Coastal vulnerability: the impact of sea level rise 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 different spatial and time scales ranging from national to local and from tens to hundreds of years, respectively. However, flooding and erosional scenarios need to be calculated at the physiographic unit (PU) 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 which aims to develop a method for assessing the CV to sea level rise, calculated at the PU scale and on the ten-year time scale. This study is based on: a) the identification of the most significant near-shore marine forcings that control the sediment transport and flooding; b) the prediction of the CV to erosion and flooding under the control 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 the XBeach software. We have integrated grain-size, bathymetric, topographic and wave data (e.g. significant wave height, mean period and average direction of origin of the wave motion).

The 18 PU was chosen for testing the method. This area is ~70 km long and extended from Capo Mongerbino and Cefalù (northern Sicily). It 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 reach the value of 1m/year. 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 to provide a map of CV to erosion and flooding at the PU scale and on a decadal scale. The method, proposed in this research, allow to understand the synergetic effects of sea level changes and marine forcings affecting the coastal system. Moreover, a fully integrated assessment of CV is useful in supporting policy decision making.