Multidisciplinary Teaching in Natural Hazards from Formation to Physical and Social Impacts

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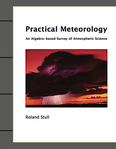
Course Overview

- Graduate level course currently offered through the College of Engineering and an interdisciplinary Ph.D. program at Charlotte.
- Intended to reach engineers, facility managers, meteorologists, emergency managers, and social scientists.
- To date, enrollment has primarily consisted of those with a background in engineering, architecture, and construction management with some students from the Department of Geography and Earth Sciences.

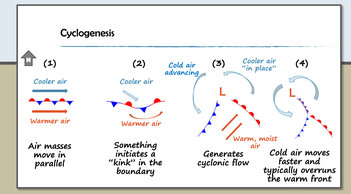
"This course is designed to consider natural hazards in a holistic manner. This course will cover basics related to how hazards form (meteorology) to the physical damage they may cause (engineering/infrastructure) to the people they impact (social vulnerability). An understanding of these events is necessary in preparing and building for a sustainable and resilient community."

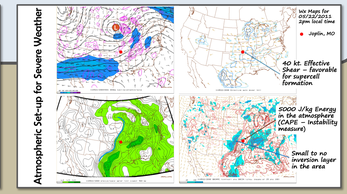
(1) Course Content: Meteorology

Week	Course Topic
1	Course Overview
2	Intro. To Atmospheric Science
3	Weather systems
4	Severe Weather & Tornadoes
5	Tropical Cyclones
6	Intro. To Climate
…11	Intro to Geophysical Hazards



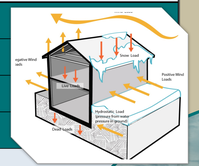
The course begins with learning how natural hazards form. Lectures are given at an introductory level to provided students with a basic understanding of the atmosphere as a fluid. Topics range from understanding how a parcel of air moves, properties of the atmosphere, cyclogenesis, how severe weather forms, and how topical cyclones form.

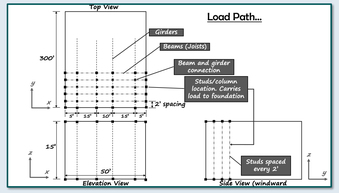




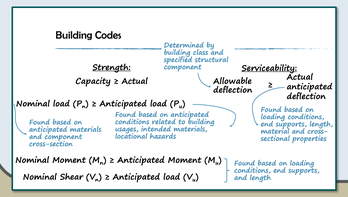
(2) Course Content: Engineering

Week	Course Topic
7	Meteorological Hazard Loading
8	Building Codes & Loads
9	Risk & Probabilities
10	Risk & Probabilities



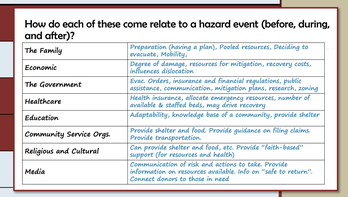


Even though the course is taught by faculty within the College of Engineering, it is still assumed that an introduction into statics is required for those students without an engineering background. The course highlights what engineers consider when solving structural problems: reactions, shear, moment, deflection. Understanding load path from the load location and transferring to the ground is then covered. From here, an overview of building codes and how hazard loads (ex: wind) are determined.



(3) Course Content: Social Sciences

Week	Course Topic
12	Communicating Risk
13	Break
14	Socio-Economic Considerations
15	Community Resilience & Modeling
16	Final Presentations



While physical damage to a structure is rooted in engineering concepts, the understanding of how *people* are impacted requires an understanding of social institutions and social vulnerability. These concepts are covered in the last few weeks of the course, along with economic loss and how all course topics tie into the concept of resilience.

Project Based

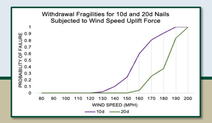
First few assignments focused on the 2011 Joplin Tornado

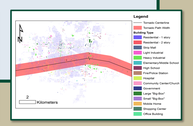
- Overlay Joplin's track with a shapefile of all buildings in Joplin and asked to calculate the total value of those within the path.
- Evaluate the meteorological setup leading to the Joplin tornado and the lessons learned from the event.

Probability assignment involves developing building fragility curves and river flow exceedance probability.

No exams.

- **Midterm: Report on a historic extreme event.**
- **Final: Evaluate a location's risk and resilience.**





Student Feedback

From Student Evaluations: "Overall I learned a lot in this course." (5 = Mostly Agree).
FA2020: 4.77/5.00
FA2023: 4.59/5.00

Summary of Written Student Comments and Instructor Observations

Positives

- Applicable to everyday life and multiple careers.
- Enjoyable lecture that encouraged discussion.
- Required deeper thought in assignments.
- High engagement

Suggestions/ Areas for Improvement

- Focus on either meteorological or geophysical hazards for a 1 semester class.
- Provide reading content prior to lecture.
- Go a bit more "in-depth with ArcGIS".
- Class management is more difficult when an >30 student lecture