ESYS 300 – Fall 2020 Investigating the Earth System

Instructors:

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Meeting Time: Wednesday, 2:35 pm – 5:25 pm, Burnside Hall Rm 511.

Course Description:

We know that the Earth's climate is changing – however, the detection of a change in a system critically depends on our knowledge of the mean state and natural variability. In order to understand the mean state and variability of the system, we need data, and need to know how to interpret that data. To measure and observe the earth system requires rigorous investigation through the use of specialized instruments and reproducible high quality observations over various temporal and spatial scales. The course has two overarching integrated objectives.

- 1. Students will learn how to use and evaluate observations of the Earth System, including using remote sensing, statistical tools, paleo/historical archives, and how they help us understand Earth System Science processes (<u>http://www.ess.mcgill.ca/</u>).
- 2. The course will cover basic science computer programming techniques, with a focus on earth system science applications.

All labs, quizzes, and exams will require the use of MATLAB, a mathematical computing language. The first month of the course is focused on learning how to program in MATLAB, followed by case study exercises that use MATLAB to explore and understand Earth System Science datasets. With the exception of short lectures to start each week, all of the classes will be taught in a lab format, with students working on individual projects on the computer.

Textbook:

MATLAB Recipes for Earth Sciences; 3rd edition; by Martin H. Trauth

Complete books available *online* through McGill Library: http://www.springerlink.com/content/978-3-642-12761-8/

Additional Material:

MyCourses will be used to post additional class information, data sets, and readings.

Grading:

Laboratory (35%):

There will be Laboratories assigned throughout the course (approximately six in total). They are due 6 days after it is assigned unless otherwise stated. Laboratories will be posted on *MyCourses*. Laboratory reports are due at 2:00 PM the day before the next class (on Tuesday) on Dropbox, and will lose 25% per day late (starting at 2:00 PM; as per the clock on Dropbox).

Laboratory needs to run on matlab without errors on the same Matlab version as in the classroom. Only the error-free part of the assignment will be graded. A zero grade will be assigned to any questions after an error occurs – irrespective whether it is correct or not. Note that some basic coding errors prevent matlab to run the code at all.

Quizzes (40%):

At the end of each of the four sections there will be an in-class quiz that will test understanding of the prior material covered. The quiz will be an extension of the preceding sections material, and will require the use of MATLAB. The quizzes will take place during class time, and are an individual effort. Talking and/or looking at other computers are not permitted. You will have access to the MATLAB code you have developed during the course earlier.

Note: Quizzes will be handed in and corrected in the same manner as the Laboratories.

Takehome Final (25%): To be discussed further.

Note: The Take-home examination will be corrected using the same rule as described above.

PLEASE NOTE:

Class time is for class related activities and should not be used for personal time on the computers (e.g. facebook, myspace, climateaudit, e-mail, tinder, etc.). *We will spend office hours time only with students that use class time to its fullest.*

<u>Academic Integrity:</u> Academic integrity is important. Anything that undermines the evaluation process at McGill undermines the value of our degrees. McGill's Code of Student Conduct and Disciplinary Procedures appears in the Handbook on Student Rights and Responsibilities Article 15(a) of the Code, which is devoted to plagiarism, reads as follows: No student shall, with intent to deceive, represent the work of another person as his or her own in any academic writing, essay, thesis, research report, project or assignment submitted in a course or program of study. Or represent as his or her own an entire essay or work of another, whether the material so represented constitutes a part or the entirety of the work submitted. Remember that, according to McGill's Code of Student Conduct and Disciplinary Procedures, plagiarism is an academic offence. Students who are found violating the Code will be reported to the Associate Dean, and appropriate action will be taken. Source: (<u>http://www.mcgill.ca/integrity/studentguide</u>) In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.

In the event of extraordinary circumstances beyond the University's control, the evaluation scheme in a Course is subject to change, provided that there be timely communications to the students regarding the change

Tentative Course Schedule

Dates	Торіс	Inst.	Lab	Quiz
Sept 5	Introduction, Syllabus, MATLAB Basics	BT-MK		
Sept 12	MATLAB Useful Commands	BT	Lab1	
Sept. 19	Sea Ice Buoy data analysis: reading data, cleaning dataset, interpolation, plotting, etc.	BT	Lab2	
Sept. 26	Sea Ice Buoy data analysis (continued): reading raw data (text format), matlab function, geo-referenced plot.	BT	Lab3	Quiz 1
Oct. 3	Global Mean Temperature: reading netcdf data, trend, statististical significance of trend.	BT	Lab4	
Oct. 10	Vostok Ice Core Data Analysis: Fourier spectrum, scatter plot, correlations.	BT	Lab5	
Oct. 17	Arctic Sea Ice Concentration: linear trend, statistical significance	BT	Lab6	Quiz 2
Oct. 24	Start signal processing	MK		
Oct. 31	Signal Processing	МК		
Nov. 7	Signal Processing, Signal processing homework, Start image processing	МК		Quiz 3
Nov. 14	Image Processing	MK		
Nov. 21	Image Processing	MK		
Nov. 28	Image Processing, Image processing homework due, Review concepts for exam	MK		Quiz 4
Dec. 5	Take Home Final			