

GLOSS National Report for Spain

REDMAR Sea Level Network (Spanish Harbours Authority)



Figure 1: REDMAR sea level stations (Spanish Harbours Authority: Puertos del Estado)

The original 1992 network has been upgraded during last years from SRD Acoustic sensors to Miros radar sensors. New stations have also been installed in the Balearic Islands (Palma de Mallorca, Alcudia, Formentera, Mahón), North of Africa and Alboran Sea (Melilla, Motril and Almería), Gibraltar Strait (Tarifa and Algeciras), Galicia (Ferrol, Marín), Catalonia (Tarragona) and Canary Islands (Hierro, La Palma and Arrecife).

At this moment practically all the stations (34) consist of a Miros system: 2 Hz raw data and 1-min averages transmitted in real time via ADSL, GPRS or Internet to Puertos del Estado (<http://www.puertos.es>), and provide agitation information each 20 minutes (significant wave height and mean period). One additional acoustic system is still in operation in Bilbao, and two Aanderaa pressure sensors remain without upgrade in the Canary Islands: Granadilla (Tenerife) and Arinaga (Gran Canaria). For these three latter old stations data-sampling is still 5-min.

All the stations are integrated in the Nivmar Sea Level Forecast System, run by Puertos del Estado, in the IBIROOS Data Portal (IBI In-situ Tac, developed within Myocean project) and practically all are also contributing to the IOC Sea Level Data Facility with 1-min data. Automatic quality control is performed in near-real time for application in operational oceanography.

In order to guarantee the use of data for long-term studies, a detailed intercomparison is being made for each upgraded station, between the old acoustic/pressure systems and the new radar systems, after about one year of simultaneous operation. The task is taking some time as the upgrade has been done gradually during last years and sometimes the new stations are located at other quay in the harbor with different sea level variability in high frequencies. Nevertheless, the REDMAR network is thought to fulfill also this application (multi-purpose station), and high precision leveling and connection between stations and the national geodetic network is being performed with funding from Puertos del Estado and each individual harbor, and the technical collaboration of the National Geographic Institute. For those harbours where another station from IEO or IGN exist, the high-precision leveling of Puertos del Estado has taken this station into account.

Only one REDMAR station has a CGPS very close to the tide gauge and leveled to the TGBM: Ibiza in the Balearic Islands. The data are being sent by Puertos del Estado to the TIGA project.

Finally, there is plan of adding meteorological stations (atmospheric pressure and wind) to the REDMAR sea level network. At this moment, both parameters are included in Tarragona, Algeciras and Vigo stations, there is also atmospheric pressure at Tarifa station and wind at Almería station. Atmospheric pressure is recorded with 1-min sampling for detection of meteo-tsunamis.

Station	Coordinates	Sensor type	Data Since-Upto
BILBAO3	43°21'26" N 03°03'00" W	Radar-Miros	1992-
BILBAO2	43°20'14" N 03°02'09" W	Acoustic SRD	2001-
SANTANDER2	43°27'45" N 03°47'22" W	Radar-Miros	1992*-
GLJÓN2	43°33'33" N 05°41'50" W	Radar-Miros	1995*-
FERROL1	43°27'46" N 08° 19'32" W	Radar-Miros	2006-
FERROL2	43°28'34" N 08°14'54" W	Radar-Miros	2006-
LA CORUÑA2	43°21'31" N 08°23'17" W	Radar-Miros	1992*-
MARÍN (PONTEVEDRA)	42°24'22"N 08°41'28"W	Radar-Miros	2009-
VILAGARCÍA2	42°35'58" N 08°46'12" W	Radar-Miros	1997-
VIGO2	42°14'35" N 08°43'33" W	Radar Miros	1992-
HUELVA5 (Mazagón)	37°08'00" N 06°49'56" W	Radar-Miros	1995-
SEVILLA (ESCLUSA)	37°19'57" N 05°59'41" W	Acoustic-SRD	1992-2008
SEVILLA (BONANZA2)	36°48'14" N 06°20'10" W	Radar-Miros	1992-

MÁLAGA3	36°42'42" N 04°25'02" W	Radar Miros	1992-
TARIFA	36°00'23"N 05°36'13"W	Radar Miros	2009-
ALGECIRAS	36°10'37"N 05°23'54"W	Radar Miros	2009-
MOTRIL2	36°43'13" N 03°31'25"W	Radar-Miros	2004-
ALMERÍA	36°49'48" N 02°28'42"W	Radar-Miros	2006-
VALENCIA3	39°26'31"N 00°18'40"W	Radar Miros	1993-
SAGUNTO	39°38'02" N 00°12'22"E	Radar-Miros	2007-
GANDÍA	38°59'44" N 00°09'06"W	Radar-Miros	2007-
BARCELONA2	41°20'30"N 02°09'49" E	Radar-Miros	1992-
TARRAGONA	41°04'48"N 01°12'36"E	Radar-Miros	2011-
IBIZA2	38°54'36"N 01°26'36"E	Radar-Miros	2003-
PALMA	39°33'37"N 02°38'15"E	Radar-Miros	2009-
ALCUDIA	39°50'05"N 03°08'21"E	Radar-Miros	2009-
FORMENTERA	38°44'05"N 01°25'08" E	Radar-Miros	2009-
MAHÓN	39°53'35"N 04°16'14" E	Radar-Miros	2009-
MELILLA	35°17'26" N 02°55'42" W	Radar-Miros	2007-
TENERIFE2	28°28'42" N 16°14'25" W	Radar- Miros	1992-
HIERRO2 (LA ESTACA)	27°47'03" N 17°54'03"W	Radar- Miros	2001-
GRANADILLA	28°05'00" N 16°30'54"W	Pressure Aanderaa	2004-
S. CRUZ DE LA PALMA	28°40'40" N 17°46'04"W	Radar-Miros	2006-
LA GOMERA (SAN SEBASTIAN)	28°05'16"N 17°06'29"W	Radar-Miros	2006-
ARINAGA	27°50'49"N 15°24'05"W	Pressure Aanderaa	2004-
FUERTEVENTURA2 (EL ROSARIO)	28°29'33"N 13°51'30"W	Radar-Miros	2004-
LAS PALMAS2	28°08'26"N 15°24'43"W	Radar-Miros	1992-
LANZAROTE (ARRECIFE)	28°58'03"N 13°31'49"W	Radar-Miros	2008-

Table 1: coordinates of REDMAR stations: blue colour for stations that have been upgraded from previous acoustic/pressure sensors and are now being studied for time series continuity.

Spanish Institute of Oceanography (IEO) Tide Gauge Network

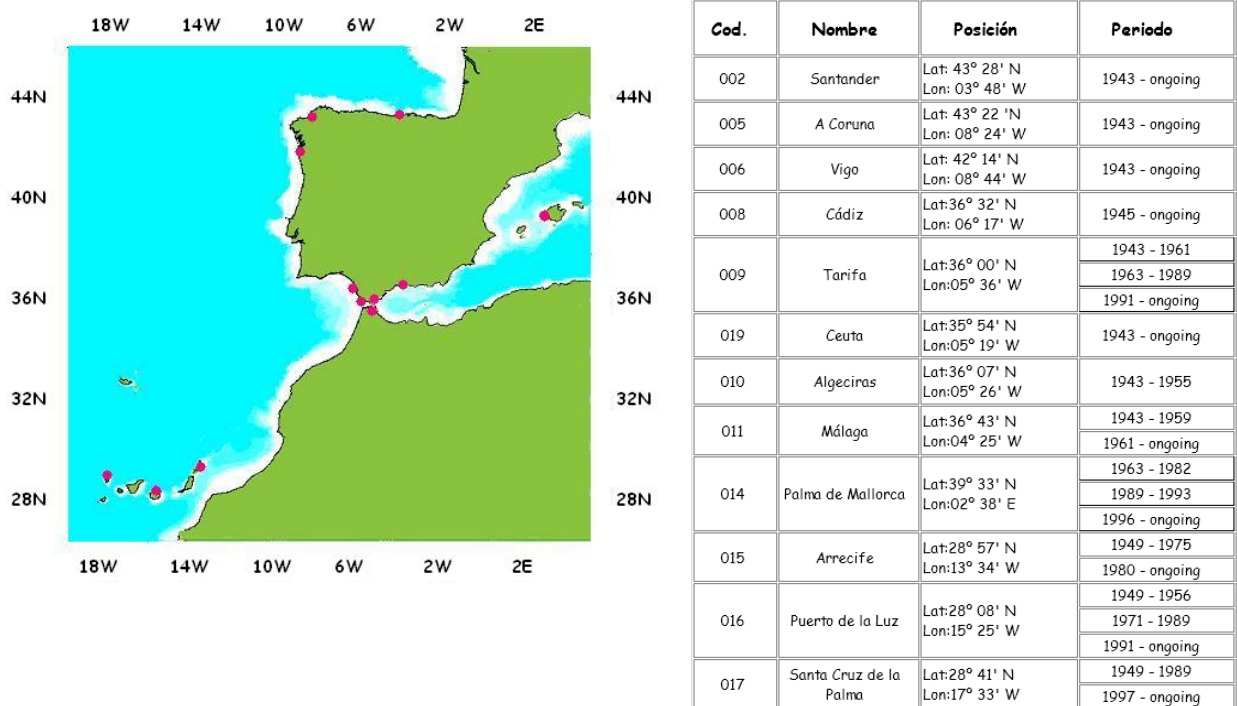


Figure 2: map and coordinates of IEO Tide Gauge Network, including period of data available (extracted from: <http://indamar.ieo.es/mareas/mareas.htm>).

The network is composed of float gauges, with additional radar systems at Santander, Algeciras and Tarifa stations. Data are automatically downloaded via modem once per day and displayed at <http://indamar.ieo.es/mareas/mareas.htm>. Plans exist to upgrade all the network to radar sensors, but IEO is still waiting for funding. All Spanish GLOSS stations belong to this network.

National Geographic Institute (IGN) Tide Gauge Network

Estación	Localización			Sistema de medida		Datos		Designación PMSL		
	Longitud	Latitud	Situación	Nombre	Tipo	intervalo	periodo			
ALAC1	00° 28' 40" W	38° 20' 18" N	ALICANTE Muelle de Levante Escollera	THOMSON I	Registrador mecánico		1927	1969	220/051 ALICANTE I	
				OTT R20	Registrador mecánico	1 h	1979	mar-08		
				OTT Thalimedes	Codificador angular	1' promedio	10 ³	ago-99		mar-00
				OTT Thales	Codificador angular	1' promedio	10 ³	mar-00		mar-09
				OTT Thales	Codificador angular	10 ³	abr-09	-		
VEGA Radar	Sensor rádar	1'	feb-10	-						
ALAC2	00° 28' 53" W	38° 20' 20" N	ALICANTE Muelle de Levante Bocana	THOMSON III	Registrador mecánico	1 h	1957	1973	220/052 ALICANTE II	
				OTT R20	Registrador mecánico	1 h	feb-76	mar-96		
				OTT OWK16	Codificador angular	1' promedio	10 ³	jul-96		may-98
				OTT Thalimedes	Codificador angular	1' promedio	10 ³	oct-98		ene-99
				OTT OWK16	Codificador angular	1' promedio	10 ³	mar-00		mar-10
				Barometro		1' promedio	10 ³	mar-00		may-10
				OTT OWK16	Codificador angular	10 ³	oct-10	-		
VEGA Radar	Sensor rádar	1'	oct-10	-						
Barometro		10 ³	oct-10	-						
ALME2	02° 29' W	36° 50' N	ALMERIA Dique Sur Dársena pesquera	SEBA Alpha	Registrador mecánico	1 h	1986	-	220/042 ALMERIA II	
				OTT Thalimedes	Codificador angular	1' promedio	10 ³	feb-00		nov-03
				OTT OWK16	Codificador angular	1' promedio	10 ³	nov-03		mar-09
				OTT OWK16	Codificador angular	10 ³	abr-09	-		
				VEGA Radar	Sensor rádar	1'	oct-10	-		
MURC2	00° 58' 24" W	37° 35' 46" N	CARTAGENA Muelle Santa Lucía Caseta Bombas	AOTT R20			abr-05	feb-10		
				OTT OWK16	Codificador angular	1' promedio	10 ³	abr-05		mar-09
				OTT OWK16	Codificador angular	10 ³	abr-09	nov-09		
				VEGA Radar	Sensor rádar	1'	feb-10	-		
				OTT OWK16	Codificador angular	10 ³	feb-10	-		
ACOR1	08° 23' 17" W	43° 21' 31" N	LA CORUNA Muelle Calvo Sotelo	Mier	Registrador mecánico		ene-50	-	200/031 LA CORUNA II	
				Thomson	Registrador mecánico		ene-50	jun-78		
				AOTT 20.030	Registrador mecánico		sep-78	-		
				OTT Thales	Codificador angular	1' promedio	10 ³	may-97		abr-98
				OTT Thalimedes 1	Codificador angular	1' promedio	10 ³	may-98		may-99
				OTT Thalimedes 2	Codificador angular	1' promedio	10 ³	oct-99		jul-05
				OTT OWK16	Codificador angular	1' promedio	10 ³	abr-05		nov-08
				OTT OWK16	Codificador angular	1'	nov-08	oct-11		
				OTT OWK16	Codificador angular	10 ³	oct-11	-		
				VEGA Radar	Sensor Rádar	1'	oct-11	-		
TN013	16° 14' 28" W	28° 28' 38" N	SANTA CRUZ DE TENERIFE Dársena Anaga Muelle Norte	AOTT 20.030	Registrador mecánico	1 h	ene-92	-	370/031 SANTA CRUZ DE TENERIFE II	
				OTT Hydrus	Codificador angular	1' promedio	10 ³	jul-97		-
				SEBA Radar	Sensor rádar	5'	may-07	nov-08		
				SEBA Radar	Sensor rádar	1'	nov-08	-		
TN021	16° 33' 2" W	28° 25' 6" N	PUERTO DE LA CRUZ	SEBA Radar	Sensor rádar	5'	oct-08	mar-09		
				SEBA Radar	Sensor rádar	1'	mar-09	-		
TN033	16° 43' 5" W	28° 2' 49" N	LOS CRISTIANOS	VEGA Radar	Sensor rádar	1'	mar-09	-		
FUER1	13° 51' 33" W	28° 29' 48" N	PUERTO DEL ROSARIO Muelle deportivo	AOTT 20.030	Registrador mecánico		feb-99	abr-02		
				OTT Thalimedes	Codificador angular	promedio	10 ³	sep-99		abr-02
				OTT OWK16	Codificador angular	promedio	10 ³	oct-05		mar-09
OTT OWK16	Codificador angular	1'	mar-09	-						

Table 2: stations of the National Geographic Institute