GLY 5888 Coastal Hazards & Mitigation

Florida International University

Department of Earth and Environment

Instructor: Dr. Stephen Leatherman; Office: AHC5, Room 385; Phone: 305-348-8364; Email: Leatherm@fiu.edu; Office Hours: Before and after class or by appointment.

Classroom and Time: PC-439; Mondays 5-7:40 PM

Reference Texts (Available at Green Library Reserve):

- Coastal Hazards, 2013, Springer
- The Human Shore, 2012, University of Chicago

Discussion Papers (Provided via Drop Box):

- Rip Current Hazard in Costa Rica, 2015, Natural Hazards.
**Literature Review:** You will be asked to locate relevant articles for some classes, which you will summarize in bullet points and discuss in class.

**Course Description and Objectives:**

Coastal hazards play a major role in today’s society because 80% of the world’s population resides near the coast. Seventeen of the twenty largest cities are located on the coast, and 90% of the world’s trade is accomplished by water transport from port cities. Large population areas, such as those located in Shanghai, China, southern Bangladesh, Venice, Italy, southwest Netherlands, and New Orleans, Louisiana, are built on low-lying river deltas. These coastal low lands are subject to hurricanes/cyclones/typhoons and sea-level rise, which make them particularly hazardous for human occupation.

Coastal hazards can cause tremendous damage and/or inflict great losses of life, yet the coastal zone is the preferred place for development. The severity of coastal disasters has been increasing in recent decades, largely because of the ever-increasing world population, but also because of global climate change, resulting in rising sea levels, which, in turn, causes increased flooding, coastal erosion, and diminished fresh water.

Intensive development of the coastal zone not only places more people and property at risk to coastal hazards, it also degrades the natural environment, interfering with nature’s ability to protect the human environment from severe events. For example, seawalls built to protect infrastructure and buildings can accelerate beach erosion and inhibit the beach’s ability to absorb storm energy, thus exposing buildings to the full force of waves and surge. Coastal development can also destroy wetlands that serve as important buffers against storm surges and other floods. While nothing can be done to prevent coastal hazard events, their adverse impacts can be reduced through proper planning, which involves complex inter-relationships among nations, government agencies at various levels, corporations and individuals.

Understanding coastal hazards and various strategies for mitigation of their impacts on society and the environment requires an understanding of their inter-disciplinary dimensions. The nature of coastal hazards spans the technical aspects to the political and economic challenges. This course examines the major coastal hazards on a worldwide basis and assesses regional susceptibilities and mitigation. Some areas are particularly prone to large tsunamis as witnessed by the Great Japanese Tsunami in 2011 that totally devastated a localized area and the 2004 Indian Ocean Tsunami that killed hundreds of thousands of people over a wide area with Indonesia, Thailand, Sri Lanka, and India being hardest hit.
Grading Policy:

Grades will be based on the following scores:

- Class discussions and debates 20%
- Weekly write-ups of assigned readings and literature reviews (use bullet format for main points) and three thought-provoking questions and/or **pro-active approaches** to lower the loss of life and/or damage (e.g., hazard mitigation) per assignment.
- Powerpoint presentation by each student (topic to be determined). 20%
- Mid-term Exam 20%
- Final Exam 20%

Grading Scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Score Range</th>
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<tbody>
<tr>
<td>A</td>
<td>93-100</td>
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<tr>
<td>A-</td>
<td>90-92</td>
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<td>F</td>
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Early Alert:

In an effort to help you succeed in your academic courses, FIU utilizes an Early Alert system. Instructors are now able to notify students’ academic advisors if there are concerns about class performance. If an alert is submitted, your academic advisor will send you a message via your Student Dashboard (accessed via your MYFIU page) to discuss ways to improve your performance. Please respond to any communication you receive from your academic advisor about an early alert. Our goal with this program is to help you to be successful by identifying any issues as early on as possible and working to address them.
# Class Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Reading</th>
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<tbody>
<tr>
<td><strong>Week 1</strong></td>
<td><strong>Ground Rules and Introduction to Course</strong></td>
<td>Syllabus</td>
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<td></td>
<td>Causes of Global Coastal Hazards</td>
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<td>Engaging Question: Are coastal disasters inevitable?</td>
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<td></td>
<td>Class discussion of causes of coastal hazards, including</td>
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<td></td>
<td>- geological, meteorological, oceanographic, and human-induced factors. (Global Awareness)</td>
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<tr>
<td></td>
<td>Learning Activity: Power Point Presentation</td>
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<td></td>
<td><strong>Assignment for next class:</strong> Two-page summary of Rip Currents in</td>
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<td>- Chapter 26 of Springer book (see DropBox).</td>
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<tr>
<td><strong>Week 2</strong></td>
<td><strong>No class—Labor Day</strong></td>
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<tr>
<td><strong>Week 3</strong></td>
<td><strong>Rip Currents: A Major Global Coastal Hazard</strong></td>
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<td>Engaging Question: What are rip currents and why</td>
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<td>- are so many people killed by this little recognized hazard with the</td>
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<td>- United States, Australia, Brazil and Israel being hot spots?</td>
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<td></td>
<td>Learning Activity: Power Point Presentation</td>
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<td></td>
<td><strong>Assignment for next class:</strong> One-page summary of article on the</td>
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<td></td>
<td>- Rip Current Hazard in Costa Rica (see DropBox).</td>
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**Week 4**  
**Rip Current Case Study: Costa Rica**

Rip currents are the leading cause of accidental death in Costa Rica, only exceeded by traffic accidents. The Pacific coast of Costa Rica is particularly dangerous because of the large, long-period swell waves that arrive from offshore storms. Four American tourists on an educational trip were drowned at Palo Seco Beach in one afternoon, which served to alert officials of this hazard. Recent studies have demonstrated that rip currents are commonly present on many of the popular beaches with Jaco Beach having the most deaths in spite of lifeguards.

Engaging Question: What actions can be taken to alert the Costa Ricans, most of whom cannot swim, as well as international tourists who are drawn to these beautiful, tropical beaches?

Learning Activity: Powerpoint Presentation

**Assignment for next class**: One-page review of rip current video that is available on [www.ripcurrents.com](http://www.ripcurrents.com) and YouTube.

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**Week 5**  
**Rip Currents: Most Dangerous Hazard at Beaches Internationally**

Engaging Question: What can be done to improve public understanding of the risk of rip currents, considering that there are five different types, which exhibit a range of characteristics and require different strategies for escape? (Global Awareness and Engagement)
Learning Activity: Power Point Presentation

Class discussion of rip currents as an often-neglected coastal hazard and the fact that only one type of warning sign is presently used on US coasts and indeed worldwide.

Assignment for next class: One-page summary of literature review of Bangladeshi cyclones in terms of impacts and possible mitigation and one-page summary of Hurricane Katrina’s impact on New Orleans.

Week 6

Hurricanes, Cyclones and Typhoons: Most Powerful Storms on Earth by Different Names

Engaging Question: What steps can be taken to reduce the impacts of storm surges in Bangladesh and Miami considering their different socio-economic conditions? (Global Perspective)

Class discussion of storm surges and flooding in the Bay of Bengal, Bangladesh and Miami (Socratic Circles)

Learning Activity: Power Point Presentation

Assignment for next class: One-page summary of Wall of Wind article (see DropBox). Write four short-answer questions (with answers) for possible use in the Mid-Term Exam.

Week 7

Hurricane Wind Impacts and Resilient Construction

Engaging Question: How can hurricane damage be mitigated?
Class Group Debate of challenges in mitigating hurricane damage considering that the City of Miami Beach is located on a barrier island. How well are buildings in “developing countries” constructed—consider the New Year’s Eve 2016 fire in a Dubai high-rise hotel. (Global Engagement)

Learning Activity: Power Point Presentation

Assignment for next class: Prepare for Mid-Term Exam

Week 8  Mid-Term Exam

Assignment for next class: One-page summary of literature review of Super Storm Sandy’s impact on beachfront development in northern New Jersey.

Week 9  Hurricane Impacts on Beachfront Properties

Engaging Question: Should beachfront property owners in northern New Jersey be allowed to rebuild their houses on what is now the oceanic beach? (Global Awareness, Perspective and Engagement)

Group discussion and debate of stakeholders, taking the position of FEMA (disaster and flood insurance programs), state officials, town mayors, homeowners, and NGOs (e.g., environmental groups such as NRDC and EDF). Who would stand to benefit or lose?

Learning Activity: Power Point Presentation

Socratic Circle discussion: What kind of impact would Super-
Storm Sandy have had if it struck Miami or the world-famous Atlantis Hotel in Nassau, Bahamas? How resilient is Miami vs. New Jersey, considering the differences among the terms hazard, vulnerability and disaster.

**Assignment for next class:** Two-page summary of literature review of Indian Ocean Tsunami of 2004 and Great Japanese Tsunami of 2011.

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**Week 10**  
**Tsunamis in a Global Context**

Engaging Question: What can be done to reduce the susceptibility of the world’s coastal populations to tsunamis?

The tsunami disaster of 2004 resulted in more than 200,000 people being killed in several countries and the Great Japanese Tsunami of 2011 raised worldwide awareness of the destructiveness of these powerful waves.

Learning Activity: Power Point Presentation

Class debate: Instead of each country fending for itself, how can global citizens help to address this huge problem in terms of better anticipation of such occurrences through technology and reducing the misery in the aftermath of such events? (Global Engagement)

**Assignment for next class:** One-page summary of Social and Economic Costs of Sea Level Rise article (see DropBox).
Week 11  Global Sea Level Rise and Responses

Engaging Question: Is it inevitable that there will be wholesale land losses in response to global warming-induced sea level rise? 

Class discussion of disaster risk management in an age of climate change (Global Awareness)

Learning Activity: Power Point Presentation

Assignment for next class: One-page summary of “Vanishing Lands” video (available in DropBox or YouTube) and review for class discussion the articles regarding Tuvalu and Maldives—two small island nations.

Week 12  No Class—Veteran’s Day

Week 13  Sea Level Rise Impacts: Coastal Flooding and Inundation

Engaging Question: How might small island nations, such as Tuvalu, respond to sea level rise compared to developed countries?

Class Discussion: What steps can be taken to reduce the impacts on small island nations; consider the formation of the Alliance of Small Island States (AOSIS)? (Global Engagement)

Learning Activity: Power Point Presentation

Assignment for next class: Two-page summary of article on Coastal Erosion and U.S. National Flood Insurance Program (see DropBox).
Week 14  Coastal Erosion Hazards

Engaging Question: How significant is the coastal erosion hazard?
Class discussion of the nature of the erosion problem, the federal response and options for beachfront communities.
Learning Activity: Power Point Presentation

Assignment for next class: Two-page summary of literature review of Exxon-Valdez spill in Alaska and BP oil spill in the Gulf of Mexico regarding impacts on wildlife.

Week 15  Oil Spills and Coastal Disasters

Engaging Question: What can be done to prevent future disasters such as the BP Deepwater Horizon oil spill in the Gulf of Mexico?
Class discussion: News reporters stated that the BP spill was the worst ecological disaster in North America, but consider the Exxon Valdez shipwreck in Alaska and the Ixtoc oil spill in Mexico.
Learning Activity: Power Point Presentation

Assignment for next class: Prepare for Final Exam

Week 16  Final Exam: The schedule will be announced when available from FIU; there will be no other activities except the Final Exam during final examination week. The Final Exam will consist of 10 multiple-part, short-answer questions as was the case for the Mid-Term Exam