English version at the end of this document

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| **Ano Letivo** | 2022-23 |
| **Unidade Curricular** | PROTEÇÃO A CHEIAS EM PLANÍCIES COSTEIRAS |
| **Cursos** | RISCOS COSTEIROS, IMPACTOS DAS ALTERAÇÕES CLIMÁTICAS E ADAPTAÇÃO - COASTHazar (2º CICLO) ERASMUS MUNDUS |
| **Unidade Orgânica** | Faculdade de Ciências e Tecnologia |
| **Código da Unidade Curricular** | 19391011 |
| **Área Científica** | ENGENHARIA |
| **Sigla** | |
| **Código CNAEF (3 dígitos)** | 582 |
| **Contributo para os Objetivos de Desenvolvimento Sustentável - ODS (Indicar até 3 objetivos)** | 11 15 |
| **Línguas de Aprendizagem** | English |

**Modalidade de ensino**

Face to face

**Docente Responsável** Óscar Manuel Fernandes Cerveira Ferreira

| DOCENTE | TIPO DE AULA | TURMAS | TOTAL HORAS DE CONTACTO (*) |
|---|---|---|---|

* Para turmas lecionadas conjuntamente, apenas é contabilizada a carga horária de uma delas.

| ANO | PERÍODO DE FUNCIONAMENTO* | HORAS DE CONTACTO | HORAS TOTAIS DE TRABALHO | ECTS |
|---|---|---|---|---|
| 1º | S2 | 25T; 25TP | 140 | 5 |

* A-Anual;S-Semestral;Q-Quadrimestral;T-Trimestral

**Precedências**

Sem precedências

**Conhecimentos Prévios recomendados**

N/A

**Objetivos de aprendizagem (conhecimentos, aptidões e competências)**

1. Explain concepts and tools for coastal flood and wave modelling and flooding forecasting.
2. Apply tools used for coastal flood modelling and flooding forecasting.
3. Understand and apply the principles of flood frequency analysis and risk-based approaches to design of flood defences.
4. Explain flood risk management with due consideration of societal aspects, including flooding in the floodplain and coastal zone, management of flood risk, planning aspects and a variety of non-structural measures.
5. Assess the impact of climate change on flood risk.
6. Develop a Disaster Risk Reduction (DRR) plan, including non-structural measures.

**Conteúdos programáticos**

Hindcasting of the large-scale wave generation and storm surge generated by a major hurricane (Michael in the Gulf of Mexico) using the Deltares SFINCS model in combination with a fast version of SWAN, HurryWave, and the subsequent overtopping, morphological impact and breaching at Mexico Beach, FL), using XBeach

Assessment of the damage to houses and infrastructure during this hurricane using Delft-FIAT

Assessment of how various non-structural measures would have affected the damage during this extreme event.

Application of a probabilistic framework, T CWiseto generate a statistically representative series of hurricanes and their consequences, in order to create flood risk maps as a basis for a DRR plan, where the effect of some promising solutions from 3. are simulated

Repeating a few cases for time slices in a limited number of future scenarios under climate change.

**Metodologias de ensino (avaliação incluída)**

The course has 5 ECTS, a total of 140 hours, with 50 hours of contact. Theoretical classes will be based on oral presentations with image support, including the discussion of case studies and the definition of best options for simulated situations. A large part of the module will be practical, hands-on exercise of state-of-the-art tools, applied to the full chain of models required to assess actual and potential hurricane damages and risk. The case will be based on Hurricane Michael, which had a huge impact on Mexico Beach, FL.

Assessment methods: Group reports (50%) and presentations (50%), subdivided into the following topics: a) model setup and hindcasting of large-scale surge and wave models; b) model setup and hindcasting of morphological change, inundation and damage; c) effect of interventions on morphological change, inundation and damage; d) preparation of flood risk maps for current and climate change scenarios; e) preparation of a Disaster Risk Reduction Plan.

**Bibliografia principal**

Leijnse et al 2021a Modeling compound flooding in coastal systems using a computationally efficient reduced-physics solver: Including fluvial, pluvial, tidal, wind- and wave-driven processes. *Coastal Eng* **,** 103796

Leijnse et al 2021b Generating reliable estimates of tropical cyclone induced coastal hazards along the Bay of Bengal for current and future climates using synthetic tracks. *Nat Haz Earth Syst Sci* **2021,** 1-40

McCall et al 2010 Two-dimensional time dependent hurricane overwash and erosion modeling at Santa Rosa Island. *Coast Eng* **57,** 668-683

Nederhoff et al. 2021 Simulating synthetic tropical cyclone tracks for statistically reliable wind and pressure estimations. *Na. Haz Earth Syst Sci* **21,** 861-878

Roelvink et al 2017 Improving predictions of swash dynamics in XBeach: The role of groupiness and incident-band runup. *Coast Eng* .

Roelvink et al. 2009 Modelling storm impacts on beaches, dunes and barrier islands. *Coast Eng* **56,** 1133-1152

Slager et al 2016 User Manual Delft-FIAT version 1

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| **Academic Year** | 2022-23 |
| **Course unit** | |
| **Courses** | Coastal Hazards - Risks, Climate Change Impacts and Adaption (COASTHazar) |
| **Faculty / School** | FACULTY OF SCIENCES AND TECHNOLOGY |
| **Main Scientific Area** | |
| **Acronym** | |
| **CNAEF code (3 digits)** | 582 |
| **Contribution to Sustainable Development Goals - SGD (Designate up to 3 objectives)** | 11 15 |
| **Language of instruction** | English |
| **Teaching/Learning modality** | Face to face |

**Coordinating teacher** Óscar Manuel Fernandes Cerveira Ferreira

| Teaching staff | Type | Classes | Hours (*) |
|---|---|---|---|

* For classes taught jointly, it is only accounted the workload of one.

**Contact hours**

| T | TP | PL | TC | S | E | OT | O | Total |
|---|---|---|---|---|---|---|---|---|
| 25 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 140 |

T - Theoretical; TP - Theoretical and practical ; PL - Practical and laboratorial; TC - Field Work; S - Seminar; E - Training; OT - Tutorial; O - Other

**Pre-requisites**

no pre-requisites

**Prior knowledge and skills**

N/A

**The students intended learning outcomes (knowledge, skills and competences)**

1. Explain concepts and tools for coastal flood and wave modelling and flooding forecasting.
2. Apply tools used for coastal flood modelling and flooding forecasting.
3. Understand and apply the principles of flood frequency analysis and risk-based approaches to design of flood defences.
4. Explain flood risk management with due consideration of societal aspects, including flooding in the floodplain and coastal zone, management of flood risk, planning aspects and a variety of non-structural measures.
5. Assess the impact of climate change on flood risk.
6. Develop a Disaster Risk Reduction (DRR) plan, including non-structural measures.

**Syllabus**

Hindcasting of the large-scale wave generation and storm surge generated by a major hurricane (Michael in the Gulf of Mexico) using the Deltares SFINCS model in combination with a fast version of SWAN, HurryWave, and the subsequent overtopping, morphological impact and breaching at Mexico Beach, FL), using XBeach

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Repeating a few cases for time slices in a limited number of future scenarios under climate change.

**Teaching methodologies (including evaluation)**

The course has 5 ECTS, a total of 140 hours, with 50 hours of contact. Theoretical classes will be based on oral presentations with image support, including the discussion of case studies and the definition of best options for simulated situations. A large part of the module will be practical, hands-on exercise of state-of-the-art tools, applied to the full chain of models required to assess actual and potential hurricane damages and risk. The case will be based on Hurricane Michael, which had a huge impact on Mexico Beach, FL.

Assessment methods: Group reports (50%) and presentations (50%), subdivided into the following topics: a) model setup and hindcasting of large-scale surge and wave models; b) model setup and hindcasting of morphological change, inundation and damage; c) effect of interventions on morphological change, inundation and damage; d) preparation of flood risk maps for current and climate change scenarios; e) preparation of a Disaster Risk Reduction Plan.

**Main Bibliography**

Leijnse et al 2021a Modeling compound flooding in coastal systems using a computationally efficient reduced-physics solver: Including fluvial, pluvial, tidal, wind- and wave-driven processes. *Coastal Eng* **,** 103796

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