Method for assessing the coastal vulnerability to erosion and flooding at the physiographic unit scale

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The Intergovernmental Panel on Climate Change foresees a significant global sea-level rise (SLR) during the 21st century, which will cause an increase in coastal vulnerability (CV) to erosion and flooding. CV can be estimated at various scales, both in space (from national to local) and time (from tens to hundreds of years). However, flooding and erosional scenarios need to be calculated at the physiographic unit (P.U.) and on a decadal scale to plan strategies for defending communities living in the coastal areas and to protect critical infrastructures and natural habitats.

We present preliminary results of a study for assessing the coastal vulnerability to erosion and flooding at the P.U. scale and on the ten-year time scale. This study is based on the analysis of natural marine near-shore factors (e.g., waves, currents) that control the sediment transport and flooding. The method consists of assessing how these factors control the phenomena of erosion and flooding under the influence of the SLR.

We have performed two-dimensional models of wave propagation, sediment transport and morphological changes in the nearshore area and sand/gravel beaches using XBeach model. We have integrated grain-size data, bathymetry, meteorological and wave data. The latter derive from the DICCA hindcast database.

For testing the method, 18 P.U. were chosen in the coastal zone between Capo Mongerbino and Cefalù (northern Sicily). This area is ~70 km long and is characterized by rocky and low sand/gravel beaches. About 37% of the coastal perimeter suffers from important erosive phenomena resulting in coastal regression with rates that in some cases exceed the value of 1 m/year (Regione Siciliana - Assessorato Territorio E Ambiente, 2006). Moreover, the coasts are characterized by different orientations and, thus, it is possible to test the influence of different exposure to wind and waves.

The expected result is a map of CV to erosion and flooding at the physiographic unit scale and on a decadal scale. This study will help to better understand the natural near-shore processes controlling the CV.

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