1 Course Details

1.1 Calendar Description

This course is focused on interpreting data of the physical environment. Students will access various online databases, such as meteorological and hydrological time series, and perform and interpret statistical analysis with the data. Issues around errors and data collection will be explored by performing simple experiments. Students will make a numerical simulation of a dynamic environmental phenomenon. Students will produce and interpret graphical presentations of data.

Pre-Requisites: 1 of ECON*2740, GEOG*2460, STAT*2040, STAT*2060, STAT*2230

1.2 Course Description

This course is focused on finding, collecting and interpreting data of the physical environment. Students will access various online databases, such as meteorological and hydrological time series, and perform and interpret statistical analysis with the data. Issues around calibration and data collection may be explored by performing calibrations and experiments. Students will also make a numerical simulation of a dynamic environmental phenomenon.

1.3 Timetable

Lecture: Wed, 3:30 pm-5:20 pm; Synchronous (AD-S; VIRTUAL)
Lab: Fri, 11:30 am-02:20 pm; Synchronous (AD-S; VIRTUAL)

Please note that class activities are planned as synchronous ones: this means that the instructor will give “live” lectures and host “live” lab sessions during which students are expected to take part in “live” interactive exercises. Attending lab sessions is highly recommended as the instructor will provide guidance for coding in R and Python and will be available to troubleshoot coding issues. Video recordings of lectures will be available on CourseLink in the exceptional case that a student cannot attend “live” lectures. However, lab
sessions will not be recorded.

1.4 Final Exam

This course does not have a final exam.

2 Instructional Support

2.1 Instructional Support Team

<table>
<thead>
<tr>
<th>Instructor:</th>
<th>Genevieve Ali (semester weeks 1-7, i.e., Sept. 11 through Oct. 21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email:</td>
<td><a href="mailto:gali@uoguelph.ca">gali@uoguelph.ca</a></td>
</tr>
<tr>
<td>Telephone:</td>
<td>+1-519-824-4120 x52740</td>
</tr>
<tr>
<td>Office:</td>
<td>ECBL 2225</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instructor:</th>
<th>Scott Krayenhoff (semester weeks 8-13, i.e., Oct. 28 through Dec. 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email:</td>
<td><a href="mailto:skrayenh@uoguelph.ca">skrayenh@uoguelph.ca</a></td>
</tr>
<tr>
<td>Telephone:</td>
<td>+1-519-824-4120 x56868</td>
</tr>
<tr>
<td>Office:</td>
<td>ALEX 108</td>
</tr>
</tbody>
</table>

2.2 Communicating with the Instructional Team

During the course, the instructors will interact with you on various course matters using the following methods of communication:

**Announcements**: The instructors will use Announcements on the course website homepage (on CourseLink) to provide you with course reminders and updates. Please check this section frequently for course updates from your instructors.

**Class time**: With synchronous activities being planned for this course, you will have unlimited access to each instructor for 5 hours each week, i.e., 2 hours of lecture and 3 hours of lab. The best time to interact with the instructor is therefore during that time.

**Email**: If you have a conflict that prevents you from completing course requirements, or have a question concerning a personal matter, you can send the appropriate instructor (see applicable weeks above) a private message by email. The instructor will attempt to respond to your email within 48 hours (weekends and holidays excepted).

**Video Call**: If you have a complex question you would like to discuss with an instructor, you may book a video meeting on Microsoft Teams. Video meetings will depend on the availability of the instructor and will be booked on a first come first served basis. If you
require a video meeting, email the appropriate instructor (see applicable weeks above).

Please note that neither emails nor video calls should be used in lieu of attending synchronous class activities.

3 Learning Resources

3.1 Required Resources

Textbook and Electronic Device(s) (Equipment)

No textbook is required. Access to a personal computer (laptop or desktop) is required for the course.

Course Technologies and Technical Support (Software)

CourseLink: The course website is available via CourseLink. CourseLink (powered by D2L's Brightspace) is the University of Guelph's online learning management system (LMS). By using this service, you agree to comply with the University of Guelph’s Access and Privacy Guidelines. Please visit the D2L website to review the Brightspace privacy statement and Brightspace Learning Environment web accessibility standards.

http://www.uoguelph.ca/web/privacy/
https://www.d2l.com/legal/privacy/
https://www.d2l.com/accessibility/standards/

You are responsible for ensuring that your computer system meets the necessary CourseLink system requirements. Use the browser check tool to ensure your browser settings are compatible and up to date (see links below).

http://spaces.uoguelph.ca/ed/system-requirements/
https://courselink.uoguelph.ca/d2l/systemCheck

If you need any assistance with the software tools or the CourseLink website, contact CourseLink Support.

Email: courselink@uoguelph.ca
Phone: 519-824-4120 ext. 56939 / Toll-Free (CAN/USA): 1-866-275-1478
Support Hours (Eastern Time):
   Monday-Friday: 8:30 am–8:30 pm
   Saturday: 10:00 am–4:00 pm
   Sunday: 12:00 pm–6:00 pm
**Zoom:** This course will use Zoom for lectures. Check your system requirements to ensure you will be able to participate.

https://opened.uoguelph.ca/student-resources/system-and-software-requirements

Direct links to the Zoom virtual classroom will be posted on CourseLink (under Content --> Modules --> Zoom). Recordings of lectures will also be made available on CourseLink.

**Teams (via Office 365):** Office 365 Teams is a collaboration service that provides shared conversation spaces to help teams coordinate and communicate information. This course will use Teams for occasional one-on-one meetings with the instructor (see section 2.2 of the course outline). It is recommended that you use the desktop version of Teams. As a student, you are responsible for learning how to use Teams and its features.

For Teams support, visit the CCS website for more information.

https://www.uoguelph.ca/ccs/services/office365/teams

**R:** R is a free software environment for data visualization and statistical computing, and it will form the basis of all lab assignments. Additional details about how to work within the R environment will be provided during weekly lab sessions. R can work on different operating systems (Windows, Mac, Unix) and is also available in different versions (R versus RStudio). While it is possible for you to succeed in this course regardless of the operating system and software version that you decide to use, please note that the instructors’ expertise mainly lies with R on Windows. The instructors may therefore not be able to troubleshoot issues that are specific to other operating systems or specific to RStudio.

For R support, visit the Comprehensive R Archive Network website.

https://cran.r-project.org/

**Python:** Python is a free programming language that will also be used for some labs. Further information about downloading and using Python will be provided in class.

For Python support, visit the following website:

https://www.python.org

**Technical Skills (Other)**
As part of your learning experience, you are expected to use a variety of technologies for assignments, lectures, teamwork, and meetings. In order to be successful in this course, you will need to have the following technical skills:

- Manage files and folders on your computer (e.g., save, name, copy, backup, rename, delete, and check properties);
- Install software, security, and virus protection;
- Use office applications (e.g., Word, PowerPoint, Excel, or similar) to create documents;
- Be comfortable uploading and downloading saved files;
- Communicate using email (e.g., create, receive, reply, print, send, download, and open attachments);
- Navigate the CourseLink learning environment and use the essential tools, such as Dropbox, Quizzes, Discussions, and Grades;
- Access, navigate, and search the Internet using a web browser (e.g., Firefox, Edge); and
- Perform online research using various search engines (e.g., Google) and library databases.

Use online support resources if you need assistance with any of the above.

**Netiquette Expectations (Other)**

The course website is considered the classroom. The same protections, expectations, guidelines, and regulations used in face-to-face settings apply to the virtual classroom. Inappropriate behaviour will not be tolerated. Examples of inappropriate online behaviour include:

- Posting inflammatory messages about the instructor or fellow students;
- Using offensive language;
- Copying or presenting someone else’s work as your own;
- Adapting information from the Internet without using proper citations or references;
- Buying or selling term papers or assignments;
- Posting or selling course materials to course notes websites;
- Having someone else complete your quiz or completing a quiz for/with another student;
- Stating false claims about lost quiz answers or other assignment submissions;
- Threatening or harassing a student or instructor;
• Discriminating against fellow students, instructors, and/or TAs;
• Using the course website to promote profit-driven products or services;
• Attempting to compromise the security or functionality of the learning management system; and
• Sharing your username and password.

3.2 Additional Resources

Lecture Notes and Library Access (Readings)

Partial lecture slide decks (i.e., handouts in PDF format) will be posted on CourseLink, typically ahead of class activities. Students will be expected to take personal notes, as needed, about additional materials not included in the handouts. The instructor will provide links to interesting instructional videos, tutorials, websites and/or phone applications when appropriate. Google can also be a useful resource for this course.

As a student, you have access to the University of Guelph’s library collection, including both physical and electronic materials. For information on checking out or couriering physical library items, accessing electronic journals and returning items to the library, visit the library website. If you are studying off-campus and would like to access the library's electronic resources, use the Off-Campus Login option and log in, either by using your Single Sign-On credentials or by using your last name and library barcode.

https://www.lib.uoguelph.ca/

https://www.lib.uoguelph.ca/campus-login

4 Learning Outcomes

4.1 Specific Learning Outcomes

By the end of this course, you should be able to:

1. Assess field data using multiple techniques
2. Create and edit visualizations of environmental data with R
3. Import, review, manipulate and summarize environmental datasets in R
4. Implement statistical analyses and tests in R
5. Select appropriate statistical analyses in light of specific objectives
6. Quantify errors and uncertainties in data and models
7. Create a simulation of a dynamic environmental phenomenon
8. Identify and access public environmental databases and use the data in analyses
9. Communicate analysis results in writing, orally and graphically according to scientific standards

5 Teaching and Learning Activities

5.1 Lectures
The schedule below is tentative; it may be adjusted through the term as needed.

Sept. 16: Descriptive statistics; Data visualization
Sept. 23: Environmental data quality; Comparing data distributions
Sept. 30: Correlation and regression
Oct. 7: Hypothesis testing
Oct. 14: Case studies: misleading graphs, and how to lie (or not) with statistics
Oct. 21: Statistics exam
Oct. 28: Writing scientific articles & reports; Intro to Lab 5
Nov. 4: Numerical modelling & simulation; Intro to Python
Nov. 11: Heat flow modelling
Nov. 18: Weather forecasting and climate models; Climate change
Nov. 25: Writing strategies; Example time series analyses
Dec. 2: Options for post-undergrad

5.2 Labs
The schedule below is tentative; it may be adjusted through the term as needed.

Sept. 11: Syllabus review; What is data; Introduction to R
Sept. 18: Introduction to R (cont’d)
Sept. 25: LAB ASSIGNMENT 1 - Descriptive statistics and graphs (due on Oct. 2)
Oct. 2: LAB ASSIGNMENT 2 – Distributions (due on Oct. 9)
Oct. 9: LAB ASSIGNMENT 3 - Correlation and regression (due on Oct. 16)
Oct. 16: LAB ASSIGNMENT 4 - Hypothesis testing (due on Oct. 23)
Oct. 23: No lab
Oct. 30: LAB ASSIGNMENT 5 - Multiple measurement methods (due on Nov. 6)
Nov. 6: LAB ASSIGNMENT 6 - Random walk modelling (due on Nov. 13)
Nov. 13: LAB ASSIGNMENT 7 - Heat flow modelling (due on Nov. 20)
Nov. 20: FINAL PROJECT Part. 1 - Analysis of climate time series
Nov. 27: FINAL PROJECT Part. 2 - Analysis of climate time series (due on Dec. 4)
Dec. 4: No lab
N.B. #1: Please note that it is during lab sessions that you will be able to get the most help from the instructional team. It is not guaranteed that the instructors will be available outside of those periods to help you navigate the nitty-gritty details of writing code in R and Python. It is also strongly recommended that you use the lab sessions to complete as much of the lab exercises as possible, as this will mean that you have less to do on your own when you leave the classroom.

N.B. #2: Lab assignments are due on the dates indicated above, at the beginning of the lab session (Friday at 11:30 am or earlier).

6 Assessments

6.1 Marking Schemes & Distributions

<table>
<thead>
<tr>
<th>Assessment Type</th>
<th>Weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab assignments</td>
<td>60</td>
</tr>
<tr>
<td>Statistics exam</td>
<td>20</td>
</tr>
<tr>
<td>Final project</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

6.2 Assessment Details

Lab Assignments (60%)
Throughout the term, you will have the opportunity to complete 7 lab assignments in R or Python. Lab assignments will always be due 1 week after they were initiated in the lab. At the end of the term, only the 6 lab assignments for which you achieved the highest marks will count toward your final course grade (60%).

Statistics Exam (20%)
The statistics exam will take place on Oct. 21, between 3:30 an 4:30 pm, and will cover all materials covered in semester weeks #1 through #6. More information about the format of the midterm will be provided in class in late September.

Final Project (20%)
Contrary to the lab assignments, the final project will span more than one week and will consist in analyzing recent and future projected climate data from the Ontario Climate Change Data Portal. The final project will be introduced in class on Nov. 18 and further elaborated in the lab session on Nov. 20. Students can complete the final project on their own time, knowing that additional instructor support will be available during lab session on Nov. 27.

6.3 Dropbox Submissions
All lab assignments, as well as the final project report, should be submitted electronically via
the online Dropbox tool available from CourseLink. When submitting your assignments or reports using the Dropbox tool, do not leave the page until your work has successfully uploaded. To verify that your submission was complete, you can view the submission history immediately after the upload to see which files uploaded successfully. The system will also email you a receipt. Save this email receipt as proof of submission.

If, for some reason, you have a technical difficulty when submitting your work electronically, please contact an instructor or CourseLink Support.

http://spaces.uoguelph.ca/ed/contact-us/

6.4 Grades and Feedback

Unofficial assessment marks will be available in the Grades tool of the course website. The instructors will attempt to have assessment marks posted online within 2 weeks of the submission deadline, if the assignment was submitted on time. Once your assignments are marked, you can view your individual marks on the course website by selecting Grades from the Tools dropdown menu on the navbar. The course website will remain open to you for seven days following the last day of the final exam period.

At the end of the term and after the final exam period has ended, as a University of Guelph student, you will be able to access your final course grade by logging into WebAdvisor (using your U of G central ID).

https://webadvisor.uoguelph.ca

7 Course Statements

7.1 Communication

You are required to check your uoguelph email on a regular basis, as important messages related to this course may be sent from CourseLink. You are also required to check the course website (CourseLink) regularly for special announcements, new documents to download, etc. The course instructors will do their best to answer emails within 48 hours (weekends and holidays excepted). However, you should remember that the best time to communicate with the instructors is during class time.

7.2 Group Work

With regards to lab assignments and the final project, you can work in groups but the written reports that you hand in should be completely your own.

7.3 Late Work

All assignments (lab assignments and final project) are to be submitted to the instructors, via CourseLink (Dropbox, see section 6.3 of this course outline), on or before the due date. Email submissions will not be accepted unless agreed upon ahead of time with the instructor. All late work will receive a 10% deduction for each day, or part thereof, that they are late, up to a limit of five (5) days. Work that is 6 days late or more is guaranteed to receive a failing
grade. Extensions will only be considered for medical reasons or other extenuating circumstances, provided that they are discussed with the instructor well before the due date. Extensions will not be granted once the due date has passed.

You should remember that a technical difficulty is not a valid excuse to turn in an assignment late. Don’t wait until the last minute as you may get behind in your work. Be sure to keep a back-up copy of all your assignments: to avoid any last-minute computer problems, save your assignments to a cloud-based file storage (e.g., Google Docs, OneDrive) or send copies to your email account so that should something happen to your computer, your assignment can still be submitted on time or re-submitted. Please note that these rules are not designed to be arbitrary, nor are they inflexible: they are designed to keep you organized, to ensure that all students have the same amount of time to work on assignments, and to help the instructor return marked materials to you in the shortest possible time.

8 University Statements

8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml
8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

8.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before
submitting it. Students who are in any doubt as to whether an action on their part could be
construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-
amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be
recorded or copied without the permission of the presenter, whether the instructor, a student,
or guest lecturer. Material recorded with permission is restricted to use for that course unless
further permission is granted.

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph’s
procedures, policies, and regulations that apply to undergraduate, graduate, and diploma
programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of
course offerings and academic schedules. Any such changes will be announced via
CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19
website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by
e-mail.

8.10 Illness

The University will not require verification of illness (doctor’s notes) for the fall 2020 or winter
2021 semesters.