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Data-driven models and artificial intelligence in coastal risk monitoring and forecasting systems

1. Bathymetric inversion for nearshore areas with video monitoring and deep learning

Knowledge of bathymetry is essential for many uses including accurate hydrodynamic modeling. The traditional methods of in situ acquisition by echo sounders provide accurate data, but they are expensive and can only be deployed in very calm sea conditions. Thus, the information obtained by this means is generally occasional, and does not allow continuous monitoring of bathymetry. An alternative is the estimation of bathymetry at a distance by remote sensing. Our objective is to develop a deep learning approach based on remote sensing to perform bathymetric inversion in the same spirit as Collins et al. (2020).

2. Operational implementation of statistical learning approaches in coastal risk forecasting systems

The goal is to integrate two statistical learning approaches developed during my thesis into operational risk monitoring and forecasting systems.

The first method is about the classification of impact regimes within videometric surveys (Callens et al. 2021). This approach, based on an AI algorithm, allows for the automatic and bulk assessment of the impact regime associated with a video capture (timestack). The deployment of this technique therefore opens up prospects for the exploitation of large databases, which are highly sought after for the study of extreme and therefore rare configurations. These results also offer prospects for application to real-time monitoring and crisis management assistance, as performed by RPT. The second method is a machine learning approach that correct the bias of wave parameters simulated by spectral model during extreme wave conditions. The complete methodology is presented in Callens et al. (2020). The aim is to use this methodology to improve the extreme wave forecasts by the coastal models

deployed by RPT, which are the main input of the submersion and associated risk models.

References:

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