

Ocean and coastal modelling in the waters of the Basque Country

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Introduction

The ocean and coastal prediction system implemented in the waters of the Basque Country by AZTI consists of a regional operational forecasting system to estimate the evolution of hydrodynamics and hydrography (EUSCOMvu) and a coastal impact forecasting system for storm hazards and long-term changes.

Methods

An early warning system for urban beaches is operated by Euskalmet (Basque Meteorological Agency). It integrates 3-day wave forecasts obtained with the WAM model and overtopping parametric estimations. Here an improved coastal forecasting system integrating simulations of XBeach-NH (phase-resolving wave model) and images from the KOSTASystem videometry technology, is being tested on Zarautz beach. Flood risk analysis and planning for adaptation to climate change in Basque estuaries are currently based on the results of Kostaegoki (bathtub-type static flood model). Lisflood-FP (dynamic process-based flood model) is used in the domain of the Txingudi estuary for operational applications and long-term climate change adaptation strategies. The EUSCOMvu system is based on the CROCO model and estimates hourly ocean fields (sea level, temperature, salinity, zonal and meridional velocity components) with a 4-day forecast horizon. This system, currently under development, is a downstream service that daily ingests data from the Copernicus Marine Atlantic-Iberian Biscay Irish- Ocean Physics Analysis and Forecast product and freshwater discharges from 13 rivers.

Results

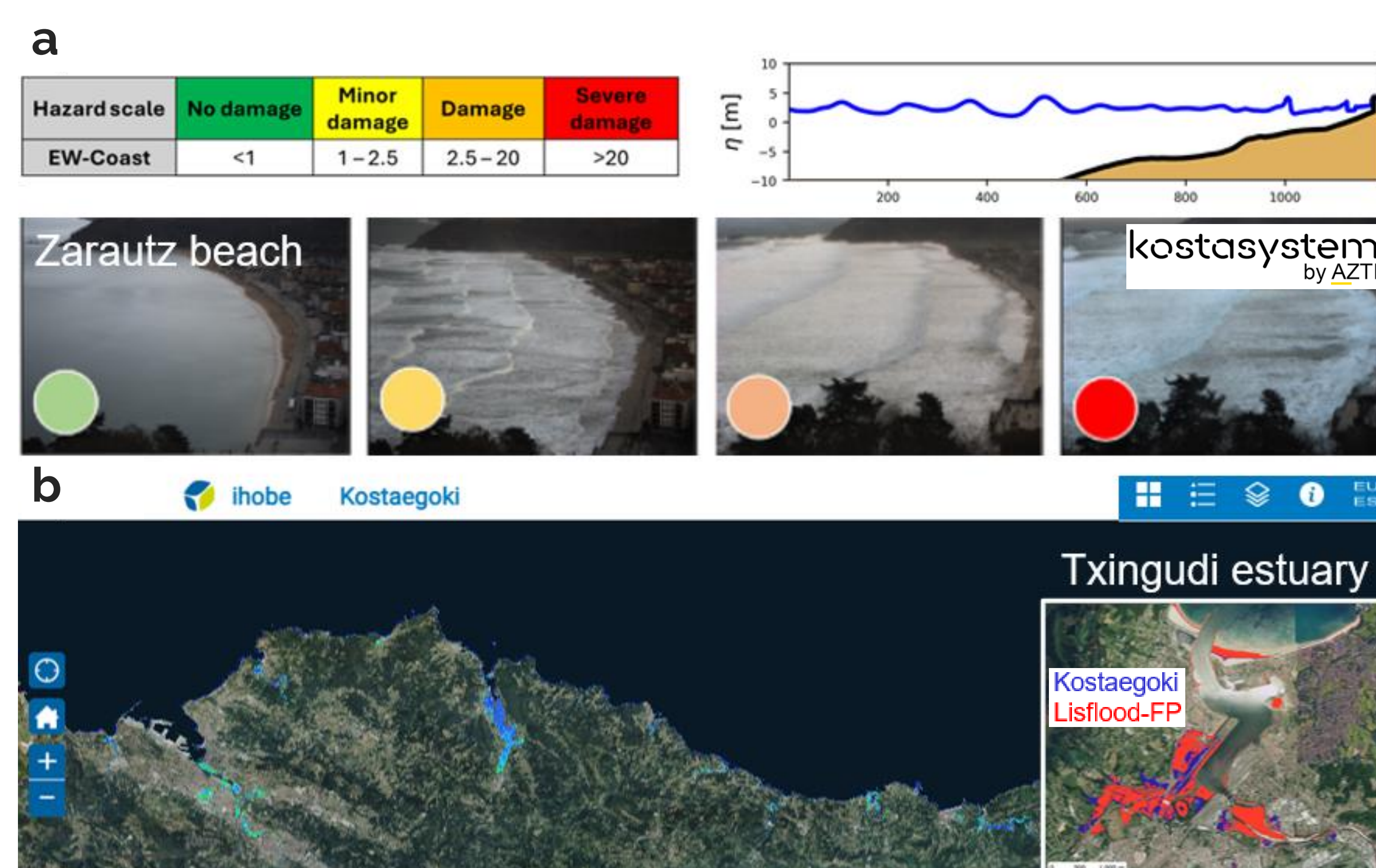


Figure 1 | a, Improved coastal forecasting system tested on Zarautz beach (XBeach-NH simulations and KOSTASystem videometry technology). **b**, Kostaegoki (Basque coast) and Lisflood-FP (Txingudi estuary) flood simulations.

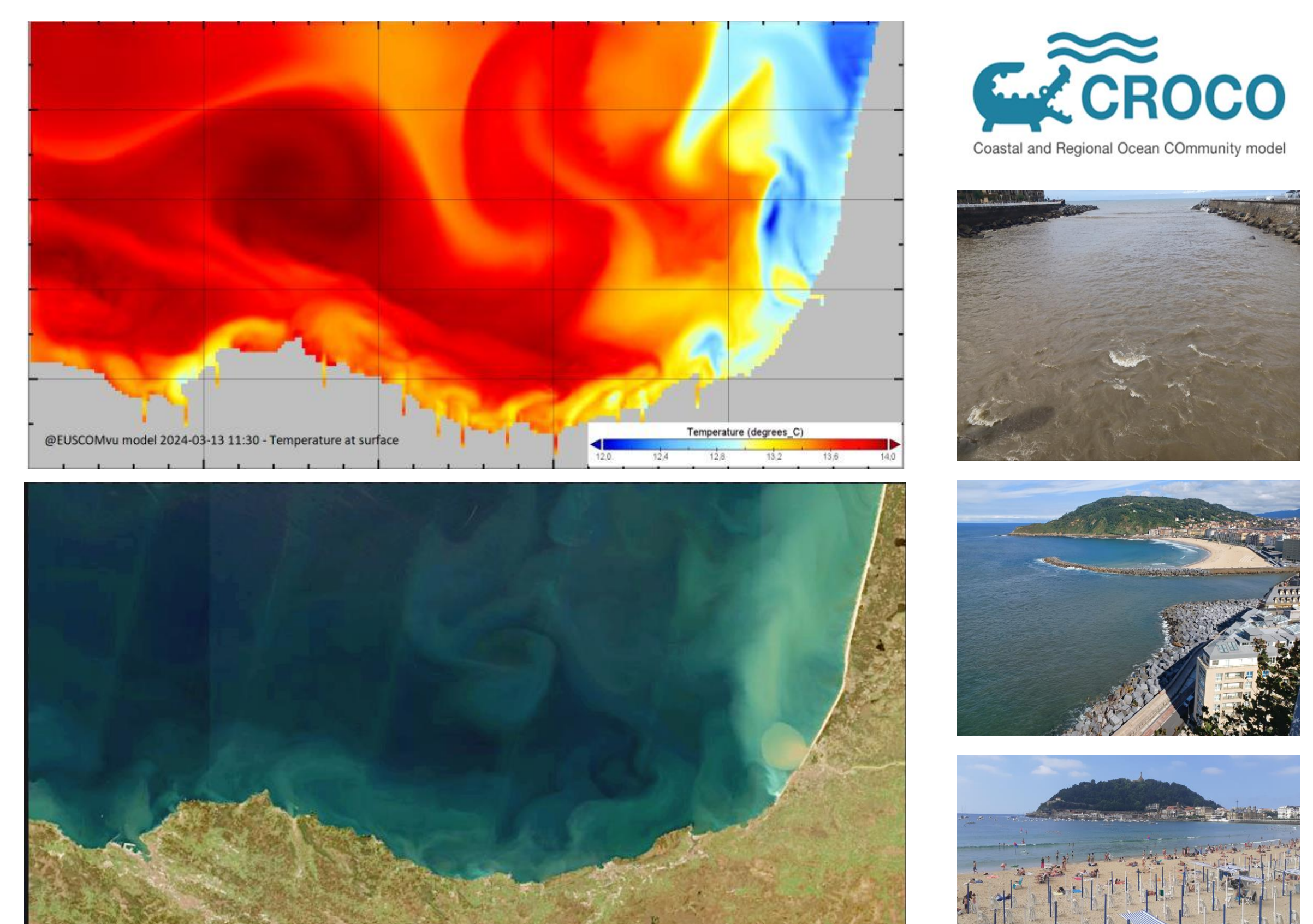


Figure 2 | Sea surface temperature from the CROCO model together with a Sentinel-2 image obtained on 13 March 2024, showing the similarities of river plume shapes and extensions between the model and the observation.

Conclusions

(1) Phase-resolving wave models improve the estimation of wave overtopping discharges and the associated hazard level on urban beaches during storms. (2) The bathtub approach tends to overestimate flooding in the upper part of the Basque estuaries. (3) The assimilation of freshwater discharges from rivers is key to modelling hydrodynamics and hydrography. The ocean and coastal prediction system implemented in the waters of the Basque Country is part of KOSTARISK, a cross-border collaboration between Spain and France. Both the French and Spanish sides operate forecasting systems and share knowledge, data and technologies.

Acknowledgements

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