POCTEFA MARLIT INTERREG Va EFA344/19

Medios de evaluación y Atenuación de los Riesgos costeros Locales debidos a Impactos de los Temporales // Moyens d'évaluation et d'Atténuation des Risques côtiers Locaux dus aux Impacts des Tempêtes

Realistic applications of modelling tools to predict the impact of extreme episodes on the ultra-local waterfront

- I. Zarautz
- II. Barcelona
- III. Biarritz





Zarautz site

Modelling strategy on Zarautz configuration

- Regional wave model
- Local hydrodynamic model
 - Parametric model
 - Process based model

Regional scale

Coastal flooding & Wave overtopping

Local scale











Zarautz site

Prediction of local wave overtopping

Assessing different approaches

Approach 1:

- Parametric model
- Eurotop approach





Configuration for a smooth dike slope + storm wall (Eurotop 2018)

 H_{m0} = incident wave height γ^* = combined influences factor (dike roughness, presence of berm, obliqueness of incidence waves)

 h_{wall} = vertical wall





- Process based model (XBeach)
- 1D
- Surfbeat

10

8

4

2

0

10

5

-5

-10

-15

8

6

2

0

1690

1695

4 <u>ح</u>

y [m] 0 2500 5000 7500

200 400 600

qx [m2/s]



- Process based model (XBeach)
- 1D
- nonhydrostatic





1710

1200 1400 1600

Zarautz site

Zarautz flooding model v.s. Data







Barcelona site

Modelling strategy on Barcelona configuration



Barcelona site

Prediction of local flooding and beach morphodynamics

Approach :

- Process based model (XBeach)
- 2DH
- Surfbeat
- 10x10m grid

Specificities :

- Post-processing of flooded cells.
- +0.005m of flooding in the cell to be considered inundated.
- Flooding represented as polygons.
- Climate change conditions implemented.







Barcelona site

Local flooding assessment from model

Decision of inundation points :

- The model simulates events of 12-hour duration, then to consider a point as flooded it has to be wet for more than 4 hours.
- This strategy reduces situations where a cell (10x10m) is treated as flooded but the water arrives to the cell only few times (1) or with reduced strength (2).







Biarritz site

Modelling strategy on Biarritz configuration Coastal hydrodynamic and wave model . Wave overtopping & Impact Local hydrodynamic + impact : multi-model approach 100 km Prévisions de vagues Prévisions au large à l'échelle hydrodynamiques atmosphériques régionale régionales Marée Spectres vagues Vent, pression atm Conditions limites incidentes en eau profonde courant 1 km Echelle spatiale caractéristique Modèle Modèle de vagues hydrodynamique à spectral côtier phase-moyennée (SWAN) 100 m (MOHID) 10 m Caractéristiques vagues au large de la plage Niveau d'eau (marée + surcote atm) Modèle à phase-Modèle Intelligence Modèle paramétrique résolue de vagues et Artificielle de submersion submersion (IA) (BOSZ) 1 m Prévision locale du risque Vagues-Submersion Modèle d'impact Phasage et localisation du risque EDIOS DE EVALUACI Interreg TENUACIÓN DE LOS RIESGOS TEROS LOCALES DEBIDOS A

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Biarritz site

Prediction of local wave overtopping & impact

Approach 1:

- Parametric model
- Tailored formulation adapted from Stockdon 2006 for wave runup

Hs, Tp \rightarrow R R







Approach 2:

- Process based model
- Phase resolving Boussinesq-type (BOSZ)
- Multiple 1D transects





Approach 3:

- Process based model
- Phase resolving Boussinesq-type (BOSZ)
- Full 2D implementation





Alongshore flooding location



HOS DE EVALUACIÓN Y NUACIÓN DE LOS RIESGOS TEROS LOCALES DEBIDOS A ACTOS DE LOS TEMPORALES

Biarritz site

Prediction of local wave overtopping & impact

Approach 4:

Data-based model through Artificial Intelligence

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ΜΕΤΕΟ

FRANCE

Bayesian network





CANDHIS

de Houle In-Situ



Biarritz site

Biarritz flooding model v.s. Data

- Field data acquisition during a severe event: Justine storm case (31/01/2021)
- Detailed assessment of overtopping models

Large impact onshore







Sensor deployment





Detailed model hindcast and assessment against data



Biarritz site

From hazard to impact prediction

Linking hazard to impact levels

Approach 1:

- Data-based model (parametric, IA) -
- Historical storm impact data-based (161/298 events) -







Approach 2:

- Process-based model
- Overtopping wave loads

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