



ICAS Newsletter

Issue 13
July 2018



Institute for Climate and Atmospheric Science

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

Met Office Update: LUMOS

The University of Leeds Met Office Strategic (LUMOS) Research Group was formally launched on the 6th July, with attendees from across the University and the Met Office. Delegates from the Royal Meteorological Society, along with representatives from partner organisations such as Leeds City Council joined us. We were also pleased to welcome Professor Peter Read, joint chair of the Met Office partnership with the University of Oxford.

The LUMOS Research Group was set up to build on the University's collaboration with the Met Office, strengthening links through six joint interdisciplinary posts. The objective of the group is to provide capability for end-to-end research into the development and use of Met Office atmospheric models for socio-economic impact.

Full details on page 7.

Image credit: Hamish Pritchard

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Antarctica retreating across the sea floor

Antarctica's great ice sheet is losing ground as it is eroded by warm ocean water circulating beneath its floating edge, a new study has found.

Research by the [UK Centre for Polar Observation and Modelling](#) (CPOM) at the University of Leeds has produced the first complete map of how the ice sheet's submarine edge, or "grounding line", is shifting. Most Antarctic glaciers flow straight into the ocean in deep submarine troughs, the grounding line is the place where their base leaves the sea floor and begins to float.

Their study, published today in *Nature Geoscience*, shows that the Southern Ocean melted 1,463 km² of Antarctica's underwater ice between 2010 and 2016 – an area the size of Greater London.

The team, led by Dr Hannes Konrad from the University of Leeds, found that grounding line retreat has been extreme at eight of the ice sheet's 65 biggest glaciers. The pace of deglaciation since the last ice age is roughly 25 metres per year. The retreat of the grounding line at these glaciers is more than five times that rate.

The biggest changes were seen in West Antarctica, where more than a fifth of the ice sheet has retreated across the sea floor faster than the pace of deglaciation.

Dr Konrad said: "Our study provides clear evidence that retreat is happening across the ice sheet due to ocean melting at its base, and not just at the few spots that have been mapped before now. This retreat has had a huge impact on inland glaciers, because releasing them from the sea bed removes friction, causing them to speed up and contribute to global sea level rise."

The researchers also found some unexpected behaviour. Although retreat of the Thwaites Glacier grounding line in West Antarctica has sped up, at the neighbouring Pine Island Glacier – until recently one of the fastest retreating on the continent – it has halted. This suggests that the ocean melting at its base may have paused.



Dr Konrad added: "These differences emphasise the complex nature of ice sheet instability across the continent, and being able to detect them helps us to pinpoint areas that deserve further investigation."

Grounding lines typically lie a kilometre or more below sea level and are inaccessible even to submersibles, so remote sensing methods for detecting them are extremely valuable.

The team were able to track the movement of Antarctica's grounding line using European Space Agency's CryoSat-2 across 16,000 km of the coastline. Although CryoSat-2 is designed to measure changes in the ice sheet elevation, these can be translated into horizontal motion at the grounding line using knowledge of the glacier and sea floor geometry and the Archimedes principle of buoyancy - which relates the thickness of floating ice to the height of its surface.

Study co-author Professor Andy Shepherd, from the School of Earth and Environment at Leeds, said: "We were delighted at how well CryoSat-2 is able to detect the motion of Antarctica's grounding lines. They are impossible places to access from below, and usually invisible on the ground, so it's a fantastic illustration of the value of satellite measurements for identifying and understanding environmental change."

[Hannes Konrad, Andrew Shepherd, Lin Gilbert, Anna Hogg, Malcolm McMillan, Alan Muir and Thomas Slater, 2018. Net retreat of Antarctic glacier grounding lines. *Nature Geoscience* 11, 258-262. DOI: 10.1038/s41561-018-0082-z](#)



Image credit: Andy Shepherd

Antarctica ramps up sea level rise

Ice losses from Antarctica have increased global sea levels by 7.6 mm since 1992, with two fifths of this rise (3.0 mm) coming in the last five years alone. The findings are from a major climate assessment known as the Ice Sheet Mass Balance Inter-comparison Exercise (IMBIE), and were published recently in *Nature*. It is the most complete picture of Antarctic ice sheet change to date - 84 scientists from 44 international organisations combined 24 satellite surveys to produce the assessment.

The assessment, led by ICAS professor Andrew Shepherd and Dr Erik Ivins at NASA's Jet Propulsion Laboratory in California, was supported by the European Space Agency (ESA) and the US National Aeronautics and Space Administration (NASA). Their findings show that, prior to 2012, Antarctica lost ice at a steady rate of 76 billion tonnes per year – a 0.2 mm per year contribution to sea level rise. However, since then there has been a sharp, threefold increase. Between 2012 and 2017 the continent lost 219 billion tonnes of ice per year – a 0.6 mm per year sea level contribution.

Antarctica stores enough frozen water to raise global sea level by 58 metres, and knowing how much ice it is losing is key to understanding the impacts of climate change today and in the future.

Andy Shepherd said: “We have long suspected that changes in Earth’s climate will affect the polar ice sheets. Thanks to the satellites our space agencies have launched, we can now track their ice losses and global sea level contribution with confidence. According to our analysis, there has been a step increase in ice losses from Antarctica during the past decade, and the continent is causing sea levels to rise faster today than at any time in the past 25 years. This has to be a concern for the governments we trust to protect our coastal cities and communities.”

Dr Ivins said: “The added duration of the observing period, the larger pool of participants, various refinements in our observing capability and an improved ability to assess both inherent and interpretive uncertainties, each contribute to making this the most robust study of ice mass balance of Antarctica to date.”

The threefold increase in ice loss from the continent as a whole is a combination of glacier speedup in West Antarctica and at the Antarctic Peninsula, and reduced growth of the ice sheet in East Antarctica. West Antarctica experienced the largest change, with ice losses rising from 53 billion tonnes per year in the 1990s to 159 billion tonnes per year since 2012. Most of this came from the huge Pine Island and Thwaites Glaciers, which are retreating rapidly due to ocean melting. At the northern tip of the continent, ice shelf collapse at the Antarctic Peninsula has driven a 25 billion tonne per year increase in ice loss since the early 2000s. The East Antarctic ice sheet has remained close to a state of balance over the past 25 years, gaining just 5 billion tonnes of ice per year on average.

Josef Aschbacher, ESA's Director of Earth Observation Programmes, said: “CryoSat and Sentinel-1 are clearly making an essential contribution to understanding how ice sheets are responding to climate change and affecting sea level, which is a major concern. While these impressive results demonstrate our commitment to climate research through efforts such as our Climate Change Initiative and scientific data exploitation activities, they also show what can be achieved by working with our NASA colleagues. Looking to the future, however, it is important that we have satellites to continue measuring Earth's ice to maintain the ice-sheet climate data record.”

[The IMBIE Team, 2018. Mass balance of the Antarctic Ice Sheet from 1992-2017. *Nature* 558, 219–222. DOI: 0.1038/s41586-018-0179-y](https://doi.org/10.1038/s41586-018-0179-y)



Image credit: Andy Shepherd

Satellites track vanishing Antarctic ice

Monitoring Antarctica from space has revealed how its ice is being lost to the oceans, providing crucial insight into the continent's response to a warming climate. Scientists from ICAS, the University of California San Diego and University of Maryland reviewed decades of satellite measurements to reveal how and why Antarctica's glaciers, ice shelves, and sea ice are changing.

Their report, published recently in Nature's special issue on Antarctica, explains how ice shelf thinning and collapse have triggered an increase in the continent's sea level contribution. It also explains that although the total area of sea ice surrounding Antarctica has shown little overall change during the satellite era, there are signs of a longer-term decline when mid-twentieth century ship-based observations are considered.

Lead author Professor Andrew Shepherd, from ICAS said: "Antarctica is way too big to survey from the ground, and we can only truly understand the trends in its ice cover by looking at the continent from space."

In West Antarctica, ice shelves are being eaten away by warm ocean water, and those in the Amundsen and Bellingshausen seas are up to 18 per cent thinner than in the early 1990s. At the Antarctic Peninsula, where air temperatures have risen sharply, ice shelves have collapsed as their surfaces have melted. Altogether, 34,000 km² of ice shelf area has been lost since the 1950s.



Image credits: Ian Joughin

"Although breakup of the ice shelves does not contribute directly to sea-level rise – since ice shelves, like sea ice, are already floating – we now know that these breakups have implications for the inland ice: without the ice shelf to act as a natural buffer, glaciers can flow faster downstream and out to sea," said Professor Helen Amanda Fricker, a glaciologist at Scripps Institution of Oceanography at UC San Diego.

More than 150 studies have tried to determine how much ice the continent is losing. The biggest changes have occurred in places where ice shelves – the continent's protective barrier – have either thinned or collapsed. In the Amundsen Sea, for example, ice shelf thinning of up to 6 metres per year has triggered a 1.5 km per year acceleration of the Pine Island and Thwaites glaciers. These glaciers have the potential to raise sea levels by more than a metre, and are now widely considered to be unstable.

Satellite observations have meanwhile provided an increasingly detailed picture of the sea ice cover, allowing us to map the extent, age, motion and thickness of the ice. The combined effects of climate variability, atmosphere and ocean circulation, and even ice shelf melting have driven regional changes, including reductions in sea ice in the Amundsen and Bellingshausen seas.

[Andrew Shepherd, Helen Amanda Fricker and Sinead Louise Farrell, 2018. Trends and connections across the Antarctic cryosphere. Nature 558, 223-232. DOI: doi.org/10.1038/s41586-018-0171-6](#)



Successes and congratulations



MBE for Prof. Chris Collier

Professor Chris Collier has been awarded an MBE in recognition of his services to atmospheric science. Chris is a former head of Strategic Partnerships at the National Centre for Atmospheric Science (NCAS) and was based at the University of Leeds.

The focus of Chris' work was to help scientists study weather and climate and improve our lives through the use of their research. In particular, Chris used weather radar to make measurements of rainfall and improve forecasting of heavy rain and floods.

Distinguished Lecture Prize

[Dr. Jim McQuaid](#) from ICAS has been selected as the European Association of Geochemistry (EAG) 2018 Distinguished Lecturer. Jim's research is primarily focused upon observations of the composition of both gas phase and aerosol species in the atmosphere, and an exciting series of lectures on these themes has been proposed for the 2018 Distinguished Lecture Tour. [See more details.](#)

The European Association of Geochemistry started its Distinguished Lecture Programme in 2011 and it currently focuses on Central and Eastern Europe. This programme aims to introduce and motivate scientists and students located in under-represented regions of the world to emerging research areas in chemistry. The Distinguished lecturer is selected each year based on a combination of outstanding research contributions to geochemistry and the ability to clearly communicate these contributions to a broad range.



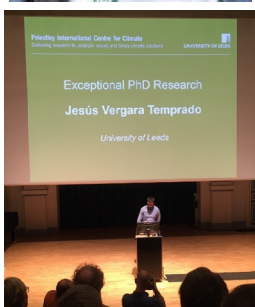
Priestley Piers Sellers PhD prize

ICAS student [Jesus Vergara Temprado](#) was one of two students (along with Kate Palmer from the Institute of Transport Studies) awarded the Piers Sellers PhD Prize by the Priestley International Centre for Climate. The annual prize recognises exceptional PhD research that furthers understanding of climate change and how to address it, and is named after Leeds alumnus, climate scientist and astronaut Piers Sellers. Winners receive £1500 to further their studies.

"Jesus very much deserves this prestigious prize, having made the rare connection all the way from laboratory experiments through to changes in our understanding of the climate system." said Professor Ken Carslaw, one of his supervisors along with Ben Murray and Paul Field.

Affiliated to the Institute for Climate and Atmospheric Science, Jesus' pioneering research focuses on modelling of ice nucleating particles in the atmosphere and was the lead author of a [paper](#) published in Proceedings of the National Academy in March this year.

The formal event was also attended by Gavin Schmidt, renowned climate scientist and Director of the NASA Goddard Institute for Space Studies, who presented the postgraduate researchers with their awards and gave an inspiring talk on his work.



University Sustainability Award

Dr Cat Scott from ICAS won the sustainability award for 'Building Knowledge & Capacity' at the University of Leeds sustainability awards ceremony. Original Tweet: <https://twitter.com/AnneTallontire/status/1006937388248158210>



Cat Scott with the VC Sir Alan Langlands

Funding

NERC large grant TerraMaris: The Maritime Continent:

A NERC large grant “TerraMaris: The Maritime Continent – Driver of the Global Climate System” (£3.7 million total, £1.5 million to Leeds) has been obtained by Cathryn Birch, Ryan Neely and John Marsham. The project includes a major field campaign in Indonesia in 2019/2020 with NCAS instrumentation and the FAAM research aircraft. The project is in collaboration with UEA and Reading University and is part of the Years of Maritime Continent international initiative to better understand tropical convection.



Awards for new UAF

Recent ICAS arrival Dr Marcelo Galdos (University Academic Fellow in Modelling Food Security and Climate Impacts) has had two recent funding applications approved:

- N8 AgriFood Local Pump Priming Scheme, to develop a research proposal in “Soil conservation practices in post-Brexit UK under a changing climate”, with researchers from the Universities of Leeds, Newcastle and Sheffield.
- Energy Leeds Pump Priming Grant, for a research visit to the Sustainable Resources Directorate of the Joint Research Centre in Ispra, Italy, to discuss collaborations in crop and soil modelling with focus on bioenergy.

Met. Soc. Award for PhD Student

ICAS PhD student Ben Pickering has been awarded a £1200 RMetS Legacies Fund award to work on a mobile radar truck for a field campaign in Argentina in Nov/Dec this year. The 6-week campaign is called RELAMPAGO and it will observe extreme weather such as lightning, tornadoes and giant hail, from storms triggered by the Andes mountains.



British Science Festival 2018

Dr Kirsty Pringle and a team from ICAS have been accepted to do an event at the British Science Festival in Hull in September. They plan to take air quality measurements (using Concentration Particle Counters (CPCs)) as they walk round the city and build up a map of pollution levels in Hull.

White Rose Collaboration Fund – Refugia of Futures Past

School of Earth and Environment researchers Dr Christopher Lyon, Dr Tracy Aze, Dr Alex Dunhill, Dr Dan J Hill (ICAS) and Prof Lindsay Stringer, with York and Sheffield colleagues, have been awarded £10 403 for scoping work into baseline conditions for the human habitability of Earth under post-2100 environmental change. “Refugia of Futures Past” draws on palaeobiology and archaeology to add a new dimension to current adaptation research and practice.



Our Partnerships: new information and latest updates

Met Office Update: LUMOS

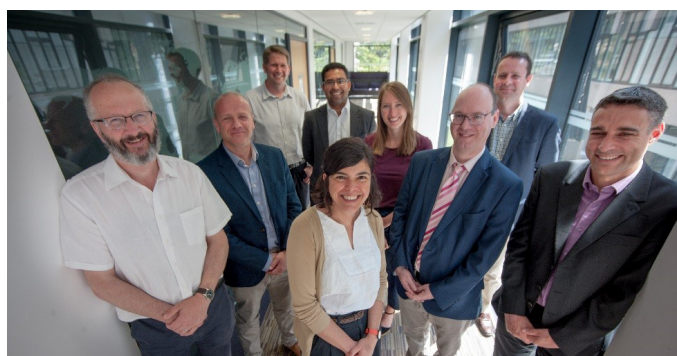
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The launch event focused on the challenges of end to end research and the ambitions of LUMOS to deliver on this, and included four presentations from staff involved with LUMOS, following an introduction from four senior members of the team, Andy Dougill, Simon Vosper, Adrian Hines and Doug Parker, pictured above. The event was filmed, so the individual presentations will be available to view. A short introductory video on LUMOS and the wider partnership will also be created. Details will be circulated when available.

The next MOGUL meeting will be held in September (dates to be finalised) and will focus on Air Quality.

The partnership which is led by Doug Parker and Paul Field now boasts 6 joint and visiting Professorial positions, six posts within the JRU and 20+ joint PhD studentships. The partnership is also supported by Suzie May-Graham who provides admin support and Ruth Lawford-Rolfe who leads on developing opportunities for impact and innovation.



Speakers at the event, clockwise from left; Doug Parker, Simon Vosper, Steven Turnock, Suraje Dessai, Suzie May-Graham (Administrator), Sean Milton, Adrian Hines, Jason Lowe and Marta Bruno Soares

Update from our Centre of Excellence for Modelling the Atmosphere and Climate (CEMAC)

A longstanding close collaboration with the UK Met Office means that ICAS has an established history of using and helping to develop Met Office modelling tools. In addition,

the University of Leeds is one of only four official Met Office Academic Partnership institutions, contributing scientific expertise to Met Office model process development across a range of areas of atmospheric science. The Met Office's flagship Unified Model (UM) is used across a wide range of ICAS science, from simulating convective-scale processes in tropical storm systems, to investigating global scale interactions between air quality and climate. CEMAC has been working to further strengthen ICAS-Met Office collaboration around use of the UM, and in particular developing new capacity for ICAS science to more explicitly inform development of model processes.

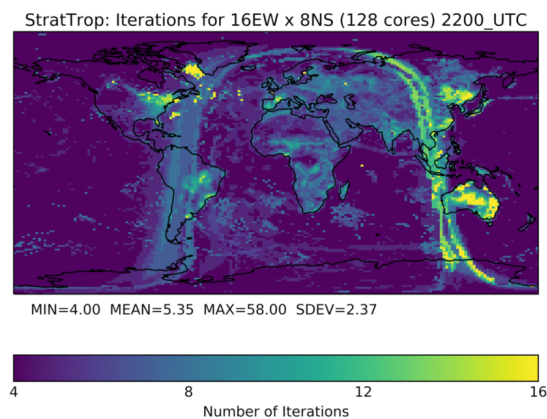


Figure: Visualisation of numerical solver iterations from the ASAD chemical solver per column of atmosphere within the UM-UKCA test suite at vn11.0, as part of new code lodged by CEMAC.

Recent work by Chris Dearden and Mark Richardson has led to our first successful lodging of new model code developed within CEMAC onto the current version of the UM. The new model development helps with efficiency of the complex atmospheric chemistry routines of the UKCA component of the UM, and has been developed under a joint Met Office-NCAS JWCRP programme. This important milestone has allowed CEMAC to develop the tools and methods needed to meet the Met Office's stringent code evaluation and management processes, and will help accelerate the future translation of ICAS science into Met Office model developments across a range of projects. Chris and Mark have also been working with the University of Leeds Advanced Research Computing (ARC) team to install UM version 10.9 on the latest Leeds ARC3 HPC system, which has more than 6000 cores and is capable of > 220 Tflops per second.

The N48 global atmosphere model has been successfully ported to ARC3, with testing underway to support higher resolution implementations along with the ability to run the nesting suite for regional studies. In addition to providing a new UM platform for ICAS science projects, the new local UM capability will allow more efficient in-house testing and development of model updates and process investigations before new code is lodged with the Met Office code standards process. Over the coming year, CEMAC aims to build on this UM installation, and begin installation and roll-out of the UK Earth System model (UKESM) on the local ARC3 system. This will give exciting new opportunities for ICAS researchers to undertake cutting-edge investigations of the coupled climate and Earth system, as well as providing potential new exciting possibilities for undergraduate and masters level research projects.

In the News

Ozone-destroying emissions are on the rise and scientists don't know why - [CNN 17th May](#)

Professor Martyn Chipperfield (Earth & Environment; iCAS) comments on new research which he describes as “puzzling rather than alarming”, which suggests there is a new source of ozone-depleting Chlorofluorocarbons in East Asia, despite the decades-old Montreal Protocol banning them altogether. Also in: [The Independent](#)

BBC Radio Leeds 24th June - Broadcast

PhD researcher Jesús Vergara-Temprado (Earth & Environment) discusses his research looking at how clouds form over the Southern Ocean.

The next decade will decide our future climate - [Earther 27th June](#)

Professor Piers Forster (Earth & Environment; Priestley) comments on a new paper in Nature Climate Change which shows how difficult a task it will be to keep global warming within 1.5 degrees Celsius of pre-industrial temperatures.

BBC Radio Leeds 3rd July - Broadcast

Professor Stephen Mobbs talks about the current hot weather, as it is set to be the hottest June for 42 years.

Climate change information for East African decision making

Rt Hon Ceclia Ogwal opens the annual HyCRISTAL meeting in Kampala, Uganda, 23-27 April 2018

The Earth is warming and East Africa's climate is changing. As the region's populations and economies grow, the impacts of future climate change must be integrated into long-term planning to develop a sustainable and resilient future. The Integrating Hydro-Climate Science into Policy Decisions for Climate-Resilient Infrastructure and Livelihoods in East Africa project ([HyCRISTAL](#)) is working both to improve climate change predictions for East Africa and to use that information to inform long-term decision-making in the region.

HyCRISTAL's annual meeting was attended by delegates from across Uganda, Kenya, Tanzania, Ethiopia, the UK and USA. During the meeting decision makers worked with the HyCRISTAL team to develop approaches to use climate change information.

Rt Hon Cecilia Atim Ogwal, Deputy Speaker in the Uganda Parliament, opened the meeting, emphasising the need to plan now for a changed climate in years to come, especially to reduce vulnerability of the region's poorest people. “I want to urge the participants to help Uganda and Africa to tap the appropriate research data and knowledge, to help build climate resilient infrastructure,” she said. “We as parliamentarians can help you to develop policies that can direct your information to the right place.”

Dr John Marsham (water@leeds, ICAS and National Centre for Atmospheric Science, UK), the HyCRISTAL project leader, emphasised this was not some far-off future, but a present and growing challenge. He said: “Droughts and floods already threaten lives and livelihoods across East Africa and increases

in weather extremes from climate change will make existing problems worse. Integrating our knowledge of climate change into decisions being made today will save both money and lives in coming decades.”

Within HyCRISTAL, the British Geological Survey team, led by David Macdonald, are working with the Ugandan Ministry of Water and Environment (MWE) to support the development of Catchment Management Plans.

Dr Callist Tindimugaya, Commissioner for Water Resources Planning and Regulation at MWE gave the second keynote, highlighting that “HyCRISTAL's work will enhance what we are doing and ensure climate issues are addressed and our plans are well grounded in climate science.”

“The work of HyCRISTAL will be very important for the country to take informed decisions.”

HyCRISTAL addresses use of climate change information for rural adaptation, urban water and sanitation, and water management, with linked projects supporting the IDAPS Integrated Data Platform, tea production and Lake Victoria transport systems.

Professor Barbara Evans, HyCRISTAL Urban Lead (water@leeds and University of Leeds) said, “We are working with Kampala and Kisumu city authorities to develop water and sanitation solutions that are more resilient to the increased flooding we expect in the years to come.”

Dr David Rowell (Met Office, UK) noted: “Events like the recent high-impact floods in Kenya are likely to become more frequent in the future. HyCRISTAL is studying the impacts of such events and what decisions can be taken today to reduce those future impacts.”

Further information

HyCRISTAL is part of the Future Climate for Africa programme, a five-year research programme (2014 – 2019) funded by the UK Department for International Development and the Natural Environment Research Council.

More information on HyCRISTAL is available from www.futureclimateafrica.org/project/hycristal/ and more information on Future Climate for Africa is available from www.futureclimateafrica.org.



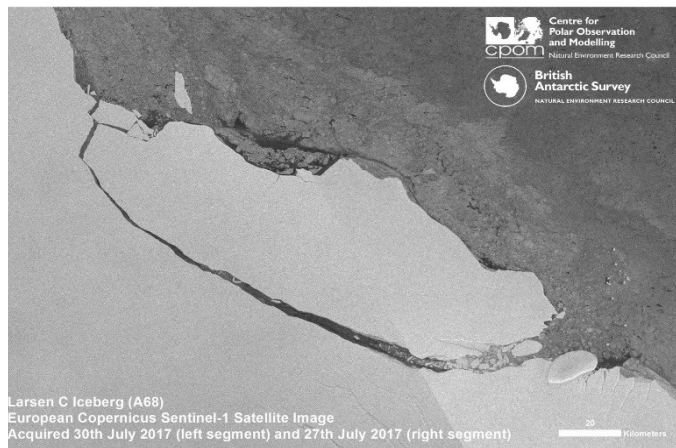
Rt Hon Cecilia Atim Ogwal (Deputy Speaker in the Uganda Parliament) opening the meeting

CPOM helps school students become Earth Observation researchers

A new project launched by the [Institute for Research in Schools](#) (IRIS) is offering students the chance to contribute to scientific understanding of the polar regions. Funded by the [UK Space Agency](#), MELT will allow schools to monitor changes at the poles using Earth Observation data.

CPOM's Anna Hogg will be helping students to understand the latest satellite Earth Observation data and investigate events such as iceberg calving, where recent dramatic changes suggest that environmental conditions have changed.

Anna said: "There are really exciting opportunities for students to work with Earth Observation scientists on major changes. We used Sentinel-1 satellite data to watch a giant iceberg four times the size of London broke free from Antarctica's Larsen-C ice shelf in 2017, and now students can use the same data to measure if new icebergs calve off some of the fastest flowing glaciers in the world!"



MELT is also challenging schools to calculate their [carbon footprint](#) and develop ideas for reducing their carbon output.

Darren Harman, from Sir Robert Woodard Academy, commented: "MELT has presented a group of our Year 9 students with an amazing opportunity to be part of novel science research, that will undoubtedly enrich their experience of learning science in a way that they wouldn't otherwise have access to until university and beyond.

"Not only are they excited at what they might discover looking at data no other human has yet cast their eyes upon, but also the prospect of inspiring students at local primary schools to share in their experience of running live science research in schools."

Professor Becky Parker, director of IRIS said: 'We're really looking forward to seeing the results from MELT. It's a great opportunity for schools to engage their students in work to impact the environment and use the latest satellite data. It's fantastic to receive the backing from the UK Space Agency and our schools can't wait to get started.'

For more information on the Institute for Research in Schools (IRIS) MELT project visit the [IRIS website](#).

Contact us

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