New Course

Proposal Reference Number	: 7698
PRN Alias	: 13-14#1111
Version No	: 3
Submitted By	: Ms Kristy Thornton
Edited By	: Ms Kristy Thornton

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	New Data
Program Affected?	N
Program Change Form Submitted?	
Subject/Course/Term	EPSC 513 • one term
Credit Weight or CEU's	3 credits
Course Activities	Schedule Type: A - Lecture; Hours per week: 3 Total Hours per Week : 3 Total Number of Weeks : 13
Course Title	Official Course Title : Climate and the Carbon Cycle Course Title in Calendar : Climate and the Carbon Cycle
Rationale	Unlike courses such as GEOG 321 Climatic Environments and ATOC 531 Dynamics of Current Climates, EPSC513 focuses on the links between the global carbon cycle and the geological evidence for large-scale changes in climate over the last 65 million years. The course closest in topic is ENVR 200, which is aimed primarily at U1-level B.A. and B.Sc. students in the domains, Minor and Diploma programs from the McGill School of Environment. EPSC 513 gives senior undergraduate students and graduate-level students an opportunity to explore this subject in depth through peer-reviewed scientific papers and with simple quantitative models.
Responsible Instructor	
Course Description	What does the rapid increase in CO2, currently driven by human activities, mean for future climate? Where will the carbon released by humans go, and how long will it take? An overview of the mechanisms governing global climate, the carbon cycle, and geological evidence for past changes in climate and the carbon cycle. Through assignments, students build their own simple Earth System models in order to explore basic principles of the coupling between climate and the carbon cycle. Output from General Circulation Models is analysed and recent peer-reviewed scientific literature is discussed.

Teaching Dept.	0289 : Earth & Planetary Sciences
Administering Faculty/Unit	SC : Faculty of Science
Prerequisites	Any one of ESYS 300, EPSC 340, ENVR 301, ATOC 315, or permission of instructor. Web Registration Blocked? : N
Corequisites	
Restrictions	
Supplementary Calendar Info	
Additional Course Charges	
Campus	Downtown
Projected Enrollment	25
Requires Resources Not Currently Available	N
Explanation for Required Resources	
Required Text/Resources Sent To Library?	
Library Consulted About Availability of Resources?	
Consultation Reports Attached?	
Effective Term of Implementation	201409
File Attachments	• EPSC513-2013 Syllabus-updated.pdf View
To be completed by the Faculty	
For Continuing Studies Use	

Approvals Summary

Show all comments

Version No.	Departmental Curriculum Committee	Departmental Meeting	Departmental Chair	Other Faculty	Curric/Academic Committee	Faculty	SCTP	Version Status
3								Submitted to Curriculum/Academic Committee for approval

								Edited by: Kristy Thornton on: Nov 21 2013
2								Submitted to Curriculum/Academic Committee for approval Edited by: Kristy Thornton on: Nov 20 2013
1								Submitted to Curriculum/Academic Committee for approval Created on: Nov 14 2013

McGill University - Earth and Planetary Sciences

EPSC-513
Climate and the Carbon Cycle

Professor: Eric Galbraith, eric.galbraith@mcgill.ca, FDA 332. Office visits by appointment (please schedule by email).

Course Description:

The rapid increase of atmospheric CO_2, currently being driven by human activity, is changing the Earth's climate on a geological scale. This course delves into the fundamental mechanisms governing both global climate and the carbon cycle, and relates these to the natural climate variability over the past 65 million years. These natural climate changes provide an invaluable set of case studies with which to ground-truth our understanding of the mechanisms governing climate, and range from the warmth of the Paleocene, when forests of ferns thrived throughout the polar regions, to the recent ice age cycles, throughout which the global mass of glacial ice regularly varied by a factor of three. Assignments, to be completed in Matlab or python, will take students through the process of building their own simple Earth system models in order to explore basic principles of the coupling between climate and the carbon cycle. Recent papers in the literature will also be discussed.

Pre-requisites: Any one of ESYS 300 / EPSC 340 / ENVR 301 / ATOC 315.

Course Mechanics:

The course will include two weekly lectures/seminars of 1.5 hr. Most will be lectures or discussion, and a few will be dedicated to student presentations. There is no assigned textbook. Useful figures will be posted on myCourses but students are responsible for taking their own notes. Supplementary readings will be posted on myCourses. Students are expected to download and read these in preparation for the relevant lectures or discussions, as specified.

Expected Learning Outcomes:

- A thorough understanding of the mechanisms controlling global climate
- A general understanding of approaches to modeling climate
- An understanding of important types of proxy records
- Familiarity with the climate history of the Cenozoic
- A geological perspective on anthropogenic climate change

Evaluation:

30% Assignments. Approximately eight assignments will be handed out throughout the semester, related to the lecture and reading material. Each one will be due within 6 days, by noon (e.g., handed out on Tuesday, due by noon on Monday).

15% Research paper presentation. Each student will be responsible for presenting one article for peer-reviewed scientific literature, selected from a list that relates to the

material covered in class. Presentations should include background information including prior work and rationale for the study, a summary of findings, and your critical analysis. Presentations will be graded based on the presenter's understanding of the article presented, style and effectiveness of communication.

20% Midterm exam. 35% Final exam. The midterm exam, scheduled during a regular class time, will cover the course material seen up to the date of the midterm exam. The final exam will be cumulative, i.e. cover material from the entire course. Students are responsible for the content of assigned readings (including the peer-reviewed papers presented by students) as well as the lectures. The exams may include short answer and essay questions.

Schedule:

The course will broadly follow the plan outlined below. Weeks with assignments are indicated by * (this may be subject to adjustments as the term progresses).

Week	Topic
1	Overview of climate, the Cenozoic era, and Earth's energy balance
2	Building a simple model of global climate*
3	The global carbon cycle part 1*
4	The global carbon cycle part 2*
5	Proxy records of climate change*
6	Hothouse climates of the Paleocene and carbon disruptions
7	Hothouse climates of the Eocene and heat transport*
8	*Student presentations*
9	Midterm exam, The Quaternary glaciation of North America
10	The Pleistocene and ice sheet dynamics*
11	The last deglaciation and ocean carbon storage
12	The Holocene and Anthropocene
13	*Student presentations*

Presentations:

Your presentation will be based on a peer-reviewed scientific paper that you select. The presentation must last at least 15 minutes and not exceed 25 minutes, and leave 5 minutes for discussion. You can use the projector, overhead, blackboard, interpretive dance, etc. But whatever you do, be sure to cover:

a) The general problem under investigation: what is the rationale for the study? Put the paper you selected in the context of prior work cited by its authors, and give us the big picture.
b) What is the novel about the paper? New results from modeling? New field measurements? Or is it a re-interpretation or a synthesis of results from prior published studies?
c) How do the results relate to the original rationale given in the paper for the study? How do the results relate to the bigger picture? Do the conclusions indicate that more work is required, or is any one scientific question definitively answered?

Don't rely only on the paper you selected. Take a look at other relevant papers, particularly those cited by the authors, and other (later) papers that cite the one you selected. If you use figures or cite data in your presentation, clearly cite their source.

The final exam will include questions related to the presentations, and the papers they discuss. Therefore, all students should read all of the papers presented, in advance of the presentations themselves.

Other stuff:

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.

McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see www.mcgill.ca/students/srr/honest) for more information).

L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site www.mcgill.ca/students/srr/honest).

Malek Yalaoui

From: Josie D'Amico
Sent: Wednesday, November 27, 2013 9:33 AM
To: Malek Yalaoui
Subject: FW: Consultation on proposed course conflict

Malek,

Here's a consultation from Geography. I have one from AOS which I'll send you in a separate e-mail.

Thanks.

Josie

From: Eric Galbraith
Sent: Tuesday, November 26, 2013 6:25 PM
To: Josie D'Amico
Cc: Jeanne Paquette, Dr.; Anthony Williams-Jones, Dr.
Subject: Fwd: Consultation on proposed course conflict

Hi Josie -

Willy informed me that I should forward to you the email consultations regarding EPSC 513, which you discussed in the Academic Committee today. Please find the first response, from Tim Moore, below, and the other from John Gyakum to follow.

Thanks,
Eric

Begin forwarded message:

From: "Tim Moore, Prof." <tim.moore@mcgill.ca>
Subject: RE: Consultation on proposed course conflict
Date: November 25, 2013 at 3:55:59 PM EST
To: Eric Galbraith <eric.galbraith@mcgill.ca>, "John R. Gyakum, Prof." <john.gyakum@mcgill.ca>, "Nigel Roulet, Prof." <nigel.roulet@mcgill.ca>, "Navin Ramankutty, Prof." <navin.ramankutty@mcgill.ca>
Cc: Kristy Thornton <kristy.thornton@mcgill.ca>, "Jeanne Paquette, Dr." <jeanne.paquette@mcgill.ca>, "Daniel Kirshbaum, Prof." <daniel.kirshbaum@mcgill.ca>, "Michel F. Lapointe, Prof." <michel.lapointe@mcgill.ca>

Eric,

In haste, I have no personal objections. Nigel and I give 'Global Biogeochemistry' GEOG505, which is divided into C and N sections, examining a series of papers in Nature/Science etc. and with a group project to define the

global budget, warts and all, for a particular biogeochemical species. It seems that your course will be complementary to this, in temporal scope/focus and involving the creation of a model.

tim

-----Original Message-----
From: Eric Galbraith
Sent: Monday, November 25, 2013 1:45 PM
To: John R. Gyakum, Prof.; Tim Moore, Prof.
Cc: Kristy Thornton; Jeanne Paquette, Dr.; Daniel Kirshbaum, Prof.; Michel F. Lapointe, Prof.
Subject: Consultation on proposed course conflict

Hi Tim and John -

We have just been informed by Josie D'Amico that I need to consult you both regarding a new course I have proposed, EPSC 513.

The details of the proposed course are given in the attached sample syllabus. It's pretty interdiscplinary, and really sits at the intersection of our three departments - I would hope that it would be potentially useful for upper level undergrads and grads in both of your departments.

If you judge that there is more than 30% overlap with any ATOC or GEOG courses, apparently we should impose restrictions, though I would actually be happier to alter the syllabus to avoid redundancy, if you do see any important conflicts. This is my first time proposing a course, so am just learning how the procedure works!

The Academic Council is meeting tomorrow, so I would need your response today - please let me know if this is not feasible. I would be happy to discuss by phone if that would be most expedient, and can be reached at 514-654-5856.

Thanks very much!

All the best,
Eric

Malek Yalaoui

From: Josie D'Amico
Sent: Wednesday, November 27, 2013 9:34 AM
To: Malek Yalaoui
Subject: FW: Consultation on proposed course conflict
Attachments: ATOC-530_Paleo_Climates.doc

Malek,

Below is a consultation report from the Chair of AOS.

I'll write to Eric Galbraith about ATOC 530/Bruno Tremblay.

Thanks.

Josie

From: Eric Galbraith
Sent: Tuesday, November 26, 2013 6:26 PM
To: Josie D'Amico
Cc: Jeanne Paquette, Dr.; Anthony Williams-Jones, Dr.
Subject: Fwd: Consultation on proposed course conflict

Begin forwarded message:

From: John Gyakum <john.gyakum@mcgill.ca>
Subject: Re: Consultation on proposed course conflict
Date: November 25, 2013 at 9:03:25 PM EST
To: Eric Galbraith <eric.galbraith@mcgill.ca>, <tim.moore@mcgill.ca>
Cc: Kristy Thornton <kristy.thornton@mcgill.ca>, Jeanne Paquette <jeanne.paquette@mcgill.ca>, <daniel.kirshbaum@mcgill.ca>, "Michel F. Lapointe, Prof." <michel.lapointe@mcgill.ca>, John Gyakum <john.gyakum@mcgill.ca>, Bruno Tremblay <bruno.tremblay@mcgill.ca>

Good evening, Eric:

I have checked on our ATOC-530 course, Climate Dynamics, Paleoclimates, which both Lawrence Mysak, and Bruno, have been teaching.

The course outline on Bruno's course is attached. Perhaps Bruno has changed his material some since this outline was produced.

There is some overlap, but I think that you and Bruno (copied in this message) can work together to reduce any perceived common material to less than 30%.

We can talk more about this tomorrow morning.

Sorry for the late reply. I had a seminar to attend this afternoon, and met with the speaker, Alan Betts, afterwards.

Your course proposal looks like a really great initiative!

Cheers,

John

On 11/25/13 1:45 PM, "Eric Galbraith" <eric.galbraith@mcgill.ca> wrote:

Hi Tim and John -

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Thanks very much!

All the best,
Eric