GLOSS National Report Spain

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NETWORKS AND INSTITUTIONS

Coastal sea level monitoring on the Spanish coastline currently carried out by several institutions:

Institution	Network/Station	Start	Nº stations	Active
Puertos del Estado (PdE, Spanish Harbours Authority)	REDMAR	1992	41	41
National Research Council (CSIC)	IEO RONIMAR	1943	11	11
	VENOM	2021	22	13
	L'Estartit TG	1990	1	1
National Geographic Institute (IGN)	IGN network	1928	17	17
Spanish Hydrographic Office (IHM)	IHM network	2021	26	4
Balearic Islands Coastal Observing and Forecasting System (SOCIB)	SOCIB network	2009	5	5
AZTI (Vasque Country)	Pasaia station	2007	1	1

At least **87 active tide gauges** installed by different stakeholders for **different purposes**
National, regional and local applications

Puertos del Estado

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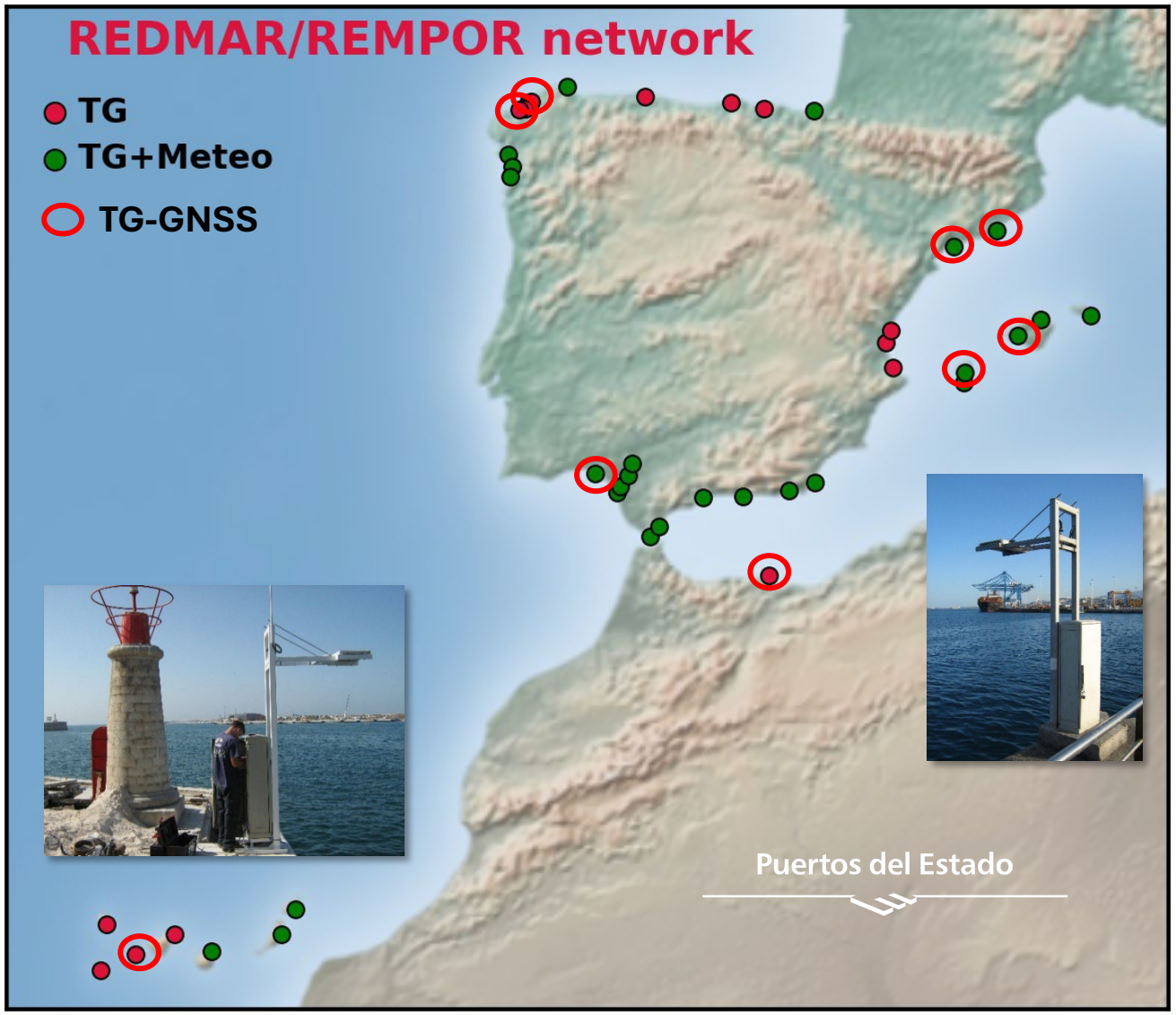
Puertos del Estado

REDMAR NETWORK. STATUS 2025:

- **41 stations** based on MIROS radar sensors (one sea level channel): **sea level (1 min) and wave parameters (every 20 min)**
- **2Hz raw data processed hourly for high-frequency sea level oscillations** (NivMarHF software)
- **Atmospheric pressure (1 min) and wind sensors** at 25 stations. **GNSS receivers** installed at 10 stations (SAMOA Project)
- **Redundant pressure sensor for tsunami** warning in Huelva (SOPRANO Project)
- **Real-time data transmission** (https/websocket): Integrated in the National Tsunami Warning System, redundant data transmisión (VSAT) with IGN in several stations

Data shared through VLIZ, PSMSL, Copernicus, EMODnet and GESLA data portals or datasets



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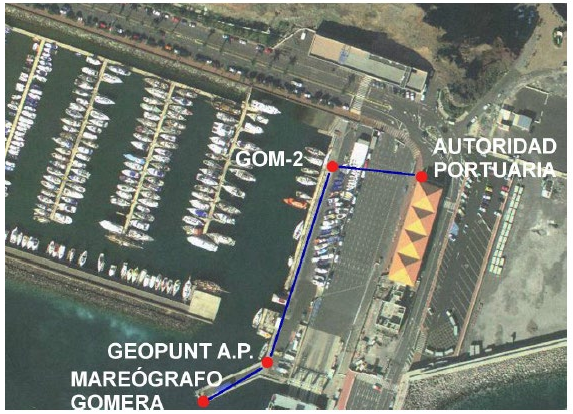
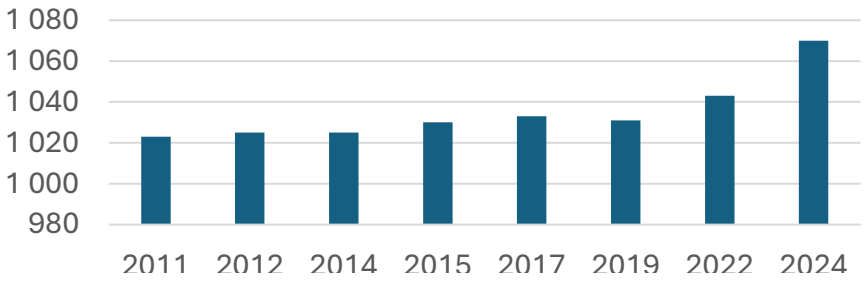
Recent and ongoing initiatives:

- **New EuroSea Project TG** installed **in Barcelona** with NOC (UK)
- **New experiment to test various novel technologies:** at least three different types of sensors will be tested for a year at three different Ports (different tidal/high-frequency/waves conditions).
- Integration of **new tide gauges** as requested by the Ports (Avilés, Carboneras, Almería, Granadilla)
- **Assessment of relative sea level rise and vertical land movement at GNSS co-llocated stations** (with ULR and IGN), combining different sources of data and periodic levelling campaigns.



Altitude difference between TG-BenchMark and stable bench mark along the years (Gomera TG):



REDMAR TG-GNSS

EuroSea TG - GNSS

National Research Council (CSIC)

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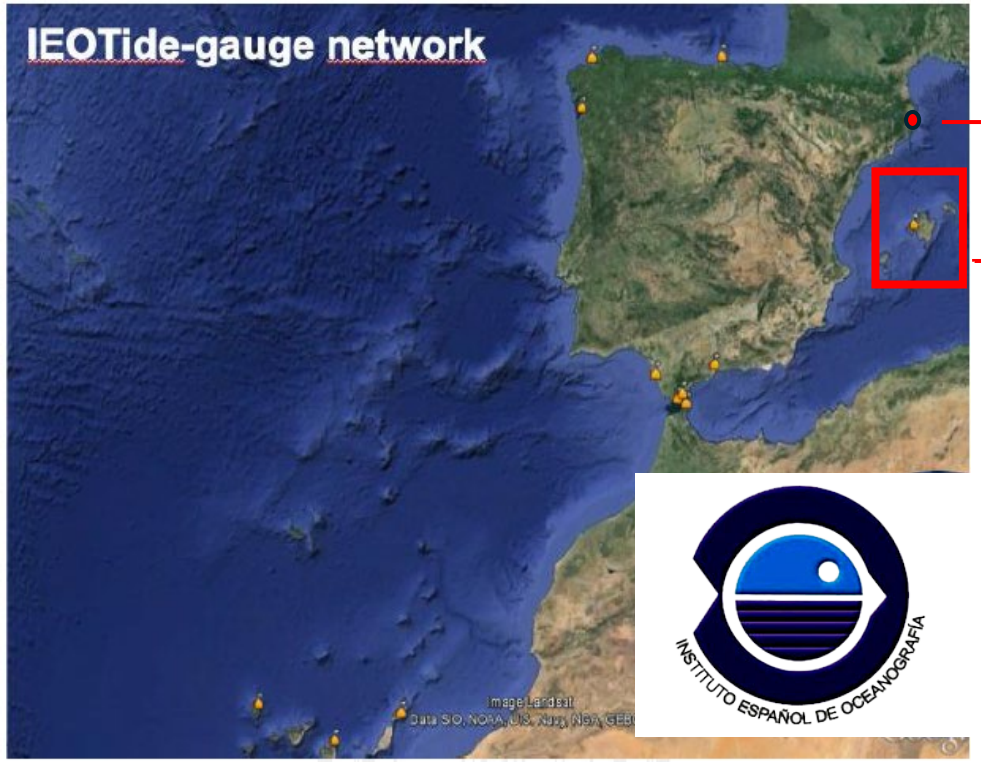
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

RONIMAR (IEO)



- 11 stations (radar + float with digital encoder)
- **Starting in 1943**
- Historical data shared through SeaDataNet portal
- **3 GLOSS Core Network stations in Spain**: Ceuta, Coruña and Las Palmas
- On-going/future: upgrade to 1-min sampling and latency

L'Estartit tide gauge (Meteoléstartit + ICM-CSIC)

- Meteorological and Oceanographhic Station in the Harbour of L'Estartit
- **Starting in 1990**
- Float gauge: sea level records in paper digitized 2h resolution

VENOM Project (IEO + University of the Balearic Islands)

- Densification of the TG network in the Balearic Islands
- In-house developed and low-cost acoustic devices
- Purpose: small scale variability of sea level variations
- **Starting in 2021**
- **13 active devices today**

National Geographic Institute (IGN)

- Oldest sea level network in the country
- **Started in the XIX century** with stations in Alicante, Santander and Cádiz
- Upgraded from float to radar. Today one or two radars per station, all co-located with GNSS)
- Contributing to PSMSL, the Spanish Tsunami Alert System and Copernicus Marine Service
- **17 active tide gauges**

Alicante TG – reference of the national geodetic datum

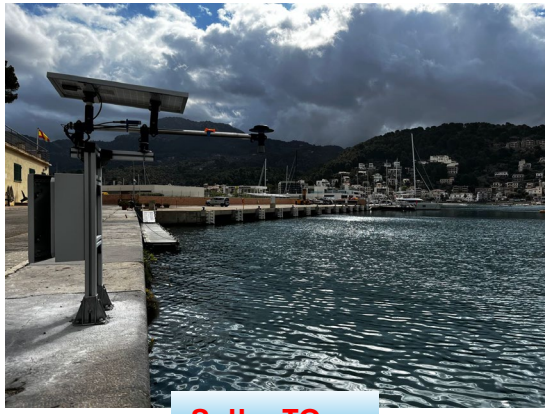
SOCIB and AZTI

SOCIB (Balearic Islands)

- **Started in 2009**
- Pressure gauges and one radar gauge (Sant Antoni)
- **6 active stations, 1-min sampling**
- All stations include atmospheric pressure
- Annual GNSS surveys of the TG Bench-marks
- Data shared with Copernicus Marine Service

AZTI (Pasaia station, Bay of Biscay)

- **Started in 2007**
- Radar sensor
- Co-llocated with GNSS
- Daily and monthly mean sea level to PSMSL



Soller TG

Andratx TG

Spanish Hydrographic Office (IHM)

MINISTERIO DE DEFENSA

IHM

- **Started in 2021**
- Sea level, atmospheric pressure, air temperature and humidity
- Low-cost acoustic sensors co-llocated with low-cost GNSS
- On-going deployment of stations
- First 4 stations to be integrated in Copernicus Marine Service this week