



Response to storm conditions of two different beaches at the Mediterranean coast of Morocco

Aldelmounim El Mrini (1,2), Giorgio Anfuso (3), Driss Nachite (1), Mohamed Taaouati (1,2)

(1) Laboratoire de Cartographie et de Gestion Environnementale et Marine, Tétouan, Maroc., (2) Géolittomer UMR 6554 LETG, CNRS et Université de Nantes, Nantes, France., (3) Departamento de Ciencias de la Tierra, Facultad de Ciencias del Mar, Cadiz, Spain.

In recent decades the increased demand for the recreational use of beaches has resulted in the uptake of studies on the morphodynamic processes which are acting on beaches. This knowledge is fundamental for appropriate coastal erosion management, suitable tourist use of littoral and for the design and shape of human construction. The Mediterranean sectors of Moroccan littoral investigated in this study, Ksar Rimal and Cabo Negro beaches, are respectively located north and south of Cabo Negro promontory and, over recent years, have been subject to increasing tourist activity. This has consisted mainly of the construction of two tourist ports (Marina Smir and Kabilia), residential developments, hotels and a motorway which runs parallel to the coast, affecting the dune ridges and two lagoons which are of great ecological interest. In detail, the dunes located in the backshore at Ksar Rimal beach, are nowadays occupied by summer houses threaten by coastal retreat. A wide, partially urbanized, backshore is observed at Cabo Negro beach.

With the intention of characterize the morphodynamic and seasonal behavior and the response of the studied beaches to storm impact, a beach monitoring program was carried out in the period 2006-2008, with special attention to the February-March 2008 stormy period. On analyzing the information obtained, it was possible to characterize the morphology and sedimentology of the studied beaches, and to calculate beach volumetric variations.

Ksar Rimal is an open, exposed beach characterized by an intermediate slope ($\tan \beta = 0.10$) with medium-coarse sands. The beach showed a reflective beach state characterized by plunging breakers. Small morphological seasonal changes were observed, most important morphological and volumetric variations (about $20 \text{ m}^3/\text{m}$) taking place after winter storms which usually gave rise to a more dissipative beach profile ($\tan \beta = 0.05$) characterized by spilling breakers. Beach recovery was quite rapid, usually lasting 2-3 weeks.

Cabo Negro beach is a partially sheltered area (because of Cabo Negro promontory) and shows a smooth, dissipative slope ($\tan \beta = 0.02$) characterized by spilling breakers. Small seasonal morphological changes took place and erosion processes associated with storm events did not produce changes in beach slope and morphodynamic state.