
Large-scale sand body dynamics and sediment routing on a low-supply continental shelf: The example of the Tarifa continental shelf

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Résumé

The Southern Atlantic Spanish continental margin extending from Tarifa to the Gracia Point is characterized by a narrow, sediment-starved continental shelf exposed to an intense hydrodynamic regime resulting from the combination of tidal currents, wind-driven storms and oceanic currents near the Strait of Gibraltar. This area is a good example to study sediment routing across a dispersive margin. Its coastal domain is characterized by highly mobile subaerial dunes (Navarro et al., 2011). However, the adjacent continental shelf remains poorly studied. In this sense, recent surveys led by the University of Cadiz allowed to characterize the major morpho-stratigraphic features of the shelf and to provide a first assessment of prevailing sedimentary processes (Lujan et al., 2011). Deformed basement rocks mainly formed by Flysch Complex units outcrop at the seabed over extensive shelf areas. These rocks are part of the Betic-Rif thrust wedge and are locally covered by Pliocene to Quaternary deposits. The sedimentary cover is molded by different fields of bedforms such as submarine dunes and comet marks that indicate the influence of hydrodynamics processes. Shelf sediment transport patterns seem to be eventually captured by a submarine channel that provides an efficient mechanism for sediment export toward deep-water settings. Nevertheless, major sediment transport pathways are still to be characterized across the continental shelf. A new data set allowed to further investigate sediment bedform distribution off Gracia Point. Results obtained so far have revealed the occurrence of a sandy banner bank located offshore Gracia Point. The bank extends over an area of 20 km² from -10 to -90 m water depths. The banner bank is covered by a field of very large dunes, where individual dunes exhibit significative short-term (i.e., annual) displacements ranging from 0 to 10 m with an apparent westward migration trend parallel to the coastline influenced by a continental margin-scale gyre. Currently, an ongoing project aims to develop a complementary hydrodynamic study using the SAMPA model. The primary objective is to incorporate the dynamics of expansive sandy bedforms into a sediment transfer scheme, while also gaining insights into the localized flow patterns influenced by various forcing mechanisms.

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Mots-Clés: Sediment transfer, marine sand dunes, sand bank, continental shelf, bathymetry