Morphodynamics of nearshore rhythmic sandbars in a mixed-energy environment (SW France): 2. Physical forcing analysis

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Résumé en anglais	The morphology and migration of rhythmic intertidal ridge and runnel systems, and subtidal crescentic bars that border the southwest coast of France were characterized using in situ surveys and maps obtained by remote-sensing methods. The period from 1986 to 2000 was investigated. A total of 35 km of coast was mapped. This data set shows several specificities, the origin of which are examined in the present report using hydrodynamic data. A complete analysis of the influence of wave climate on both the shape and the movements of these rhythmic sedimentary patterns was performed. In addition, SWAN and MORPHODYN-coupled numerical models were used to provide quantification of both wave breaking and longshore currents for wave parameters that were representative of the mean values and of the energetic conditions. This study demonstrated the short time response of intertidal systems to the wave forcing. When the offshore significant wave height (Hs) was lower than 2.5 m, regular coastal ridge and runnel systems developed in the intertidal zone and migrated in the longshore-drift direction at a rate of 1.7–3.1 m day^{-1}. By contrast, the ridge and runnel system morphology abruptly changed when the Hs exceeded 2.5 m, and after the storm, the typical ridge and runnel rhythmic topography was recovered within 5–9 days. The crescentic bars, which had a convex seaward shape, were affected by waves with Hs values greater than 3 m (slightly less for short waves). Depending on the wave orientation, the crescentic bars moved in the longshore-drift direction at a rate that reached 1 m day^{-1}. The data suggested a slight negative correlation between the mean alongshore length of the crescentic bar and the mean Hs. Finally, it seemed that increasing the wave obliquity with respect to the coast resulted in the flattening of the crescentic bars. Thus, coupling Spot and in situ mapping to hydrodynamic records allow the characterization of coastal morphology and dynamics, with time and space samplings that are particularly well adapted to the little studied alongshore morphodynamics. This approach should improve the difficult parameterization of morphodynamic models in high-energy environments.
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