



ICAS Newsletter

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Institute for Climate and Atmospheric Science

SCHOOL OF EARTH AND ENVIRONMENT

WELCOME FROM NEW DIRECTOR PROF MARTYN CHIPPERFIELD

I am honoured and delighted to have taken on the role of ICAS Director. I have been in Leeds since before the formation of ICAS (around 15 years ago) and it has been amazing and rewarding to see how it has grown into the centre for world-leading atmospheric and climate research that it is today. That success is built on the quality and enthusiasm of our staff at all levels of seniority and experience. I look forward to helping that success continue.

On behalf of everyone I would like to say thank you to the outgoing director, **Ken Carslaw**, for his excellent leadership and dedication to ICAS over the past 3 years. During his time ICAS continued to grow and raise its profile to the outside world. Significant activities that he oversaw include the creation of CEMAC and the Priestley Centre. With the help of Mollie he also set up the ICAS Newsletter that you are now reading. These newsletters really do convey a sense of the enormous range of work that goes on in ICAS and through our external collaborations.

Prof Martyn Chipperfield

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SHINING A LIGHT ON THE DARKNESS OF SOOT IN AIR POLLUTION

Researchers are a step closer to understanding the relationship between the colour of soot particles and the effect of such atmospheric pollution on climate.

Their breakthrough, which relates how transparent coatings on atmospheric soot particles enhance light absorption, will help inform policymakers considering climate change.

A study recently published in *Nature Geoscience*, which involved scientists from ICAS, identifies the specific amount of transparent material at which light absorption enhancement begins to take place, causing soot to become darker.

Lead author Dr Dantong Liu, from the University of Manchester, explained: “The atmosphere contains a mixture of man-made and natural particulates that can have either a warming or cooling effect on climate.”

“Of the pollutant particles, black carbon is the most important contributor to warming. Black carbon absorbs light at all wavelengths, causing a highly efficient and very localised warming effect on the atmosphere.”

The researchers focused on the mix of black carbon and other substances in soot particles that are released by combustion processes, such as wood burning, diesel engines and industry. They tested different types of soot during Bonfire Night in 2014 which, due to weather conditions that day, was particularly polluted and had a high concentration of atmospheric woodsmoke particles.

GLOMAP, a computer model of aerosol microphysical and chemical processes developed by ICAS, was then used to calculate the details of the particle distribution in the atmosphere.

Study co-author [Prof. Dominick](#)



[Spracklen](#), from ICAS, said: “The right mix of black and non-black carbon forms a coating that makes the black carbon interact strongly with light. GLOMAP lets us look at the quantity and ratio of black and non-black carbon contained in particles in the atmosphere.” Different forms of combustion create different ratios of black and non-black carbon and the study identified the specific mass ratio at which the light absorption enhancement begins to take place, causing the soot to become darker.

If there is less than one-and-a-half times more non-black carbon to black carbon on the soot particle – then no enhanced absorption is detected. This is believed to be because the material fails to fully coat the black carbon. This ratio is typically found in diesel exhaust fumes, for example.

But if there is more than three times non-black carbon than black carbon on the soot particle, this creates an optimum lensing effect and light absorption is enhanced. These higher ratios are found on soot from wood burning, which is a major source of soot worldwide from forest fires and farming.

Study co-author Dr James Allan from the University of Manchester

said: “Soot particles are known to affect climate, particularly on local scales where they can influence weather systems – but their exact effect is currently highly uncertain. “However, evidence for this effect in the field has been inconsistent. With a combination of lab and atmospheric measurements we’ve shown that this coating mass has to reach a certain threshold for this to take effect.”

“These findings will help us reconcile results from previous experiments and field observations and should help us develop more accurate climate models in the future.”

Dantong Liu, James Whitehead, M. Rami Alfarra, Ernesto Reyes-Villegas, Dominick V. Spracklen, Carly L. Reddington, Shaofei Kong, Paul I. Williams, Yu-Chieh Ting, Sophie Haslett, Jonathan W. Taylor, Michael J. Flynn, William T. Morgan, Gordon McFiggans, Hugh Coe & James D. Allan. (2017) Black-carbon absorption enhancement in the atmosphere determined by particle mixing state, *Nature Geoscience*, 10, 184–188. [doi:10.1038/ngeo2901](https://doi.org/10.1038/ngeo2901)

Photo: Woman preparing lunch over wood fire, Malawi. Credit: Natalie Suckall.

RESEARCH PAPER IN TOP 100 ARTICLES OF 2016

A study co-authored by researchers from the Institute of Climate and Atmospheric Science and National Centre for Atmospheric Science has been named amongst the top 100 publications of 2016. The original article published in *Science* on the Emergence of healing in the Antarctic ozone layer came in at number 36 in the Altmetric top 100 and number 14 on Discover magazine's 100 Top Stories of 2016.

Dr. Ryan Neely and **Dr. Anja Schmidt** are co-authors on the paper that discovered the hole in the ozone layer is, on average, about 20% smaller than in previous years.

Recovery of the hole has varied from year to year, due in part to the effects of volcanic eruptions. But accounting for the impacts of these eruptions allowed the team to show that the ozone hole is healing, and they see no reason why the ozone hole should not close permanently by the middle of this century. This research was done in collaboration with researchers at MIT, and the National Center for Atmospheric Research.

Dr. Ryan Neely says:

"It is fantastic to see all the positive public interest and broad engagement the results of this research are having."

Dr. Anja Schmidt says: "Our work demonstrates the success of the Montreal Protocol, which provided a solution to a global environmental issue. It is great to see so much public engagement and interest in this topic."

Altmetric tracks millions of different research outputs to identify the top 100 discussed articles. This includes tracking how often research from an article is in the news and how much people engage with it on social media. This strong international collaboration received over 2200 interactions, with over 200 news stories. Congratulations to Dr. Neely and Dr. Schmidt on this great achievement.

Susan Solomon, Diane J. Ivy, Doug Kinnison, Michael J. Mills, Ryan R. Neely III, Anja Schmidt. (2016) Emergence of healing in the Antarctic ozone layer. *Science*, aae0061. doi: [10.1126/science.aae0061](https://doi.org/10.1126/science.aae0061)

TWO ICAS SCIENTISTS NAMED IN 2016 LIST OF HIGHLY CITED SCIENTISTS WORLDWIDE

Two ICAS scientists, **Prof. Dominick Spracklen** and **Prof. Ken Carslaw**, have been named in a list of the most highly cited scientists across the world.

The Clarivate Analytics Highly Cited Researchers Award (formerly known as the Thomson Reuters Highly Cited Researchers Award) is given to those researchers ranking among the top 1% most cited for their subject field and publication year, earning them 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 2004 to 2014.

This year's list included only 15 Geoscientists in the UK. Ken Carslaw was also named in the 2014 and 2015 list. To see the full

list, please visit <http://highlycited.com>.

Some examples of their most highly cited papers include:

Merikanto J; Spracklen DV; Mann GW; Pickering SJ; Carslaw KS (2009) Impact of nucleation on global CCN, *Atmospheric Chemistry and Physics*, 9, pp.8601-8616. doi: [10.5194/acp-9-8601-2009](https://doi.org/10.5194/acp-9-8601-2009)

Righelato R; Spracklen DV (2007) Environment - Carbon mitigation by biofuels or by saving and restoring forests?, *Science*, 317, pp.902-902. doi: [10.1126/science.1141361](https://doi.org/10.1126/science.1141361)

Carslaw KS; Harrison RG; Kirkby J (2002) Atmospheric science: Cosmic rays, clouds, and climate, *Science*, 298, pp.1732-1737. doi: [10.1126/science.1076964](https://doi.org/10.1126/science.1076964)

Carslaw, K.S., Luo, B.P., Clegg, S.L., Peter, Th., Brimblecombe, P., Crutzen, P.J. (1994) Stratospheric aerosol growth and HNO₃ gas phase depletion from coupled HNO₃ and water uptake by liquid particles, *Geophysical Research Letters*, 21, pp.2479-2482. doi: [10.1029/94GL02799](https://doi.org/10.1029/94GL02799)

OUTREACH: BE CURIOUS FESTIVAL

By Amanda Maycock & Cat Scott

ICAS was well represented at the annual University of Leeds Be Curious festival on March 25th. People turned out in droves on a wonderful sunny Saturday morning to learn about research taking place across the university on the theme "About Leeds and Yorkshire".

Our Physical Climate Change group presented a stand on behalf of the Priestley Centre called "Discover Yorkshire's climate: past, present and future", which was located in Parkinson Court. Visitors enjoyed looking at animations of climate model data for the past 120,000 years on the LIDA Omniglobe, specially produced for the event by CEMAC, and facilitated by explanations from climate researchers Ruža Ivanović, Lauren Gregoire and Illka Matero.

The stall was adorned with drawings and paintings of past and future climate scenes from Yorkshire produced by artist James McKay, who works in Engineering. On display was James' original painting of Kilnsey Crag near Conistone 12,000 years ago showing bears and wolves in the area. People were particularly interested to learn about the Leeds Hippos, whose bones were dug up by workmen near Armley in 1851 and which now reside in the Leeds City Museum.

The Physical Climate team had specially commissioned for the event a 3-D printed map of the north of England to use as a tool to explain how the landscape of Yorkshire has changed over the last glacial-interglacial cycle. Children in particular enjoyed building the "Yorkshire ice sheet jigsaw", built for the event from modelling clay, and seeing whether their homes would have been covered by ice at the Last Glacial Maximum around 23,000 years ago.

Chris Smith, Amanda Maycock and Piers Forster talked visitors, including the University's Deputy Vice Chancellor Lisa Roberts, through an animation of climate



Photos: (Front page) Staff from the Physical Climate Change group ready for action! (Above) Where are the highest pollution levels found between Headingley and the University. Credit: Cat Scott.



Photo: (Above) Lauren Gregoire and Illka Matero help a group get to grips with future sea level change on the 3-D Yorkshire map. (Below) Members of the public enjoy taking part in the British Ecological Society's poo matching game. Credit: Cat Scott.



OUTREACH: BE CURIOUS FESTIVAL



model data showing the effects of increasing greenhouse gas emissions over the 21st century on northern European climate. This was accompanied by sea level overlays on the 3-D map to show areas of the Vale of York that are at risk of increased flooding as a result of possible future sea level rise. Copies of James McKay's graphic novel "Dreams of a low carbon future" were also handed out for visitors to take away.

Also representing ICAS were the aerosol modellers in the Biosphere Atmosphere Group and CEMAC with a stand on "Air Pollution: Making the Invisible Visible". As well as a range of air quality monitors, the stand was home to a real (model) erupting volcano! Members of the public had the opportunity to 'measure' the number of particles in the volcanic plume and find out about Kirsty Pringle's local air quality monitoring project, the Air in Saltaire.

The stand also featured a preview of a video made by Laura Kiely, Tom Thorp and Ailish Graham as part of the NERC-funded Making the Invisible Visible project. The video explores how pollution levels vary along two typical cycling routes from Headingley to the University - visitors to the stand were asked to mark on a map where they might expect the highest levels of pollution to occur.

The final ICAS contribution was from Cat Scott who joined Julie Peacock and Karen Bacon from the School of Geography to "Explore Urban Ecology".

Visitors to the urban ecology stand learned about plants that are good for different kinds of pollinators and were encouraged to think about the kind of animals and plants you might expect to find in urban areas. Children (and adults!) were also challenged to identify which animal was responsible for which poo – a useful skill for budding ecologists! Copies of the Leeds Ecosystem Atmosphere and Forest (LEAF) centre's A Brief Guide to the Benefit of Urban Green Spaces were also given away.

The day was a huge success, with more than 1000 people attending the event, and the ICAS stalls were very busy throughout.

Photo: Ruža Ivanović describes the landscape at Kilnsey crag 12,000 years ago as depicted in a painting by James McKay.

EXPANSION PLANS FOR THE PRIESTLEY CENTRE AND MET OFFICE UNIT

The University Capital Group recently gave the go-ahead for an exciting £7.5M investment for the School of Earth and Environment which will allow it to expand into levels 7 and 10 of the adjacent Staff Centre building. This will bring major benefits to ICAS by creating new collaborative space for the Priestley International Centre for Climate and the Met Office Joint Research Unit.

The expansion marks the continued success and growth of the school, which continues to maintain its strong foundations of world leading research excellence and being a national market-leader in student recruitment.

The establishment of the Priestley Centre research platform will help it realise its mission to promote interdisciplinary world-class research into climate solutions. The creation of the Met Office Joint Research Unit strengthens further the links between ICAS and one of our major partners. The dedicated space will enhance collaborations and facilitate the exchange of staff.

A programme of enabling works is currently underway to facilitate the creation of more office and meeting room space. The project is scheduled for completion in autumn 2018.

IMPROVING THE ACCURACY OF ESSENTIAL AFRICAN WEATHER FORECASTS

A comprehensive new handbook about weather forecasting in West Africa could help safeguard lives and resources in the region.

Meteorology of Tropical West Africa: The Forecasters' Handbook was coordinated by the University of Leeds in collaboration with international researchers and meteorological agencies to help the region's weather forecasters. It results from the African Monsoon Multidisciplinary Analysis (AMMA), the biggest research programme into African weather and climate ever conducted.

The handbook includes theory, weather forecasting methods, and case studies of West African weather systems. It follows 15 years of collaborative international research.

Handbook editor and coordinator, [Prof. Douglas Parker](#) a meteorologist at Leeds' School of Earth and Environment, said:

"Accurate weather forecasts are essential for early warning systems that can protect lives, property, and water and food resources. The handbook is the first time any global region has produced a definitive document for forecasting.

"Not only is this handbook a way for new research to be brought rapidly into practice it represents an international effort to disseminate important information to a region that has been neglected in the past."

Handbook co-editor Dr Mariane Diop-Kane, Director of Meteorology at the Agence Nationale de L'Aviation Civile et de la Meteorologie (ANACIM) in Senegal added: "West Africa has a large population dependent on agriculture and rural transport infrastructure, both of which are vulnerable to weather systems."

"Abrupt changes in weather can have devastating consequences on populations, their health

and economies. The use of the handbook as a training tool will provide a new resource for forecasters to help safeguard this region."

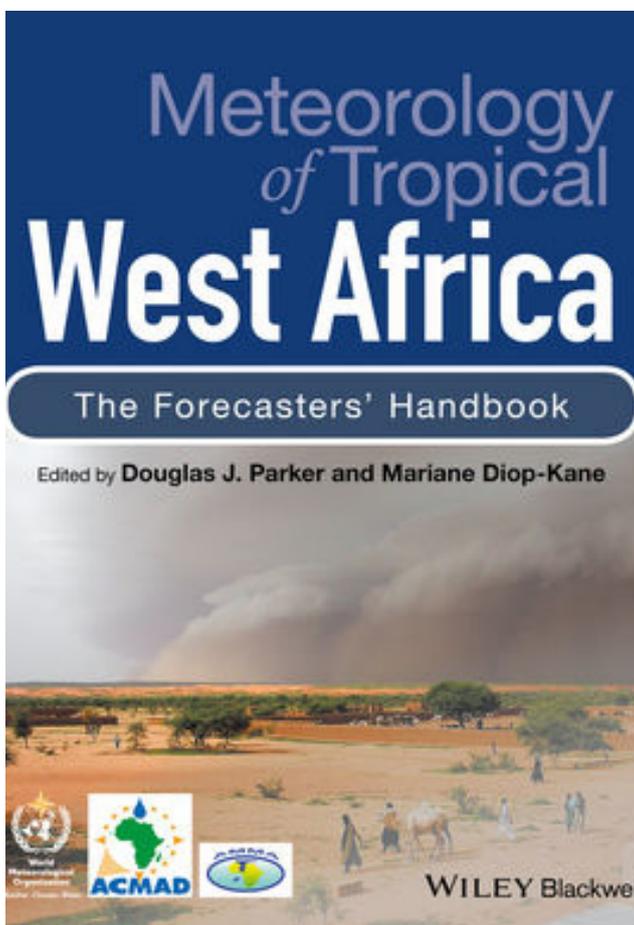
Many of the new forecasting methods described in the handbook were developed as part of the training and coordination of 15 West African forecasters by Jean-Philippe Lafore from Météo France. These West African forecasters provided support during a four-month AMMA field campaign in 2006 by producing bespoke weather forecasts used in the deployment of research instruments such as weather balloons and research aircraft.

West African forecasters further developed these new forecasting methods at the University of Leeds in 2012 during a three-month stay. The forecasters interacted with researchers from the UK, France and Germany, to combine the latest theoretical data with the experience weather forecasters have gained from professional practice.

The Met Office in the UK has actively supported the project, contributing to the scientific workshops and leading two of the book's 11 chapters. The Met Office is providing funding to purchase copies of the book and ensure the distribution of Meteorology of Tropical West Africa: The Forecasters' Handbook to West African forecasters and training centres. The book will be used by the Met Office as a resource for the training of forecasters in African and tropical weather prediction.

Meteorology of Tropical West Africa: The Forecasters' Handbook English language edition is published by [Wiley Publishing](#).

Meteorology of Tropical West Africa: The Forecasters' Handbook. [Douglas J. Parker](#) (Editor), [Mariane Diop-Kane](#) (Editor) ISBN: 978-1-118-39130-3 496 pages, April 2017, Wiley-Blackwell.



ICAS ANNUAL SCIENCE MEETING NOVEMBER 2016

The ICAS Annual Science Meeting took place on 3 November 2016. The meeting held at the Doubletree Hilton Leeds was full science programme made up of three oral and poster sessions (following ICAS's research themes on <http://www.see.leeds.ac.uk/research/icas/research-themes/>). Invited Speaker Prof. Thomas Peter from ETH Zurich gave an enlightening keynote address on "The atmospheric sulfur cycle during quiescent and volcanically perturbed conditions: Impacts on atmospheric chemistry and climate".

The poster sessions highlighted recent research from across the institute with 127 posters presented. Prizes were awarded as voted on by all attendees:

ICAS Annual Science Meeting 2016 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: **Thomas Richardson** for Demystifying land precipitation change: Past, Present and Future
Runner up: **Tim Keslake** for The influence of fire emissions on reactive gases and aerosols: A case study for composition data assimilation

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

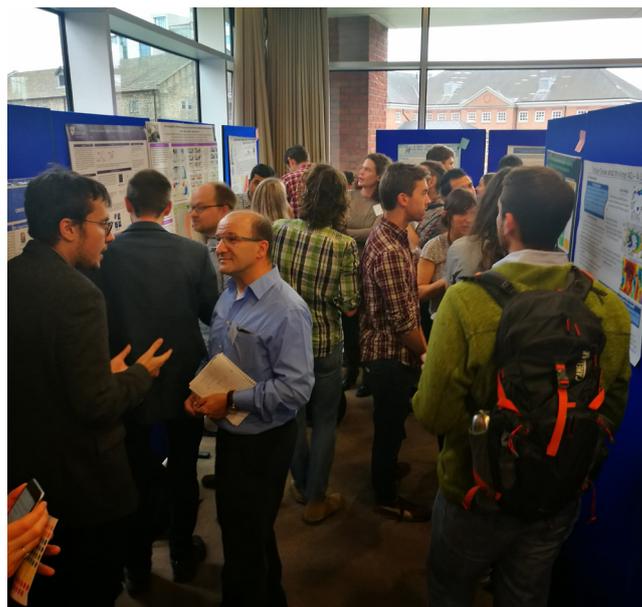
Winner: **Joe McNorton** for Recent trends in atmospheric methane and latest work on Isolating isotopologues
Runner up: **Cat Scott** for The impacts of deforestation on projected warming and latest work on Quantifying variability in natural aerosol radiative effects

Outstanding research by a PhD student supported by the Met Office

Winner: **Beth Woodhams** for Severe convective storms in East Africa
Runner up: **Hana Pearce** for Nitrate aerosol: implications for European air quality and climate

Outstanding scientific communication

Winner: **Joe McNorton** (postdoc)
Runner up: **Thomas Thorp** (1st year PhD student)



Group achievement:

The Ice Nucleation Group, led by **Prof. Ben Murray**, for creative and innovative research in many new directions, including new instrument development to push the frontiers of ice nucleation measurements, commercialisation of research, new field deployment capability, and scaling up of laboratory research to global and weather-scale models.

Photos: Back row (L-R) Ken Carslaw (former Director of ICAS), Beth Woodhams, Thomas Richardson, Joe McNorton, Tim Keslake. Front row (L-R) Hana Pearce, Cat Scott, Thomas Thorp. Credit: Mollie Van der Gucht.

FEATURED PERSON: JULIANE SCHWENDIKE

What is your role in ICAS?

I am a lecturer in Meteorology and the Programme Leader in Meteorology and Climate Science.

What do you like the most about ICAS?

I really like that no harsh boundaries exist between individual research groups and that the borders between research groups are fluid. The collegial, collaborative and welcoming atmosphere makes ICAS a great place to work.

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

I greatly enjoy research and teaching and being a lecturer gives me the opportunity to do both.

I did my PhD at the Karlsruhe Institute of Technology, Germany, on how convection embedded in an African Easterly wave over West Africa led to the formation of Hurricane Helene (2006). I also have a Diplom (5-year degree with one-year research thesis) in Meteorology.

I moved to Leeds from Melbourne, Australia, where I was a post-doctoral research fellow at Monash University working on the Hadley and Walker circulations, as well as on tropical cyclones.

What scientific achievement are you most proud of?

Developing a new method to describe local and regional Hadley and Walker circulations.

What does a typical working day involve for you?

An average day at work involves meeting with colleagues or students, teaching, working on either a paper or a proposal, and setting up or analysing model simulations.

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

The most exciting aspect of my job is that I can start building my own group and to develop ideas of what research I would like to do in the future. As I am interested in tropical cyclones it gives me great pleasure to supervise student's projects on this topic and to work on a project looking at tropical cyclones in South-east Asia.

What's the most challenging aspect of your job?

At the moment the most challenging aspect of my work is to find enough time to do research.

How do you decompress outside work?

I enjoy doing sports, reading books and going to the theatre.

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

I love to investigate the weather in the tropics, but I don't want to live there. It's way too hot and humid, but visiting often is perfectly fine.

