An early warning system for marine storm hazard mitigation

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The present contribution presents efforts towards the development of an operational Early Warning System for storm hazard prediction and mitigation. The system consists of a calibrated nested-model train which consists of specially calibrated Wave Watch III, SWAN and XBeach models. The numerical simulations provide daily forecasts of the hydrodynamic conditions, morphological change and overtopping risk at the area of interest. The model predictions are processed by a 'translation' module which is based on site-specific Storm Impact Indicators (SIIs) (Ciavola et al., 2011, Storm impacts along European coastlines. Part 2: lessons learned from the MICORE project, Environmental Science & Policy, Vol 14), and warnings are issued when pre-defined threshold values are exceeded. For the present site the selected SIIs were (i) the maximum wave run-up height during the simulations; and (ii) the dune-foot horizontal retreat at the end of the simulations. Both SIIs and pre-defined thresholds were carefully selected on the grounds of existing experience and field data. Four risk levels were considered, each associated with an intervention approach, recommended to the responsible coastal protection authority. Regular updating of the topography/bathymetry is critical for the performance of the storm impact forecasting, especially when there are significant morphological changes. The system can be extended to other critical problems, like implications of global warming and adaptive management strategies, while the approach presently followed, from model calibration to the early warning system for storm hazard mitigation, can be applied to other sites worldwide, with minor adaptations.