University of Reading

DEPARTMENT OF METEOROLOGY

FORECASTING FOR THE FUTURE

“The University of Reading is ranked 4th in the world for Atmospheric Science[1] and learning with and from our world-leading faculty will enable you to gain the skills needed to make your own contribution to addressing environmental challenges.

The opportunity to get involved with research, our excellent staff-student ratio, and 100% overall satisfaction score[2] means that our students are well-supported to achieve their potential. We are committed to equality of opportunity for all as shown by our Athena SWAN silver award.

We need talented and enthusiastic people to address some of the scientific problems that are most critical to society, and I hope that you will choose to join us.”

Professor Andrew Charlton-Perez
Head of the School of Mathematical, Physical and Computational Sciences

reading.ac.uk/meteorology

[1] Shanghai Ranking 2022 Global Ranking of Academic Subjects

[2] National Student Survey 2022

“The Department of Meteorology brings together a gifted community of scientists united by a passion to explore how mathematics and physics may be best applied to better predict weather and climate. We are helping to understand climate change, improving our ability to anticipate extreme weather and developing new tools to forecast space weather.”

STINGING STORMS

Professor Suzanne Gray

The "Great Storm" that hit the UK in October 1987 was the first published case in which a "Sting Jet" was identified, by Emeritus Reading Professor Keith Browning. It produced winds of 115mph, knocked over ~15m trees, damaged property across England and northern Europe and took at least 22 lives. Sting jets are especially difficult to predict as they last a relatively short time: hours, compared to storm's fronts, which can last a day or more.

Professor Suzanne Gray's research into the dynamics and predictability of weather systems is driven by her fascination with different storm types. She won the 2016 Buchan Prize from the Royal Meteorology Society for her work on Sting Jets.

Sting jets are descending jets of air that accelerate, causing strong surface winds in a relatively small area. Sting jets get their name from associated clouds, shaped like a scorpion's sting, swirling around the storm centre. Perhaps one third of North Atlantic storms give rise to sting jets, however, it is difficult to directly observe where and when they occur, so their formation processes remain unclear. Reading researchers recently led the first aircraft flight to take observations inside a sting jet storm.

Sue and her team have developed tests for identifying sting jets in historic storms reproduced using the Met Office shared supercomputer.

These tests are now run in real time on the Met Office's weather forecasts to provide operational guidance, and to assess whether climate models predict sting jet conditions to increase in a warmer world.

Sue also works with industrial partners to inform their decision-making when preparing for extreme weather events, and with the insurance industry to help them understand the risks and damage potential from sting jets.

In the Department of Meteorology, Sue runs the Mesoscale Group bringing together academic staff, postdoctoral researchers and students, and Met Office researchers, and she regularly supervises undergraduate and master's dissertations, involving students at all levels in her research into weather systems.

Sue incorporates her research into her undergraduate module 'Introduction to Meteorology', which features real-life storm case studies. She says: "Being able to teach is very important to me and is the reason that I chose to work at the University. It's very rewarding getting to know the students, helping them to master key concepts and develop their skills, and see them move on to exciting careers or further study."

Read more staff and student stories at **reading.ac.uk/meteorology/stories**

FLYING IN THE FACE OF ASH CLOUDS

The 2010 eruption of Iceland's Eyjafjallajökull volcano closed European airspace and cost the global airline industry an estimated $200 million per day. It also disrupted the journeys of over 10 million passengers.

Professor Helen Dacre worked with the Met Office to analyse some of the data from the event. Helen was already engaged in researching pollution transport by weather systems, using the same model employed by the Met Office for its own operational volcanic ash forecast. The collaboration raised further questions.

Can we make good predictions about where ash is going to go?

Can we use those predictions to make decisions about where to fly?

Helen's research initially focused on evaluating the models used to forecast volcanic ash movement. Helen determined just how good these models were at predicting volcanic ash in the right place, at the right time. Once she was convinced that the models could do this, Helen then focused on the more challenging task of reducing airspace closures following a volcanic eruption.

To do this, the models would need to predict the concentration of ash, as well as the right place and time. Helen and colleagues in the Department of Meteorology helped to successfully develop models that predict the dispersal of volcanic ash after eruptions, as well as instrumentation that monitors ash clouds during flight bans. In fact, these procedures are credited with being one of the main reasons why the 2011 Grímsvötn eruption caused much less disruption.

Professor Helen Dacre

Helen's research feeds directly into the 'Atmospheric chemistry and transport' undergraduate and postgraduate modules, where her research on volcanic ash serves as a great visual example of how large-scale pressure systems can affect the movement of pollutants. Helen convenes a master's-level course, where students use hazardous weather case studies to analyse observational and model data and deepen their understanding of the physical processes leading to weather systems that produce damagingly hazardous conditions.

Read more staff and student stories at **reading.ac.uk/meteorology/stories**

STORYLINES: CHANGING CLIMATE CHANGING WEATHER

Professor Ted Shepherd

Professor Ted Shepherd, Grantham Chair in Climate Science at the University of Reading and a Fellow of the Royal Society, is renowned for his work in the field of atmospheric fluid dynamics. He has also been the Chair of the Science Review Group for the Met Office Hadley Centre on climate variability and change.

Ted and his team have been developing "storylines", a new approach to providing decision-makers with useful information in response to climate change. Storylines provide a "case study" approach that can bridge the gap between traditional sources of scientific information and the evidence needed for decision-making. They explain past weather events, which may be familiar to decision makers, and the range of possible future events or pathways, where the atmospheric conditions leading to the events can be accounted for in detail.

For example, in south-eastern South America there has been a trend over the past 60 to 70 years of increased precipitation, allowing for agricultural expansion in the region. It isn't clear if this trend is a result of global warming and will continue.

It could be due to unrelated changes to regional conditions, such as long-term variations in sea surface temperatures, or the influence of the ozone hole. Ted's team can provide an alternative storyline for each of these explanations to explore different implications for what to expect in the future. The storylines approach is being adopted in several other projects with colleagues in Meteorology and other Reading departments.

Ted says: "I am tremendously excited about being able to do this research in the Department of Meteorology at the University of Reading. I spent part of my early research career in the UK and have always admired the UK's deep commitment to research excellence and the fact that UK society looks to scientists for their expertise concerning problems of societal importance.

"As a climate scientist, I hope to use my position to increase the public awareness of climate change and issues of climate risk and resilience. In this way I can make my own contribution to communicating science to inform evidence-based discussion of important societal issues."

Read more staff and student stories at **reading.ac.uk/meteorology/stories**

SHIPPING THROUGH THE ARCTIC

The decline of sea ice in the Arctic is undoubtedly one of the most striking signs of climate change, yet, Dr Nathanael Melia's research shows that this could make shipping through the Arctic a reality by the end of the 21st century.

Nathanael studied for his undergraduate degree, master's degree and PhD at the University of Reading.

"The more time I spent in the Department of Meteorology, the more I began to realise the high calibre of the lectures in a global research context – something I'm still comprehending years after finishing my PhD.

"While other departments can have more of a workplace feel to them, the Department of Meteorology has a real sense of community."

Nathanael is now a research scientist and believes that each of his degrees prepared him in their own ways for a career in research.

"My favourite component of my BSc and MSc were my dissertations. These were a great preparation for the style of exciting independent work involved in a PhD.

"The skills learnt and the scientists that I was lucky enough to meet and work with during my PhD gave me the skills and confidence to go out into the post-PhD world."

Nathanael's interest in climate science stems from wanting to learn more about what will happen to our planet in the future. While studying for his PhD, Nathanael found that the number of non-specialised vessels that could travel through the Arctic Sea is expected to double over the next 100 years. Access to such routes could potentially save at least 10 days on voyages from Europe to Asia as a result of faster, more direct routes becoming available.

"The reduction in summer sea ice, perhaps the most striking sign of climate change, may also provide economic opportunities. There is renewed interest in trans-Arctic shipping because of potentially reduced costs and journey times between Asia and the Atlantic."

The research also found that the length of time these routes will be open increases from currently just a few weeks to a few months, although this would vary considerably from year to year. However, ice-strengthened ships will be able to regularly sail directly across the Arctic for the majority of the year by the end of the century, depending on the level of future greenhouse gas emissions.

Read more staff and student stories at **reading.ac.uk/meteorology/stories**

UNDERGRADUATE PROGRAMMES

BSc METEOROLOGY AND CLIMATE[1] [2]

MMet METEOROLOGY AND CLIMATE WITH A YEAR IN OKLAHOMA[1]

[1] These courses are approved by the Royal Meteorological Society as appropriate academic training for meteorologists seeking the qualifications of Chartered Meteorologist (CMet) or Registered Meteorologist (RMet).

[2] We offer a four-year BSc Meteorology and Climate with International Foundation Year specifically for international students who don't meet the requirements for direct entry onto the BSc Meteorology and Climate.

RMetS
Royal Meteorological Society

BSc METEOROLOGY & CLIMATE

Explore all aspects of meteorology and climate, from atmospheric science to oceanography. Understanding the science of the atmosphere is a vital tool for dealing with some of the biggest challenges we face, such as climate change, ozone depletion and atmospheric pollution. In the final year of your degree, you will specialise and extend your knowledge by exploring areas of interest in greater depth and undertake a research project.

Year one topics include:

- Calculus
- Weather and climate fundamentals
- Skills for environmental science
- Physics of the natural world
- Linear algebra

Year two topics include:

- Differential equations
- Atmosphere and ocean dynamics
- Atmospheric physics
- Numerical methods for environmental science
- Climate change
- Statistics for weather and climate science
- Forecasting: practice and presentation
- Atmospheric chemistry and transport
- Vector calculus

Year three topics include:

- Boundary layer meteorology
- Atmospheric science field course
- The global circulation
- Numerical weather prediction
- Oceanography
- Space weather
- Atmospheric electricity
- Remote sensing
- Dynamics of weather systems

MMet METEOROLOGY & CLIMATE WITH A YEAR IN OKLAHOMA

Explore all aspects of meteorology and climate, before taking the unique chance to study severe weather systems up close. Spend a year abroad to focus on the weather of the US High Plains regions and the methods used to observe and forecast it.

In the final year of your degree, you will specialise and extend your knowledge by exploring areas of interest in greater depth and undertake a research project.

Year one topics include:

- Calculus
- Weather and climate fundamentals
- Skills for environmental science
- Physics of the natural world
- Linear algebra

Year two topics include:

- Differential equations
- Atmosphere and ocean dynamics
- Atmospheric physics
- Numerical methods for environmental science
- Climate change
- Statistics for weather and climate science
- Forecasting: practice and presentation
- Atmospheric chemistry and transport
- Vector calculus

Year three

A selection of topics at the University of Oklahoma, including the following examples:

- Synoptic meteorology
- Cloud physics
- Weather forecasting
- Mesoscale meteorology
- Radar meteorology
- Climate dynamics

Year four topics include:

- Boundary layer meteorology
- Atmospheric science field course
- Oceanography
- Tropical meteorology
- Current topics in weather and climate research
- Numerical weather prediction
- Atmospheric electricity

OUT IN THE FIELD

UNDERGRADUATE

Gain valuable fieldwork experience and apply what you learn in the classroom and labs to real-world scenarios. The skills you develop during fieldwork exercises will help you in your own project work, and are highly sought-after by employers.

During your final year, you'll have the option to attend a field trip; in recent years students have gone to Blencathra in the Lake District, but the location of the field class is subject to change.

Whilst out in the field you will take meteorological measurements – measuring energy fluxes, launching and tracking weather balloons, and preparing and delivering local weather forecasts to staff and fellow students. You'll also learn a wide range of analytical skills, such as how to read tephigrams and process eddy-covariance data.

PLACEMENTS

UNDERGRADUATE

Enhance your career prospects, apply what you learn during your studies and develop a network of contacts through a work placement[1].

You may choose to apply to undertake paid or unpaid placements at companies and organisations within the meteorological, climate and related sectors. You can opt to do a placement during a vacation period, such as over summer, or in between your second and final year by choosing one of our courses with a built-in placement year.

Our dedicated placements team will support you to identify and contact a company or government laboratory working in your chosen scientific area.

In recent years, students within the Department have undertaken placements with organisations such as the Met Office, Pixalytics, Rezatec, Nationwide, and RPS Group.

[1] Terms and conditions apply; please see inside back cover for details

“My placement has been a brilliant opportunity to put into practice skills gained during my degree, including programming, working within a team, public speaking, statistical analysis of data and knowledge of a variety of remote sensing networks. Everyone has been super friendly, and I have felt very well supported in this role.”

Chase Jackson
Undergraduate meteorology student
Placement with Met Office

CAREERS

UNDERGRADUATE

A degree from the Department of Meteorology will help you to become highly sought-after by employers in a diverse range of industries. 100% of graduates from Meteorology are in work or further study within 15 months of graduation; of those in full-time employment, 92% are in graduate-level roles[1].

You will have the opportunity to develop vital scientific skills throughout your course, including forecasting, computer modelling and programming, and scientific communication. We also support you to develop transferable skills, including numeracy, problem-solving, teamwork and presentation skills.

Our graduates go on to work in a wide range of areas within the meteorological, climate and related sectors, applying their skills in areas such as broadcast meteorology, water resource management, environmental consultancy, energy supply, flood modelling, pollution prediction, and terrestrial and space weather forecasting.

You'll also be well placed for career opportunities outside the meteorological and climate world, including insurance, finance, power, transport, education, agriculture and health.

Recent graduates have gone on to work for organisations including the Met Office, the Natural Environment Research Council, the National Centre for Atmospheric Research, the Environment Agency Fugro, Risk Management Solutions, Nemein, WeatherNet Ltd.

[1]Based on our analysis of HESA data © HESA 2022, Graduate Outcomes Survey 2019/20; includes all Meteorology responders

MASTER'S PROGRAMMES

MSC ATMOSPHERE, OCEANS AND CLIMATE[1]

MSC APPLIED METEOROLOGY AND CLIMATE[1]

MSC APPLIED METEOROLOGY AND CLIMATE WITH MANAGEMENT[1]

MSC CLIMATE CHANGE AND ARTIFICIAL INTELLIGENCE (AI)

[1] This course is approved by the Royal Meteorological Society (RMetS) and is your first step towards becoming professionally accredited as either a Registered Meteorologist (RMet) or Chartered Meteorologist (CMet).

RMetS
Royal Meteorological Society

MSc ATMOSPHERE, OCEANS & CLIMATE

Gain a deep quantitative understanding of the climate system and build experience in meteorological observation, forecasting, and data interpretation. Develop your understanding of the physical and dynamical building blocks of our climate, and the methods used to construct state-of-the-art models of the climate system. You will develop independent research skills by completing a dissertation project and a practical field course.

Topics include:

- Weather systems
- Atmospheric physics
- Weather and climate discussion
- Professional skills
- Fluid dynamics of the atmosphere and oceans
- Numerical modelling of atmospheres and oceans
- Climate change
- Tropical weather systems
- Oceanography
- Remote sensing
- Global circulation of the atmosphere and oceans
- Atmospheric chemistry, pollution and transport

MSc APPLIED METEOROLOGY AND CLIMATE

Develop expertise in atmospheric physics, forecasting, and meteorological and climate data analysis. You will build a strong foundation in the understanding and interpretation of meteorological and climate data, forecasts and observations. Utilise your independent research skills by completing a dissertation project and a practical field course.

Topics include:

- Measurements and instrumentation
- Computing
- Forecasting systems and applications
- Weather systems
- Atmospheric physics
- Weather and climate discussion
- Professional skills
- Boundary Layer Meteorology
- Statistics for weather and climate science
- Climate change
- Tropical weather systems
- Hazardous weather analysis
- Remote sensing
- Atmospheric chemistry, pollution and transport

MSc APPLIED METEOROLOGY & CLIMATE WITH MANAGEMENT

Combine the study of meteorology and climate science with management training with this interdisciplinary course, delivered in collaboration with the triple-accredited Henley Business School. Deepen your understanding of meteorology and climate, and prepare for current – or future – managerial responsibilities. You will develop independent research skills by completing a dissertation project and a practical field course.

Topics include:

- Managing people and organisations
- Computing
- Forecasting systems and applications
- Atmospheric physics
- Weather and climate discussion
- Professional skills
- Preparing for floods
- Statistics for weather and climate science
- Climate change
- Tropical weather systems
- Hazardous weather analysis
- Remote sensing
- Atmospheric chemistry, pollution and transport

MSc CLIMATE CHANGE & ARTIFICIAL INTELLIGENCE (AI)

Learn how AI can be applied to help solve and understand complex global challenges, including the climate crisis. You will develop an understanding of both our changing climate and artificial intelligence, together with the business acumen to deploy that understanding effectively. By completing a dissertation project you will broaden your independent research skills.

Topics include:

- The science of climate change
- Foundations of statistical inference
- Applied data science with python
- Managing people and organisations
- Climate services and climate impact modelling
- Causal inference and decision-making
- Artificial intelligence and machine learning
- Climate change: values, ethics and justice
- Professional skills

CAREERS

MASTER'S

Graduates of our first three master's courses should be well placed to pursue a scientific career in weather forecasting and meteorological or climate research. Graduates of our MSc Climate Change and AI should be well prepared for jobs in business where AI can be used to understand climate change and its impacts and inform decision-making. 100% of graduates from Meteorology at Reading are in work or further study within 15 months of graduation[1].

Employers value our postgraduates for their strongly developed skills in numeracy, spatial awareness, quantitative and analytical reasoning skills, practical use of measurements and numerical modelling, and application of first-class scientific and mathematical principles to real-world problems.

Many of our students choose to continue their studies to PhD level at the University of Reading or elsewhere, or pursue research in industry. In recent years, our graduates have been recruited by organisations including the Met Office, Fugro, Aerospace and Marine International Corporation, AIR Worldwide, Green Cat Renewables and Metdesk. Others pursue careers associated with diverse aspects of environmental measurement, risk management and policy development. Opportunities outside of the meteorological world include careers in insurance, finance, power, utilities, transport, space, education, agriculture and health sectors.

[1] Based on our analysis of HESA data © HESA 2022, Graduate Outcomes Survey 2019/20; includes postgraduate (taught) and postgraduate (research) Meteorology responders

“Our subject is an amazing branch of physics and mathematics. It is both fascinating and incredibly important - it is central to our future on this planet.”

Sir Brian Hoskins
Emeritus Professor of Meteorology,
Commander of the British Empire,
Fellow of the Royal Society

Important Information
This brochure was issued in 2023 and is aimed at prospective undergraduate students wishing to apply for a place at the University of Reading (the University) and start a course in autumn 2024. The University makes every effort to ensure that the information provided in the brochure is accurate and up-to-date at the time of going to press (May 2023). However, it may be necessary for the University to make some changes to the information presented in the brochure following publication – for example, where it is necessary to reflect changes in practice or theory in an academic subject as a result of emerging research; or if an accrediting body requires certain course content to be added or removed. To make an informed and up-to-date decision, we recommend that you check **reading.ac.uk/study**

The University undertakes to take all reasonable steps to provide the services (including the courses) described in this brochure. It does not, however, guarantee the provision of such services. Should industrial action or circumstances beyond the control of the University interfere with its ability to provide the services, the University undertakes to use all reasonable steps to minimise any disruption to the services.

Topics
Topics are provided as a taster of the areas of study that may be available on each course. Information is correct at the time of going to press (May 2023), for a list of compulsory (core) modules please check **reading.ac.uk** for the most up to date information. Teaching staff on specific courses mentioned in this brochure may be subject to change.

Joint courses
Our joint courses may have extra requirements, including English language requirements. Please check the individual course pages on our website for further details.

Year abroad and placement fees
Some courses include an optional or compulsory year abroad or placement year. During this year you will only pay a partial fee which is currently set at 15% of the normal tuition fee. Check the website for the latest information: **reading.ac.uk/fees-and-funding**

Placements
Programmes with a Professional Placement Year (also known as 'Year in Industry' or 'Placement Year') are fully dependent on students securing their own placement opportunity, normally through a competitive recruitment process. The University provides dedicated career and application support for placement year students. Students who do not secure a placement or who are unable to complete the placement year due to extenuating circumstances, have the option to transfer to a three year variant of their programme with agreement from their School/Department.

Study abroad
The partnerships listed are correct at the time of publication (May 2023). For up to date information on the University's partnerships contact **studyabroad@reading.ac.uk**

Where Study Abroad is not a compulsory part of the degree programme, the University of Reading cannot guarantee that every applicant who applies for the scheme will be successful. Whilst efforts are made to secure sufficient places at partner institutions, the number of places available and the University's partners can vary year-on-year. In all cases, the University cannot guarantee that it will be possible for applicants to choose to study abroad at a particular institution.

Further, certain courses and/or institutions may require you to satisfy specific eligibility criteria. It can be a competitive process. For further information on the University's Study Abroad Scheme please contact **studyabroad@reading.ac.uk**

University of Reading

Department of Meteorology
reading.ac.uk/met

Ask us a question
reading.ac.uk/question

B29870 04.23

Athena SWAN Silver Award
ECU GENDER CHARTER
Stonewall DIVERSITY CHAMPION
The Queen's Anniversary Prizes for Higher and Further Education 2021