



ICAS Newsletter

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Institute for Climate and Atmospheric Science

SCHOOL OF EARTH & ENVIRONMENT <https://environment.leeds.ac.uk/institute-climate-atmospheric-science>

DIRECTOR'S CUT

I'm pleased to welcome you to the Autumn 2020 ICAS Newsletter.

This is my first as ICAS Director after taking over from Prof Martyn Chipperfield in July. I'd like to personally thank Martyn for his commitment to supporting ICAS over the past 3 years and ensuring that we continue to develop from strength to strength. The COVID-19 pandemic is creating challenges that are unprecedented in our lifetimes. I admire all of you for adapting to the extraordinary changes in our working and personal lives. The content of this newsletter is a testament to the continuing dedication of our PhD, postdoctoral researchers and staff in spite of the myriad impacts of COVID-19 on our lives.

At this time of the year we look forward to welcoming the new cohorts of PhD and MRes students to the Institute. I'm delighted this year that we have bumper intakes of 21 PhD and 13 MRes students joining us from all over the world. As part of this we welcome the first intake of students from the SENSE Centre for Doctoral Training co-led by Dr Anna Hogg in ICAS.

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SUCCESSSES: ICAS PROFESSOR ELECTED AGU FELLOW

This year sixty-two individuals have been elected to the American Geosciences Union 2020 Class of Fellows.

One of which is [Professor Martyn Chipperfield](#), former ICAS Director for “world-leading contributions to atmospheric model development and the understanding of chemistry and dynamics in the troposphere and stratosphere”.

AGU say “The members of this year’s class of Fellows have made exceptional contributions in our Earth and space sciences community through breakthrough, discovery, or innovation in their disciplines. Since 1962, AGU has elected fewer than 0.1% of members to join this prestigious group of individuals.”

“Thanks to their dedication and sacrifice, AGU Fellows serve as global leaders and experts who have propelled our understanding of geosciences. We are confident that they will remain curious and relentlessly focused on answers as they continue to advance their research, which pushes our boundaries of knowledge to create a healthy planet and beyond.



We are grateful for their invaluable contributions. We also recognize that numerous individuals were pivotal to their success, and we thank them too.”

The AGU Fall Meeting is online everywhere this year, so a virtual ceremony will be held to celebrate the new class of Fellows as well as the other Honors and Recognition recipients.

Huge congratulations to Martyn for all his hard work and dedication to science.

He joins other ICAS professors

Piers Forster and Ken Carslaw who were elected AGU Fellows in 2019. ICAS Associate Prof John Plane (School of Chemistry) is also an AGU Fellow, which helps to demonstrate the extent of world-leading atmospheric science which happens in Leeds.

Photo: AGU Fellow Prof Martyn Chipperfield

DIRECTOR’S CUT CONTINUED...

Unfortunately, we aren’t able to meet in person this year for the ICAS Annual Science Meeting. In place of this we will be running a series of themed workshops during the academic year and I’m pleased that the first of these on “Cloud Feedbacks and Climate”, held jointly with the Met Office, is reported in this edition.

We also report on new ICAS publications ranging from the environmental impacts of the COVID-19 lockdowns to alarming rates of icesheet melt causing global sea level rise.

Our Featured Person is Mollie Van der Gucht who has a key role as Research Support Administrator for ICAS.

Happy reading!

Photo: ICAS Director Dr Amanda Maycock.



SUCSESSES: ICAS PROFESSOR AWARDED PRESTIGIOUS ROYAL METEOROLOGICAL SOCIETY PRIZE



An ICAS professor has been awarded the 2019 Adrian Gill Prize by the Royal Meteorological Society.

Presented to [Professor Ken Carslaw](#), the award recognises his eminence in atmospheric science research and aerosol modelling. His is one of 18 prizes [announced by the Royal Meteorological Society](#), recognising people and teams who have made exceptional contributions relating to weather, climate and associated disciplines.

Ken's influence on the field of atmospheric science has been to bring aerosol physics from the margins, into the heart of climate understanding and climate modelling. This body of work has transformed operational models for weather, climate and air quality modelling, and the appreciation of uncertainties in projections of climate change.

On accepting the award, Ken said: "I am honoured to receive the Adrian Gill award, and very grateful to the Royal Meteorological Society and my nominators.

"Although it is almost a cliché to say that this award should be shared with all my great collaborators, it is absolutely true. I am never more productive or inspired than when I am working with sharp-minded people who question my

ideas.

"I'm also grateful to the University of Leeds and to ICAS, which have provided a stimulating environment for collaboration and for pushing new ideas forwards."

Having made fundamental discoveries in the physical processes of aerosol formation, and applying these discoveries to numerical models used for weather and climate prediction, Professor Carslaw has had an outstanding career in the field.

The Adrian Gill Award, named after the Australian meteorologist and oceanographer, is awarded annually to a member of the Society who has made a significant contribution to their field in the preceding five years.

Full details of all awards and winners for 2019, along with citations and acceptance messages, can be found on the [Royal Meteorological Society website](#).

Photo: Prize winner Professor Ken Carslaw

CHRIS SMITH WINS NERC-IIASA COLLABORATIVE RESEARCH FELLOWSHIP

[Chris Smith](#) was awarded a three-year [NERC-IIASA collaborative research fellowship](#) which started in May.

He'll be extending the simple climate model that he and others developed for the IPCC's Special Report on 1.5C° to provide climate impact projections to various emissions scenarios, and working with International [Institute for Applied Systems Analysis](#), Austria to integrate climate impacts on energy supply and demand into socioeconomic projections

SUCCESSES: PRIESTLEY CHAIR AWARDED AN OBE



Professor Jason Lowe, Chair in Interdisciplinary Climate Research at the Priestley Centre and Institute for Climate & Atmospheric Science, has been awarded an OBE for services to climate science.

A world-leading expert in his field, Professor Lowe is also Head of Climate Services at the Met Office. His work has helped the UK and other countries plan for and respond to the impacts of climate change, directly shaping national and international policy and informing vital decisions to protect businesses and communities.

He has pioneered a more collaborative approach to climate research, bringing together climate science with other academic disciplines, such as economics and social sciences, and emphasising working directly with end-users, from private enterprise to local government.

Jason led the multinational 'Avoiding Dangerous Climate Change' programme from 2009, the first in the world to use a collaborative approach between academia and government which has been highly influential in both UK and international policy.

Jason said: "Climate change is one

of the biggest issues facing humans today. We are already seeing the effects of rising temperatures and changes in rainfall on the UK and around the world.

"As we build towards the next major climate conference, CoP26, which will be hosted by the UK in 2021, it is exciting to be working alongside colleagues in the Priestley Centre developing solutions to the challenges that the changing climate brings."

Jason is one of three leading academic researchers at the University of Leeds to be recognised in the Queen's Birthday Honours.

Cath Noakes, Professor of Environmental Engineering for Buildings, has been given an OBE for "services to the COVID-19 response". Cath studies indoor air pollution and has research links with members of ICAS. Professor Sheena Radford, the Director of the Astbury Centre for Structural Molecular Biology, has also been honoured with an OBE, for her research at the frontiers of molecular biology.

Professor Simone Buitendijk, Vice-Chancellor of the University, said: "It is fantastic news that four colleagues have been recognised in the Queen's Birthday Honours

List. What unites them is their strong belief in advancing research and knowledge to benefit the public and the wider community.

"The honours represent a considerable personal achievement to each of the recipients but they are also a reflection on the strengths and ethos of the University and the vision for the city of Leeds to be seen as a place of research and teaching excellence."

Photo: OBE recipient Professor Jason Lowe.

FEATURED PAPER: PREDICTING TORNADOES ON UK COLD FRONTS FOR THE FIRST TIME

Weather forecasters can more accurately predict when a tornado is likely to hit the UK thanks to a new tool devised in a partnership between the ICAS and the Met Office.

Around 30 tornadoes occur in the UK each year, 40% of which develop on cold fronts – but a lack of forecasting methods for these conditions means they strike without warning.



Above photo: Wind damage 2009, Monkwood, Hampshire. Credit: Matthew Clark

Now researchers at Leeds and the Met Office have for the first time created a prediction for how likely tornadoes are to occur on cold fronts, meaning a more accurate assessment of tornado risk can be made before a cold front crosses the UK.

[Matthew Clark](#), a Met Office scientist who is currently studying for a PhD at ICAS, said: “Tornadoes are a relatively common weather hazard on UK cold fronts, but the Met Office have never before had any way of predicting which cold fronts are likely to produce tornadoes, nor did we understand why tornadoes occurred in some fronts but not others.

“These findings should help to improve the UK forecasts of localised, intense wind damage associated with these kinds of weather system. This should enable organisations and people to take precautions and minimise damage and risk.”

Mr Clark and [Douglas Parker](#), Professor of Meteorology at ICAS, analysed tornado reports from the Tornado and Storm Research Organisation (TORRO), radar imagery and surface analysis charts from 114 weather events over a 35 year period. One such event was the largest tornado outbreak in European history when 104 tornadoes touched down across England and Wales on 23 November, 1981, leaving a trail of damage in their wake.

The researchers identified patterns across the weather events, establishing which cold fronts were likely to produce a single tornado, which could produce several, and which would produce none. The research found that most of these tornadoes form when a region of strong winds approaches the front from the cold side. This creates a bulge in the front which helps to make it sharper, increasing the contrast in wind speed and direction across the front. Where this contrast increases over time, tornadoes are more likely to “spin up” along the front. Occasionally, relatively large outbreaks of tornadoes can occur in this situation. Forecasters can recognise these weather patterns, which alert them to the general risk of a tornado.

Matthew and Doug also used their findings to create a predictive tool, which is already being used on an experimental basis by the Met Office to pinpoint regions at increased risk of tornadoes. Using the wind fields ahead and behind the cold front, forecasters can now compute a percentage probability that tornadoes will happen.

The tool is currently being tested



Above photo: Wind damage - 29 May 2015, Binegar, Somerset. Credit: Matthew Clark

in the Met Office, and was put to use on 29 February this year, successfully predicting the risk of tornadoes in southeast England, with a tornado occurring in Kent as the cold front swept through during the morning. Although use of the product is experimental at the moment, it is hoped that in time it will allow for appropriate messaging to be issued to local responders and other organisations such as airports.

Met Office Chief Meteorologist Paul Davies said: “By explaining, for the first time, “how” and “why” tornadoes form in a given weather system, meteorologists are much better prepared to anticipate events in advance, to interpret and challenge the results of numerical weather prediction models, and to communicate their confidence in a given forecast.”

Front page photo: Storm damaged trees 2016 Ternhill, Shropshire. Credit: Matthew Clark

Reference: Matthew R. Clark Douglas J. Parker (2020) **Synoptic and mesoscale controls for tornadogenesis on cold fronts: A generalised measure of tornado risk and identification of synoptic types** QJRMS doi.org/10.1002/qj.3898

FEATURED PAPER: LOCKDOWN IN CHINA SAW ONLY A MODEST DROP AIR POLLUTION

The two pollutants most harmful to human health, PM2.5 and Ozone, were only slightly reduced or barely affected during the lockdown in China, according to a new study.

The ICAS and the Southern University of Science and Technology in Shenzhen, China have undertaken a detailed analysis of key pollutant concentrations from January 2015 to April 2020 to isolate the changes during the lockdown period.

Large improvements of air quality in China during the lockdown have been widely reported, however, the study's findings reveal PM2.5 – fine particles measuring less than 2.5 µm – had a modest reduction of 11% across China, and was not reduced in north-east China.

While concentrations of nitrogen dioxide (NO₂) did show improvements with a 27% decrease across China during the lockdown, the study found almost no change in ozone concentrations.

Lead author [Ben Silver](#), from ICAS, said: "The largest reductions of NO₂ were in Hubei province, where NO₂ concentrations were over 50% lower

during the lockdown.

"Much smaller reductions were observed for other pollutants. PM2.5 particles had only a modest reduction and are the most harmful constituent of air pollution, as they travel deep into the lungs and bloodstream and damage the lungs and heart.

Understanding the impacts of COVID-19 control measures on air quality has been complicated by several compounding factors, including the Lunar New Year, which has a well-documented impact on air pollution in China and the rapidly changing air quality in China during recent years.

The study, published in the journal *Environmental Research Letters*, analysed five years of data from 1,600 air quality-monitoring stations in China to isolate the impact of the lockdown on air quality. The study controlled for and quantified the inter-annual trend, seasonal variation and effect of Lunar New Year on air quality in each province and city across China.

To understand the impact of the control measures during the

COVID-19 outbreak, the researchers compared pollutant concentrations in 2020 with expected concentrations had the COVID-19 outbreak not occurred.

Senior author [Professor Dominick Spracklen](#), from ICAS, said:

"Although China's air quality has improved in recent years, indoor and outdoor air pollution still has serious health impacts, with 12% of deaths in China in 2017 attributable to it.

"Understanding trends in air quality is therefore essential to assess the effectiveness of recent air quality measures and help inform future air pollution mitigation. The application of control measures during the COVID-19 outbreak enabled us to analyse the potential air quality improvements resulting from a reduction in emissions."

Co-author Xinyue He, from the Southern University of Science and Technology, Shenzhen, China, said: "Chinese NO_x (nitrogen oxide) emissions are dominated by transport (35%), industry (35%), and power generation (19%, all of which are likely to have been affected by the lockdown. Reduction in emissions from these dominant sectors and



FEATURED PAPER: LOCKDOWN IN CHINA SAW ONLY A MODEST DROP AIR POLLUTION CONTINUED...

short lifetime explain the larger reduction in NO₂ compared to other pollutants.

“PM_{2.5} concentrations in China are heavily influenced by residential emissions, which are likely to have been less affected by the control measures.

“The larger relative reductions in PM₁₀ and CO (carbon monoxide) compared to PM_{2.5}, may be due to a greater reduction in primary emission sources and the greater contribution of secondary aerosol to PM_{2.5}.

“Reductions in emissions of volatile organic compounds and NO_x, combined with changes in PM concentrations, resulted in little overall change in ozone concentrations.”

Spracklen added: “The modest improvement in air quality during the lockdown, despite very large reductions in emissions from some sources such as traffic, highlights the challenge facing China as it tries to further improve air quality.

“Our study provides insight into the effects of future emission reductions and can help inform development of effective air pollution mitigation strategies.”

Reference:

Ben Silver, Xinyue He, Steve R Arnold, and Dominick V Spracklen.

The impact of COVID-19 control measures on air quality in China.

Environmental Research Letters.

<https://doi.org/10.1088/1748-9326/aba3a2>

Photos:

Bottom of previous page: Zhengzhou, China. Credit: V.T. Polywoda.

Above: Air pollution at Great Wall of China. Credit-M. Ogilvy-Gucht



WELCOME TO NEW PGR COHORT

Student	Project	Supervisors	Funding
Samuel Bancroft	A new methodology for assessing future food production based on machine learning, remote sensing and crop models	Challinor/Comp: Cohn/Cohen/Ext: Julia Chatterton	SENSE CDT CASE Unilever 2020
Lauren Burton	Palaeo constraints on the 1.5oC World: What does Pliocene tell us about the long-term effects of atmospheric CO2 at ~400ppmv	Haywood/Dolan/Hill	NERC Panorama DTP 2020
Serafeim Christodoulou	Model which predicts the Föhn Effect in Crete, Greece	Mobbs/Burton/Colfescu	NCAS
Connor Clayton	Co-benefits of a low carbon economy: Improved air quality and reduced global warming	McQuaid/Phys: Dan Marsh	Alumni/Priestley Scholarship
Jonathan Coney	Use of artificial intelligence to understand mountain weather and climate processes	Ross/Denby/Comp: Wang	PANORAMA Met Office CASE
Emily Dowd	Detection and quantification of local methane sources using novel high resolution satellite data	Wilson/Chipperfield/Geog: Gloor/Ext: Manning(MO)/Doherty (Edinburgh)	SENSE CDT CASE Met Office 2020
Sophie Durston	Causes and solutions for the Great Atlantic Sargassum Belt	Grosvenor/Carslaw/Ext: Wolf/Gommerginger (NOC)	SENSE CDT CASE Pixalytics Ltd 2020
Bryony Freer	Antarctic grounding line migration from ICESat-2 altimetry	Hogg/Ext: Marsh (BAS)/Fricker(UnivCalifornia)	SENSE CDT CASE isardSAT Ltd 2020
Amethyst Johnson	Boundary layer processes in tropical cyclones in the Met Office operational forecasting model	Schwendike/Ross/Ext: Lock/Edwards/Keppert(MO)	PANORAMA Met Office CASE
Rebecca Kelly	Improved understanding of arctic atmospheric composition and climate through exploitation of satellite observations	Arnold/Pope/Ext: Jones(BAS)	SENSE CDT 2020 CASE MO
Eszter Kovacs	Using satellite data to understand the influence of marine biogenic activity on high latitude clouds and climate	Grosvenor/Carslaw/Ext: Mulcahy(MO)/Lachlan-Cope(BAS)	SENSE CDT 2020
Fan Qiao	Improved understanding of Chinese air quality to inform emission control strategies	Spracklen/Arnold	AIA Air Quality in Asia/3.5 yrs
Paolo Sartorelli	Restoration of degraded tropical forests in Vietnam	Spracklen/Geog: Phillips	ERC DECAF
Trystan Surawy-Stepney	Ice speed and AI: Using satellite data and advanced computer techniques to detect ice sheet change	Hogg/Comp: Hogg/Ext: Cornford	Alumni/ESA/SEE
Ben Wallis	Change in the ice speed and mass balance of the Antarctic ice sheet from satellite observatory	Hogg/McMillan/Comp: Hogg	PANORAMA DTP
Wenlu Wu	Application of multi-scale chemical mechanism to simulate the interactions between regional and local air pollution	Arnold/Spracklen	SUSTech 2020
Fenn Sternburg	Interaction of Atmospheric Deep Convection with the Tropical Circulation	Parker/Comp	Fluids CDT 2020
Katie Thompson	The size, sources and transport of the seeds of ice in clouds	Murray/Noakes	EPSRC Aerosol Science CDT 2020
Isobel Louise Lloyd	Measuring and modelling greenhouse gas fluxes between agricultural soils and the atmosphere	Valadares Galdos/Geog: Chapman/Grayson/Ext@ Ross Morrison (CEH)	NERC DTP 2020
Rachel Dobson	Integrating climate and species modelling to predict movements of migratory and nomadic birds in sub-Saharan Africa	Challinor/Dallimer/Koehler/Ext: Robert Cheke (Natural Resources Institute), Stephen Willis (Durham University)	NERC DTP 2020
Megan Tresise	Identifying strategies for net zero arable farming in England and Wales under future climate change pressures	Valadares Galdos/Biology: Firbank, Kunin	N8 Agrifood Programme
Jacob Perez Regime	Behaviour of Earth's jet streams and role for extreme weather	Maycock/McKenna/Maths/Computing	Fluids CDT 2020

UNIVERSITY OF LEEDS – MET OFFICE CLOUD FEEDBACKS AND CLIMATE WORKSHOP

On 5th November 2020, ICAS hosted the virtual “Cloud Feedbacks and Climate” workshop where we welcomed scientists from within ICAS and from the Met Office to discuss our work and ideas on this important topic, as part of our Met Office Academic Partnership (MOAP).

A major aim was to increase communication between different research groups within ICAS and with the Met Office, which has suffered during these times of working from home. The workshop was part of the activities being planned to replace our ICAS Annual Science Meeting, which isn't possible this year due to COVID-19 restrictions.

Cloud feedbacks refer to how cloud properties respond to surface temperature, sea-ice and land changes resulting from climate change. Cloud feedbacks are extremely important because they are one of the main causes of disagreement between different climate models in terms of the simulated temperature response to changing greenhouse gases.

The workshop also built upon a number of recent grant successes at Leeds as part of the NERC Clouds Strategic Programme (M-Phase, DC-MEX), the EUREC4A field campaign in early 2020, new CMIP6 results and other ongoing work.

The workshop comprised two oral presentation sessions in the morning, with poster and discussion sessions in the afternoon. The first oral session had a global climate modelling perspective. Piers Forster (ICAS) described how we might use observations and detailed process modelling to constrain climate sensitivity and cloud feedbacks as part of the EU H2020 funded CONSTRAIN project.

Mark Ringer (Met Office) discussed the similarity of cloud feedbacks between models with and without the consideration of oceans, and showed how models that produce more positive shortwave, but more negative

longwave, cloud feedbacks have the largest climate sensitivities. Yoko Tsushima (Met Office) showed how varying the representation of physical processes in a perturbed parameter model ensemble can give insight into which processes are important for cloud feedbacks and which cause the greatest uncertainty. William Ingram (Met Office) described how greatly increasing model vertical resolution had remarkably little effect on cloud feedbacks in the Met Office HadGEM3 model.

The second oral session was focused on cloud ice microphysics, kicking off with a great summary of the EUREC4A field campaign by Alan Blyth (NCAS), which focused on subtropical shallow convection, and the upcoming DC-MEX field campaign that will study clouds forming over a mountain in New Mexico. The importance of considering ice-nucleating particles (INPs) in cloud feedbacks was highlighted in an informative talk by Ken Carslaw (ICAS), summarising the background and objectives of the recently funded M-Phase project with Ben Murray (ICAS) and Paul Field (Met Office/ICAS).

The influence of INPs and secondary ice processes on clouds was further explored in a talk by Rachel Hawker (ICAS), who showed results from high resolution modelling of deep convection.

The poster session included 18 posters presented by both ICAS and Met Office researchers. Concurrent breakout rooms were used with four poster blocks and 25 mins of discussion for each poster.

By all accounts, the poster sessions generated a great deal of discussion on topics encompassing feedbacks in climate models, ice cloud microphysics and the use of drones for monitoring difficult to reach places.

Finally, we held a discussion session where the opportunities for synergy and collaborations across ICAS and the Met Office were discussed,

together with opinions on the “big” science questions that should be addressed and the ways in which we might use observations and high resolution modelling to constrain cloud feedbacks. Details of the discussions, alongside the posters, can be found on the conference website at <https://conferences.leeds.ac.uk/icas/>.

Overall, the virtual workshop was a great success, and it was fantastic to see different parts of ICAS and the Met Office team discussing science together, particularly during these times when face-to-face discussions are not possible. We are sure the workshop will lead to more collaboration between ICAS and the Met Office on the current and upcoming projects and even future proposals.

Keep an eye out for other similar workshops on different topics in the future. Finally, we wish to thank all attendees for making the day a great success, and special thanks go to Mollie Van der Gucht for her behind-the-scenes organisation of the meeting and for setting up the website.

[Dan Grosvenor](#), [Jennifer Fletcher](#), [Leo Saffin](#), [Mark Tarn](#) (Organising Committee for Cloud Feedbacks and Climate workshop)

FEATURED PERSON: MOLLIE VAN DER GUCHT

What is your role in ICAS?

I am the Research Support Administrator for the ICAS and the Sustainability Research Institute (SRI). I support the Institute Directors, administer the monthly meetings, look after comms like producing this and the weekly circular as well as many other jobs too numerous to mention. You name it I can do help or point you in the right direction!

What do you like the most about ICAS?

The breadth of knowledge is amazing and I love that I learn new things everyday working with different people and groups.

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

It was more of an accident than any intention, I moved to Leeds in 2008 and knew I wanted to work at the University, so after much applying and a random meeting in an aqua class here I am!

What scientific achievement are you most proud of?

Ha ha ha, making bread!

What does a typical working day involve for you?

Emails and more emails, supporting the Directors of ICAS and SRI, chasing people for the University's latest scheme, creating this newsletter and everything else in between.

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

Working with the new Director Amanda Maycock, helping her with new, different and exciting projects.

What's the most challenging aspect of your job?

Balancing all the competing demands and keeping on top of my to do list!

How do you decompress outside work?

Doing yoga keeps me sane, wrestling with my 2 year old Harris reminds me what's important, and walking our ageing dog Stella dodging cats that seem to have it in for her for excitement!

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

I almost started a pizza restaurant in Ghana!

Photo: ICAS Research Support Administrator Mollie Van der Gucht and son Harris

