

# Coastal Erosion Management

<b>MODULE TITLE</b>	Coastal Erosion Management
<b>LECTURER(S)</b>	Dr Memos
<b>ECTS VALUE</b>	8
<b>PREREQUISITES</b>	Physics, Geology, Applied Mathematics
<b>COREQUISITES</b>	Numerical Analysis
<b>DURATION OF MODULE</b>	15 weeks

## TOTAL STUDENT STUDY TIME

Overall, the module is expected to involve students in approximately 200 hours of learning: 12 5-hour lectures; 58 hours assignments; 78 hours private study; 4-hour examination.

**WEB LINK** <http://www.water-msc.org/en/wrem404.htm>

## AIMS

This module aims at providing a solid framework of knowledge required for the proper management of coastal erosion. Reference is made to integrated coastal management and how coastal erosion is embedded in it. Thus the contents of this module support the formation of a primary tool for coastal engineers and other scientists in applying planning and other managerial interventions to the coastal zone respecting the principles of sustainability.

## INTENDED LEARNING OUTCOMES

### 1. Subject Specific Knowledge, Understanding and Skills

By the end of this module, the students should:

- a) be able to specify coastal zones and to identify coastal erosion as a prime factor in the framework of integrated coastal zone management;
- b) be able to identify and understand the basic properties of the main environmental factors playing a role in coastal erosion;
- c) understand the physical processes related to wind wave generation and shoreward propagation; coastal currents and long waves; sediment transport in the coastal zone.
- d) Have acquired basic knowledge and understanding on coastal geomorphology, including estuaries;
- e) be able to identify and initialise the layout of possible interventions, including mild ones, to prevent coastal erosion;
- f) understand the main factors and processes underlying coastal flooding;
- g) acquire basic information regarding the European coastal zone management perspective.

### 2. Core Academic Skills

By the end of this module, the students should:

- a) be able to identify, formulate and analyse coastal erosion problems;
- b) be able to propose interventions toward solving coastal erosion problems;

- c) have acquired a sound understanding of the impact of coastal erosion on the integrated coastal erosion management;
- d) have acquired some practical experience in using simple modelling techniques related to coastal physical processes.

### **3. Personal and Key Skills**

By the end of this module, the students should have:

- a) improved further the necessary skills for independent learning;
- b) enhanced reporting skills;
- c) improved some IT skills.

### **LEARNING/TEACHING METHODS**

Lectures, problem sheets.

### **ASSIGNMENTS**

Two assessed coursework assignments (2,500 equivalent words each including graphs and tables).

Problem sheets and computer based problem solving.

### **ASSESSMENT**

Examination paper (60%), Course work (40%)

3-hour examination - use of notes and books allowed

2 assignments on applications to real life problems (2\*20% = 40%, 5,000 equivalent words, including graphs and tables)

### **SYLLABUS PLAN**

#### **1. Introduction and module overview**

- 1.1. Overview of the module contents
- 1.2. The coastal zone and its components
- 1.3. Importance of the CZ to man and the environment
- 1.4. Man-produced pressures and land use conflicts
- 1.5. The physical nature of the coastal zone
- 1.6. Sediment balance and coastal erosion
- 1.7. References

#### **2. Main environmental factors**

- 2.1. Winds and their effect on the coastal zone
- 2.2. Generation of deep-water wind waves
- 2.3. Wave-induced currents: shore-normal and longshore
- 2.4. Tides and other long waves
- 2.5. Coastal sediments and transport
- 2.6. Sand dunes and wind action
- 2.7. References

#### **3. Deep water waves**

- 3.1. Small amplitude wave theory
- 3.2. Wave energy
- 3.3. Wave dispersion and group velocity
- 3.4. Irregular waves and wave prediction
- 3.5. References

#### **4. Wave propagation over shallow water**

- 4.1. Wave transformations
- 4.2. Edge waves

- 4.3. Wave breaking due to depth limitation
- 4.4. Surf zone processes
- 4.5. Wave uprush on beaches
- 4.6. References

## **5. Currents and long waves**

- 5.1. General circulation
- 5.2. Wind- and wave-induced drift
- 5.3. Longshore and cross-shore currents, cell circulation
- 5.4. Tidal currents
- 5.5. Long waves
- 5.6. References

## **6. Coastal sediments**

- 6.1. Sources
- 6.2. Size and physical characteristics
- 6.3. Coastal sediment transport
- 6.4. Beach profile and longshore shape
  - 6.4.1. Beach profile
  - 6.4.2. Beach longshore shape
- 6.5. References

## **7. Estuaries and coastal inlets**

- 7.1. Definitions and general description
- 7.2. Estuarine processes and morphology
- 7.3. Coastal inlets
- 7.4. References

## **8. Morphological changes**

- 8.1. Coastal geomorphology
- 8.2. The form and function of coastal landforms
- 8.3. Cliffs and shore platforms
- 8.4. Beach morphodynamics and sea-level change
- 8.5. References

## **9. Interventions to prevent erosion**

- 9.1. Types of interventions and design constraints
- 9.2. Groynes
- 9.3. Shore-parallel breakwaters
- 9.4. Seawalls and revetments
- 9.5. References

## **10. Mild interventions for beach protection**

- 10.1. Submerged structures and wave transmission
- 10.2. Beach re-fill
- 10.3. Discussion
- 10.4. References

## **11. Coastal flooding**

- 11.1. Overview
- 11.2. Hurricanes and wave prediction
- 11.3. Water level fluctuations
  - 11.3.1. Wind setup
  - 11.3.2. Storm surge and seiches
  - 11.3.3. Astronomical tides
- 11.4. Coastal flood defences
- 11.5. References

## **12. The European Coastal Zone Management**

- 12.1. The European coastal zone
- 12.2. European policies related to coastal zone
- 12.3. The European framework for ICZM
- 12.4. References

### **INDICATIVE BASIC READING LIST**

1. Department of the Environment, UK, 1993, Coastal Planning and Management: A Review, HMSO.
2. US Army Corps of Engineers, 2004, Coastal Engineering Manual, Veri Tech Inc.
3. Dean R.G., Dalrymple R.A., 1984, Water Wave Mechanics for Engineers and Scientists, Prentice-Hall Inc.
4. Pethick I., An Introduction to Coastal Geomorphology, 1984, Edward Arnold.

### **EXTENDED READING LIST**

1. European Environment Agency, 2006, The changing faces of Europe's coastal areas, EEA Report No 6/2006.
2. European Environment Agency, 2007, Europe's Environment, the 4<sup>th</sup> Assessment: Marine and Coastal Environment.
3. Pilkey O.H., Dixon K.L., 1996, The Corps and the Shore, Island Press.
4. Healy M.G., Doody J.P. (Eds), 1995, Directions in European Coastal Management, Samara Publishing Ltd.
5. Kinsman B., 1965, Wind Waves, Prentice-Hall Inc.
6. Soulsby R., 1997, Dynamics of marine sands, Thomas Telford.
7. Pond S., Pickard G. L., 1983, Introductory Dynamical Oceanography, 2<sup>nd</sup> ed., Pergamon Press.
8. Dean R. G., 2002, Beach Nourishment, Advanced Series on Ocean Engineering, Vol. 18, World Scientific.
9. Partheniades E., 1992, Tides and Currents, Handbook of Coastal and Ocean Engineering, Vol. 3, Herbich J. B.
10. Bruun P., 1981, Port Engineering, 3<sup>rd</sup> ed., Gulf Publishing Company.

### **AUTHORS**

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