EWC 471: Basic Coastal Engineering

Introductory Lecture

Course Contents

Coast and coastal features, tides and currents, tidal flow measurement, waves and its characteristics, forces of waves and tides in the design of coastal and harbour structures: coastal water level fluctuation - storm surge, tsunami and basin oscillation, coastal zone processes, deltas and its characteristics, estuary and estuary control, docks and harbors, design considerations of shore protection works.

My Part: Coast and coastal features, waves and its characteristics, forces of waves and tides in the design of coastal and harbour structures: coastal water level fluctuation - storm surge, tsunami and basin oscillation, estuary and estuary control

Course Rationale

The students will be acquainted with the key concepts, basic analysis and design techniques in Coastal Engineering.

Course Objectives

1. To understand and quantify ocean wave processes including wave generation, propagation, refraction, shoaling, diffraction, and breaking.
2. To learn ocean wave properties important to coastal engineering, including wave heights, speeds, induced water velocities, pressures, making appropriate approximations for deep and shallow waters.
3. To characterize tides and quantify basic coastal sediment transport processes and rates.
4. To analyze coastal sites and to estimate hydrodynamic forces on simple structures.
5. To understand the design criteria of simple shore protection structures.
6. To identify different shoreline protection methods.

Course Outcomes (COs)

After completion of the course, it is expected that the students will be able:

1. To understand the ocean: waves, currents, tides and water levels.
2. To understand how waves and currents move sediment and impact shorelines and structures.
3. To understand how to put all of this together to design shoreline protection structures/coastal projects.

References:

- Basic Coastal Engineering, Robert M. Sorensen. (Available online)
- Coastal Engineering Manual, U.S. Army Corps of Engineers. (Available online)
- Shore Protection Manual, Vol. I and II, US Army Corps of Engineers (Available online).
- Water Wave Mechanics for Engineers and Scientists, Dean and Darlymple, World Scientific. (for process understanding)
- Coastal Processes with Engineering Applications, Dean and Darlymple, Cambridge University Press. (for process understanding)
- Introduction to Coastal Engineering and Management, J.W. Kamphuis, World Scientific. (for process understanding)
- Random Seas and Design of Maritime Structures, Y. Goda, World Scientific Publishing Company Pvt. Ltd.
- Estuary and Coastline Hydrodynamics, T. Ippen, McGRAW-HILL Book Company. (for process understanding)
- Dock and Harbour Engineering (Second Edition) by Oza and Oza.
- Coastal Engineering-2 by R Silverster.

Marks distribution

- Attendance/ class participation: 5%
- Class Test/ Assignment (1-3): 20%
- Mid Term: 15%
- Final Exam: 60%

Lesson Plan (Tentative)

Lecture #	Contents
#1	Definitions and nomenclature of the coastal zones, Typical beach profiles
#2	Coastal diversity, human and coastal zones
#3	Factors influencing coastal morphology and processes
#4	Definition of wave parameters, waves and its characteristics-concept
#5	Linear wave theory: wave celerity, length, and period, the sinusoidal wave profile, local fluid velocities and accelerations-concept
#6	Water particle displacements, subsurface pressure, group velocity, wave energy and power-problem
#7	Wave propagation in shallow water, summary of linear wave theory- problem
#8	Changes in wave forms in coastal water
#9	Coastal zone processes, coastal erosion
#10	Storm surge, wind stress

Lesson Plan (Tentative)

Lecture #	Contents
#11	Continental shelf, examples of surges-problem
#12	Tsunami: physical characteristics of tsunami, causes of tsunami
#13	Tsunami: mitigation of risks and hazards, prediction and early warnings
#14	Deep-ocean assessment and reporting of tsunamis
#15	Hydrodynamics and Sediment Dynamics of Tidal Inlets
#16	Coastal-Offshore Ecosystem
#17	Physics of Shallow Estuaries and Bays
#18	Estuarine Cohesive Sediment Dynamics
#19	Offshore and Coastal Modelling
#20	Harbor layout: Types, port terms, site selection, features

Coastal areas comprises of some of the most beautiful places on earth!

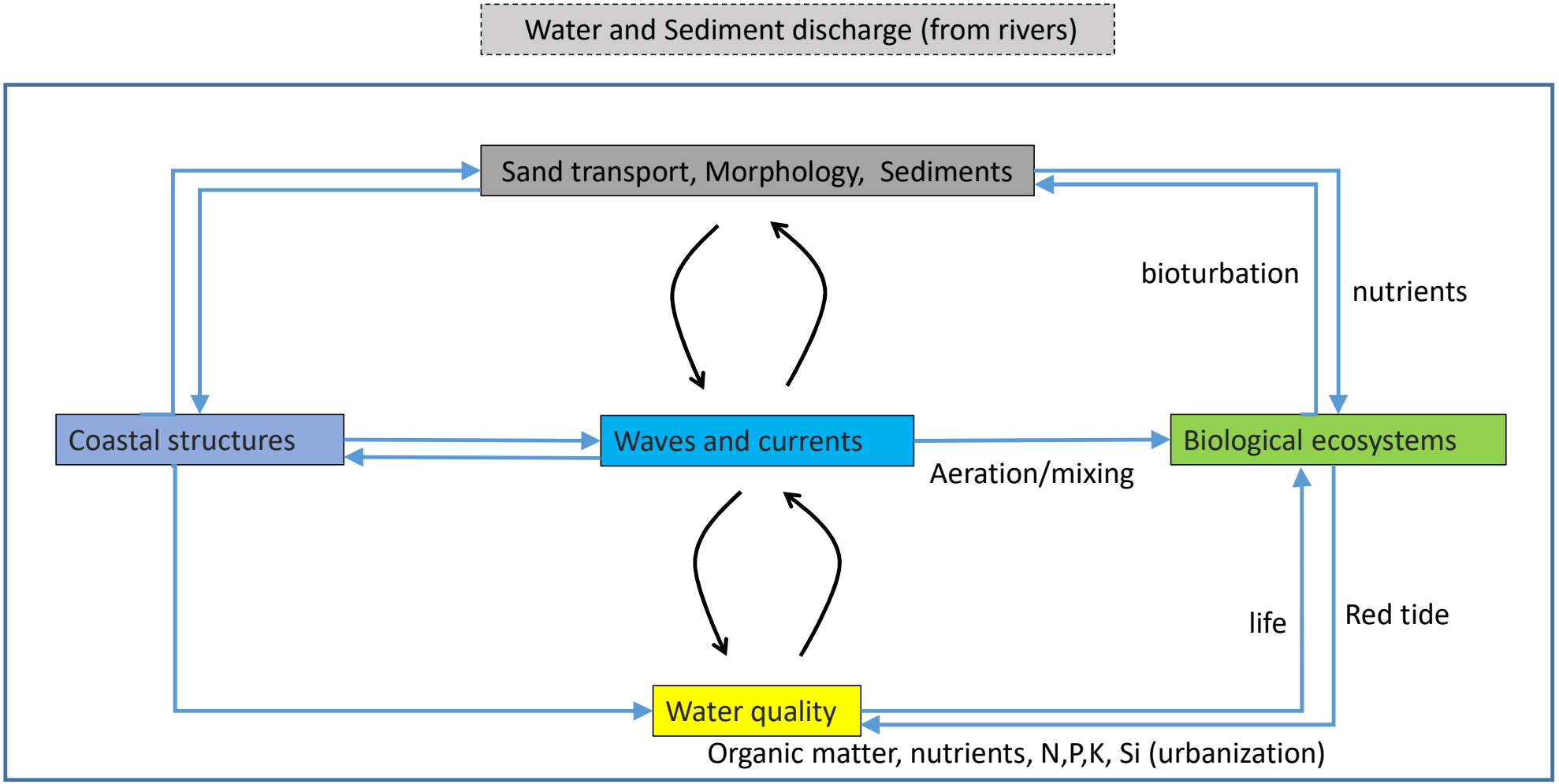








Putting things in context



Storm surge videos :

Cyclone Aila (2009)

Cyclone Aila
Formed: May 25, 2009
Dissipated: May 27, 2009
Highest winds: 3-minute sustained: 110 km/h (70 mph)
1-minute sustained: 120 km/h (75 mph)
Lowest pressure: 968 hPa (mbar)
Fatalities: 339 total; Damage: at least $1 billion (2009 USD)





Aila became a severe cyclonic storm at 06UTC on May 25 and made landfall at its peak intensity (60kt, 967hPa) between 08 and 09UTC.

From the video:

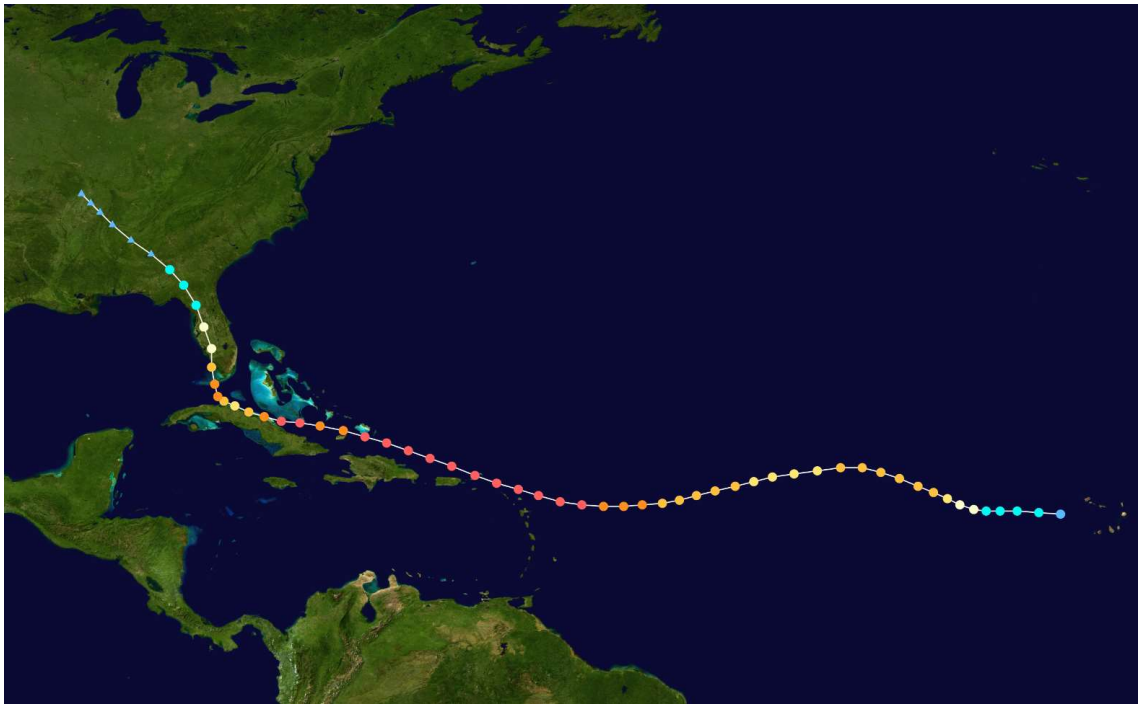


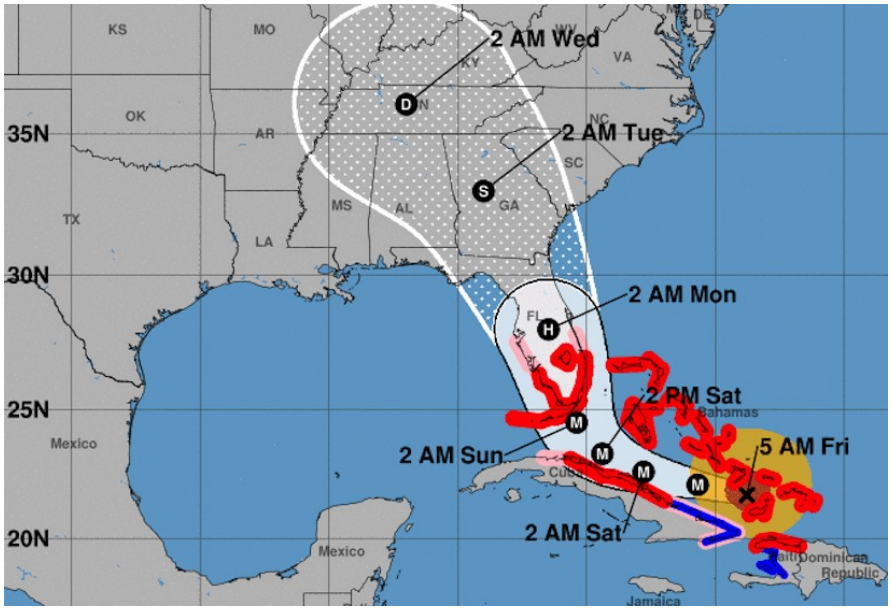
We need to take care of the livestock

Storm surge videos :

Cyclone Irma (2017)

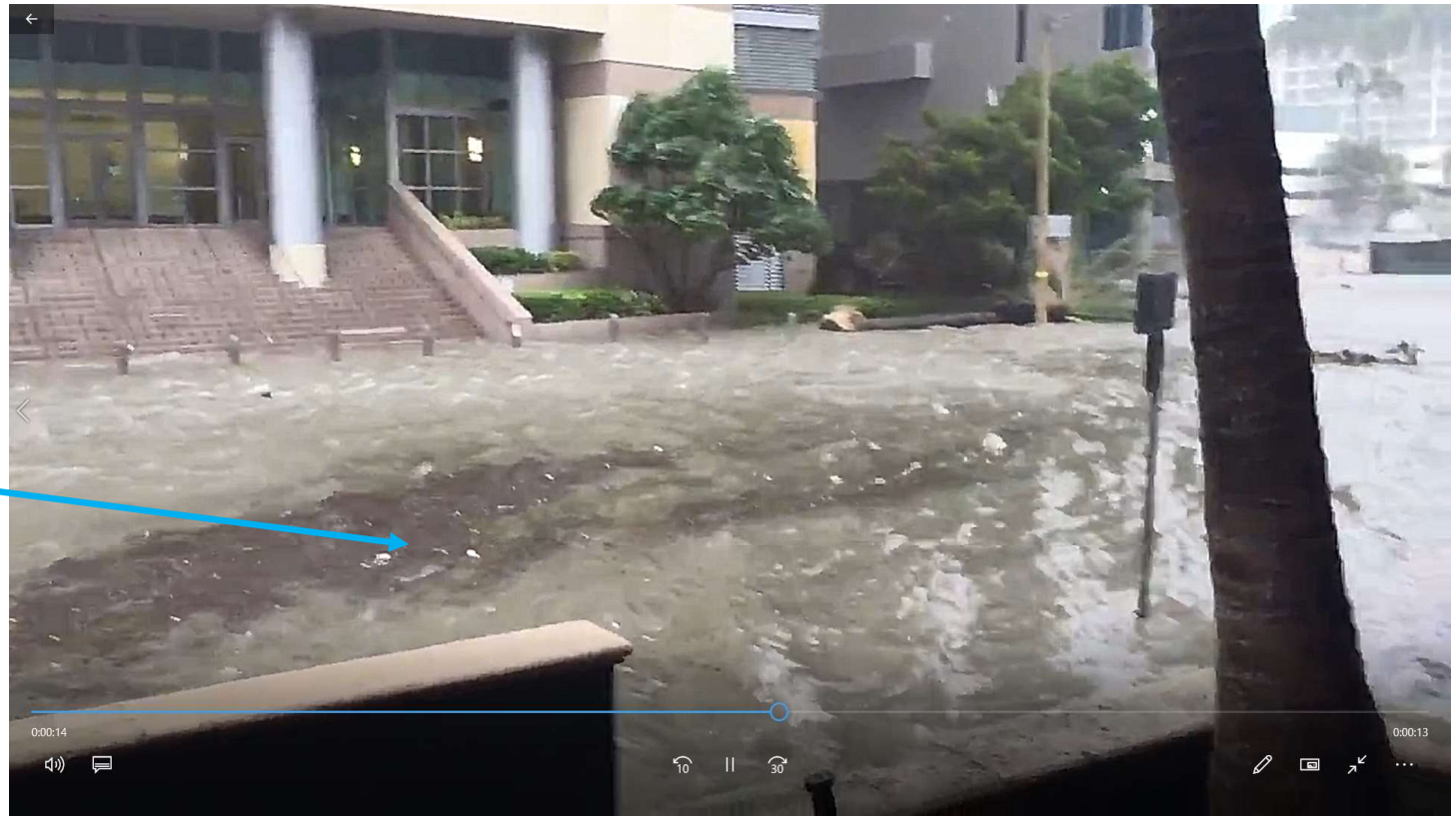
Cyclone Irma
Formed: August 30, 2017
Dissipated: September 14, 2017
Highest winds: 1-minute sustained: 180 mph (285 km/h)
Lowest pressure: 914 hPa (mbar)
Fatalities: 52 direct, 82 indirect; Damage: $77.16 billion (2017 USD)





Irma was the second-most intense tropical cyclone worldwide in 2017 in terms of barometric pressure, and the strongest worldwide in 2017 in terms of wind speed..

From the video:



Drainage is an important issue in urban context

Thank You