



Advanced coastal flood alert system for the Basque coast: the role of videometry in beach data assimilation

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Coastal flooding due to storms poses significant challenges to both natural environments and human societies, potentially leading to substantial economic losses, community displacement, and disruption of daily life. This study aims to refine the existing Basque coast Early Warning System (EWS) by updating the beach shape information through video monitoring into the high-resolution local hydrodynamic model chain, thus improving the current risk management approach.

The Basque coast, spanning ~150 km with around 30 beaches, is highly urbanized. All beaches of the Basque coast are embayed systems bounded by natural or in some cases artificial, outcrops. The coast is facing North, and it is open to North Atlantic swells. The intensity and frequency of storms are seasonally variable with the most energetic periods coinciding with autumn and winter seasons.

The EWS relies in two main components, a high-resolution predictive modelling chain and the observation module. The predictive modelling component involves downscaling Copernicus Marine data to provide detailed forecasts of wave conditions and total water levels (TWL) at the beach scale. This includes the use of spectral wave models and phase-resolving models to simulate wave runup and overtopping processes. The observation component utilizes the Basque Videometry Network complemented with a network of in-situ monitoring systems, including wave buoys and tide gauges. The Basque Videometry Network collects morphological (beach shape) and flooding (wave overtopping) information, which is assimilated by the numerical modelling chain to improve the coastal impact forecast and validate the numerical approach.

Findings show that excluding the assimilation of beach morphology into the hydrodynamic models can considerably increase the uncertainty of the predictions, thus weakening the proper management of coastal zones during extreme events.