

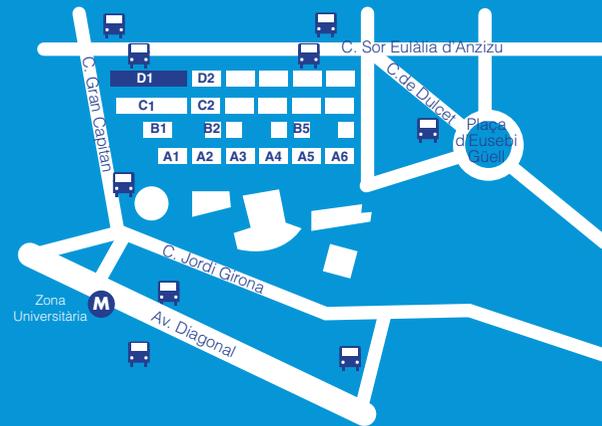
# CIEM

Canal  
d'Investigació  
i Experimentació  
Marítima

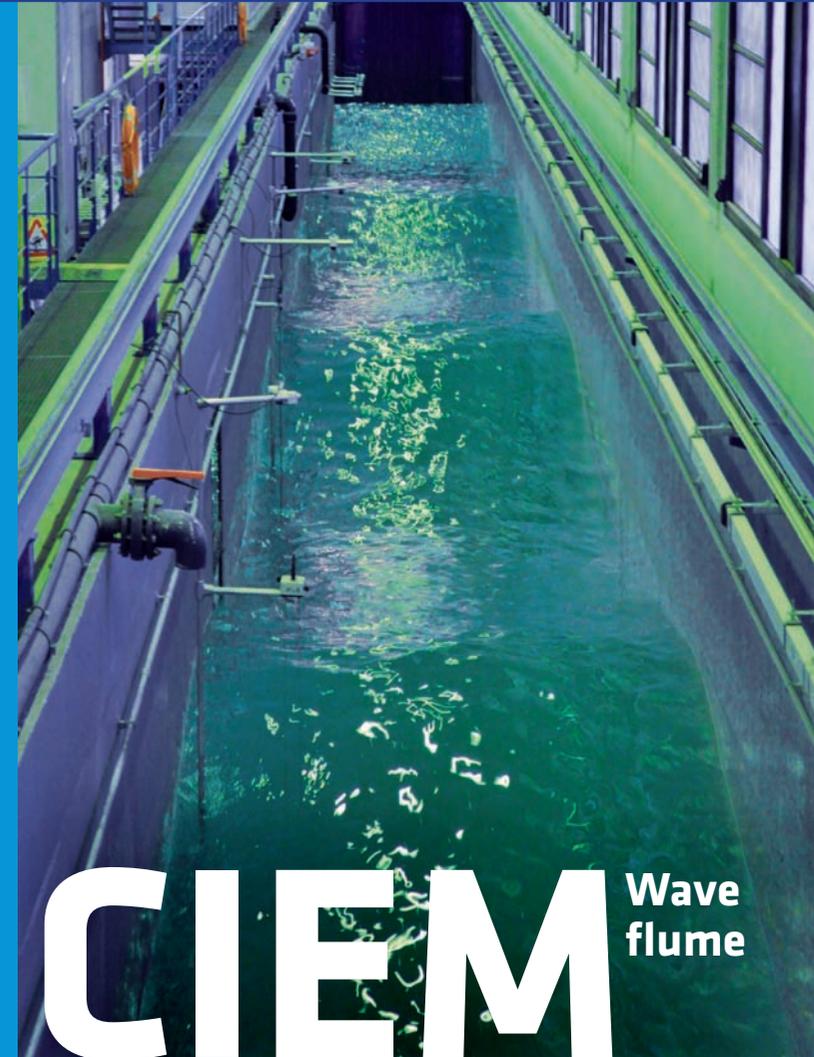
The Canal d'Investigació i Experimentació Marítima (CIEM), a large-scale wave flume at the Laboratori d'Enginyeria Marítima (LIM) of the Universitat Politècnica de Catalunya (UPC), is an international research facility for controlled hydraulic experiments in coastal, harbour and oceanographic engineering, and in other fields such as aquaculture and the study of wave energy.



Many national and international projects have been carried out at the facility since 1993, the year it opened. In 1997, it was recognized as a large-scale facility by the EU's Directorate-General for Research, and in 2006, as an outstanding science and technology installation (ICTS) by the Spanish Ministry of Science and Education.



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 Wave flume

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## Canal d'Investigació i Experimentació Marítima

Laboratori d'Enginyeria Marítima

## Dimensions

The CIEM wave flume, which is 100 m long, 3 m wide and up to 7 m deep inside the current generator's wells, is a facility of excellence for scaled tests and studies under close-to-real conditions. Typical working scales are between 1:2 and 1:20, although it is also possible to work at other scales. The larger scale ratios enable the scale effects inherent to all scaled experiments to be reduced.



The windows along the flume and the pumping and filtering system, that keeps the water clean, allow non-intrusive optical observation techniques to be used in a wide range of experimental arrangements on a close- to-real scale.

## Wave and current generation

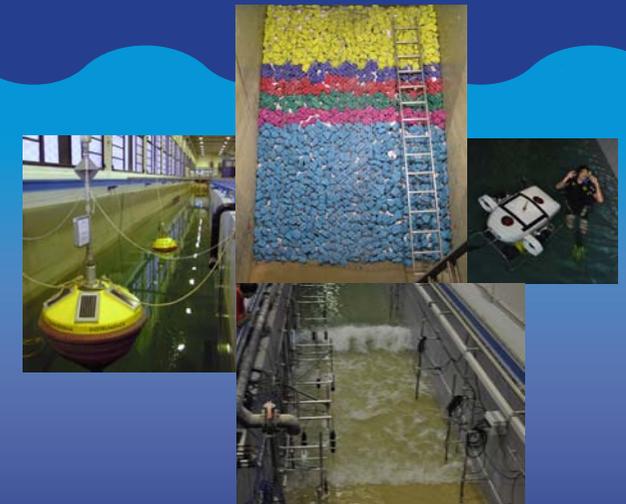
Waves and currents are generated by a wedge-type wave generator, which is particularly suitable for generating waves in intermediate water conditions, and a bidirectional pumping system whose capacity is 2,000 l/s. The system is hydraulically actuated and PC-controlled, and is capable of reproducing waves with heights up to 1.6 m.



The control software allows regular and irregular waves (e.g. parametric or user-defined spectra and measured time series) to be generated. Additionally, a PC-based active absorption system allows tests to be run on wave series for as long as required, without the effect of spurious model-induced reflections. This is an essential feature for testing highly reflective structures and for analyzing equilibrium shapes in beach profiles, particularly accretive sequences.

## Main uses

The generation of waves can be used to study the influence of sea swell on beach profiles and coastal defence structures. Tests can be carried out to assess projects and to identify innovative solutions to a given problem. The generation of currents allows their interaction with waves and sediments to be studied, and enables experiments to be carried out with submersible vehicles and energy devices.



The wave flume allows the following to be studied:

- Structural stability and functional hydrodynamics, e.g. run-up, run-down, overtopping, reflection and transmission.
- Beach profile morphodynamics.
- Wave, beach and structure interactions, e.g. scouring, fluxes through and above the structure and modified profile morphodynamics.
- Floating structures, e.g. fish cages, floating breakwaters, buoys and energy-extracting devices.