GGS 777

Remote Sensing Natural Hazards

Spring 2017 semester (01/23-05/17)

Lecture: Every Tuesday 04:30 pm-07:10 pm

EXPL 2312

Instructors

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Contacts

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## Abstract

Every year several catastrophic natural hazards strike somewhere on Earth. These may cause thousands of lives, cause damages of billions of dollars, destroy natural landmarks, cause tsunamis, floods, landslides, and at worst even trigger an economic depression that might affect directly or indirectly the entire world, render a large territory uninhabitable or destabilize the military and political balance in a region. Most of these events are caused by nature but their potential catastrophic consequences are tied to overcrowding and the emergence of megacities; the proliferation of nuclear power plants and nuclear waste storage facilities; and the existence of high dams, and other facilities whose destruction pose an unacceptable risk of global reach. Thus the study of natural hazards and of the processes that govern their occurrences has become a fundamental challenge for the survival of our civilization.

This course is designed to give students with Earth science and remote sensing background a thorough introduction to gathering an overview of remote sensing and applications in natural hazards. The main emphasis of this course is satellite remote sensing applications in Hazards

studies, such as flood/drought, tornados/hurricanes, earthquakes, volcanic ash detections. The course may be modified according to students' interests.

The course will focus on the governing dynamics for different hazards, including but not limited to earthquakes, volcanic eruptions, severe weather and cyclones, increasingly harmful dust storms, floods, droughts, and at local scales avalanches and landfalls. The course will concentrate on observing, tracking and even forecasting such events using primarily satellite based observations. These can be used to monitor the Earth's surface and atmosphere to give early warning information about impending hazards and information for risk management and disaster relief.

Each class will consist of either a lecture by the instructor and/or a guest speaker, or by a class discussion. Each lecture will focus both on the governing dynamics of one or more hazards, and the satellite data available for the study of each hazard. The class will be in Hybrid style, third-half will be Online Long-Distance education. Students are encouraged to suggest topics of their interest which can be studied more in depth.

Students will be required to complete a term project and submit a final report related to the use of remote sensing data to study a natural hazard of their choice, as well as to give presentations, complete homework assignments and actively participate in each lecture.

**Online Learning Community**

Working online requires dedication and organization. Students must check their GMU email messages on a daily basis and communicate any questions or problems that might arise promptly.

**Learning Outcomes**

At the end of the semester, students will be able to:

1. understand, describe, and analyze major natural hazards through scientific presentations, and reading academic literature
2. develop critical thinking skills through discussions and short essays
3. build skills by using remote data and visualization
4. develop a project that demonstrates knowledge of a natural hazard and remote sensing applications in hazard studies

**Exercises**

Five exercises are scheduled this semester.

Each exercise will expose the students to question, description and critical thinking.

**Discussions**

Five discussions are scheduled this semester.

**Project**

This is a project due during the last week.

The project will include a PowerPoint presentation, at least 10 slides, not including the title slide, and a term paper due at the last week.

**Grading**

**The final grade is computed out of 100 points using the following letter mapping:**

**100-96 A+; 95-93 A; 92-90 A-;**

**89-87 B+; 86-83 B; 82-80 B-;**

**79-77 C+; 76-73 C; 72-70 C-;**

**69-60 D; < 59 F**

**15% Attendance, Participation and Preparation**

Attendance will be taken at the beginning of each class. Students more than 15 minutes late will be consider absent. Two absences are allowed with no penalty. One point will be taken for each additional absence up to a total of 12 absences. Students absent for more than 12 lectures will receive an F. Oral questions about the course material and the reading assignments will be asked and students are expected to actively participate in the discussion.

**35% Homework**

Students will be divided in groups of 3-4 students. Each group will be assigned a specific region of the world, and throughout the class each group will investigate how specific hazards affect their region. Students are encouraged to use for their research from any sources they believe appropriate. Students will be asked to provide an oral summary of their findings in class.

**20% Midterm**

The midterm covers material from both lectures and assignments. This is an individual, closed book, in class exam.

**30% Final Project**

The final exam covers material from both lectures and assignments. This is an individual, closed book, in class exam.

**Policies**

**Policy on Absence**

Students are expected to actively participate in the lecture, lab and class discussion. When a student misses a lecture, he/she is invited to let the instructor know in advance. The student is still responsible for the material and assignments covered in the lecture.

Refer to the attendance section of the Syllabus for grading information.

**Policy on Exams**

The midterm and the final exams are mandatory. There is no make up exam, unless for extreme circumstances. If a student does not take the midterm exam, he/she will receive a 0 score. If a student does not take the final exam, he/she will receive an F grade.

**Policy on Late Work**

Homework will be due after two weeks of the assignemnt. 2 points will be taken for each 24 hours starting from 14:00 of the due date.

**Policy on Reading Assignments**

Students are required to read the book chapter relative to each lecture BEFORE coming to class. Questions about the text will be asked during the lecture, and students are expected to be able to answer them.

**University Policies**

The University Catalog, http://catalog.gmu.edu, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at http://universitypolicy.gmu.edu/. All members of the university community are responsible for knowing and following established policies.

**GMU EMAIL ACCOUNTS**

Students must use their Mason email accounts-either the existing MEMO system or a new MASONLIVE account to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information.

**Honor Code**

Students must strictly follow the honor code, both for individual and team work. No exception will be made. University policy requires that faculty members report incidents of Honor Code Violation. Scholastic dishonesty includes but is not limited to plagiarism (reference your sources and quotations), copying others' work, limiting others' access to course materials, sabotaging others' work, turning in the same paper or project for two classes without permission from all instructors, and many other things. You are responsible for the GMU Scholastic Honor Code, found in the GMU University Catalogue.

**Students with Disabilities**

If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Resources at 703/993-2474. All academic accommodations must be arranged through that office.

## Class Cancellation

If a class is cancelled due to inclement weather or other reasons, the syllabus will be updated as early as possible. Best efforts will be made to send each student an email with information on the cancellation of class. Make up classes will be scheduled during the next lecture. When an exam is cancelled, it will be given during the next lecture.

## Schedule

| Date | Topic |
|---|---|
| **Week1**<br><br>**(Jan. 24)** | **Introduction, Natural Hazards and Disasters**<br><br>**Class discussion: Which hazards are most dangerous? Which parts of the world are most at risk from natural hazards, and which parts are safer?** |
| **Week 2 (Jan. 31)** | Disaster response from NASA case studies (case studies for the Nepal Earthquake, Louisiana Floods, Hurricane Matthew. Dr. Green would introduce the disaster charter and volunteer networks) |
| **Week 3**<br><br>**(Feb. 7)** | More detail on NASA disaster response, more examples of remote sensing assets uses, products generated and means of distribution of access (Dr. Green) |
| **Week 4**<br><br>**(Feb. 14)** | Several other disaster case studies from after action reports and lessons learned and scenario exercise (Dr. Green) |
| **Week 5**<br><br>**(Feb. 21)** | **Remote sensing applications in Earthquake studies** combining satellite, GNSS and SAR |
| **Week 6**<br><br>**(Feb. 28)** | **Volcanic ash detection from satellite observations** with MODIS, GOES, GOES-R, OMPS etc |
| **Week 7**<br><br>**(Mar. 7)**<br><br>**Mar. 13-19** | **Exercises and Discussions (Online)**<br><br>**(Take home Midterm exam)**<br><br>**Spring Break** |
| **Week 8** | **Remote Sensing Applications in Tsunami studies** combining satellite, |

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|---|---|
| (Mar.20) | GNSS and SAR<br><br>Class discussion: What causes tsunami and their destructive power? |
| Week 9<br><br>(Mar. 27) | Severe weather, Thunderstorms, and Tornadoes<br><br>Class discussion: What are Tornadoes, and why do they exist. Are tornadoes increasing in strength and frequency? |
| Week 10<br><br>(Apr. 4) | Remote Sensing in Tropical Cyclone/Hurricane studies |
| Week 11<br><br>(Apr. 11) | Climate Change |
| Week 12<br><br>(Apr. 18) | Flood detection from satellite observations<br><br>Class discussion: How can remote sensing help in studying and preventing floods? |
| Week 13<br><br>(Apr. 25) | Drought detection from satellite observations<br><br>Class discussion: How can remote sensing help in studying and preventing droughts? |
| Week 14<br><br>(May 9) | Fire detection from satellite observations<br><br>Class discussion: The importance of forests and the consequences of their destruction |
| May 16 | Project presentation/ Project paper due |