

Robert H. Smith School of Business
University of Maryland
BUFN 758C Climate Modeling and Analytic Tools
Spring Term C 2024

Course Description

Climate change is recognized as perhaps the greatest challenge of our generation. The science on climate change is unassailable as since the industrial revolution, levels of greenhouse gas emissions have increased corresponding to deforestation and the increased use of fossil fuels. Early climate model predictions were accurate and those results have been reinforced with more sophisticated simulations. The number of extreme weather events are accelerating as are the number of billion dollar natural disasters. Governments, corporations and individuals are grappling with how to address this global challenge. Preparing for it will require a concerted private and public efforts to build resiliency into all aspects of life. Financing and investing in new technologies, efforts to transition from a brown to green economy, among other activities will be essential to the success of these efforts.

Banks, asset managers, insurance companies, government-sponsored enterprises such as Fannie Mae and Freddie Mac along with other companies face a number of daunting financial challenges related to managing climate risk. These include how to conduct climate-related stress tests on their portfolios and balance sheets, computing the amount of financed emissions in their lending activity, providing climate financial disclosures, assessing changes in market values to portfolios from climate change and determining the pricing of insurance and reinsurance products in light of accelerating extreme weather events.

An overview of the methodologies, assumptions and data used to develop climate models used for scenario and stress test analysis by financial services companies and other institutions will be the primary focus of the course. The course will focus on climate models and associated analytics including a such concepts as climate value-at-risk (VaR) models, integrating physical climate-related outputs such as carbon emissions with financial and risk models, simulation-based methodologies to assess the risk of different types of financial assets as well as the mechanics behind climate and integrated assessment models (IAMs) use in generating climate scenarios for financial and risk analysis.

This course is taught by two faculty members; one, Professor Tim Canty, a climate scientist from the College of Computer, Mathematics and Natural Sciences with years of research in atmospheric science, and the other Professor Cliff Rossi, a former C-level executive heading risk management at some of the largest financial institutions for 23+ years.

Course Learning Objectives

This course aims to be at the intersection of science, finance and risk management, focusing on gaining an understanding of climate, economic and financial concepts, methodologies, data and models used to make financial and risk decisions relating to climate-related activities. Specific objectives are:

- To understand the fundamentals of climate science
- To learn what climate models are, how they are developed, strengths and limitations

- To learn what socio-economic IAM models are, how they are developed, strengths and limitations
- Understand what climate scenario and stress testing is and how banks and insurance companies are developing their analyses
- Review some of the issues facing insurance and reinsurance markets from climate change and how it affects availability and pricing of various products
- Use various climate-related databases in conjunction with financial and risk databases for climate-related financial and risk analysis
- Understand what climate-VaR is and how it can be measured
- Learn what financial and risk tools are used in assessing physical and transition climate risk

Meeting Dates/Times

Course Website: <https://myelms.umd.edu/>

Tuesday/Thursday 4-5:50PM

VMH TBD

Professors

Dr. Tim Canty

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Dr. Clifford Rossi -

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Student Background

A graduate course in the principles of financial management or equivalent knowledge is expected. Other graduate courses in fixed income, investments, and corporate finance are helpful, but not required. There is some overlapping content with these other courses, such as derivatives and bank management, but this course emphasizes risk measurement and mitigation strategies. While some basic concepts of pricing and valuation of derivatives will be reviewed, BUFN 761 (Derivatives) provides more in-depth treatment of these instruments. This course provides broader scope of the application of climate risk management to financial firms.

Class Preparation & Expectations

I highly recommend reviewing the assigned readings prior to class if you have had no prior courses in climate science, corporate finance, investments, or derivatives. No advanced understanding of calculus or higher level mathematics is required.

Grading

Grading will be based on the following components:

- 35% Midterm Examination
- 35% Final Examination
- 15% Case Study 1
- 15% Case Study 2

ACADEMIC INTEGRITY

The University's *Code of Academic Integrity* is designed to ensure that the principles of academic honesty and integrity are upheld. All students are expected to adhere to this Code. The Smith School does not tolerate academic dishonesty. All acts of academic dishonesty will be dealt with in accordance with the provisions of this code. Please visit the following website for more information on the University's Code of Academic Integrity:

http://www.inform.umd.edu/CampusInfo/Departments/JPO/AcInteg/code_acinteg2a.html

On each exam or assignment you will be asked to write out and sign the following pledge. *"I pledge on my honor that I have not given or received any unauthorized assistance on this exam/assignment."*

Special Needs

Any student with special needs should bring this to the attention of the instructor as soon as possible, but not later than the second week of class. This includes any prior arrangements regarding examinations. Make-up examinations will only be allowed with proper advance notice to the instructor and only in family emergency situations or illness. Schedule conflicts with other courses or non-academic meetings will not be grounds for rescheduling exam dates.

Notice of Mandatory Reporting

Notice of mandatory reporting of sexual assault, sexual harassment, interpersonal violence, and stalking: As a faculty member, I am designated as a "Responsible University Employee," and I must report all disclosures of sexual assault, sexual harassment, interpersonal violence, and stalking to UMD's Title IX Coordinator per University Policy on Sexual Harassment and Other Sexual Misconduct.

If you wish to speak with someone confidentially, please contact one of UMD's confidential resources, such as [CARE to Stop Violence](#) (located on the Ground Floor of the Health Center) at 301-741-3442 or the [Counseling Center](#) (located at the Shoemaker Building) at 301-314-7651. You may also seek assistance or supportive measures from UMD's Title IX Coordinator, Angela Nastase, by calling 301-405-1142, or emailing titleIXcoordinator@umd.edu. To view further information on the above, please visit the [Office of Civil Rights and Sexual Misconduct's](#) website at ocrsm.umd.edu.

Lecture Topics by Week:

Week/Dates	Instructor	Topics
Week 1 Thursday 1/25 Tuesday 1/30	Canty and Rossi Rossi	Course Introduction and overview to climate finance
Week 2 Thursday 2/1 Tuesday 2/6	Canty Rossi	Fundamentals of Climate Science IAM models, damage functions and climate scenario analysis
Week 3 Thursday 2/8 Tuesday 2/13	Canty Rossi	Evidence for Climate Change Climate stress testing and scenario analysis
Week 4 Thursday 2/15 Tuesday 2/20	Canty Rossi	Climate model and scenario overview Climate VaR analysis and applications
Week 5 Thursday 2/22 Tuesday 2/27	Canty Rossi	Impacts of climate change Insurance and reinsurance markets and models, pricing and risk
Week 6 Thursday 2/29 Tuesday 3/5	Canty Rossi	Climate adaptation and mitigation Financial disclosures, financed emissions and climate project finance
Week 7 Thursday 3/7 Tuesday 3/12	Canty Canty and Rossi	Geoengineering of climate Integrating science into financial and risk analysis: prospects and pitfalls

Final Exam: Date TBD