

Georgia Institute of Technology/School of Earth and Atmospheric Sciences

**Introduction to Weather Risk and Catastrophe Modeling  
(3 credit hours)**

**Instructor - Professor Yi Deng**

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Office hours - Tuesday 11am-12 PM (prior notification by E-mail is recommended), or by appointment

Class days/time/place – Mon/Wed 3:00-4:25 PM (Room 1118 Ford ES&T building)

**Recommended Textbook:**

*Severe and Hazardous Weather: An Introduction to High Impact Meteorology*, 4<sup>th</sup> edition, Bob Rauber, John Walsh and Donna Charlevoix, Kendall Hunt Pub Co, 2005.

**Additional sources:**

*Catastrophe Modeling: A New Approach to Managing Risk*, edited by Patricia Grossi and Howard Kunreuther, Springer, 2005

**Grading:**

Homework – 30%

Exam – 30%

Term project – 30%

Hazards review – 10%

Graduate students will be given two additional problems (compared to undergraduates) for each homework assignment, and two additional problems for the exam. The points for individual problems in the homework and exam will be adjusted accordingly. Homework and exam will be graded on a 100-point scale. Term project will also be graded on a 100-point scale with 50 points for the project report and 50 points for the project presentation. Hazards review will be graded on a 10-point scale.

**Prerequisites:**

Introductory meteorology, basic knowledge of probability and statistics

**Goal:**

The goal of this course is to provide students a an overview of the physics and dynamics behind different types of hazardous weather and climate phenomena, and introduce to the students mathematical modeling tools built to quantify and manage the risks associated with these phenomena.

**Learning Outcomes:**

Upon completion of this course, students will be able to:

1. Describe the physical and dynamical processes leading to the development of hazardous weather and climate phenomena occurring at various temporal and spatial scales.
2. Understand the philosophy and concepts behind risk management and insurance.

3. Understand the fundamental concepts and methodologies in the construction of a catastrophe model for assessing financial risk associated with hazards weather and climate phenomena.
4. Develop the necessary skills for coding and validating the hazards module of a catastrophe model.

**Overview:**

Severe and hazardous weather and climate events pose great threats to the socioeconomic wellbeing of the society. This course will provide a general context for students to understand the physical origins and lifecycles of these events and to gain hands-on experiences on building mathematical modeling tools that are used to quantify financial risks associated with these hazards.

**Description:**

This course is intended for junior/senior undergraduate and junior graduate students who are interested in learning about weather risk and its management in real life. The first part of the class will provide students detailed knowledge of physical processes that lead to hazardous weather at various temporal and spatial scales. The second part of the class will introduce to the students the philosophy, concept and methodology of catastrophe modeling of natural hazards and discuss the application of catastrophe models in the insurance/reinsurance industry and in the general financial market.

**Academic Integrity:**

Academic dishonesty will not be tolerated. This includes cheating, lying about course matters, plagiarism, or helping others commit a violation of the Honor Code. Some exams (when specifically announced in class) allow the use of self-prepared supporting information (one sheet of paper, either typed or handwritten, could be double-sided); no other support materials are allowed at tests. Plagiarism includes reproducing the words of others without both the use of quotation marks and citation. Students are reminded of the obligations and expectations associated with the Georgia Tech Academic Honor Code and Student Code of Conduct, available online at [www.honor.gatech.edu](http://www.honor.gatech.edu).

**Learning Accommodations:**

If needed, we will make classroom accommodations for students with documented disabilities. These accommodations must be arranged in advance and in accordance with the Office of Disability Services (<http://disabilityservices.gatech.edu>).

**Absences:** The Institute Absence policy is available at: [www.catalog.gatech.edu/rules/4/](http://www.catalog.gatech.edu/rules/4/)

**Schedule of Topics:**

Week 1:	Overview of natural hazards
Week 2:	Review of introductory meteorology
Week 3:	Thunderstorms and tornadoes
Week 4:	Hailstorms, lightning, and downburst
Week 5:	Tropical cyclones
Week 6:	Extratropical cyclones
Week 7:	Freezing precipitation and ice storms
Week 8:	Lake effect snow storms
Week 9:	Great plains blizzards

Week 10	Mountain snow storms
Week 11:	Storm track dynamics
Week 12:	Cold and heat waves, mountain wind storms
Week 13	Floods and drought
Week 14	Basics of risk management, catastrophe model and insurance
Week 15:	Building a hurricane loss estimation model
Week 16:	Model validation, uncertainty, and application