MONASH University

MONASH
EARTH, ATMOSPHERE AND ENVIRONMENT

monash.edu/earth-atmosphere-environment

GROUP OF EIGHT AUSTRALIA

EARTH, ATMOSPHERE AND ENVIRONMENT

Our motto is 'The world is our lab', and our work takes us from the Earth's core to the top of its atmosphere, from the tropics to the Antarctic ice sheet, and from the highest mountains to the deepest ocean trenches. The earth, atmospheric and environmental sciences are also key to exploring and understanding our solar system and beyond.

WHERE WILL YOUR STUDIES TAKE YOU?

Studies in the School of EAE will qualify you for many exciting careers as future leaders in applied or fundamental science, in industry, government, or academia.

Earth and Environmental Scientists earn some of the highest graduate salaries, even higher than Medicine, Law and Economics (source: www.graduatecareers.com.au).

YOUR CAREER NETWORK

We have our eye on your future and we work collaboratively with industry so our students develop an early link with real-world problems.

EAE has links with employers including the Bureau of Meteorology, Melbourne Water, Snowy Hydro, Hydro Tasmania, Geoscience Australia, Victorian Department of Land, Water and Planning, Victorian Department of Jobs, Precincts and Regions, and a range of companies in the minerals sector, as well as a number of environmental consultancies, not-for-profits and Cooperative Research Centres.

Some career options include

- Environmental Consultant
- Weather Forecaster
- Policy Analyst/Advisor
- Materials analyst
- Environmental impact assessor
- Science Communicator
- Geospatial (GIS) analyst
- Exploration Geologist
- Water management
- Geotechnical Engineer
- Science Education
- Climate Change risk manager
- Data Analyst
- Many varied government roles
- Research in universities or in research laboratories

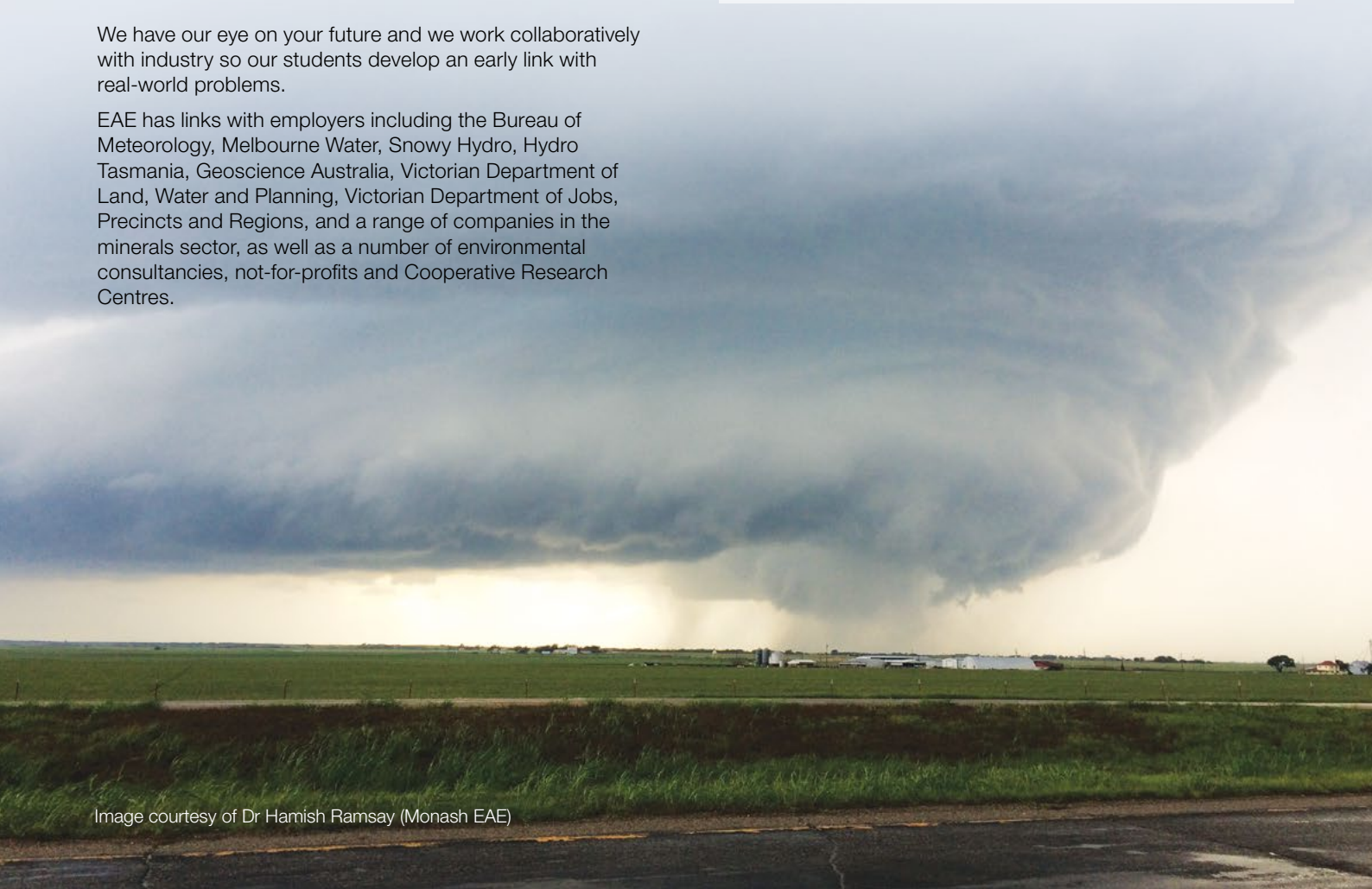


Image courtesy of Dr Hamish Ramsay (Monash EAE)

WHAT YOU'LL STUDY

The majors offered are Earth Science (consisting of 3 streams), Atmospheric Science and Geographical Science. Earth Science and Geographical Science are also offered as extended majors. There are also many electives to choose from. Environmental science and climate units offered by EAE also form part of the Environmental Science extended major managed by the School of Biological Sciences. For further details about the units you will study, as well as the electives available, visit the handbook: monash.edu/pubs/handbooks.

TO SHAPE OUR WORLD FOR A SUSTAINABLE FUTURE, WE NEED TO KNOW HOW THE EARTH WORKS.

Majors	First year units	Brief description
Earth Science Geoscience The Earth's Physical Environment The Earth's Climate	**EAE1011:** Earth Atmosphere and Environment 1 **EAE1022:** Earth Atmosphere and Environment 2 **SCI1300:** Climate Change: From Science to Society	Earth Sciences is a broad discipline that addresses the major processes that have shaped our planet over time and continue to pose natural hazards to society, and provide resources that we need to sustain a modern society. In the Geosciences stream, you will learn about geological processes: plate tectonics, basin formation, volcanology, earthquakes, and formation of the critical mineral resources needed for our transition to a renewable energy future. In the Earth's physical environment stream you will learn about the interaction of physical systems with the biosphere (rivers, groundwater, soils, landscapes). In the Earth's Climate stream you will learn how to understand and predict natural and anthropogenic climate change and its impacts.
Atmospheric Science	**EAE1011:** Earth Atmosphere and Environment 1 **EAE1022:** Earth Atmosphere and Environment 2 **SCI1300:** Climate Change: From Science to Society	Atmospheric Science is an interdisciplinary science that draws on the strengths of Environmental Science, Applied Mathematics and Physical Geography. It also applies concepts derived from Physics and Chemistry. Atmospheric Science explains how the weather and climate system works; from a gust of wind to global-scale climate change. Weather and climate are both critical to understanding the natural environment and how it is changing with human influence.
Geographical Science	**ATS1310:** Extreme Earth! Elective **ATS1309:** The Global Challenge **EAE1022:** Earth Atmosphere and Environment 2 **SCI1300:** Climate Change: From Science to Society	Geographical Science is the interdisciplinary study of understanding how natural and human processes affect our planet including soils, vegetation, water, landforms and climate throughout time. You will learn to analyse and synthesise complex environmental, economic, social and political information to enable a geographical understanding of humans, environments and the planet, and their management.

What you'll study in first year

EAE1011: Earth Atmosphere and Environment 1

This unit provides an introduction to the science involved in studying the Earth, including explanations of how and why our planet has changed over its 4.56 billion year history. You will study the formation and anatomy of the Earth and the processes that drive change within our planet and its environmental systems; from its core to its crust, to the systems driving and sustaining the planet's living surface, to the forces and processes involved in the development of mountains, ice sheets and oceans, and our changing atmosphere and climate.

EAE1022: Earth Atmosphere and Environment 2

This unit will expand your knowledge of the environmental, geological and atmospheric processes that create the unique physical environment in which we live, and will demonstrate how these processes influence our lives and affect the society in which we live. You will examine how and why the Earth's surface, atmosphere, ice sheets and oceans have changed in the past, and are predicted to change in the future, as a result of human influences such as deforestation, agricultural practices and human-induced climate change.

ATS1310: Extreme Earth!

This unit will focus on the catastrophes of our world today, such as droughts, earthquakes, epidemics, fires, floods, hurricanes, landslides, tsunamis and weather extremes. You will seek to understand the mechanics and dynamics of these environmental phenomena and how they interact with the social contexts in which these disasters occur. You will also investigate the role of international aid and risk management using local and international case studies.

ATS1309: The Global Challenge (Elective Unit)

What can you do in a world that is challenged by questions of poverty, environmental degradation, social inequality and economic exclusion? Insight is gained into the new and emerging forces of social, economic and environmental change. The unit examines how changing population and migration dynamics, urban development, patterns of consumption and growth, and labour markets intersect at local, national and global scales.

SCI1300: Climate Change: From Science to Society (Elective Unit)

This unit provides the scientific background to climate change, and assesses the environmental and societal impacts, and community and political responses to climate change. Starting from the basic principles and processes that define and govern the Earth's climate, this unit explores how the different parts of the Earth interact to produce the rich past and current variability of climate in space and time, and how human influences are shaping the future of the Earth's climate. This unit investigates what options humankind has to respond to the economic, ethical and political challenges of climate change, including global and national governance models required to mitigate and adapt to its effects. This unit will provide students with the foundation and knowledge to respond to climate change challenges throughout their career, independent of their specific discipline.

UNIQUE LEARNING SPACES

Images courtesy of Prudence Perry and Associate Professor Ruth Reef (Monash EAE)

You will be taught in the award-winning Monash Earth Sciences Garden – an outdoor teaching laboratory that depicts the geology of Victoria – as well as brand new laboratory facilities on campus and field locations across Victoria.

The Monash Earth Sciences Garden is an outdoor teaching space composed of more than 500 rock specimens laid out to form a 'living' geological map of Victoria.

Our state-of-the-art teaching laboratories and practical classes are also complemented by innovative field experiences. Some of the places you can choose to visit include the volcanic plains of western Victoria, Cape Liptrap, the Otway and Gippsland coasts, Wilsons Promontory and Lake Eildon in Victoria; and Broken Hill and Bermagui in New South Wales. We also have a field unit based in Italy in the Cinque Terre, Liguria. Come and learn with us as we quantify the forest biomass in the Victorian Alps, investigate underground in Victoria's Goldfields, and conduct environmental monitoring on an oceanographic research cruise.

As a student, you have the opportunity to accompany senior researchers on fieldwork expeditions, to places including the Nullarbor Plain, Antarctica and Africa. You can also take part in student exchange programs with other Universities across North America, UK and Europe.

Harness the breadth of all your life and physical science studies while applying them in multiple specialised fields. Choose to study specialisations such as;

OCEANOGRAPHY AND COASTAL SCIENCE

Explore global oceanography and learn about coastal processes such as erosion that pose significant management challenges for societies, and global concerns such as sea level rise, overfishing and pollution.

SOIL SCIENCE AND LAND MANAGEMENT

Soils are critical for food and water security, effective nutrient cycling for terrestrial ecosystems and sustaining human life. You can explore alternative land uses and sustainable management of land and soil resources.

REMOTE SENSING AND GIS

Gain experience in GIS and remote sensing technologies, including satellite and UAV datasets. Equip yourself with the fundamental knowledge and essential skills in collecting, analysing and communicating spatial data.

ENVIRONMENTAL CHEMISTRY

Learn about elemental cycling in the biosphere, lithosphere and hydrosphere, how humans' impact on these cycles and how to remediate contaminated environments using lab, field and computational methods.

MODELLING AND CODING

Models simplify complex real-life phenomena and improve predictability of many Earth systems such as climate, tectonism, atmospheric circulation and ice sheet projections. Study physical and mathematical concepts, learn to code, and use cutting edge software environments.

GLACIERS AND ICE SHEETS

Develop a deep understanding of the factors and processes driving and affecting the cryosphere. Study the Greenland and Antarctic Ice Sheets, glaciers, sea ice and the Earth's changing climate.

ECONOMIC GEOLOGY

Learn about the geological systems responsible for forming metalliferous ore deposits and the mineral resources that are essential for our renewable energy future.

GEODYNAMICS AND GEOPHYSICS

Plate tectonics drives rock deformation, initiating earthquakes and building mountains. Observe and measure structural elements in the field, model 3D structures and apply kinematic analysis to global-scale geodynamics.

HYDROGEOLOGY

Understand groundwater and surface water resources for water security and environmental management. Study groundwater flow and the hydrological cycle, groundwater chemistry, tracers and contamination.

FUTURE CLIMATES AND PALAEOCLIMATOLOGY

What does the science say about human-induced climate change? How do we know what the climate has been in the past? Get familiar with policy frameworks concerning climate change and mitigation responses.

GEOCHEMISTRY AND MINERALOGY

Geochemistry has many applications in industry and scientific research; from understanding explosive volcanism and mining waste, to tracing the beginnings of the planet or performing advanced analytical chemistry for industrial purposes. Learn about inorganic chemistry, isotopes and crystallography.

DYNAMICAL AND PHYSICAL METEOROLOGY

Do you want to know how a tornado works? Ever wondered why we can make accurate weather forecasts? Physical meteorology examines the major physical forces that affect the behaviour of the atmosphere.

FIELD GEOLOGY AND MAPPING

Hone your skills in surveying, landscape interpretation and map construction. Determine the geological history of deformed terrane, assess mineralogical and spatial information for exploration geosciences and research.

You can also undertake a research project in a discipline of your choosing. Projects are tailored to your interests and can include disciplines as diverse as ore geology and bushfire modelling. The choice is yours!

WEATHER AND CLIMATE

SUSTAINABLE RESOURCES

ENVIRONMENTAL SYSTEMS

EARTH, ATMOSPHERE AND ENVIRONMENT
3

RESEARCH SNAPSHOT

The School of Earth, Atmosphere and Environment has an extensive and highly successful research program with research strengths in Atmosphere and Climate, Geography and Environment and Geoscience. You can become part of our vibrant research community and undertake an Honours, Masters or PhD, being mentored by some of Australia's leading scientists.

MASTERS

The School of Earth, Atmosphere and Environment provides opportunities for you to pursue a Master's degree.

MASTER OF SCIENCE IN EARTH SCIENCE

The Master of Science in Earth Science is an innovative, interdisciplinary two-year course that will equip students for a career in resource exploration or environmental earth science. Students can specialise in applied geoscience, remote sensing and spatial data science, or environmental earth science. Graduates gain skills in data analytics, advanced 3D geological modelling, remote sensing, spatial data science, GIS, drones and sensors. Training in these areas will be enhanced by the cutting-edge facilities and equipment available at Monash including the Cave II immersive visualisation facility, state-of the-art geochemical and materials analytical laboratories, drones and sensors.

For more information visit:
monash.edu/science/future-students/graduate-options/master-of-science-in-earth-science

MASTER OF SCIENCE IN ATMOSPHERIC SCIENCE

The Master of Science in Atmospheric Science is a two-year course designed to give students the knowledge and skills necessary for a professional career in weather and climate science. Students can select units in statistics for climate dynamics, dynamical meteorology, the general circulation, atmospheric modelling, atmospheric boundary layers and ocean circulation and dynamics as well as undertaking research projects in theoretical, computational or observation-based atmospheric science.

For more information visit:
monash.edu/science/future-students/graduate-options/master-of-science-in-atmospheric-science

You can also use these Masters as a springboard to a PhD.

TAKE YOUR HIGHER DEGREE WHERE YOU WANT TO GO

by joining our world leading research programs in Geoscience, Geography and Environment, and Atmosphere and Climate research.

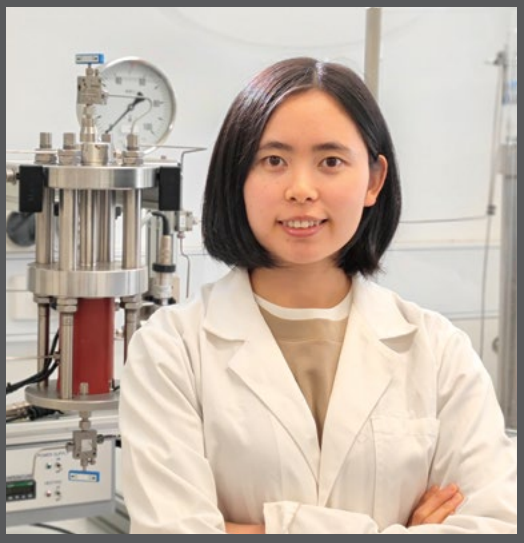
We are home to globally prominent groups that you can be a part of including;

- ARC Centre of Excellence in Climate Extremes (CLEX)
- Monash Ice Sheet Initiative (MISI)
- Securing Antarctica's Environmental Future (SAEF).

We offer research projects in disciplines including, but never limited to;

- Structural Geology and Tectonics
- Geodynamics
- Geochemistry and Geochronology
- Geophysics
- Remote Sensing and GIS
- Soil Science
- Clouds and Convection
- Coastal Science
- Hydrogeology
- Climate Science
- Economic Geology
- Volcanology
- Biogeography
- Economic Geology
- Urban and Applied Climatology
- Palaeoclimatology
- Environmental Geochemistry
- Cryospheric Sciences
- Oceanography
- Meteorology
- Materials Science
- Planetary Science
- Fire and Fire Weather
- Minerals, Microbes and Solutions

"My PhD study can help to determine global mineral distributions by assessing mineral fluid reactions on micrometre and nanometre scales"



PROJECT: UNDERSTANDING ORE MINERAL REPLACEMENT REACTION MECHANISMS IN HYDROTHERMAL CONDITIONS

PHD CANDIDATE: GAN DUAN

I study mineral fluid reactions in the deep earth. These reactions are components of the rock cycle and determine element redistribution, transportation and reprecipitation, forming large-scale ore deposits around the world.

I look at the effect of fluid chemistry on mineral alteration processes and microstructural changes within minerals by using different microscopes, such as scanning and transmission electron microscopes. My investigations include field, laboratory and thermodynamic modelling work.

My research has enabled me to develop a wide range of employability skills and pave a road for my career after graduation. Through my work we can have a better idea of the mineral-fluid reaction process in the real world. This will guide us to find the deep and potential deposits formed under earth based on the large-scale alteration minerals formed on Earth's surface.

"My research has allowed me to conduct meaningful research across different aspects of the environment, providing me with the opportunity to explore Victoria's coastline whilst also completing my studies."

PROJECT: AN INVESTIGATION INTO THE DYNAMICS OF GASEOUS EXCHANGE AND BIOGEOMORPHOLOGY OF TEMPERATE COASTAL WETLANDS

PHD CANDIDATE: MATTHEW PECK

I study how climate change and natural disturbance affects Victoria's coastline. My research investigates how changes to these ecosystems may affect the benefits they provide, including the storage of greenhouse gases, water availability and movement, and protection to human infrastructure. I look at how change is likely to occur within these environments, what affects this change, and at what rate this change is occurring.

I investigate these disturbance features through both field and laboratory work. For example, one aspect of my work allows me to utilise our world-class drone platform; where I am able to investigate coastal subsidence down to the millimetre scale across large wetland areas.

My research has enabled me to develop wide range of employability skills, preparing me for life after University.

Through this work I aim to improve our understanding as a society of the importance and fragile nature of coastal wetland ecosystems in Victoria. This will allow us to develop our knowledge base of how these systems shift with a changing climate, improving our understanding of what Victoria's coastline may look like in the future.

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Further information

monash.edu/earth-atmosphere-environment

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