



# ENVS302

## Urban Climate and Air Quality

S1 Day 2018

*Dept of Environmental Sciences*

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#### **Disclaimer**

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

## General Information

Unit convenor and teaching staff

Unit Lecturer

Associate Professor Paul Beggs

[paul.beggs@mq.edu.au](mailto:paul.beggs@mq.edu.au)

Contact via By email

12 Wally's Walk, Office 413

Generally anytime, but it is best to make an appointment if you are coming in specially to meet

Paul Beggs

[paul.beggs@mq.edu.au](mailto:paul.beggs@mq.edu.au)

Katrina MacSween

[katrina.macsween@mq.edu.au](mailto:katrina.macsween@mq.edu.au)

Credit points

3

Prerequisites

(39cp at 100 level or above) including (ENVE216 or ENV5216 or GEOS216)

Corequisites

Co-badged status

Unit description

More than half of the world's population lives in urban areas, and virtually all countries are becoming increasingly urbanised. Australia is one of the most urbanised countries in the world, with about 90% of our population living in urban areas. For these reasons, urban climate and air quality are extremely important, directly influencing the health and wellbeing of billions of people around the world. This unit explores urban climate and air quality through detailed study of interactions between the atmosphere and the Earth's surface in the relatively thin veneer of air that we live in known as the planetary boundary layer. The unit will be of interest to all students in science and engineering and more generally any student with an interest in the environment, and provides knowledge and skills that will be of value for a range of careers and employers, ranging from environmental consultancy and local and state government, to private industry.

## 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:

At the end of this unit of study, students will be able to describe urban climate and air quality, including the physical, chemical and biological processes operating to produce or change the state of the urban atmosphere. Also at the end of this unit of study, students will be able to demonstrate sufficient knowledge and conceptual understanding of the dispersive capabilities of the atmospheric environment near the surface of the earth, how pollutants emitted into the atmospheric environment move and interact with the surface, and some appreciation for the atmosphere's role in biogeochemical cycles.

At the end of this unit of study, students will be able to formulate a problem, develop its methodical analysis, and critically interpret the findings in order to find an appropriate climate science solution.

At the end of this unit of study, students will be able to contend with the temporal and spatial scales of climate science and constraints associated with the absence of a universal approach or answer, in a creative and innovative manner.

At the end of this unit of study, students will be able to demonstrate practical knowledge to undertake analysis of climatic data and work with apparatus common to the climate science discipline.

At the end of this unit of study, students will be able to examine, analyse, interpret and integrate scientific information from various primary and secondary sources.

At the end of this unit of study, students will be able to demonstrate practical laboratory and field based skills associated with typical measurement problems in the field of climate science.

At the end of this unit of study, students will be able to describe a research problem, propose its analysis, and then articulate the respective findings through oral, written, and non-traditional media which are important tools in the communication of climate science.

## General Assessment Information

This unit has six assessment tasks. The first three relate to the first half of the unit, and the last three relate to the second half of the unit.

Quizzes 1, 2, and 3, and the mid semester test must be done in a ENVS302 Practical class under the supervision of one of the academic staff teaching the unit.

Extensions for Assignment 1 and Assignment 2 may be granted, and applications must be submitted by email to the Unit Convenor prior to the due date where possible.

Penalties apply for late submission of Assignment 1 and Assignment 2 without an extension.

This is 10% of the total possible mark per day or part thereof (i.e., the assignments are worth 20%, so the penalty is 2% (i.e., 2 marks) per day or part thereof.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#"><u>Quiz 1</u></a>	15%	No	Week 4 Practical
<a href="#"><u>Mid semester test</u></a>	15%	No	Week 7 Practical
<a href="#"><u>Assignment 1</u></a>	20%	No	3 May 2018 via Turnitin 10am
<a href="#"><u>Quiz 2</u></a>	15%	No	Week 10 Practical
<a href="#"><u>Quiz 3</u></a>	15%	No	Week 13 Practical
<a href="#"><u>Assignment 2</u></a>	20%	No	14 June 2018 via Turnitin 10am

### Quiz 1

Due: **Week 4 Practical**

Weighting: **15%**

The quiz comprises 20 multiple choice questions and usually requires about thirty minutes to an hour to complete. The quiz is conducted in the ENV5302 Practical class. Questions in the quiz are randomised. It will be drawn from lecture and practical material covered prior to the date of the quiz. Feedback is available to students as soon as they complete the quiz. This feedback includes their number grade, an indication of if each question was answered correctly or not, and a written response to the answer provided for each question.

On successful completion you will be able to:

- At the end of this unit of study, students will be able to describe urban climate and air quality, including the physical, chemical and biological processes operating to produce or change the state of the urban atmosphere. Also at the end of this unit of study, students will be able to demonstrate sufficient knowledge and conceptual understanding of the dispersive capabilities of the atmospheric environment near the surface of the earth, how pollutants emitted into the atmospheric environment move and interact with the surface, and some appreciation for the atmosphere's role in biogeochemical cycles.
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to undertake analysis of climatic data and work with apparatus common to the climate science discipline.

- At the end of this unit of study, students will be able to demonstrate practical laboratory and field based skills associated with typical measurement problems in the field of climate science.
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## Mid semester test

Due: **Week 7 Practical**

Weighting: **15%**

The mid semester test is a closed book test carried out in the Week 7 Practical class. The only aid allowed is a scientific calculator. No smart phones allowed. The test covers the material in the lectures delivered by Dr Edwards. The test is limited to 3 hrs in duration.

On successful completion you will be able to:

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and field based skills associated with typical measurement problems in the field of climate science.

- At the end of this unit of study, students will be able to describe a research problem, propose its analysis, and then articulate the respective findings through oral, written, and non-traditional media which are important tools in the communication of climate science.

## Assignment 1

Due: **3 May 2018 via Turnitin 10am**

Weighting: **20%**

Literature review on an Atmospheric Boundary Layer topic. Further instructions to be posted on iLearn.

On successful completion you will be able to:

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non-traditional media which are important tools in the communication of climate science.

## Quiz 2

Due: **Week 10 Practical**

Weighting: **15%**

The quiz comprises 20 multiple choice questions and usually requires about thirty minutes to an hour to complete. This quiz covers the Urban Climate lectures and practicals (Weeks 8 and 9) delivered by Associate Professor Paul Beggs. Questions in the quiz are randomised. Feedback is available to students as soon as they complete the quiz. This feedback includes their number grade, an indication of if each question was answered correctly or not, and a written response to the answer provided for each question.

On successful completion you will be able to:

- At the end of this unit of study, students will be able to describe urban climate and air quality, including the physical, chemical and biological processes operating to produce or change the state of the urban atmosphere. Also at the end of this unit of study, students will be able to demonstrate sufficient knowledge and conceptual understanding of the dispersive capabilities of the atmospheric environment near the surface of the earth, how pollutants emitted into the atmospheric environment move and interact with the surface, and some appreciation for the atmosphere's role in biogeochemical cycles.
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## Quiz 3

Due: **Week 13 Practical**

Weighting: **15%**

The quiz comprises 20 multiple choice questions and usually requires about thirty minutes to an hour to complete. This quiz covers the Urban Climate lectures and practicals (Weeks 10, 11, and 12) delivered by Associate Professor Paul Beggs. Questions in the quiz are randomised. Feedback is available to students as soon as they complete the quiz. This feedback includes their number grade, an indication of if each question was answered correctly or not, and a written response to the answer provided for each question.

On successful completion you will be able to:

- At the end of this unit of study, students will be able to describe urban climate and air quality, including the physical, chemical and biological processes operating to produce or change the state of the urban atmosphere. Also at the end of this unit of study, students will be able to demonstrate sufficient knowledge and conceptual understanding of the dispersive capabilities of the atmospheric environment near the surface of the earth, how pollutants emitted into the atmospheric environment move and interact with the surface, and some appreciation for the atmosphere's role in biogeochemical cycles.
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- At the end of this unit of study, students will be able to examine, analyse, interpret and integrate scientific information from various primary and secondary sources.
- At the end of this unit of study, students will be able to demonstrate practical laboratory and field based skills associated with typical measurement problems in the field of climate science.

## Assignment 2

Due: **14 June 2018 via Turnitin 10am**

Weighting: **20%**

Urban Climate Data Analysis Research Report. Details of this assignment will be provided in Week 8 by Associate Professor Paul Beggs.

On successful completion you will be able to:

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## **Delivery and Resources**

### **Required Text**

The required text for this unit is:

Oke TR, Mills G, Christen A, Voogt JA (2017) Urban climates. Cambridge University Press, Cambridge.

There are enough copies in the Co-op Bookshop for each ENV302 student to purchase a copy. The Library provides online access [QC981.7.U7 O34 2017].

Also highly recommended:

Oke TR (1987) Boundary layer climates (2nd ed). Routledge, London. [QC981.7.M5.O34/1987]

### **Recommended Texts**

- Arya SPS (2001) Introduction to micrometeorology (2nd ed). Academic Press, San Diego. [QC883.8.A79/2001]
- Foken T (2008) Micrometeorology. Springer-Verlag, Heidelberg, [QC883.8]
- Hewitt CN, Jackson AV (2009) Atmospheric science for environmental scientists. Wiley-Blackwell UK. [QC861.3 AB66]
- Monteith JL, Unsworth MH (2008) Principles of environmental physics (3rd ed). Edward Arnold, Melbourne. [QH505.M58/1990]
- Scorer RS (2002) Air pollution meteorology. Horwood, Chichester. [QC882.S35]

### **Recommended Journals**

Agricultural and Forest Meteorology [S600.A35 and Electronic journal]

Atmospheric Environment [TD881.A8 and Electronic journal]

Boundary-Layer Meteorology [QC851.B6 and Electronic journal]

Energy and Buildings [TJ163.5.B84.E523 and Electronic journal]

International Journal of Biometeorology [QH543.I5 and Electronic journal]

International Journal of Remote Sensing [G70.4.I56 and Electronic journal]

Journal of Applied Meteorology [QC851.A66 and Electronic journal]

Journal of Applied Meteorology and Climatology [QC851.A66 and Electronic journal]

Journal of Geophysical Research [QC811.J6]

Meteorological Applications [QC851.M15]

Photogrammetric Engineering and Remote Sensing [TA593.A2.P5]

Remote Sensing of Environment [G1.R4 and Electronic journal]

Technical Note / World Meteorological Organization [QC851.W6444]

Theoretical and Applied Climatology [QC851.A732 and Electronic journal]

Urban Climate [Online access]

### Unit Web Site

The web page for this unit can be found at: <https://ilearn.mq.edu.au/>

### Required Storage and Calculator

You will be required to supply your own computer storage media – USB disks or blank CD ROMs - for data storage or records of what you have been working on in the practical classes. Finally, you will need to own, or have access to, a reasonable scientific calculator (including functions ln, log10, ex, sin, cos, tan,  $\pi$ , and 1/x) for this unit.

## Unit Schedule

Week	Lecturer	Lecture Topic	Practical Topic	Assessment
1	GE	<a href="#">Welcome, and Introduction to boundary layer climates</a>	No practical	
2	GE	Atmospheric Stability	Field Practical (Weather Station)	
3	GE	Turbulent Diffusion in the Planetary Boundary Layer (PBL)	Field Practical Boundary Layer Profiling (Balloon). If rain then laboratory tour	

4	GE	Plume Behaviour in the PBL	Quiz 1	Quiz 1
5		No Lecture (Good Friday Public Holiday)	No Practical (Good Friday Public Holiday)	
6	GE	Modelling Pollutant Dispersion in the PBL	Modelling Practical Ausplume/WindTrax	
7	GE	Mass Balance	Mid Semester Test	Mid Semester Test
Recess				
8	PB	Urban Climates: Introduction and Concepts Urban Airflow	Integrated Monitoring of the Urban Atmosphere	
9	PB	Urban Radiation and Energy Balance	Physical Modelling of Urban Airflow	
10	PB	Urban Heat Island	Quiz 2 TAPPAS (Tool for Assessing Pest and Pathogen Aerial Spread)	Quiz 2
11	PB	Urban Water and Atmospheric Moisture	Urban Climate	
12	PB	Urban Clouds and Precipitation	Urban Climate	
13	PB	Climate-Sensitive Urban Design	TEDS LEU/LET Quiz 3	Quiz 3

## Learning and Teaching Activities

### Lectures

There is 1 2-hour lecture each week held on Friday 8:00am to 10:00am in 11 Wally's Walk 180 Tutorial Room.

### Practicals

There is 1 3-hour practical each week held on Friday 12:00pm to 3:00pm in 11 Wally's Walk 260

Faculty PC Laboratory.

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Grade Appeal Policy](#)
- [Complaint Management Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#) (**Note:** *The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.*)

Undergraduate students seeking more policy resources can visit the [Student Policy Gateway \(https://students.mq.edu.au/support/study/student-policy-gateway\)](https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/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](https://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](http://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](http://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/](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

- At the end of this unit of study, students will be able to describe urban climate and air quality, including the physical, chemical and biological processes operating to produce or change the state of the urban atmosphere. Also at the end of this unit of study, students will be able to demonstrate sufficient knowledge and conceptual understanding of the dispersive capabilities of the atmospheric environment near the surface of the earth, how pollutants emitted into the atmospheric environment move and interact with the surface, and some appreciation for the atmosphere's role in biogeochemical cycles.
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## **Assessment tasks**

- Quiz 1
- Mid semester test
- Assignment 1
- Assignment 2

## **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**

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## Assessment tasks

- Quiz 1
- Mid semester test
- Assignment 1

## 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

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## Assessment tasks

- Quiz 1
- Mid semester test
- Assignment 1

## 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

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## **Assessment tasks**

- Quiz 1
- Mid semester test
- Assignment 1
- Quiz 2
- Quiz 3
- Assignment 2

## **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**

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## Assessment tasks

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- Mid semester test
- Assignment 1
- Quiz 2
- Quiz 3
- Assignment 2

## 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

- At the end of this unit of study, students will be able to describe urban climate and air quality, including the physical, chemical and biological processes operating to produce or change the state of the urban atmosphere. Also at the end of this unit of study, students will be able to demonstrate sufficient knowledge and conceptual understanding of the dispersive capabilities of the atmospheric environment near the surface of the earth, how pollutants emitted into the atmospheric environment move and interact with the surface, and some appreciation for the atmosphere's role in biogeochemical cycles.
- At the end of this unit of study, students will be able to formulate a problem, develop its methodical analysis, and critically interpret the findings in order to find an appropriate climate science solution.
- At the end of this unit of study, students will be able to contend with the temporal and spatial scales of climate science and constraints associated with the absence of a universal approach or answer, in a creative and innovative manner.
- At the end of this unit of study, students will be able to examine, analyse, interpret and integrate scientific information from various primary and secondary sources.
- At the end of this unit of study, students will be able to demonstrate practical laboratory and field based skills associated with typical measurement problems in the field of climate science.
- At the end of this unit of study, students will be able to describe a research problem, propose its analysis, and then articulate the respective findings through oral, written, and

non-traditional media which are important tools in the communication of climate science.

## **Assessment tasks**

- Quiz 1
- Mid semester test
- Assignment 1
- Quiz 2
- Quiz 3
- Assignment 2

## **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**

- At the end of this unit of study, students will be able to describe urban climate and air quality, including the physical, chemical and biological processes operating to produce or change the state of the urban atmosphere. Also at the end of this unit of study, students will be able to demonstrate sufficient knowledge and conceptual understanding of the dispersive capabilities of the atmospheric environment near the surface of the earth, how pollutants emitted into the atmospheric environment move and interact with the surface, and some appreciation for the atmosphere's role in biogeochemical cycles.
- At the end of this unit of study, students will be able to formulate a problem, develop its methodical analysis, and critically interpret the findings in order to find an appropriate climate science solution.
- At the end of this unit of study, students will be able to examine, analyse, interpret and integrate scientific information from various primary and secondary sources.
- At the end of this unit of study, students will be able to describe a research problem, propose its analysis, and then articulate the respective findings through oral, written, and non-traditional media which are important tools in the communication of climate science.

## **Assessment tasks**

- Quiz 1
- Mid semester test

- Assignment 1
- Assignment 2

## 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

- At the end of this unit of study, students will be able to formulate a problem, develop its methodical analysis, and critically interpret the findings in order to find an appropriate climate science solution.
- At the end of this unit of study, students will be able to contend with the temporal and spatial scales of climate science and constraints associated with the absence of a universal approach or answer, in a creative and innovative manner.
- At the end of this unit of study, students will be able to examine, analyse, interpret and integrate scientific information from various primary and secondary sources.
- At the end of this unit of study, students will be able to describe a research problem, propose its analysis, and then articulate the respective findings through oral, written, and non-traditional media which are important tools in the communication of climate science.

### Assessment tasks

- Mid semester test
- Assignment 1

## 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

- At the end of this unit of study, students will be able to formulate a problem, develop its methodical analysis, and critically interpret the findings in order to find an appropriate

climate science solution.

- At the end of this unit of study, students will be able to contend with the temporal and spatial scales of climate science and constraints associated with the absence of a universal approach or answer, in a creative and innovative manner.
- At the end of this unit of study, students will be able to examine, analyse, interpret and integrate scientific information from various primary and secondary sources.
- At the end of this unit of study, students will be able to describe a research problem, propose its analysis, and then articulate the respective findings through oral, written, and non-traditional media which are important tools in the communication of climate science.

## Assessment tasks

- Mid semester test
- Assignment 1

## Changes from Previous Offering

The name of the unit has been changed to better reflect the focus of the unit. A field trip has been removed from this offering of the unit.

## Workload Guide

Activity	Hours Per Week	Hours Per Session
Lectures	2	24
Practicals	3	33
Readings	1.5	15
Quiz Study		21 (7 each)
Assignments		50 (25 each)
Mid Semester Test Study		7
TOTAL	10	150