Geophysics 9526A/B, Modelling Catastrophe Risk: Catastrophe Models, Model Creation, Portfolio Risk Management and Prizing

Natural hazards are an important and expanding are of research both nationally and internationally. Significant effort is ongoing in the insurance industry to both develop internal hazard models that include financial risk and loss, in addition to those developed by vendors that consult to the emergency response community, government planners and the insurance industry in general. Integration of individual, specific scientific models with users and industry often is limited by two factors: communication difficulties resulting from a lack of familiarity with terminology on both sides and, more importantly, a lack of understanding of the requirements, priorities and standards that drive industry. Currently, Western does not offer a graduate course in modeling catastrophic risk, primarily because of the lack of expertise, which is industry resident. Dr. Michel, an expert in insurance catastrophic risk modeling, has offered to help us create and deliver such a course. His interests include a desire to improve the science of risk modeling in the insurance industry, and he sees training graduate students in the field as the first step in this effort. The short course format is chosen partly because Dr. Michel is not available throughout the semester, but also because the intensive, one week format is optimal for computer modeling instruction and programming. The course will provide a rare opportunity for our students to gain expertise in an area that is of interest to government, industry and academia. We anticipate that the course will be of interest not only to Earth Science students, but also to graduate students from Engineering, Statistics and Actuarial Sciences and Computer Science.

Instructor: Dr. Kristy Tiampo, with guest lecturer Dr. Gero Michel

Lectures: March 23-27, 9:00 am to 12:30 pm, 1:30 pm to 5:00 pm.

Term and Duration: Winter term, 1 week (5 days)

Course Goals: This course aims to provide insight into the catastrophe insurance and reinsurance market and the products, tools and models it uses to quantify, assume and manage risk. The first section (1) will concentrate on introducing students to the catastrophe insurance and reinsurance market, its products, and decision making processes. The second section (2) will then focus on models and model creation from hazard to financial risk and will provide insight into how these tools are created and why they are deemed to be capable of analyzing global risk ranging from assessing single risks to managing global portfolios. The last section (3) will shed a critical light on the current processes in the catastrophe market, will target the offset between supply and demand in risk assessment, discuss whether current models and processes actually do what they are supposed to do and whether current catastrophe insurance risk management is efficient or likely to change. A major theme throughout the course is the clash in communications, behavior and thought between the insurance market and science which continues to hinder their convergence.

Prerequisites: None.

Text: TBD.

Description: Natural and man-made catastrophes continue to a) change the insurance and reinsurance world, b) demand the largest amounts of insurance and reinsurance capital, and c) drive the fortune or misfortune of companies. Catastrophe risk assessment has evolved

significantly over the last two decades, creating catastrophe-specific consulting companies and vendor models, as well as a new breed of employees called modelers. However, very few science organizations have been successful in the catastrophe insurance world despite the fact that there is a significant need for science in the area. A few private vendors have however been successful and made significant returns with highly expensive tools and models. Catastrophe reinsurance, so far the largest consumer of catastrophe models and consulting, also is seeing considerable rate softening, a change that has not yet been reflected in vendor model licensing fees and consulting costs.

In this course we will examine the following questions: What do insurance executives mean when they talk about catastrophes? What is needed to understand, price, and assume catastrophe risk? How are insurance and reinsurance deals structured? What supply chain is needed to understand and insure risk? What is covered and what is excluded in policies and how are policies evolving? What is a market cycle? What models and model platforms are currently available? How is a catastrophe model created and what does it entail? How is the hazard and financial side of risk modelled? Which territories and perils are covered? What is not modelled? What is the role of a modeler? How are catastrophe risk portfolios constructed and managed? What needs to be reported to CROs, CEOs, company boards, regulators or rating agencies? Are models and processes efficient and accurate? Will the ultra-hard catastrophe vendor model market change?

Evaluation Criteria:

a) Daily questionnaire/quizzes (30%);
b) Class participation (5%);
c) Design and creation of a model (30%);
d) Oral presentation of that model (5%);
e) A report (30%) on topics to include but not limited to:
    (i) What might be needed in the market in the future.
    (ii) How could we quantify the shortcomings in the current market.
    (iii) How can catastrophe insurance risk be managed and priced.
    (iv) Describe how to program an end-to end catastrophe model.

The report will be due one week after the last class.

Computing: Familiarity with MATLAB or Excel may be required.

Late Policy: Homework assignments are due on the date specified on the assignment. 10% will be deducted for every day late. If you have exceptional circumstances, please contact Dr. Tiampo prior to the due date.

Electronic Devices: Computers, cell phones, music players and cameras will not be used during class time.

Syllabus (subject to revision):

Monday, March 23: Introduction to insurance, markets, policies, reinsurance and industry financing. Legal and financial rules and implications.

Tuesday, March 24: Type and assessment of natural hazards and catastrophes, methods of hazard quantification.

Wednesday, March 25: Catastrophe modeling from an insurance perspective – platforms, vendor models, what is included and what isn't.

Thursday, March 26: Programing a hazard/insurance model.

Friday, March 27: Discussion and presentation of models.

Academic Honesty Statements:

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_grad.pdf.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Graduate Course Health and Wellness:

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre. Numerous cultural events are offered throughout the year. for example, please check out the Faculty of Music web page http://www.music.uwo.ca/, and our own McIntosh Gallery http://www.mcintoshgallery.ca/. Information regarding health- and wellness-related services available to students may be found at http://www.health.uwo.ca/. Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at http://www.health.uwo.ca/mental_health/resources.html.