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Coastal flooding hazard assessment on potentially vulnerable coastal sectors at Varna regional coast

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Storm induced flooding is one of the most significant threats that the coastal communities face. In the light of the climate change it is expected to gain even more importance. Therefore, the adequate assessment of this hazard could increase the capability of mitigation of environmental, social, and economic impacts.
The study was accomplished in the frames of the Coastal Risk Assessment Framework (CRAF) developed within the FP7 RISC-KIT Project (Resilience-Increasing Strategies for Coasts – toolkit).
The hazard assessment was applied on three potentially vulnerable coastal sectors located at the regional coast of Varna, Bulgarian Black Sea coast. The potential "hotspot" candidates were selected during the initial phase of CRAF which evaluated the coastal risks at regional level.
The area of interest comprises different coastal types – from natural beaches and rocky cliffs to man modified environments presented by coastal and port defense structures such as the Varna Port breakwater, groynes, jetties and beaches formed by the presence of coastal structures.
The assessment of coastal flooding was done using combination of models –XBeach model and LISFLOOD inundation model applied consecutively. The XBeach model was employed to calculate the hazard intensities at the coast up to the berm crest, while LISFLOOD model was used to calculate the intensity and extent of flooding in the hinterland.
At the first stage, 75 extreme storm events were simulated using XBeach model run in "non-hydrostatic" mode to obtain series of flood depth, depth-velocity and overtopping discharges at the predefined coastal cross-shore transects. Extreme value analysis was applied to the calculated hazard parameters series in order to determine their probability distribution functions. This is so called response approach, which is focused on the onshore impact rather than on the deep water boundary conditions. It allows calculation of the hazard extremes probability distribution induced by a variety of combinations of waves and surges. The considered return periods were 20, 50 and 100 years.
Subsequently, the overtopping volumes corresponding to preferred return periods were fed into LISFLOOD model to calculate the intensity and extent of the hinterland flooding.
For the beaches with fast-rising slopes backed by cliffs a combination of XBeach and LISFLOOD output was applied in order to properly map the flood depth and depth-velocity spatial distribution.