



Puertos del Estado, a pioneer in this field, has shared its automation techniques and recommendations for use and verification

UNESCO publishes its sea level data quality control manual, with Puertos del Estado in charge of its drafting

- In 2019, the Group of Experts on the Global Sea Level Observing System, dependent on UNESCO, requested that an updated manual be drawn up for quality control protocols and related data processing for the global network.
- The Spanish port system has 38 sea level measuring stations, distributed amongst all of Spain's ports and integrated through a complex monitoring and forecast system known as Portus.

06-26-2020 (Ministry of Transportation, Mobility and Urban Agenda). The United Nations, through its specialized Educational, Scientific and Cultural Organization (UNESCO), has asked Puertos del Estado experts to direct the drafting of an updated manual on quality control protocols and sea level data processing for the entire **Global Sea Level Observing System** (GLOSS: <https://www.gloss-sealevel.org/>). Fruit of this task is the recently published manual (available on-line at <https://unesdoc.unesco.org/ark:/48223/pf0000373566>), which incorporates new automation techniques that are currently operating and recommendations for use and verification, addressed to those institutions that have not yet started to use them.

The GLOSS program of UNESCO's International Oceanographic Commission has been gathering sea level station data from all around the world since the '80s. One of the program's main objectives is to confirm a rise in the average sea level due to the planet's global warming.

Based on these data and according to the latest report issued by the Intergovernmental Panel on Climate Change (IPCC https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_SPM_FINAL.pdf), the world's average sea level has increased 17-21 cm between 1901 and



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2010. Ever since satellite measurements began in 1993, this growth rate in the global average level has increased over the one observed in the XX century, from 3.1 +/-0.7 mm/year between 1993 and 2010 (the value has been obtained using onshore sea level stations and satellite data).

In addition to this global change, the growth rate in average levels varies from one side of the planet to another, depending on coastal features, temperature, vertical movement of the land, etc., and may be greater or less than the global value. A rise in the sea's average level increases the damage caused by storms and related swells along the coastline, given that waves have greater inland penetration capacity and are potentially more dangerous due to spreading at a higher average level.

Recently, sea level stations, mostly located in ports, have been incorporated into coastal phenomenon or tsunami alert systems all over the world, which is why process automation and data quality control have become very important.

– 38 STATIONS IN SPAIN'S PORT NETWORK

Since 1992, the Spanish Port System has a sea level station network (REDMAR) with currently 38 stations. This network is part of a set of monitoring and forecast systems, known as Portus (<https://portus.puertos.es/>), which are able to predict the state of the sea, monitoring it in real time and providing a climatic classification.

The need for data in quasi-real time and their integration into alert systems in place in Puertos del Estado, resulted in measures taken several years ago to develop and implement automatic quality control and data processing systems. This is why Puertos del Estado has pioneered this algorithm study, to the extent that it has now become the base for those used in the COPERNICUS program for Europe's coast.

Since 1992, based on Puertos del Estado data, the average sea level along Spain's coast has risen 2-5 mm per year, depending on the coastal area (less in the Cantabrian, more in the Mediterranean and the Canary Islands). A rise of 5 mm/year means that the current average level is 13.5



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cm higher than in the early '90s, which is why the flooding height during extreme weather is more easily reached.

All countries have sea level station networks similar to the Portus system. In many cases these stations have been running since the late XIX century. However, the automation of quality control and generation of derivative products or services is not as generalized. The manual that has now been published will allow other institutions, in countries with less modern systems, to adopt the working methods it recommends, making a global contribution to more reliable and accurate sea level data. These will be used in many applications with a huge socioeconomic impact, such as studies on the rise in sea level, tsunami or flooding alert systems.