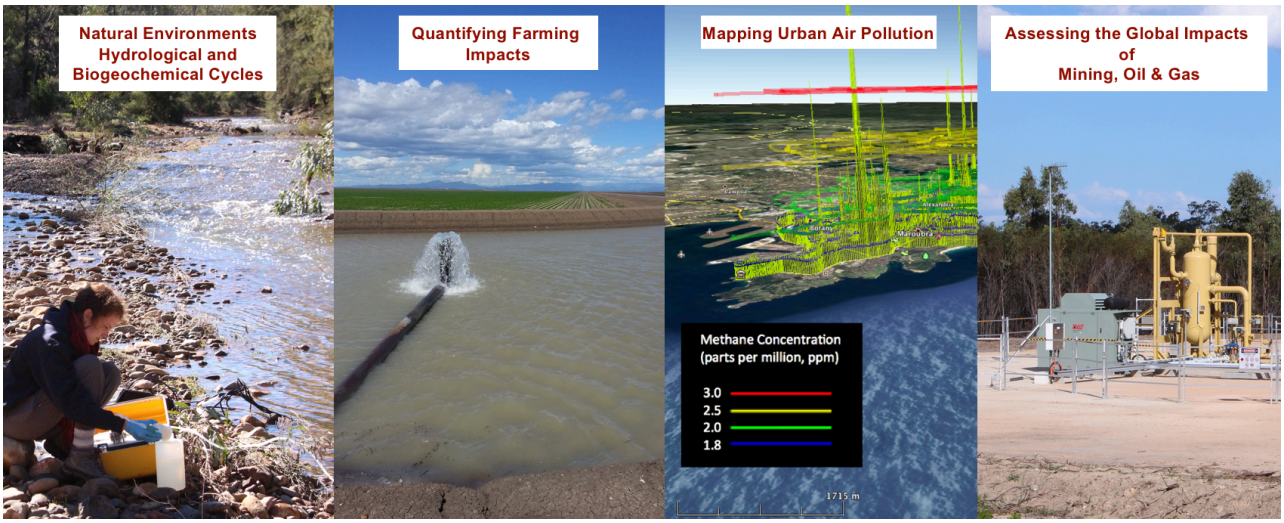
FACULTY OF SCIENCE

School of Biological, Earth and Environmental Sciences

GEOS2291

Earth's Interconnections



Term 3
2020

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Faculty of Science - Course Outline

1. Information about the Course
NB: Addition course information can be found in the UNSW Handbook: https://www.handbook.unsw.edu.au

Year of Delivery	2020
Course Code	GEOS2291
Course Name	Earth's Interconnections
Academic Unit	Biological, Earth and Environmental Science
Level of Course	UG
Units of Credit	6UOC
Term(s) Offered	T3
Assumed Knowledge, Prerequisites or Co-requisites	*No set prerequisites.* *BIOS1301, GEOS1211, GEOS1701 recommended but not required.* *No co-requisites*
Hours per Week	Up to 7 hours per week
Number of Weeks	10
Commencement Date	T3 Week 1

Summary of Course Structure (for details see 'Course Schedule')

Component	HPW	Time	Day	Location
Online – Lecture & Tutorials	7	See Timetable	See Timetable	See Timetable
TOTAL	7			
Special Details				

2. Staff Involved in the Course

Staff	Role	Name	Contact Details	Consultation Times
Course Convenor		A/Prof. B. Kelly	bryce.kelly@unsw.edu.au	Arrange via email
Additional Teaching Staff	Lecturers & Facilitators	Prof. R. Kingsford Prof. A. Baker	richard.kingsford@unsw.edu.au a.baker@unsw.edu.au	Arrange via email

3. Course Details

Course Description[1] (Handbook Entry)	Earth's Interconnections (GEOS2291) provides students with core background knowledge on how the atmosphere, hydrosphere, biosphere and geosphere (Earth's Systems) are interconnected. During this course, you will learn how to measure the chemistry of air and water, and quantify how the chemistry of these fluids change as they flow through the landscape. These skills are needed to improve our knowledge about the interconnections between Earth's systems, and to quantify the impact of human developments. To support the energy, food and material needs of modern societies humans have had an impact on almost all ecosystems on Earth. We have altered the flow of rivers, cleared vast areas of land for agriculture, mined coal, extracted oil and gas, and mined many minerals to build our cities and support our lifestyles. Humans have extensively altered the chemistry of the atmosphere. This course teaches you how to measure the impacts of current and proposed human activities and how to collect the data required to sustainably manage our Earth.
Course Aims[2]	GEOS2291 provides you with a broad background to the interconnections between the hydrological cycle, biogeochemical cycles and ecosystem response. You will gain an understanding of the influence of human activities on air and water quality and quantity. You will be taught how to analyse data that relate to air and water and how to interpret the patterns and trends hidden within the data. From case studies, tutorial problems and field trip observations, you will gain an appreciation of why management decisions that relate to air and water cannot be made in isolation and that decisions need to be based on scientific analysis of data.
Student Learning Outcomes[3]	The course develops your skills in the following areas: • Earth Systems (atmosphere, hydrosphere, biosphere and geosphere) • Measuring water chemistry, flow paths and fluxes • Measuring air pollution, flow paths and fluxes • Mapping greenhouse gases' sources and sinks (carbon dioxide, methane and nitrous oxide) • River and wetland management • Analysing spatial and temporal data sets for environmental impact assessment • Quantifying human impacts on urban environments and natural ecosystems • Carbon accounting and carbon offsetting • Writing science journal articles

Graduate Attributes Developed in this Course[4]		
Graduate Attribute	**Select the level of FOCUS** *0 = NO FOCUS* *1 = MINIMAL* *2 = MINOR* *3 = MAJOR*	**Activities / Assessment**
Research, inquiry and analytical thinking abilities	***3***	Air sampling and analyses Interpreting water chemistry data Data analysis, and modelling the movement of water and air Writing a scientific commentary Writing a scientific paper
Capability and motivation for intellectual development	**3**	Lectures and Tutorials
Ethical, social and professional understanding	**3**	Lectures and Tutorials
Communication	**2**	Group MS Team Meetings and Assignments
Teamwork, collaborative and management skills	**2**	Group MS Team Meetings and Assignments
Information literacy	**3**	Lectures, Tutorials and Assignments

4. Rationale and Strategies Underpinning the Course

Teaching Strategies	Interactive lectures – engaging discussion forums that place the learning goals and presented information in the context of scientific analysis, societal goals and environmental management. Observations and measurements, report writing. Computer laboratories – problem-based learning (a toolbox of methods for data analysis).
Rationale for learning and teaching in this course.	Environmental careers are often multidisciplinary and require knowledge from many fields of study including atmospheric science, geology, hydrogeology, microbiology and ecology. Professionals need a comprehensive knowledge of natural environmental processes and the impacts humans have on Earth's systems. Environmental consultants' and scientists' careers focus on measuring environmental conditions and processes, quantifying the impact of human activities and developing solutions to enable sustainable societies and ecosystems. This course will prepare you for careers in: • Environmental Consulting • Land and Water Management • Agriculture • Contaminated Land Remediation • Greenhouse Gas Monitoring • Carbon Accounting and Carbon Offsetting • Environmental Research GEOS2291 graduates work for consulting companies, State and Federal Government departments, and in research careers in universities worldwide.

5. Course Timetable

Some of this information is available on the Virtual Handbook and the UNSW Timetable.

UNSW Virtual Handbook: https://ww.handbook.unsw.edu.au
UNSW Timetable: http://www.timetable.unsw.edu.au/
Refer to the timetable spreadsheet at the end of this outline.

6. Assessment Tasks and Feedback

Assignment 1 - worth 10% - Due 25 Sep 2020, 5pm
Topic: Global water bottle label major ion chemistry and source rocks – Prof. Andy Baker
Written feedback will be provided within two weeks (provided all students have submitted in a timely manner).

Assignment 2 - worth 30% - Due 16 Oct 2020, 5pm
Topic: Modelling groundwater recharge – Prof. Andy Baker
Written feedback will be provided within two weeks (provided all students have submitted in a timely manner).

Assignment 3 - worth 20% - Due 6 Nov 2020, 5pm
Topic: Nature/Science Commentary on water management in the Murray-Darling Basin – Prof. Richard Kingsford
Written feedback will be provided within two weeks (provided all students have submitted in a timely manner).

Assignment 4 - worth 40% - Due 20 Nov 2020, 5pm
Topic. Air sampling and analyses, combined with HYSPLT atmospheric modelling – Asscoiate Prof. Bryce Kelly
The write-up for this assignment is to be structured as a scientific paper to be submitted to Atmospheric, Chemistry and Physics. You will be graded considering:

- Quality of data analysis (appropriate method, handling of units and errors).
- Adherence to the scientific method: background, aims, method, results, discussion and conclusion.
- Adherence to the style guide for the journal.

Written feedback will be provided within two weeks (provided all students have submitted in a timely manner).

Late report submission
"For assignments submitted up to seven (7) days late a 10% per day penalty applies.
Assignments submitted more than seven (7) days late will not be marked.
If medical grounds preclude submission of report by due date, contact should be made with subject authority as soon as possible. A medical certificate will be required for late submission on medical grounds and must be appropriate for extension period."

7. Additional Resources and Support

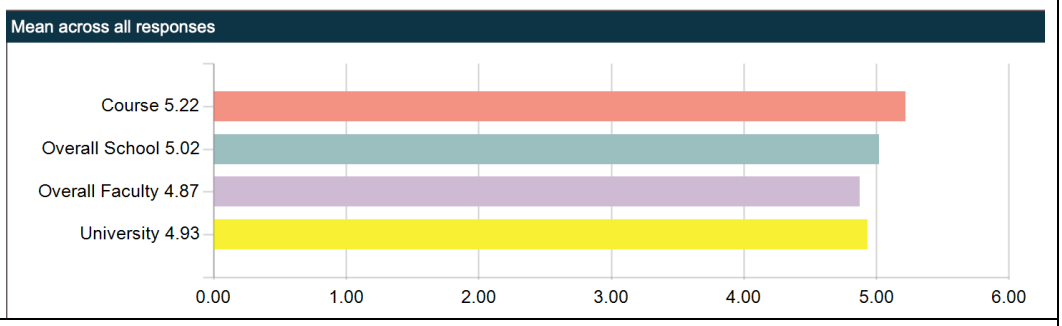
Text Books	**Recommended** • Berner K. E. and Berner R.A. (2012) Global Environment: Water, Air, and Geochemical Cycles. 2nd Edition. • Fitts C.R. (2013) Groundwater Science. Academic Press • Kingsford, R.T. Ed. (2006) Ecology of desert rivers. Cambridge: Cambridge University Press. • Boulton, A. J. and Brock, M.A. (1999) Australian freshwater ecology: processes and management. Glen Osmond, S. Aust.: Gleneagles Publishing
Course Manual	All lectures will be uploaded to Moodle and MS Teams
Required Readings	Web links to required reading will be provided at the end of each set of lecture slides.
Additional Readings	Web links to additional reading will be given on the lecture slides.
Recommended Internet Sites	Links to internet sites will be provided in the lecture slides.
Societies	- International Association of Hydrogeology (IAH; http://www.iah.org.au) - American Geophysical Union (AGU; http://sites.agu.org) - European Geosciences Union (EGU; https://www.egu.eu)
Computer Laboratories or Study Spaces	Computer Laboratory will be run online in MS Teams. Much of the data analysis will be done in Excel. You will also be using HYSPLIT, which runs in most web browsers. https://www.ready.noaa.gov/HYSPLIT.php All software used in the course is freely available. Web links to the software will be provided in the course material.

8. Required Equipment, Training and Enabling Skills

Equipment Required	An air sampling kit will be mailed to you in Week O for sampling in Week 1. Please select a safe location to do the air sampling near your home. Sample well away from any buildings and trees. Check that all is clear overhead before collecting your air samples.
Enabling Skills Training Required to Complete this Course	Any first-year science course. A background in chemistry, physics, biology or the environmental sciences is helpful.

9. Course Evaluation and Development

Student feedback is gathered periodically by various means. Such feedback is considered carefully with a view to acting on it constructively wherever possible. This course outline conveys how feedback has helped to shape and develop this course.

Mechanisms of Review	Last Review Date	Comments or Changes Resulting from Reviews
Major Course Review	*2020*	This course has been adapted in 2020 for online teaching. It has not been reviewed in its current format. We have moved the course online to overcome many of the challenges being experienced by all in 2020. The core content is the same as the face-to-face experience. We have adapted the assement to align with the course goals and skills required for a career in environmental science.
myExperience	*2019*	
Student Comments	*2019*	**Student Comments** "The professors were extremely understanding and helpful when it came to the course workload and the amount of time each assignment took. They also did a great job at making everything that we learned relate to real problems and research in NSW and the rest of the world." "The way the lectures were presented was engaging. I particularly liked how the lab sessions reinforced what was learnt and made it practical. The assessments were related to the course but also felt they taught useful skills for future employment. I have really enjoyed this course and the lecturers were amazing." "I liked that we were able to work on assignments during the lab classes so there was always either Bryce or Andy on hand to help. Also the lectures were always kept very up to date with the latest news articles from the conversation etc. which shows how passionate the lecturers are in delivering a course that is engaging and relevant." **Student Concerns** "Introduction to Mathematica should be improved to cover more basics or should take a longer time to absorb so we can better work through the Mathematica assignments." "I did not have prior experience with Mathematica so it was very frustrating to use." **How we adapted.** We have removed Mathematica from the course to cater for students with diverse educational backgrounds. In 2020 the modelling will be done online using Excel and HYSPLIT.

10. Administration Matters

Expectations of Students	Attendance at 80% of lectures and laboratories is expected. Both Moodle and MS Teams keep a log of student access.	
Assignment Submissions	Assignments will need to be submitted via Moodle, MS Teams or email as directed on the assignment handout.	
Occupational Health and Safety[5]	The School of BEES recognises its obligations to provide a safe working environment for all persons involved in School-related activities. To achieve this goal with regards to teaching and learning, the School adopts the UNSW Occupational Health and Safety Policy (2001) and the UNSW OH&S Responsibility and Accountability Document (2001). These documents stipulate that everyone attending a UNSW workplace must ensure their actions do not adversely affect the health and safety of others. This outcome is achieved through the establishment of a documented chain of responsibility and accountability for all persons in the workplace, extending from the Head of School through to the students undertaking courses offered by the School of BEES. As part of this chain of responsibility and accountability, the Course Authority is responsible for ensuring all activities associated with this course are safe. The Course Authority has undertaken detailed risk assessments of all course activities and identified all associated potential hazards. These hazards have been minimised and appropriate steps taken to ensure your health and safety. For each activity, clear written instructions are given and appropriate hazard warnings or risk minimisation procedures included for your protection. It is the student's responsibility to prepare for all practical work. Students should be familiar with the written procedures scheduled for the practical class and identify all personal protection requirements needed to complete the exercise in a safe manner. Students must comply with all safety instructions given by the Course Authority and/or Laboratory / Field Demonstrator, and observe the Safety Information located outside or within teaching rooms. If you are unsure of any safe operating procedures or written instruction regarding safety, you should seek further information from the Course Authority and/or Laboratory / Field Demonstrator before attempting the task. **NOTE: Students should discuss OHS matters in Labs and Field work as part of their research with their supervisor. These activities do not fall under the OH&S requirements of BEES 4511/4521/9011** Failure to comply with safety instructions may, in the first instance, be considered as a form of academic misconduct. If the outcome of a student's failure to comply with safety instructions results in personal injury, or endangers the health and safety of others, then the matter may be dealt with by WorkCover as a breach of the NSW OH&S Act (2000). For more information on OHS and Safety at UNSW visit the following site: www.ohs.unsw.edu.au/ or the relevant pages on the BEES website at: https://www.bees.unsw.edu.au/health-and-safety	
Assessment Procedures	*Please Read the UNSW Assessment Policy* *https://my.unsw.edu.au/student/academiclife/assessment/AssessmentPolicyNew.html*	
Equity and Diversity	Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course Convenor prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (phone: 9385 4734) https://www.edi.unsw.edu.au Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made. Information on designing courses and course outlines that take into account the needs of students with disabilities can be found at: https://www.hr.unsw.edu.au/diversity/uploads/unsw-disability-inclusion-action-plan.pdf	
Grievance Policy	In all cases you should first try to resolve any issues with the course convener (SM). If this is unsatisfactory, you should contact the Director of Teaching in BEES (A/Prof Stephen Bonser s.bonser@unsw.edu.au) or the Head of School, School of BEES (A/Prof Alistair Poore, a.poore@unsw.edu.au). UNSW has formal policies about the resolution of grievances that can be reviewed in MyUNSW A to Z Guide (see https://student.unsw.edu.au/complaints).	**BEES Student Advisor** Faye Mo Tel: +61 (2) 9385 2961 https://www.bees.unsw.edu.au/biosciences-student-office

11. UNSW Academic Honesty and Plagiarism

What is Plagiarism?

Plagiarism is the presentation of the thoughts or work of another as one's own.
*Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

https://student.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle
† Adapted with kind permission from the University of Melbourne

Term 3 Week	Week	Day	Time	Lecturer	Online Space	Topic	Assignments and Due Date
Week 1	Sep 14-18	Monday	9:00am to 12:00 midday	A/Prof. Bryce Kelly	MS Teams Lecture / Moodle Files	Introduction / Earth Systems / Hydrogeology	
		Thursday	1:00pm to 5:00pm	A/Prof. Bryce Kelly	MS Teams Tutorial and Files	Data Mining for Climate Trends: Air Sampling	
Week 2	Sep 21-25	Monday	9:00am to 12:00 midday	Prof. Andy Baker	MS Teams Lecture / Moodle Files	Water Chemistry	
		Thursday	1:00pm to 5:00pm	Prof. Andy Baker	MS Teams Lecture / Moodle Files	Water Chemistry	**Assignment 1 (Andy Baker)** **Worth 10%** **Bottle Water Chemistry - source rock identification** **Due 25 Sep 2020, 5 pm**
Week 3	Sep 28 - Oct 2	Monday	9:00am to 12:00 midday	Prof. Andy Baker	MS Teams Lecture / Moodle Files	Water Isotopes, Past, Present and Future	
		Thursday	1:00pm to 5:00pm	Prof. Andy Baker	MS Teams Lecture / Moodle Files	Water Isotopes, Past, Present and Future	
Week 4	Oct 5 - 9	Monday	9:00am to 12:00 midday	Prof. Andy Baker	MS Teams Lecture / Moodle Files	Caves as Observatories of Groundwater Recharge	
		Thursday	1:00pm to 5:00pm	Prof. Andy Baker	MS Teams Lecture / Moodle Files	Modelling Groundwater Recharge	
Week 5	Oct 12 - 16	Monday	9:00am to 12:00 midday	Prof. Andy Baker	MS Teams Lecture / Moodle Files	Interconnections Between Fire and Water	
		Thursday	1:00pm to 5:00pm	Prof. Andy Baker	MS Teams Lecture / Moodle Files	Interconnections Between Fire and Water	**Assignment 2 (Andy Baker)** **Worth 30%** **Modelling Groundwater Recharge** **Due 16 Oct 2020, 5 pm**
Week 6	Oct 19 - 23	Monday	9:00am to 12:00 midday	UNSW Study Week	********	UNSW Study Week	
		Thursday	1:00pm to 5:00pm	UNSW Study Week	********	UNSW Study Week	
Week 7	Oct 26 - 30	Monday	9:00am to 12:00 midday	Richard Kingsford	MS Teams Lecture / Moodle Files	Rivers and Wetlands	
		Thurday	1:00pm to 5:00pm	A/Prof. Bryce Kelly	MS Teams Lecture and Files	Greenhouse Gases Source Identification for Mitigation / Tracking Air Movement and Mixing	
Week 8	Nov 2 - 6	Monday	9:00am to 12:00 midday	A/Prof. Bryce Kelly	MS Teams Tutorial and Files	Keeling plot analysis of air samples	
		Thursday	1:00pm to 5:00pm	A/Prof. Bryce Kelly	MS Teams Lecture and Tutorial	HYSPLIT Lecture and Tutorial	**Assignment 3 (Richard Kingsford)** **Worth 20%** **Nature/Science Commentary: Water management in the Murray-Darling Basin** **Due 6 Nov 2020, 5 pm**
Week 9	Nov 9 to 13	Monday	9:00am to 12:00 midday	A/Prof. Bryce Kelly	MS Teams Lecture and Files	Air Pollution and Monitoring Urban, Industry and Bushfires	
		Thursday	1:00pm to 5:00pm	A/Prof. Bryce Kelly	MS Teams Lecture and Files, Assignment Help	Keeling Plot and Hysplit Help with assignment 4	
Week 10	Nov 16 to 20	Monday	9:00am to 12:00 midday	A/Prof. Bryce Kelly	MS Teams Lecture and Files	Carbon Accounting Bottom-Up (IPCC Methodology for Greenhouse Gas Inventories) vs Top-Down (Field Measurements) - Energy and Agriculture	
		Thursday	1:00pm to 5:00pm	A/Prof. Bryce Kelly	MS Teams Lecture and Files	Carbon Offsetting Soil and Vegetation UNSW's property Fowlers Gap Honour Projects	**Assignment 4 (Bryce Kelly)** **Worth 40%** **The isotopic chemistry of carbon sources, isotope mixing models and HYSPLIT modelling** **Due 20 Nov 2020, 5 pm**