

Coastal Erosion & Management Sitges

The battle between humans and the sea – Sitges

Catalonia has a marina for every 15 km of coastline on average. **These marinas interrupt the movement of sediment along the coast and have led to a steady loss of sand, of the order of 5-10%.**

The intense transformation of the coastline dramatically accelerated in the 1960s and 70s and radically altered the coastal dynamics. Historically, rivers and streams, because of soil erosion, deposited considerable volumes of sediment in the sea. The waves, arriving obliquely to the coast, transported the sediment longitudinally along the coast (LSD), especially during storms, which occur regularly at the end of spring and autumn. The force of the waves varies with the seasons.

In **winter, more frequent south-easterly waves tend to erode the beaches.** In summer, waves from the west bring new materials to the beach and by September the beaches normally increase in size again. (note that we went in June when this process was just starting again). **Overall, there was a net transport of sand from north to south for hundreds of thousands of cubic metres per year.** The continuous contribution of sediment from rivers and streams, and the existence of areas with dunes, made it possible for beaches to always regain their profiles. Thus, taking into consideration a long enough period of observation, the beaches have remained in stable equilibrium, depending on the dynamics of marine and climatic circumstances.

The promenades and sea walls are designed to defend the beaches from wave attack. But, they can erode beaches if poorly planned (vertical walls and close to the direct action of the sea), because the waves can reach the wall and be **reflected, doubling the effect of the wave and increasing their ability to move sediment.**

In the 1960s, responding to the growing tourist demand for wide sandy beaches, Sitges proceeded to artificially regenerate its beaches, depositing large amounts of sand on the original surface of pebbles. It also used large rock groynes to create breakwaters, arranged perpendicular to the current, whose aim was to retain the maximum possible sand provided by the ocean currents. The Aiguadolç marina was constructed in 1976. A further series of rock groynes were then built in 1985 together with rock islets arranged parallel to the coast, to curb the impact of the waves and prevent beach erosion. **These constructions acted as a barrier to sediment, thus reducing the contribution of materials to the beaches.**



The beaches of Sitges originally received the sediment from various streams leading to the beaches. Currently, only one of these streams provides materials to the coastal area of Sitges, the stream of San Pedro, located to the west of the town.

Artificial regeneration of beaches

Artificial regeneration of beaches is used to mitigate the consequences of an inadequate transport natural sand because of ports and other structures (such as dams upstream in rivers) and cause a major impact on the coast. Sand is mined offshore with suction pumps, and then poured into the coastline. This activity, besides being very expensive, produces many negative effects on the coastline and the organisms that live there.

Sitges in the 1920's. No marinas = nice wide beaches!



Key Vocabulary

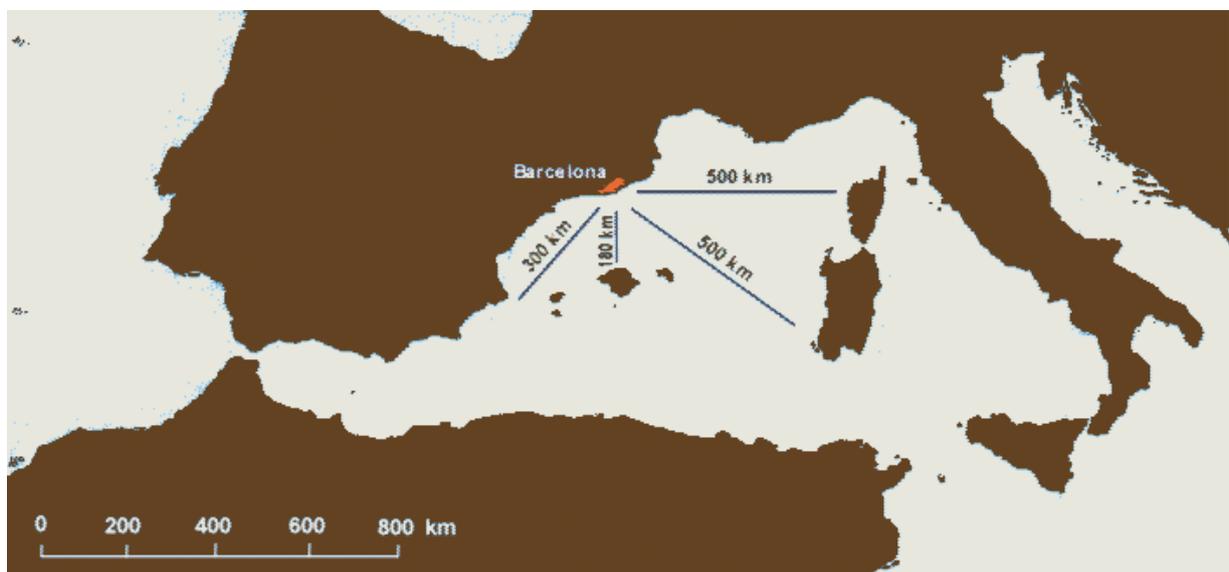
Fetch: Refers to the distance or length of water that the wind has blown.

Erosion: This is the breaking down of rock and the beach by wave action.

Destructive wave: Are large plunging waves with a short wavelength. They are associated with erosion due to their strong backwash.

Constructive wave: Are smaller waves with a stronger swash and weak back wash. They have a long wave length and are shorter in height and are associated with building beaches.

Study the map of fetch directions and lengths below. From which direction are destructive waves most likely? From which direction are constructive waves most likely?



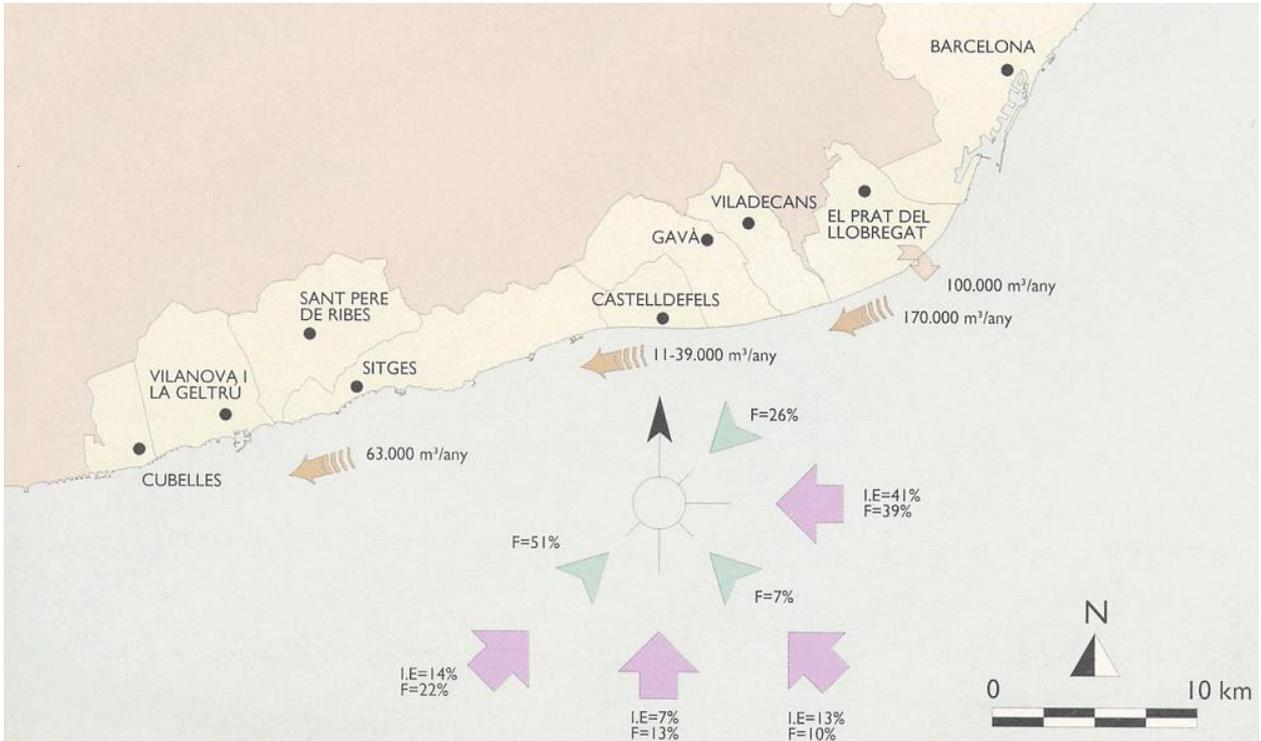
Map to show the fetch of the waves from different directions from Sitges. Check out the fetch of the waves that hit Sitges in the winter, from the southeast! Can you think why this means that they are more destructive?

Check out the fetch of the waves from the southwest (summer direction). Can you explain why these tend to be more constructive in nature?

Wave Attack & Longshore Drift

The diagram below shows you the direction that the waves hit the coastline where Sitges is located. You should refer to the purple arrows on the diagram. I.E refers to the incident energy and F is the frequency of time that the waves travel in that direction.

You can also see the direction and quantity of transport of sediment along the coast with the orange arrows.



Beach satellite image	Beach Name	Notes on the beach
 <p>A satellite view of a beach area. A prominent curved pier extends into the water. To the left of the pier is a sandy beach. To the right is a large parking lot filled with cars. A building is visible near the pier. The water is a deep blue-green color.</p>	<p>Beach 1</p>	
 <p>A satellite view of a beach area. A long pier extends from the left side into the water. The beach is sandy and has many umbrellas. There are several buildings and a parking lot along the coast. The water is dark blue.</p>	<p>Beach 2</p>	
 <p>A satellite view of a beach area. A long pier extends from the left side into the water. The beach is sandy and has many umbrellas. There are several buildings and a parking lot along the coast. The water is dark blue.</p>	<p>Beach 3</p>	

