

# Morphodynamics of sandy embayed beaches from the Southwest Portugal rocky coast

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## Abstract

This study compares five embayed sandy beaches (São Torpes, Furnas, Amoreira, Monte Clérigo and Arrifana) from the southwest Portugal rocky coast, between Sines and São Vicente capes. In order to analyse morphodynamics of these beaches were studied the volumetric active sediment changes, wave climate characteristics and propagation effects to nearshore for a period of two years. Major volumetric changes were largely associated with storm effects that caused berm and foredune retreat in the Furnas and Amoreira beaches. Obtained estimations of dimensionless fall velocity of São Torpes, Furnas, Amoreira and Arrifana beaches are characteristic of an intermediate morphodynamic stage with low tide terrace (ridge and runnel system), while Monte Clérigo beach is dissipative. The wave breaking height and beach configuration is responsible for different degrees of exposure to the dominant NW wave direction. The wave breaking height reduction is differently influenced by the wave diffraction, which is insignificant in the Amoreira and Monte Clérigo beaches. Comparison between real beach planform and predicted equilibrium configurations for these beaches suggests that the Arrifana beach represents a perfect example of a fully developed parabolic bay shape while, the other four beaches are not represented by any theoretical curve approach. This study shows that studied beaches morphodynamic behaviour is function of a complex equilibrium between the subaerial beach configuration, the ridge and runnel system, the longshore sedimentary distribution, the degree of exposure to the dominant NW wave direction and the storm incidence.

## 1 Introduction

Headland embayed beaches characteristic, of rocky shorelines with sea-cliffs represent 51% of the world's coast ([Short & Masselink, 1999](#)). The alongshore variation of morphodynamic characteristics including planform rotation and establishment of equilibrium state of those particular beaches have been studied on detail during the last six decades ([Bascom, 1951](#); [Yasso, 1965](#); [Silvester & Hsu, 1997](#); [Short & Masselink, 1999](#); [Klein & Menezes, 2001](#)).

[Klein & Menezes \(2001\)](#) reasserted that for a headland bay coast the range of alongshore beach morphology mainly results from the distance from the headland, the shape of the bay, the wave obliquity, alongshore grain size distribution and the nearshore beachface slope. Morphodynamics of such kind of embayed beaches are mainly dependent on geological inheritance (indentation ratio) and hydrodynamic factors (wave breaking height, period, wave exposure and relative tidal range).

In this work we present new data of five different embayed beaches from the southwest Portugal rocky coast to analyse their morphodynamic behaviour. The surveyed period includes different wave climate conditions with the incidence of two winter storms. These five beaches were analysed according to morphometric embayed parameters, the dominant wave direction and the diffraction effect. The real