establish a Living Lab for Air Quality on the University of Leeds campus. Poor air quality causes both respiratory and cardiovascular health problems, and has been linked with conditions such as strokes and dementia. In the UK, exposure to particulate pollution and nitrogen dioxide (NO_2) are thought to cause around 40,000 premature deaths a year, with 700 of these in Leeds itself. Like many UK cities, annual mean concentrations of NO_2 in several locations in Leeds exceed the legally binding EU limit of 40 ug m^{-3}.

Leeds has two air quality monitoring stations that are part of the national Defra network and several stations operated by Leeds City Council. However, our knowledge of air quality in and around the University of Leeds campus, and how it varies, is poor.

Cat Scott, Jim McQuaid, Steve Arnold, Mark Richardson and **Kirsty Pringle** are designing a 12-month campus monitoring strategy to build
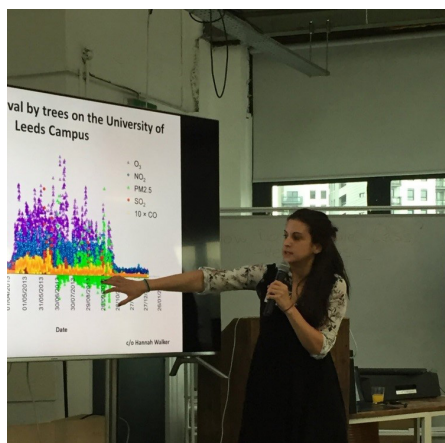
up a picture of air quality on campus and how it varies. The air quality data collected will be visualised by CEMAC and reported online. The team are looking for volunteers to help with measurement collection on campus (email Cat if you are interested: c.e.scott@leeds.ac.uk). This information will help the University to protect staff and students from poor air quality and make strategic decisions about development.

Steve, Jim and Cat also contributed to the recent Leeds Climathon (26-27th October) on air quality.

One hundred and four cities from

45 countries over six continents took part in the Climathon simultaneously, with seven cities in the UK (London, Leeds, Manchester, Edinburgh, Bangor, Bristol and Glasgow). These 24-hour "hackathon" events are designed to tackle an urban climate-related challenge and stimulate innovation and entrepreneurship in the creation of solutions. The Leeds Climathon 2017 was organised by the Leeds Climate Commission, the Priestley Centre and the Cities theme at the University of Leeds. Participants came from a wide range of backgrounds and were encouraged to form teams and develop ideas that would help tackle air quality in Leeds.

Steve introduced participants to the links between climate change and air quality, Jim focussed on air quality in cities and Cat talked about the relationships between urban green spaces and air quality. As well as hearing from a wide range of experts, the teams got to do some practical work. Having been thoroughly briefed by Jim and Cat, each team was given an air monitoring kit and set off around

Photos: Top: Cat Scott briefing the Climathon participants. Bottom: Climathon teams. Credit: Priestley Centre.

UNIVERSITY OF LEEDS LIVING LAB FOR AIR QUALITY + CLIMATHON...continued

Leeds to check out the levels for themselves, which revealed predictable spikes near passing vehicles - demonstrating the need to choose less congested routes and stand back from traffic at junctions. In a separate activity, Katy Wright a community engagement specialist, also challenged them to go out and talk to members of the public about air pollution (with surprising results; some people were not well informed or particularly concerned).

At the end of the 24 hours, the teams pitched their ideas to a panel of judges. All the teams were complimented on their innovative ideas and while the judges would have liked to have found a way of combining all of them, two were picked as joint winners: Plants for Pollution and Be a Stop Idol (a team which featured ICAS's own Hana Pearce). These two teams have been invited to present their solutions to Leeds City Council's State of the City event in December, at which all 99 council members and many stakeholders will get together to discuss air pollution.

Photos: Above: Brainsotrming ideas for Climathon. Below: The teams present their ideas. Credit: Priestley Centre.
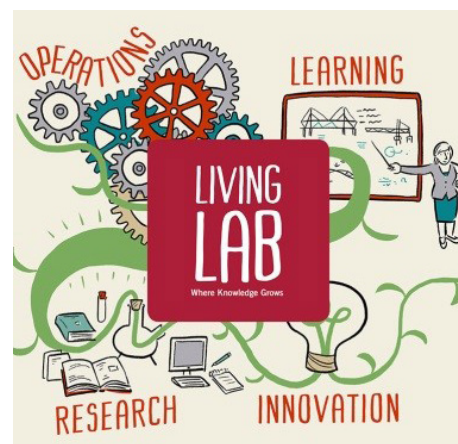
ANNUAL SCIENCE MEETING 2017

Thursday 2nd November saw another successful Annual Science Meeting for ICAS. This year it was held at the new venue of the Leeds Park Plaza which offered more floor space for our large meeting, and good catering. Around 120 members of ICAS attended for a day of talks, poster presentations and plenty of stimulating scientific discussion and interaction.

Keynote speaker Prof John P. Burrows FRS of the Institute of Environmental Physics/Institute of Remote Sensing IUP/IFE at the University of Bremen gave a wide-ranging and engaging talk entitled "Observing the changing Anthropocene from Space".

The poster sessions highlighted recent research from across the institute with 95 posters presented. Prizes were awarded as voted on by all attendees:

ICAS Annual Science Meeting 2017 Award Winners

Individual awards were for poster presentations at the ASM as voted on by all attendees.

- **Most significant scientific advance or discovery by a PhD student**

Winner:
Lauren Marshall: Investigating the climatic forcing from volcanic eruptions using statistical emulation

Runner up:
Luke Conibear: Residential energy use emissions dominate health impacts from exposure to ambient particulate matter in India

- **Most significant scientific advance or discovery by an early career researcher (<8y since PhD)**

Winner:
Richard Pope: Widespread changes in UK air quality observed from space

- **Outstanding research by a PhD student supported by the Met Office**

Winner:
Chris Kelly: Chemistry-climate model simulations of a mesospheric source of nitrous oxide

Runner up:
Oliver Halliday: Convectively Coupled Waves in the CP4-Africa Data
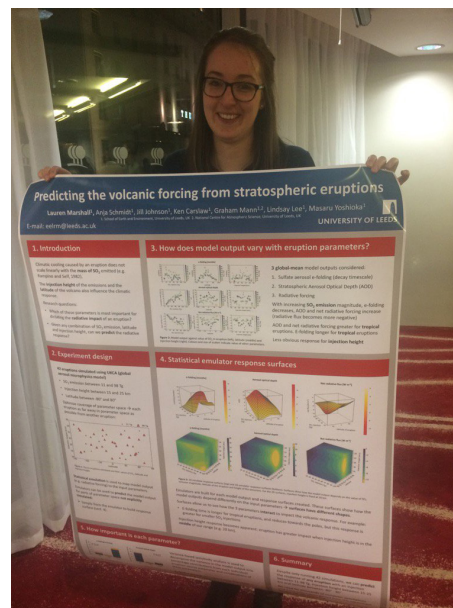
- **Outstanding scientific communication**

Winner:
Anna Hogg: Icebergs in Antarctica

Runner up:
Craig Poku: Aerosol Activation - why a new parameterisation is needed

Photos:Above PhD Student Lauren Marshall with her winning poster; "Investigating the climatic forcing from volcanic eruptions using statistical emulation". Below photos: Poster presentations. Credit: Jim McQuaid.

FEATURED PERSON: ANDREW CHALLINOR

What do you like the most about ICAS?

It's breadth

Why did you choose this career and how did you get here?

I did a PhD, here at Leeds, in boundary layer flows and then got a postdoc in Reading on combined weather and food forecasting. I remember thinking that if I could crack that in the three years allotted then I'd have done something useful (main goal) and proven myself along the way. The postdoc got extended - I didn't quite crack the problem - and eventually I was lured back to Leeds. By then climate change was a big deal for society and for funders.

What scientific achievement are you most proud of?

Showing that the breeding of new maize crops in Africa is already being outpaced by warming.

What does a typical working day involve for you?

I'm glad to report that "typical" varies a lot, from updating a Masters module, to project meetings in Africa or Colombia, and to science discussions with students, postdocs and staff.

What's the most interesting aspect of your job right now?

Its diversity always fascinates me: a core of identity through leading a vibrant and friendly research group plus interactions ranging from first year students to government officials. Right now I'm most excited about a new project looking at the feasibility of using former coca land for common beans, and about the broader collaboration with global agricultural research centres on which that project is founded.

What's the most challenging aspect of your job?

Prioritising. I don't like to delete emails without replying, but like many, I have to.

How do you decompress outside work?

I try to avoid getting too compressed by having a healthy work-life balance, including contemplative prayer / meditation, fell running and seeing if I can out-daft my two children.

What bit of information about you is likely to surprise your colleagues?

I met the Queen twice in one day and had to pretend the first meeting didn't happen. Second time round I (effectively) introduced her to Julia Slingo (now a Dame). I say effectively, Julia kind of snook in next to me, proclaiming to be "his boss" - which she was at the time. Is that little story surprising in any way, or am I just showing off? Anyway, the Queen is great and so is Julia.

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