Course Description: The course will study problems in climate science using methods of applied mathematics using the text *Mathematics and Climate* by H. Kaper and H. Engler (SIAM, 2013). The course focuses on conceptual models that capture important aspects of Earth's climate system as well as mathematical and statistical techniques for analyzing these models. Topics from climate science include the Earth's energy balance, temperature distribution, ocean circulation patterns, ice caps and glaciation periods, the carbon cycle, and atmospheric convection models. Mathematical and statistical techniques used include dynamical systems and bifurcation theory, Fourier analysis, conservation laws, regression analysis, extreme value theory, Bayesian statistics, and Kalman filtering.

Prerequisites:
- This is a Master's level class in applied mathematics which can be taken by advanced undergraduates.
- Students must have taken MTH 141, 142, 241, 306, 309 with grade of "B" or above, or equivalent background in calculus, differential equations and linear algebra.
- Students must have had some experience with mathematical models of scientific phenomena and/or have taken MTH 443 Fundamentals of Applied Mathematics I.
- Strongly recommended for students to have had some experience with introductory statistics (eg MTH 412), partial differential equations (eg MTH 418), and computational mathematics (eg MTH 337). By strongly recommended, I mean if you have not had these classes you may have to do some extra reading/learning as we go along to fill in background knowledge.


Coursework: About 2/3 of the topics and assignments will involve some usage of computational software written in matlab (or python). Depending on the size of the class, the coursework may include: graded homework, ungraded homework, projects, group work, in-class participation, in-class presentations, exams, and comprehensive final exam. Determination of specific coursework requirements will be given in the course syllabus, made available in late August 2016.

Other Info: The course was last offered in Spring 2015 and was taken by 2 undergrad and 10 grad students. Some comments from the course evaluations:

*The MATLAB/python assignments were very effective at showing the applications of what we learned.*

*I found the lectures to be extremely effective and stimulating. I appreciated the level of depth that each topic was approached with, yet the extremely varied nature of the topics covered allowed us to cover a wide array of classic applied math topics. I found the assignments to span an appropriate range of difficulty, with sufficient leeway to explore topics to greater depths if the student so chooses. Although I’m not the biggest fan of climate,
I found the methods and the approaches used to study the topic to be useful and invaluable. This is the applied math course UB so desperately needs and I’m thankful I had the chance to take it.

The assignments really helped us to understand the material in class and how it can be used. I also loved the book we used and liked how the professor expanded on the book and provided a discussion of Matlab code in class.

Nice to have a course that is relevant to modern issues.

It was a very engaging course. The weekly assignments were especially effective. Every week or so we’d cover a different tool in applied mathematics and apply it to climate science. We’d get hands on experience working with a model/method, applying it to real climate change data, using it numerically and analyzing the results. Very few courses offer an experience like this.