GLY 4881 Coastal Hazards

Global Learning Course

Department of Earth and Environment

Florida International University

Fall 2020

Instructor: Dr. Stephen Leatherman; Leatherm@fiu.edu

Time: Mondays 5-7:40 PM; taught synchronous remote via Zoom

Discussion Papers (Provided via Canvas):

- Rip Current Hazard in Costa Rica, 2015, Natural Hazards.
- Game-Changing New Smart Sponge Soaks up Oil Spills, 2020, Science magazine.

Literature Review: You will be asked to locate relevant articles on-line for some classes, which you will summarize in bullet points.

Course Description:

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 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.

**Global Learning Course Objectives and Outcomes:**

This is a discipline-specific Global Learning course that counts towards your FIU Global Learning graduation requirement.

**Global Awareness**—Students will be able to demonstrate an understanding of the interconnection of coastal hazards on a global basis, that these problems have no national borders, and that these problems are affected by geological, meteorological and oceanographic factors as well as socioeconomic, technological and cultural conditions.
Global Perspective—Students will be able to conduct analyses of the impact and mitigation of coastal hazards in a global context and the extent to which multiple factors, such as economics, technology and social norms, contribute to or help solve the problem.

Global Engagement—Students will collaborate in groups to devise solutions to problems of mitigating coastal hazards, which are appropriate within the framework of economic, technological and societal factors at regional, national and global levels.

Active Learning Strategies:
Students will participate in a number of activities via Zoom, including:

- Class Discussions
- Discussion Groups
- Power-point Presentations

Project and Papers
There will be no exams. Instead of a mid-term exam, you will (1) prepare a 3-page, double-spaced paper (not including illustrations and references) on how to make Miami Beach safer by reducing rip current drownings and (2) write a 30 second to 1 minute script for a PSA (public service announcement) that could be made into a video about the danger of rip currents, remembering that comedy is often the best approach. Instead of a final exam, you will prepare a 5-page, double-spaced paper (not including illustrations and references) on the design of a new Hurricane Scale or Scales, considering the following impacts of wind damage, storm surge flooding and freshwater flooding.

Grading Policy:
Grades will be based on the following scores:

- Attendance and class discussions via Zoom 20%
- Weekly write-ups (bullet points format) of assigned readings and literature reviews (use Google Scholar) and three thought-provoking questions and/or pro-active approaches to lower loss 25%
of life and/or damage (e.g., hazard mitigation).

- Power-point presentation by each student 15%
- PSA and Rip Current Paper regarding Miami Beach 20%
- Hurricane Scale(s) Term Paper 20%

**Grading Scale:**

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<tr>
<th>Grade</th>
<th>Minimum Score</th>
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<tr>
<td>A</td>
<td>93-100</td>
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<tr>
<td>B</td>
<td>83-86</td>
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<td>C</td>
<td>70-76</td>
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<td>D</td>
<td>60-69</td>
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<td>F</td>
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<td>A-</td>
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<td>80-82</td>
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<td>B+</td>
<td>87-89</td>
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<td>C+</td>
<td>77-79</td>
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**Class Schedule**

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<tr>
<th>Date</th>
<th>Topic</th>
<th>Reading</th>
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<tbody>
<tr>
<td>Week 1</td>
<td>Ground Rules and Introduction to Course</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>Class discussion of causes of coastal hazards, including</td>
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<td>geological, meteorological, oceanographic, and human-induced factors.</td>
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<td>(Global Awareness)</td>
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<td>Learning Activity: Power Point Presentation</td>
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<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; this is one of the Discussion Papers provided</td>
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<td>via Canvas. This chapter provides a good introduction to and summary of</td>
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<td>rip currents as the greatest hazard at surf beaches.</td>
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Week 2

**Rip Currents: A Major Global Coastal Hazard**

Engaging Question: What are rip currents and why are so many people killed by this little recognized hazard with the United States, Australia, Brazil and Israel being hot spots?

Learning Activity: Power Point Presentation

Assignment for next class: One-page summary of article on the Rip Current Hazard in Costa Rica; this is one of the Discussion papers provided via Canvas. Costa Rica is a very popular country to visit for its ecological resources, and the beaches are very inviting but unfortunately prone to rip currents, especially on the Pacific coast.

Week 3

No class—Labor Day

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: Power-point Presentation

Assignment for next class: One-page review of the rip current video that is available on www.ripcurrents.com and YouTube (Google Dr. Beach: Rip Currents). This 6-minute video is used by the Boys Scouts to promote beach safety and to earn a merit badge.

Week 5 Rip Currents: Most Dangerous Hazard at Beaches Internationally

Engaging Question: What can be done to improve public understanding of 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 Bangladeshi cyclones impact on the population, and one-page summary of Hurricane Katrina’s impact on New Orleans (e.g., separate write-ups). You should obtain 3-5 references using Google Scholar and Google for each article. Considering
the devastating consequences in each case, what could possibly be done to mitigate (e.g., lower) the damage in each case?

**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.

Learning Activity: Power Point Presentation

**Assignment for next class:** One-page summary of Wall of Wind Article (see Discussion Papers as available via Canvas). The Wall of Wind which resides at the FIU Engineering campus is the first hurricane simulator in the world. Also, consult Google Scholar for updates (e.g., 12-fan electric Wall of Wind now being used).

**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:** PSA and Rip Current paper are due. The PSA should be the script for a 30-second to 1-minute Public Service Announcement (PSA) to warn beachgoers about rip currents and promote beach safety. The Rip Current paper should be 3-page double-spaced that provides specific recommendations to make Miami Beach safer, considering that it is the #3 rip drowning beach in the nation. You should consult at least 5 articles via Google Scholar in preparing this paper.

**Week 8**

Class Power-Point Presentations; PSA and Rip Current Paper Due

**Assignment for next class:** One-page summary of literature review of Super Storm Sandy’s impact on beachfront development in northern New Jersey. You should consult at least 5 articles via Google Scholar to understand the uniqueness of this very devastating coastal storm and the reasons for so much damage. Also include information on the rebuilding process as required by FEMA (Federal Emergency Management Agency).

**Week 9**

**Hurricane Impacts on Beachfront Properties**

Engaging Question: Should beachfront property owners in northern New Jersey be allowed to rebuild their houses in the wake of Super Storm Sandy and without elevating? (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 might benefit or lose?

Learning Activity: Power Point Presentation

Class 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. Consult Google Scholar to obtain at least 3 articles for each event. Why was the death rate so high in each case? Can anything be done to mitigate (e.g., lower) the damage and death rate in the future?

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; this article is provided in the Discussion Papers via Canvas. Sea level rise is not usually thought to be a coastal hazard by the general public because it is occurring slowly (e.g., ocean levels are only rising a few millimeters per year), but over time high water levels make coastal storms more devastating and result in beach erosion.

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

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 via YouTube) and review for class discussion the articles regarding Tuvalu and Maldives—two small island nations.
Rising sea level has resulted in loss of small islands in the Chesapeake Bay during historical times and is even threatening island nations such as Tuvalu and Maldives because of higher water levels and flooding as well as coastal erosion.

Week 12

Student Power-point Presentations

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; this article is provided in the Discussion Papers for the class via Canvas. The Federal Emergency Management Agency is responsible for the National Flood Insurance Program which regularly runs huge deficits because the policies are not actuarially sound. Reforms are slow in coming because the U.S. Congress must pass new legislation, and wealthy and influential beachfront property owners are not in favor of paying higher insurance premiums and have enormous

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political clout.

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. Use Google Earth to find information about the two worst oil spills in U.S. history. While the BP accident was horrific and cited by the media as the worst environmental disaster in our country, the Alaska spill was far more devastating to marine life and fisheries. Why do you think that this was the case?

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: Complete the Term Paper which should be 5-page, double spaced (not including illustrations and references) on the design of a new Hurricane Scale or Scales, considering the following
impacts of storm surge flooding and freshwater flooding. Use Google Earth to find at least 10 references to assist you in your analysis. The Saffir-Simpson Hurricane Scale was recently renamed the Saffir-Simpson Hurricane Wind Scale.

Week 16 Term Paper Due and Class Power-Point Presentations