

Paper Number: 2475

Effects of anthropic development in a urban beach of south Sardinia (Italy, western Mediterranean) evaluated using hydrodynamic models, run-up and DSAS indices

De Muro, S.¹, Frongia, P.¹, Pusceddu, N.¹, Passarella, M.¹, Buosi, C.¹, and Ibba, A.¹

¹Department of Chemical and Geological Sciences, University of Cagliari, Cagliari, Italy, marinegeology@unica.it

This work evaluates, using hydrodynamic models, run-up and DSAS indices, the effects of anthropogenic impact on southern Sardinian urban beach near Cagliari (Italy, western Mediterranean Sea) as a part of NEPTUNE (Natural Erosion Prevision Through Use of Numerical Environment) Project, Tender6 (L n. 7/2007).

This beach is about 11 km long and is characterized by fine to coarse quartz sand, backed by dune ridges and lagoons. The studied inner continental shelf includes a wide *Posidonia oceanica* meadow that extends between -5m and -40m.

In the last century the surrounding areas have been interested by several modifications linked to the increase of urbanization such as the development of residential settlement, the building of the canal harbor, and the construction of several coastal defense structures. Medium-term evolution, over a period of 60 years, was carried out by ortho-images (1954-2015) for reconstructing coastline changes using *Digital Shoreline Analysis System* (DSAS) software [1] at this temporal scale. In addition, short-term variations [2,3] have been periodically monitored (2014-2015) during 5 different field surveys (DGPS and Echo-sounder data) obtaining topo-bathymetric digital models. Sedimentary and hydrodynamic characteristics have been studied. Wave propagation, coastal currents and sediment transport, have been simulated through numerical models within Delft3D software [4]. The wave run-up height and the associated horizontal distance have been calculated on transverse transects in order to evaluate the vulnerability of this coastal area. The elevation of the 2% exceedance level for run-up has been calculated following the Stockdon formula [5], which account for offshore significant wave height and length, and the foreshore beach slope.

Results demonstrate, in medium-term scale, the human modification, and in short-term scale, the consequent human conditioning in sediment transport.

Among the medium-term changes, the loss of 2.5km of beach and the asymmetric accumulations (lee zones) linked to erosion phenomena are the main consequences of the building of the canal harbor, and the construction of several coastal defense structures, respectively. The erosion of the studied beach has been estimated by DSAS in maximum 90m in twenty years.

The short-term results obtained by hydro- and sediment-dynamics models allowed to visualize the response of the beach to wave stress, forced from SW, S, SE (Cagliari buoy and weather data).

From the run-up calculation, it appears that several transects are reached entirely by the extreme wave event.

Based on these results, it seems that the estimation of run-up and the measure of shoreline changes (by DSAS) with the hydro- and sediment-dynamics models can be used as indices to improve management of the coastal zone, including development of hazard warning systems.

References:

- [1] Thieler E.R. et al. (2009) U.S. Geological Survey Open-File Report 2008-1278.
- [2] Batzella T. et al. (2011) Rendiconti Online della Società Geologica Italiana 17: 17-23.
- [3] Pusceddu N. et al. (2011) Rendiconti Online della Società Geologica Italiana 17: 155-159.
- [4] De Muro et al. (2015) Journal of Map, doi:10.1080/17445647.2015.1051599
- [5] Stockdon H.F. et al. (2006) Coastal Engineering 53: 573-588.

