Impacts, Conflicts and Risks: Present and Future Conditions (250612)

General information

School:	ETSECCPB
Departments:	Departament d'Enginyeria Civil i Ambiental (DECA), Departament d'Enginyeria Gràfica i de Disseny (DEGD), Grup de Recerca Aplicada en Hidrometeorologia (CRAHI)
Credits:	5.0 ECTS
Programs:	MÀSTER UNIVERSITARI ERASMUS MUNDUS EN ENGINYERIA I GESTIÓ COSTANERA I MARÍTIMA, pla 2022 - (codi pla 1525)
Course:	2023/2024

Main teaching language at each group

- Group 10Q2 English (Q2)

Faculty

Responsible faculty: Agustin Sanchez-arcilla Conejo

Teachers: Jose Maria Alsina Torrent, Corrado Altomare, Ivan Caceres Rabionet, Florian Grossmann, Marc Mestres Ridge, Agustin Sanchez-arcilla Conejo, Francisco Javier Sanchez Vila, Daniel Sempere Torres

Generic objectives

This course studies in a comprehensive basis, the coastal and estuarine zones, and the climatic drivers (air and water temperature, precipitation rates, river discharge, sea level and storm patterns) that acts on them. Next it presents the general framework to assess biogeophysical hazards (flooding, erosion, droughts, and water quality), followed by a simple and yet robust evaluation of those hazards.

Skills

Specific skills

Management techniques.

Environmental issues before and after construction of e.g. a port.

Entrepreneurship and corporate social responsibility.

How climate change uncertainties can be managed to reduce risks when designing and operating resilient infrastructure.

Design navigational infrastructure with resilience and adaptation to climate change in mind.

Perform risk management (concepts and techniques).

Know how to make the stakeholders and community to work together to make a project acceptable and wanted.

Coastal hydrodynamics and processes.

Short-term and long-term wave climate.

Sediment transport and morphology.

Coastal and oceanographic numerical modelling.

Physical models for coastal processes, structures and their interactions.

Coastal vulnerability within a sustainable framework.

Field campaigns and data treatment to evaluate problematic situations and plan/design solutions.

Developing beach management strategies for real-world coastal systems.

The basis behind climate change and its effect on the coast.

How to cooperate with administrations and private companies.

Understand and predict the impacts of coastal interventions.

Offer alternatives to hard coastal engineering.

Analyse and interpret collected field data in order to understand the physical drivers at short, mid and long-time or climatic scales.

Compute the risk, vulnerability and hazard analysis including the decadal (climatic) scale.

Generic skills of subject

Social responsibility of business and entrepreneurship.

Develop knowledge and understanding of the coastal environment at an advanced level, applying classic (hard and soft) coastal engineering complemented with building with nature concepts, with ability to analyse, evaluate, assess and synthesis of data and information from different sources with contemporary techniques and technologies.

Handle engineering problems dealing with waves, currents, their interactions, their effects on the coastline and man-made interventions, spanning from short (storms) to decadal scales, to incorporate the climate change dimension.

Propose creative and innovative solutions by themselves or as a work group for current and future problems by enhancing their own interpersonal understanding, work as a team and oral and written communication skills.

Take a leadership role in the community, exerting awareness of ethical, cultural and social issues within a global context in the exercise of their professional skills and responsibilities.

ECTS credits: total hours of student work

		Dedication	
		Hours	Percent
Supervised Learning	Theory	30.00	66.7%
	Assignments	11.00	24.4%
	Laboratory	4.00	8.9%
	Supervised activities	0.00	0.0%
Self-Learning		80.00	

Contents

Introduction

Dedication

2.0h. Theory

Description

In this module, students will be shown the structure of the course and its main objectives, illustrated with real examples.

Objectives

Objectives and organization. Definition of concepts and examples

Risks associated with coastal circulation and waves

Dedication

4.0h. Theory + 3.0h. Assignments

Description

This module will present the most common analytical equations and numerical models for estimating the circulation in the bypass zone and the wave characteristics up to the bypass zone and then to the coastline itself, including the SWASH zone. The different formulations will be presented and critically analyzed illustrating the error range for hydrodynamic estimates. Thereafter, flood and erosion risks for coasts without infrastructure will be analyzed, analyzing how these risks evolve under climate scenarios.

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In this modules it will be shown

Objectives

To present the most common analytical formulations and models for wave circulation in the bypass zone.

To familiarize the student with erosion and inundation estimates in the coastal zone, including their level of uncertainty and for different climatic scenarios.

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Definition concepts and examples

Coastal sediment transport risks

Dedication

2.0h. Theory

Description

This module will present the most common formulations for calculating sediment transport, longitudinal and transverse, together with the transport of suspended sediment, including nutrients and pollutants in the coastal zone. From here, the associated risks, transport patterns, their gradients and dominant concentrations will be analyzed.

Objectives

To present the main mechanisms of sediment transport as a function of diameter and density, analyzing in an integrative way the transport of suspended sediment with that of nutrients and pollutants.

To familiarize the student with the current division of suspended sediment transport in terms of a longitudinal and a transverse component and how all these estimates can be used to estimate risk generation under different climate scenarios.

Risk in harbour / coastal engineering

Dedication

1.0h. Theory + 2.0h. Assignments

Description

This module will present the risks of the most common port infrastructures with emphasis on outer docks and will do the same for traditional coastal infrastructures such as parallel breakwaters on the coast and free-standing docks.

The risks associated with the ultimate limit state of these structures will be presented as well as the risks associated with the different service limit states.

The generation of the risk and how it evolves over time will be analyzed, considering also its mitigation according to the maintenance and observation policy.

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Objectives

To familiarize the student with the main types of risks for port infrastructures with emphasis on outer docks.

To familiarize the student with the main types of risks for traditional rigid coastal infrastructures such as shore breakwaters and free-standing docks.

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To familiarize the student with the main types of risks for traditional rigid coastal infrastructures such as shore

Risks of erosion and accretion considering artificial feeding

Dedication

4.0h. Theory

Description

This module will present the erosion and accretion risks for a coast without interventions, a stiffened coast and a coast with a maintenance policy based on artificial nourishment.

Students will be familiarized with the erosion risks for different types of low shore, but also with the accretion risks considering cases such as the mouth of harbors. The risk associated with artificial feeding will also be considered in terms of its environmental impact and the duration of feeding.

Finally it will be considered how an artificial nourishment affects erosion and flooding risks.

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Finally it will be considered how an artificial nourishment affects erosion and flooding risks.

Objectives

Present the onset and evolution of erosion and accretion risks in low-lying coastal areas considering the effect of artificial nourishment.

To present the risks in terms of environmental impact and duration of conventional artificial feeding operations under different climate scenarios.

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Risk associated with coastal pollution and plastic risks

Dedication

4.0h. Theory

Description

This module will present the main sources of coastal pollution including distributed and concentrated discharge from the land area and also emphasize the pollution produced by plastics of different sizes and composition. It will also present the most common models to estimate the dispersion and concentration of pollution and plastics, depending on their characteristics and the hydrodynamics and hydro-morphological conditions of the typical coastal areas (open coast, mudflats, etc.).

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Objectives

To familiarize the student with the origin and evolution of risk due to coastal pollution including plastics.

Estimates of risks due to coastal pollution and the presence of plastics will be presented with concrete examples, all considering the meteoceanographic conditions of the area and their interactions (e.g. temperature peaks with pollutant concentrations).

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Coastal aquifers risks

Dedication

11.0h. Theory

Description

In this module, the characteristics and dynamics of coastal aquifers will be introduced. The importance of coastal groundwater, the threat of sea water intrusion, and the existence of submarine groundwater discharge to the sea will be explained. The mass balance of coastal aquifers will be explained, together with the basic formulations to estimate the location of the saline water interface. Lastly, the influence of groundwater on coastal ecosystems will be assessed.

In this module, sea water intrusion in coastal aquifers will be explained in detail and the main formulations to understand its spatial and temporal changes. Moreover, the importance of geology and hydrogeology on its dynamics, as well as its variations under different environmental conditions, will be shown. Risks and impacts produced by the combination of anthropogenic actions and climate change will be assessed with real case studies and projected future scenarios.

In this module, the pollution risks in coastal aquifers will be presented. Reactions taking place in the mixing fresh-saline water zone (subterranean estuary) will be explained to understand biogeochemical processes affecting and modifying groundwater quality in coastal areas. Different methods to identify (geophysics, remote sensing) and quantify (seepage meters, Radium isotopes, modelling) submarine groundwater discharge will be assessed under different real case studies. The expected impact and risk of climate change on submarine groundwater recharge will be evaluated.

Objectives

Present the main features of coastal aquifers and its importance on both land (fresh and brackish water) and coastal seawater together with the main formulations to understand these systems and the threats and risks affecting these environmental systems.

Present the main the importance of seawater intrusion in coastal aquifers, the main formulations to understand and assess its changes and the main risks and impacts affecting coastal groundwater under global change.

In this module, the objective is to understand the main sources of pollution in coastal aquifers, its transformations along the aquifer and its impact on coastal zones through submarine groundwater discharge.

Flash flood risks

Dedication

1.0h. Theory + 2.0h. Assignments

Description

The lecture will be oriented to allow students to understand the concept of flash floods and how they generate a number of risks in almost every region. Real-case examples of previous events and their observed impacts will be presented while addressing how variables such as vulnerability and exposure can increase the local flash flood risks. Moreover, recent innovative methodologies and technological tools to improve the monitoring, forecasting and communication of flash flood risks will be shown with some examples of real implementation.

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Objectives

Flash floods are the result of intense precipitation exceeding the capacity of natural or artificial (human-made) drainage systems. Now exacerbated due to climate change, these events can cause significant negative impacts for regions and their urban areas.

Definition concepts and examples

Precipitation and flooding risks

Dedication

1.0h. Theory + 2.0h. Assignments

Description

The lecture will be oriented to allow the students to understand the effects of these heavy rains and how they generate a number of risks in coastal areas (e.g., compound floods from riverine/pluvial and storm surges). Various observatons and models providing precipitation estimates will be presented, and their challenges (limitations) will be addressed. Recent applications of the flood risk modeling (heavy rainfall induced floods, coastal floods) will be shown with some examples available from Copernicus Emergency Management Service.

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Objectives

Precipitation, and particularly heavy rain, is the cause of a number of risks that are now increasing due to climate change.

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Seminar related to floods and risks

Dedication

2.0h. Assignments

Description

This module will show

Objectives

Definition concepts and examples

Coursework

Dedication

4.0h. Laboratory

Activities

Grading rules (*)

(*) The evaluation calendar and grading rules will be approved before the start of the course.

The document and the presentation will be taken into account. The final grade will be the integration of the course work and the continuous evaluation.

Test rules

The document and the presentation will be taken into account. Delivery of course work material (report and ppt) and public defense of the same.

Teaching methodology

The course consists of certain number hours of classroom lectures, combining theory and practice.

The remaining hours are dedicated to the elaboration of a paper included in the same. Additional training classes, where appropriate, on specific coastal risk issues, defining and illustrating associated impacts and conflicts. Application in coursework with critical analysis and extraction of recommendations.

Support material is used in the form of a detailed teaching plan through the ATENEA virtual campus: contents, schedule of assessment and directed learning activities and bibliography.

Although the majority of sessions will be held in the language indicated in the guide, sessions supported by other guest experts from time to time may be held in another language.

Office hours

An appointment will be made by email with the students who request it.

Basic bibliography

- Navarra, A. & Tubiana, L. . **Regional Assessment of Climate Change in the Mediterranean**. Springer. 2013. ISBN ISBN 9400757808, 9789400757806.
- Navarra, A. & Tubiana, L. . **Case Studies**. Springer. 2013. ISBN https://doi.org/10.1007/978-94-007-5769-1. .
- H.H. Lamb. **Climate, History and the Modern World**. World. Ed. Routledge, Taylor & Francis Group. 1997. ISBN ISBN 0-415-12735-1.
- Navarra, A. & Tubiana, L. . **Agriculture, Forests and Ecosystem Services and People**. Springer. 2013. ISBN 10.1007/978-94-007-5772-1.
- D. Basco.. **Design of Coastal Hazard Mitigation Alternatives for Rising Seas**. World scientific. 2019. ISBN ISSN 1793-074X.