ENVS216

The Atmospheric Environment

S1 Day 2016

Dept of Environmental Sciences

Contents

General Information

Unit convenor and teaching staff
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Credit points
3

Prerequisites
ENVE117(P) or ENVS117(P) or GEOS117(P) or GEOS112(P) or 3cp in PHYS units at 100 level

Corequisites

Co-badged status

Unit description
This unit provides an introduction to the major atmospheric, oceanic and other environmental processes that are responsible for our weather and climate. The unit builds on themes introduced in ENVS117 and GEOS112 with a focus on Australian region weather and climate. Severe weather events such as tropical cyclones, thunderstorms, hail and tornadoes are discussed, and each year an operational meteorologist will contribute to our teaching program. Besides the regular lectures, online training modules are available to enhance the understanding of lecture topics. This unit is offered under the flipped classroom model, in which online training modules built within iLearn are available to let students obtain the background knowledge on the topics at their own pace. On-campus students participate in practicals and group discussions with instructors, while external students are able to complete the same practicals in online mode. Assessment tasks in the unit include regular assignments, project-based reports and formal examination. One of the tasks is to participate in an open weather forecast game created by the Australian Meteorological and Oceanographic Society. While mathematical skills at HSC level are beneficial to completing some of the assessment tasks in the unit and will be introduced in the unit, conceptual understanding of weather and climate phenomena is emphasized.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

Understand the fundemantal principles on which meteorology and climatology are based
Understand the important meteorological and oceanic processes which shape weather and climate
Recall and appropriately utilise meteorological and climatological terminology
Recognise and appropriately utilise basic equations which govern weather and climate
Apply basic concepts and equations to practical (real world) problems
Acquire field skills to collect data by measurement or observation (e.g., familiarity with the use of basic meteorological instruments)
Critically evaluate scientific literature in the fields of meteorology, oceanography and climatology
Analyse and evaluate categorical and numerical data (e.g., interpreting environmental data)
Conceptualise and apply simple models related to weather and climate processes

Assessment Tasks

Name	Weighting	Due
Reading Game	5%	Week 13
Class Discussion	5%	N/A
Horizontal Motion of Air	15%	Week 5
Atmospheric Stability	15%	Week 7
Weather Tipping Competition	25%	Week 12
Examination	35%	TBA

Reading Game

Due: **Week 13**
Weighting: **5%**

The 'Reading Game' is a utility previously developed by our Learning and Teaching Centre that

allows you to generate your own questions and answer those created by your peers. You will get more marks in the Game when your questions are popular and attract a lot of feedbacks. The aim of this Game is to let you think about the weather phenomena occurring around you and try to understand them through discussion with your peers.

On successful completion you will be able to:

- Understand the fundemantal principles on which meteorology and climatology are based
- Understand the important meteorological and oceanic processes which shape weather and climate
- Recall and appropriately utilise meteorological and climatological terminology
- Critically evaluate scientific literature in the fields of meteorology, oceanography and climatology

Class Discussion

Due: **N/A**
Weighting: **5%**

According to our flipped classroom model, there will be no formal lecture in this unit. Instead, in-class discussion sessions will be held very week to look at your progress of reading the textbook and going through the online modules. In particular, focuses will be put on the questions you generate in the Reading Game (see the first assessment) such that each session is adaptive to the areas you mostly need assistance. For this purpose, it is requested that you participate in at least half of the discussion sessions throughout the semester.

On successful completion you will be able to:

- Understand the fundemantal principles on which meteorology and climatology are based
- Understand the important meteorological and oceanic processes which shape weather and climate
- Recall and appropriately utilise meteorological and climatological terminology

Horizontal Motion of Air

Due: **Week 5**
Weighting: **15%**

This assignment consists of numerical questions on the various types of horizontal motion of air or winds, and their responsible driving forces. Understanding of the governing equations and application of them in algebric calculations are expected.

On successful completion you will be able to:

- Understand the fundemantal principles on which meteorology and climatology are based
- Understand the important meteorological and oceanic processes which shape weather

and climate
- Recall and appropriately utilise meteorological and climatological terminology
- Recognise and appropriately utilise basic equations which govern weather and climate
- Apply basic concepts and equations to practical (real world) problems
- Acquire field skills to collect data by measurement or observation (e.g., familiarity with the use of basic meteorological instruments)
- Analyse and evaluate categorical and numerical data (e.g., interpreting environmental data)

Atmospheric Stability

Due: **Week 7**
Weighting: **15%**

This assignment consists of questions on the representation of moisture in the atmosphere and the concept of stability, which are the basis of cloud and precipitation development. Answers are in the form of numerical and graphical analysis, written explanation and supports from drawn diagrams.

On successful completion you will be able to:
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- Understand the important meteorological and oceanic processes which shape weather and climate
- Recall and appropriately utilise meteorological and climatological terminology
- Recognise and appropriately utilise basic equations which govern weather and climate
- Apply basic concepts and equations to practical (real world) problems
- Acquire field skills to collect data by measurement or observation (e.g., familiarity with the use of basic meteorological instruments)
- Analyse and evaluate categorical and numerical data (e.g., interpreting environmental data)

Weather Tipping Competition

Due: **Week 12**
Weighting: **25%**

The Weather Tipping Competition (http://tipping.amos.org.au/dist/pages/index.php#static/home) is a game open to the public organised by the Australian Meteorological and Oceanographic Society (AMOS). The game will start from early April and last for about 10 weeks (or rounds). Students are asked to participate in this game, but instead of just submitting your forecast (of temperatures and rainfall) you are requested to document your reasonings behind the forecasts based on the concepts learnt from this unit. A case study on a weather system using

meteorological analysis techniques is also required in this report. A more detailed description of this assessment will be released.

On successful completion you will be able to:

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- Understand the important meteorological and oceanic processes which shape weather and climate
- Recall and appropriately utilise meteorological and climatological terminology
- Apply basic concepts and equations to practical (real world) problems
- Acquire field skills to collect data by measurement or observation (e.g., familiarity with the use of basic meteorological instruments)
- Critically evaluate scientific literature in the fields of meteorology, oceanography and climatology
- Analyse and evaluate categorical and numerical data (e.g., interpreting environmental data)
- Conceptualise and apply simple models related to weather and climate processes

Examination

Due: **TBA**
Weighting: **35%**

Exam date, structure, etc., will be available later in the semester. The exam is run through the formal university examination process. The exam structure may take the form of numerical, short answer and/or essay questions. You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in draft form approximately 8 weeks before the commencement of the examinations and in final form approximately 4 weeks before the commencement of the examinations. (http://www.timetables.mq.edu.au/exam) The only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. You are advised that it is Macquarie University policy not to set early examinations. All students are expected to ensure that they are available until the end of the teaching semester; that is the final day of the official examination period.

On successful completion you will be able to:

- Understand the fundemantal principles on which meteorology and climatology are based
- Understand the important meteorological and oceanic processes which shape weather and climate
- Recall and appropriately utilise meteorological and climatological terminology
- Recognise and appropriately utilise basic equations which govern weather and climate

- Apply basic concepts and equations to practical (real world) problems
- Critically evaluate scientific literature in the fields of meteorology, oceanography and climatology
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Delivery and Resources

This unit will be conducted using the **'Flipped Classroom'** model. That is, instead of running the regular lectures, students will learn the background knowledge and fundamental principles at your own times based on the assigned textbook and the accompanied electronic supplementary materials. Online modules developed by the convenor will also be provided, especially in the context of discussing weather systems specific to the Australian region. These online modules are in the form of sequences in the Learning Activities Management System (LAMS), which have been builted into iLearn. External online resources developed by other educational institutes and publishers will also be utilised, and if login information are necessary other than iLearn they will be delivered to you by the convenor.

Besides the times you spend on learning from the textbook and online materials, you are to finish the assessment tasks set for the unit, which consist of participation in the **Reading Game** (see Learning and Teaching Activities), participation in class discussion, two short regular assignments and a research report based on your experience of participating in the **Weather Tipping Competition** organised by the Australian Meteorological and Oceanographic Society (AMOS). Under this 'Flipped Classroom' model, the convenor and other instructors of this unit will be your consultants to help you learn from the online resources and work out the assessment tasks. We are going to use the contact hours (i.e., the lecture and practical sessions set in the university timetable) in very flexible ways. These contact hours for this year are

Monday 12 am - 1 pm (E5A 120); Wednesday 12 pm - 1 pm (E5A 160)

Monday 9 am - 11 am (E5A 270); Friday 1 pm - 3 pm (E5A 260); Friday 2 pm - 4 pm (E5A 270)

The two assigned lecture hours on Monday and Wednesday will be used for our discussion sessions, in which you can ask questions about the difficulties you meet and we know about the progress of your learning. In particular, we will focus on the most popular or controversial questions in the Reading Game. You do not need to come in every session, however, in order to encourage you doing so 5% of the unit final mark has been assigned for students to participate in at least half of the sessions throughout the semester. Because there will be no recorded lectures for this year, we do not have to access the Echo360 system. A computer with internet access, web browser, Microsoft Office or equivalent word processing tool and software to read 'pdf' documents is necessary to access the online teaching modules and completing the assessment tasks. If you need the computers in our laborabories to perform your work in the weeks without scheduled practicals, they are always available within the designated practical sessions.

Seven practical sessions have been scheduled for you to work on exercises that enhance your

understanding of the theories developed in the textbook (see Unit Schedule in the following). Attending these practical sessions is mandatory. The several written assignments are closely related to these practicals, thus after these practical sessions completing the assignments should be straight forward.

The textbook we use is **Aguado, E., and J. E. Burt, 2015: Understanding Weather and Climate (7th global edition, ISBN 978-0-321-98730-3), Pearson, 596 pp**. It is essential for you to obtain a copy of this textbook together with an access card to the **Pearson MyLab and Mastering** online system (http://www.pearsonmylabandmastering.com/au/). They will be sold as a package in the Co-op Bookstore. We will make use of materials from the **MasteringMeteorology** website to enhance your understanding the textbook, and there are also quiz questions for you to self test your progress. When we discuss weather systems and climate specific to the Australian region, the useful reference book is Sturman, A., and N. J. Tapper, 2006: The Weather and Climate of Australia and New Zealand (2nd edition), Oxford University Press, 541 pp, which is accessible from the University Library.

Unit Schedule

Based on our 'Flipped Classroom' teaching model, there will be no regular lectures (except the first one). The textbook, online modules and asessment tasks will cover the following topics, which are based on the chapters in Aguado and Burt (2015):

Introduction and Course Overview (29 February, please come to the classroom for first meeting)

Energy and Mass

Chapter 1: Composition and Structure of the Atmosphere

Chapter 2: Solar Radiation and the Seasons

Chapter 3: Energy Balance and Temperature

Chapter 4 Atmospheric Pressure and Wind

Water in the Atmosphere

Chapter 5: Atmospheric Moisture

Chapter 6: Cloud Development and Forms

Chapter 7: Precipitation Processes

Distribution and Movement of Air

Chapter 8: Atmospheric Circulation and Pressure Distributions (including climate variability such as the El Nino Southern Oscillation)

Chapter 9: Air Masses and Fronts

Disturbances

Chapter 10: Midlatitude Cyclones

Chapter 11: Lightning, Thunder and Tornadoes

Chapter 12 Tropical Storms

Weather Forecasting

Chapter 13: Weather Forecasting

Of course, we do not need to fulfill every learning outcome from each of these chapters. **Specific learning outcomes for each chapter will be listed on iLearn** such that you can follow when reading the textbook. Moreover, whenever there are relevant online tutorials and animations in the MasterMeteorology website to enhance your understanding on these topics, they will be listed on iLearn.

Seven **practical sessions** have been scheduled on the following topics:

Week 2: Energy Balance We will visit the Macquarie University Automated Weather Station (aws.mq.edu.au), which is located next to the univeristy sports field to examine the standard measuring equipments in a weather station. Then we will make use of the measurement data to calculate the surface energy balance.

Week 4: Atmospheric Motion. We will learn about the forces governing the wind direction and speed, starting from the large-scale situation, based on simple equations.

Week 5: Atmospheric Moisture. We will learn about various measures of moisture content in air and how to do conversion between them through calculations and graphical methods.

Week 6: Saturation and Atmospheric Stability. We will learn how saturation of water affects the atmospheric stability, which is the concept behind cloud development and precipitation. A chart used by meteorologists will be used to determine such stability.

Week 7 (after semester break): Weather Map Analysis. We will learn how weather conditions are recorded on various types of weather maps, and their implications to the development of interesting weather systems.

Week 8: Weather Forecasting. To facilitate your participation to the AMOS Weather Tipping Competitation, we will perform an exercise forecast session and discuss the techniques weather forecasters applied to predict the weather.

Week 10: Severe Weather Systems. We will learn about the data based on which the behaviour of severe weather systems, such as east coast low, fronts and midlatitude cyclones, tropical cyclones, thunderstorms and hails, can be analysed. We will also learn about the rules behind the strong winds of some of these systems.

Learning and Teaching Activities

Student Workload

You are expected to spend a minimum of 9 hours per week on this course. Given the teaching model we apply this year, you can learn with your own available time. However, it is recommended that you follow this sequence of study each week: 1. Go through the textbook and online modules in the order set by the instructor, and perform any quizzes assigned to you 2.

Participating in the Reading Game peer discussion regularly 3. Record the questions you have during reading and attend the discussion sessions to get assistance from the instructor 4. Attend the scheduled practical sessions 5. Set aside time a few hours each week to work on assignments and projects for the assessments 6. From early April, register at the AMOS Weather Tipping Competition and start submitting your forecasts

Participation in the Reading Game

Here is a description of the Reading Game by its developers: The Reading Game – encouraging learners to become questionmakers rather than question-takers by getting feedback, making friends and having fun. The Reading Game is a question and answer game designed to engage learners in the content of their coursework. The class of student participants creates a collective learning space where every action serves to introduce, build, or clarify concepts from the curriculum. The quality of the multiple-choice questions and the contents of the quizzes are determined by the participants who receive points for their efforts in both asking and answering questions. Participants can comment on and rate questions deemed outstanding by their peers, which directly impacts the contents of review quizzes. Participants progress to the next level of the game using their accumulated points onto asking open questions to the teachers and their cohort. Writing good questions is the winning strategy of the game. The key claim in the Reading Game is that creating questions is one of the fundamental cognitive elements that guide our conscious reasoning.

Participation in the Weather Tipping Competition

Here is how the Weather Tipping Competition is introduced by AMOS at the website http://tipping.amos.org.au/dist/pages/index.php#static/home: This is a special AMOS event where you can test your weather forecasting skills for different locations around Australia. The competition will follow the familiar format of a regular AFL football tipping competition but instead of winners, we're looking for your predictions of minimum temperature, maximum temperature and rainfall. Prizes will be awarded to the players with the lowest overall errors for each category at the end of the home and away season. In addition, the top eight players at the beginning of the finals period will enter the playoffs for the premiership!

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy.

The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- Recognise and appropriately utilise basic equations which govern weather and climate
- Apply basic concepts and equations to practical (real world) problems
- Acquire field skills to collect data by measurement or observation (e.g., familiarity with the use of basic meteorological instruments)
- Critically evaluate scientific literature in the fields of meteorology, oceanography and climatology
- Analyse and evaluate categorical and numerical data (e.g., interpreting environmental data)
- Conceptualise and apply simple models related to weather and climate processes

Assessment tasks

- Reading Game
- Horizontal Motion of Air
- Atmospheric Stability
- Weather Tipping Competition
- Examination

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Recognise and appropriately utilise basic equations which govern weather and climate
- Acquire field skills to collect data by measurement or observation (e.g., familiarity with

the use of basic meteorological instruments)
- Critically evaluate scientific literature in the fields of meteorology, oceanography and climatology
- Analyse and evaluate categorical and numerical data (e.g., interpreting environmental data)
- Conceptualise and apply simple models related to weather and climate processes

Assessment tasks

- Reading Game
- Horizontal Motion of Air
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Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcomes

- Apply basic concepts and equations to practical (real world) problems
- Critically evaluate scientific literature in the fields of meteorology, oceanography and climatology
- Conceptualise and apply simple models related to weather and climate processes

Assessment tasks

- Reading Game
- Horizontal Motion of Air
- Atmospheric Stability
- Weather Tipping Competition
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Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where

relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Understand the fundemantal principles on which meteorology and climatology are based
- Understand the important meteorological and oceanic processes which shape weather and climate
- Recall and appropriately utilise meteorological and climatological terminology
- Recognise and appropriately utilise basic equations which govern weather and climate
- Apply basic concepts and equations to practical (real world) problems
- Acquire field skills to collect data by measurement or observation (e.g., familiarity with the use of basic meteorological instruments)
- Critically evaluate scientific literature in the fields of meteorology, oceanography and climatology
- Analyse and evaluate categorical and numerical data (e.g., interpreting environmental data)
- Conceptualise and apply simple models related to weather and climate processes

Assessment tasks

- Reading Game
- Class Discussion
- Horizontal Motion of Air
- Atmospheric Stability
- Weather Tipping Competition
- Examination

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Understand the fundemantal principles on which meteorology and climatology are based

- Understand the important meteorological and oceanic processes which shape weather and climate
- Recall and appropriately utilise meteorological and climatological terminology
- Recognise and appropriately utilise basic equations which govern weather and climate
- Apply basic concepts and equations to practical (real world) problems
- Acquire field skills to collect data by measurement or observation (e.g., familiarity with the use of basic meteorological instruments)
- Critically evaluate scientific literature in the fields of meteorology, oceanography and climatology
- Analyse and evaluate categorical and numerical data (e.g., interpreting environmental data)
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- Examination

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Recognise and appropriately utilise basic equations which govern weather and climate
- Apply basic concepts and equations to practical (real world) problems
- Acquire field skills to collect data by measurement or observation (e.g., familiarity with the use of basic meteorological instruments)
- Analyse and evaluate categorical and numerical data (e.g., interpreting environmental data)
- Conceptualise and apply simple models related to weather and climate processes

Assessment tasks

- Horizontal Motion of Air
- Atmospheric Stability
- Weather Tipping Competition
- Examination

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Acquire field skills to collect data by measurement or observation (e.g., familiarity with the use of basic meteorological instruments)
- Conceptualise and apply simple models related to weather and climate processes

Assessment tasks

- Horizontal Motion of Air
- Atmospheric Stability
- Weather Tipping Competition
- Examination

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

- Recall and appropriately utilise meteorological and climatological terminology
- Apply basic concepts and equations to practical (real world) problems
- Critically evaluate scientific literature in the fields of meteorology, oceanography and climatology

Assessment tasks

- Reading Game
- Class Discussion
- Horizontal Motion of Air
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- Examination

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes

- Understand the important meteorological and oceanic processes which shape weather and climate
- Recall and appropriately utilise meteorological and climatological terminology
- Critically evaluate scientific literature in the fields of meteorology, oceanography and climatology

Assessment tasks

- Reading Game
- Class Discussion
- Horizontal Motion of Air
- Atmospheric Stability
- Weather Tipping Competition
- Examination