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Sele coastal plain flood risk due to wave storm and river flow interaction

Guido Benassai (1), Pietro Aucelli (2), Gianluigi Di Paola (3), Renata Della Morte (1), Luca Cozzolino (1), and Angela Rizzo (2)

(1) Dipartimento di Ingegneria, Università Parthenope, Napoli, Italy, (2) Dipartimento di Scienze e Tecnologie, Università Parthenope.Napoli, Italy, (3) Dipartimento di Bioscienze e Territorio, Università del Molise, Pesche (IS), Italy

Wind waves, elevated water levels and river discharge can cause flooding in low-lying coastal areas, where the water level is the interaction between wave storm elevated water levels and river flow interaction. The factors driving the potential flood risk include weather conditions, river water stage and storm surge. These data are required to obtain inputs to run the hydrological model used to evaluate the water surface level during ordinary and extreme events regarding both the fluvial overflow and storm surge at the river mouth.
In this paper we studied the interaction between the sea level variation and the river hydraulics in order to assess the location of the river floods in the Sele coastal plain.
The wave data were acquired from the wave buoy of Ponza, while the water level data needed to assess the sea level variation were recorded by the tide gauge of Salerno.
The water stages, river discharges and rating curves for Sele river were provided by Italian Hydrographic Service (Servizio Idrografico e Mareografico Nazionale, SIMN).We used the dataset of Albanella station (40º29'34.30"N, 15º00'44.30"E), located around 7 km from the river mouth. The extreme river discharges were evaluated through the Weibull equation, which were associated with their return period (TR).
The steady state river water levels were evaluated through HEC-RAS 4.0 model, developed by Hydrologic Engineering Center (HEC) of the United States Army Corps of Engineers Hydrologic Engineering Center (USACE,2006). It is a well-known 1D model that computes water surface elevation (WSE) and velocity at discrete cross-sections by solving continuity, energy and flow resistance (e.g., Manning) equation. Data requirements for HEC-RAS include topographic information in the form of a series of cross-sections, friction parameter in the form of Manning's n values across each cross-section, and flow data including flow rates, flow change locations, and boundary conditions. For a steady state sub-critical simulation, the boundary condition is a known downstream WSE, in this case the elevated water level due to wave setup, wind setup and inverted barometer, while the upstream boundary condition consisted in WSE corresponding to river discharges associated to different return periods.
The results of the simulations evidence, for the last 10 kilometers of the river, the burst of critical inundation scenarios even with moderate flow discharge, if associated with concurrent storm surge which increase the water level at the river mouth, obstructing normal flow discharge.