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Annual and seasonal shore morphodynamics of a Cuspate Foreland: Les Grands Sables (Groix Island, France)

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Studies on the dynamics of convex beaches "Cuspate foreland" have shown that these formations are directly influenced by the joint action of climatic-oceanic and meteorological-marine forcing conditions such as wind, swell, tide and associated currents. They are very dynamic beaches that can migrate longitudinally over a few to hundreds of meters, as well as flatten or lengthen in response to variable weather and sea forcing. These cuspate foreland beaches may also manifest seasonal cycles of beach erosion and recovery driven by the bi-directional approaches of wave climates or by the seasonal changes in swell and wave patterns.

The "Grands Sables" beach on the island of Groix in the Morbihan - France is one of the most famous convex beaches in Europe. This beach is located to the north of the Pointe de la Croix, the eastern tip of the island of Groix. This beach, extending over nearly 800m, is located on a coastline formed by low cliffs extended to the south by the wide rocky plain. This work describes the seasonal morphodynamics of the Grands Sables cuspate foreland over a period of three years. and three-dimensional beach changes were measured and coupled to wave energy and wind conditions. Thus, the winter seasons, dominated by a strong westerly swell component, favour the movement of the beach towards the south. The summer seasons, on the other hand, allow the beach to find a state of stability between the north-east quarter winds and the south-west/south-east quarter winds, which compensate each other. These north-east quarter winds, which are frontal to the coastline, are also the driving force behind the morphological changes in the beach profile. They contribute to the cross-shore remobilisation of sediments in the intertidal domain, directly at the top of the beach and indirectly below the MHWL level through the action of the swell. In addition to seasonal variations, exceptional storm events also contribute to the southward or northward migration of the beach. During these events, the direction of beach movement is based on the incidence of wave and wind climate in relation to the orientation of the coastline. Results indicate that energetic waves play a significant role in shoreline dynamics and Grands Sables landform shape. Seasonal or high-energy event-driven morphological changes of the beach have occurred without a significant loss of local sedimentary stock.

The findings of this study have improved the understanding of seasonal and multiannual cuspate foreland morphodynamics, setting the groundwork for a potential long-term evolution model of Les Grands Sables beach.