CENTRE FOR PORT AND COASTAL STUDIES (CEPYC)

2024 Activity Report

"CEPYC charts routes between science and the sea, promoting the sustainable development of our coasts and ports with rigour and knowledge."

One of the main objectives of the **Centre for Port and Coastal Studies (CEPYC)** is to provide scientific and technical services to the directorates-general and public bodies of the ministries to which CEDEX reports. These services, geared towards the exercise of the powers of the **Ministry of Transport and Sustainable Mobility (MITMS)** and the **Ministry for Ecological Transition and Demographic Challenge (MITECO),** take the form of multi-year contracts that the various entities of these ministries formalize with CEDEX, making use of its status as an in-house agency.

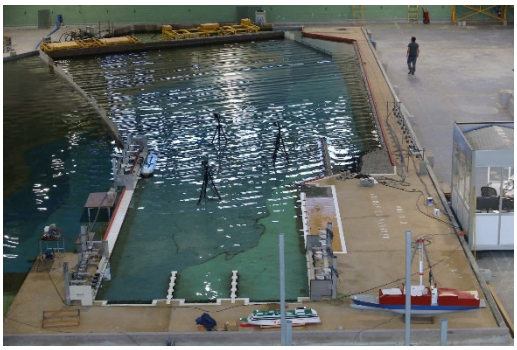
The various assignments include the development of studies and actions. In addition to specialized technical assistance, there is applied research based on the use of experimental facilities and equipment that enable physical modeling, the application of numerical models, and simulators that operate in real time.

During 2024, the different areas of **CEPYC** have worked on various actions included in the **State Ports** Commission's assignment to **CEDEX** to carry out technical assistance, applied research, and technological development work in areas of interest to the state-owned Port System (2023-2025).

The **Maritime Experimentation Laboratory** carried out various tests on a 2D physical model for the **Study of the Evolution of Damage to Sloped Dikes**, reproducing a section with a main layer of cube-type concrete blocks subjected to the action of successive waves in increasing order, measuring the evolution of damage to the slope of the dike as the energy of the incident waves increased.

2D tests of failure evolution in sloping dams

In addition to previous work on testing the behavior of port infrastructure, **3D physical model tests of the agitation and behavior of moored ships** have been carried out for the **future expansion phases of the Africa Dock at the Port of Las Palmas.**



3D tests on wave action and moored vessels for the future expansion of the Africa Dock at the Port of Las Palmas

Likewise, work continued to support **Puertos del Estado (State Ports)** in the development of the **National Plan for Adaptation to Climate Change in the State-owned Port System**.

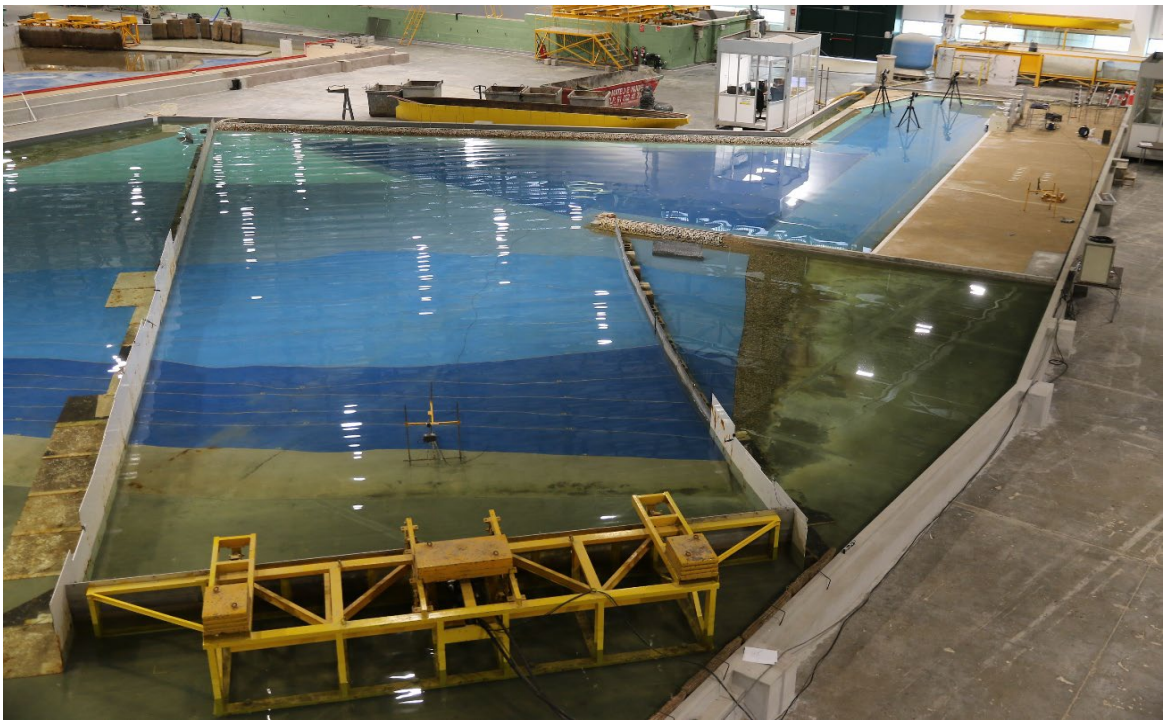
Also, as part of this assignment, the **Ship Maneuvering Unit** conducted a **study on the control of greenhouse gas emissions** and other pollutants generated by ships, using information based on AIS data, and a study consisting of the development of a statistical analysis methodology for simulations of ship maneuvers in which turns are carried out without tugboats.

The **Marine Environment Department** has provided **support to Puertos del Estado** (the Spanish State Ports Authority) in sustainability, mainly to improve environmental procedures through the

creation of an **Environmental Information System** and the development of a **Methodology for the Biological Characterization of Ports**. As part of the permanent technical assistance on environmental matters included in the assignment, work has been carried out on a **study of alternatives to the E/8 discharge point** for dredged materials from **Galician ports**, as well as on the completion of the **Inventory of Dredging** in **Spanish State-owned Ports**, the objective of which is to record and document the most relevant environmental aspects of the dredging carried out in recent years.

In addition to the State Ports Commission to CEDEX, actions were carried out through commissions co-financed by State Ports and the Port Authorities. In this type of commission, the activity of small-scale physical models in 2024 focused on the agitation and behavior tests of moored ships corresponding to the **New North Terminal of the Port of Valencia**, a commission co-financed by **State Ports and the Port Authority of Valencia**, which was completed in July 2024.

Also noteworthy is the signing in May 2024 of a co-financed contract between **Puertos del Estado and the Port Authority of Las Palmas** for a physical model study of wave action and moored ships in construction phases 2 and 3 of the expansion of the **Africa Dock at the Port of Las Palmas.**



3D tests at the North Terminal of the Port of Valencia

With regard to the activity carried out in the **Ship Maneuvering Simulation Unit**, in January 2024, a contract was signed between **Puertos del Estado and the Port Authority of Motril** to carry out a **numerical model study of climate and agitation** and a ship maneuvering simulation study to optimize the tugboat fleet and analyze the conditions for the entry and exit of a capesize bulk carrier. The study, which contemplated future dredging of the **Port of Motril**, was completed in October and supplemented with an addendum for the study of the departure of a bulk carrier with a draft of 13 meters.

250 m long bulk carrier assisted by tugs at the Port of Motril

In August 2024, **a commission co-financed by Puertos del Estado and the Port Authority of Las Palmas** was formalized to carry out studies in **Puerto del Rosario (Fuerteventura),** including a climate and wave action study using a numerical model and a ship maneuvering simulation study to analyze the safety of access to the inner commercial dock in two port layout configurations.

Tug pushing a 203 m long ferry from the starboard bow

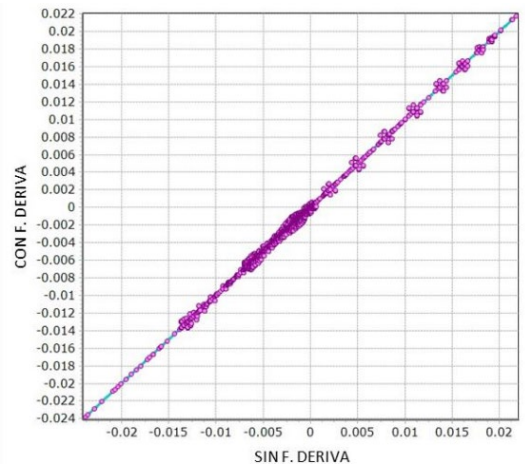
For **the Port Authority of Santander**, through a commission co-financed by Puertos del Estado, a **numerical study was carried out on the dispersion of powdery particles** during the unloading of goods at the Port of Santander with the aim of analyzing the emission of particles from different products during the unloading process at some of the port's docks.

In order to study the effects on the internal agitation of the **Port of Ibiza** of possible modifications to the configuration and type of infrastructure that could be introduced to improve the operability of its docks, a commission was formalized in March 2024 with CEDEX, co-financed by **Puertos del Estado and the Balearic Islands Port Authority**.

In relation to the project to expand the infrastructure of the Campamento dock in the **Port of Algeciras**, and through a commission co-financed by **Puertos del Estado** and the **Port Authority of the Bay of Algeciras**, work has been carried out on a climate and agitation study using numerical modeling.

Numerical modeling was also used to carry out a study of the movements of ships docked at the **Petronor Terminal in the Port of Bilbao**. The study was co-financed by the

Port **Authority of Bilbao and Puertos del Estado**, with the aim of analyzing whether the incidents of broken mooring lines suffered by some of the ships operating at berth SP-3 of the Petronor liquid bulk terminal could be caused by the presence of long waves.



Yaw (deg) with and without average drift force (T=200s)

On behalf of the Permanent Commission for the Investigation of Maritime Accidents and Incidents (CIAIM), the Port Studies Department carried out a study to analyze the sea, wind, current, and navigation conditions encountered by the dredger MIMAR CINCO between the **Nido dock in the port of La Luz in Gran Canaria and the islet on the NNE coast of the island of Gran Canaria**.

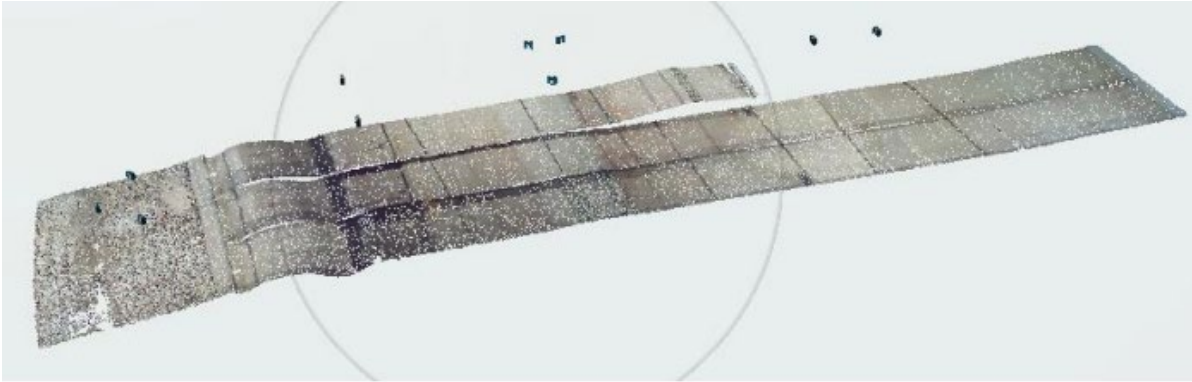
In 2024, **two commissions from MITECO** were completed, including the work carried out by the Marine Environment Department of CEPYC. In September, work was completed for the **Directorate-General for Biodiversity, Forests, and Desertification (DGBBD),** which provided support in the process of designating new marine protected areas by defining methodologies to characterize the pressures caused by human activities at sea, as well as in the preparation of studies on the impact of certain human activities at sea on these areas. In addition, **maritime traffic studies were carried out in the Canary Islands and the Balearic Islands** to determine the **risk of collisions between ships and large cetaceans**, with the aim of proposing measures to reduce this risk.


Danger index associated with maritime traffic in the Mallorca channel

On the other hand, the assignment that includes the work carried out by the **Marine Environment Directorate for the Directorate-General for the Coast and the Sea (DGCM)** was completed in November, with all the descriptive reports on the progress of the various tasks carried out being delivered, highlighting: 1) work relating to the definition of the environmental status of the five Spanish marine regions, as the initial part of the third cycle of marine strategies; 2) experimental work related to the pollution of certain points on the coast particularly affected by the presence of pellets; 3) a set of works related to the marine environment information system (INFOMAR).

The **Coastal Engineering Department** contributed to the aforementioned project during 2024 by developing strategies for actions on **the coasts of Alicante and Murcia** and provided support in reviewing

DGCM projects. Within the framework of this commission, small-scale physical model tests were carried out to study solutions for Portmán beach, which were completed in November.



Portmán Point cloud resulting from the 2D physical molding scan of the alternatives for Portmán beach

Other actions carried out by the **Coastal Engineering Department** consisted of responding to various issues raised by the DGCM, completing the "Implementation of the database and form" for the DGCM's actions, drafting various technical guides, and conducting two bathymetric surveys **in Premiá de Mar** y **Oropesa de Mar**.

As part of **ADIF's commission to CEDEX** to carry out studies to improve the defense and reduce the **vulnerability of the railway line on the Maresme coast (Barcelona),** 3D and 2D physical model tests were carried out to study the passability and stability of the longitudinal defense dyke of the railway in Maresme.

For the **Directorate General of Merchant Shipping**, the **Ship Manoeuvring Unit** has been working on the development of a guide with recommendations for offshore **wind farm developers** to carry out a formal assessment of the risk to maritime navigation.

3D test in the multidirectional wave tank to study the overtopping and stability of the longitudinal defense dike of the railway in Maresme.

In the field of **European projects**, work was completed on the **MSP-OR project**, which aimed to support the implementation of the Maritime Spatial Planning Directive in outermost regions. Within this project, work was carried out on the characterization of key sectors, such as **marine renewable energy**, **tourism,** and **recreational activities in the Canary Islands**, to fill knowledge gaps that hinder spatial planning. The work carried out has made it possible to identify specific planning needs for the implementation of wind farms and for the management of activities such as recreational boating, whale watching, and coastal tourism.

The **ReMAP project** has completed the design of the 11 proposed tools to aid decision-making in maritime spatial planning. Once the data sets necessary to use each of the tools have been defined, information is collected for the three use cases, with CEDEX being responsible for this task for **the Spanish part of the Western Mediterranean use case**.

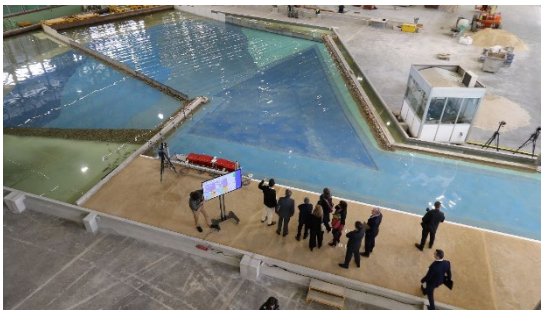
In addition to the activity carried out within the framework of the Commissions for the Ministries, work has also been carried out for the **private sector**.

For the **company ACCIONA**, tests were carried out on a three-dimensional (3D) physical model of an offshore GBS caisson for hydrogen storage, with the study being completed in July 2024. Similarly, in June 2024, a physical model study was completed to analyze the dynamic response of a hydrogen storage device, commissioned by **ARIEMA ENERGÍA Y MEDIOAMBIENTE S.L.**

Among the dissemination and technology transfer activities carried out by the Centre for Port and Coastal Studies, it is worth highlighting its participation in the **Spanish Conference on Coastal and Port Engineering**, held **in Ibiza** in May 2024, where the centre was significantly represented with various presentations on its recent activities. In July, the **IAHR** organized a **conference on sustainable seas and coasts**, with significant participation from MITECO and the Marine Environment Department of the **CEPYC**.

In December 2024, **a conference organized by the Technical Association of Ports and Coasts** was held at **CEPYC**, attended by representatives of State Ports and various Port Authorities, as well as companies related to the port and coastal sector, at which a presentation of the Centre's activities was given, together with a visit to its facilities.

It is worth noting that in 2024, a new edition of the "**Practical course on coastal dynamics: diagnosis and analysis of coastal problems"** was held for DGCM technicians.



Visit by members of the CEDEX Governing Council to CEPYC

During 2024, **visits to CEPYC** were organized by different organizations and entities, including the visit held on International **Day of Women and Girls in Science**, the visit by students from the Master's program at the **Naval School of the Polytechnic University of Madrid (UPM),** the visit by representatives of the **LPEE laboratory in Morocco**, the visit by students from the **Master's Degree in Naval and Ocean Engineering** at the **universities of Cadiz, Cartagena** and **Ferrol**, the visit organized by **Puertos del Estado** for **PR PORTS**, and the visit by students from the **Master's Degree in Infrastructure Management and Planning** organized by the **Higher Technical School (ETS) of Civil Engineering at the UPM**. In February 2024, the **CEDEX Governing Council** meeting took place, which also gave its members the opportunity to visit the Centre's facilities.