



Lessons learned by SIDMAR on maintenance of wave and tide gages monitoring networks in Spain

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Abstract:

SIDMAR (Society for Marine Documentation and Research) is a Spanish research company that focuses its activity in oceanographic studies and services, being a pioneer in this field in Spain. One of the key points SIDMAR's activities in this country is marine sensor (*operational* or *measurement*) networks management. SIDMAR currently manages several data networks from different customers both private companies and public centres. Two of the main networks are composed of tide gauge level sensing devices and directional swell buoys, both belonging to *Puertos del Estado* (Ministry of Public Works and highways). The goal of this article/presentation is to introduce the keynote aspects of real time environmental sensor networks operation and maintenance in the coast of Spain performed by SIDMAR.

Keywords:

Operational networks – Puertos del Estado – Tide gauge – Water level – Directional swell – Miros – Axy's technologies

1. Introduction

The Spanish Port System is composed of 44 ports of general interest, managed by 28 Port Authorities, whose coordination and efficiency is controlled by *Puertos del Estado* Public Authority (part of the Ministry of Public Works and Highways).

Puertos del Estado also offers these port authorities real time environmental data as part of their operational network programs:

- *Deep Sea Network* for swell wave height, air and water temperature, atmospheric pressure, etc.
- *Coastal Network* (REDCOS) for directional wave parameters (Hs, Tp, etc.), air and water temperature, etc.
- *Tide Gauge Network* (REDMAR) for water level and tide gauge sensing (including tsunami detection), (PÉREZ *et al.*, 1997).

This data is publicly available on real time through their Web Site at <http://puertos.es>.

For these environmental sensing networks to work, it is crucial to operate with the most recent technologies, automatic monitoring, operational networks and installation of oceanographic instrumentation (including maintenance and calibration).

SIDMAR, among other activities, is currently servicing Puertos del Estado in the tasks of management, operation control, and maintenance of the REDMAR and part of the REDCOS.

2. The REDMAR Network

The REDMAR (water level and tide gauge) network consists of more than 40 different water level sensing devices placed all around the coast of Spain (including Canarias and Baleares islands). These water level sensors are, currently, of three different kinds and manufacturers (ÁLVAREZ *et al.*, 2001):

- Water pressure sensors from AADI/AANDERAA® (<http://www.aanderaa.com>).
- Acoustic sensors, from SRD® (<http://www.srduk.com>).
- Radar sensors from MIROS® AS (<http://miros.no>).

Currently all the network technology is moving to MIROS® Range Finder devices because they provide the right accuracy to measure sea water level as well as ocean swell. SIDMAR is in charge of installation, maintenance and calibration of the sensors. SIDMAR also assures that real time data is transparently transmitted to Puertos del Estado through GSM (GPRS or 3G) or high band width (DSL or optical fibre) technologies. Figure 1 shows the setup of one of the MIROS® Range Finder installed at the Sagunto Port. The performance of this equipment was compared with a different radar technology (Vega Puls 62) (Figure 2).

SIDMAR also develops hardware and software tools that allow port authorities access the tide gauge data directly on the port desktop computers or to check whether the sensor is properly working or not.

3. The REDCOS

The REDCOS is the swell monitoring network from Puertos del Estado which consists of a total of 28 buoys dedicated to ocean wave parameters measurement both directional and non directional.

Currently SIDMAR, within the frame of the REDCOS, is in charge of 9 Triaxys directional buoys from Axys Technologies. These buoys can transmit hourly directional values of T_p and H_s among other values using several kinds of telemetry technologies. SIDMAR uses plain VHF transmissions from the buoy to an antenna and a 40.5 Mhz radio receiver equipped target PC on a nearby location. Nevertheless, occasional satellite transmissions (Inmarsat and Argos) can be used when needed.



Figure 1. MIROS Range Finder station in Sagunto Port. The sensor is tested for right operation by comparing its measurements with a Vega Puls 62 (radar technology). Data is stored in an embedded PC and transmitted through GPRS.

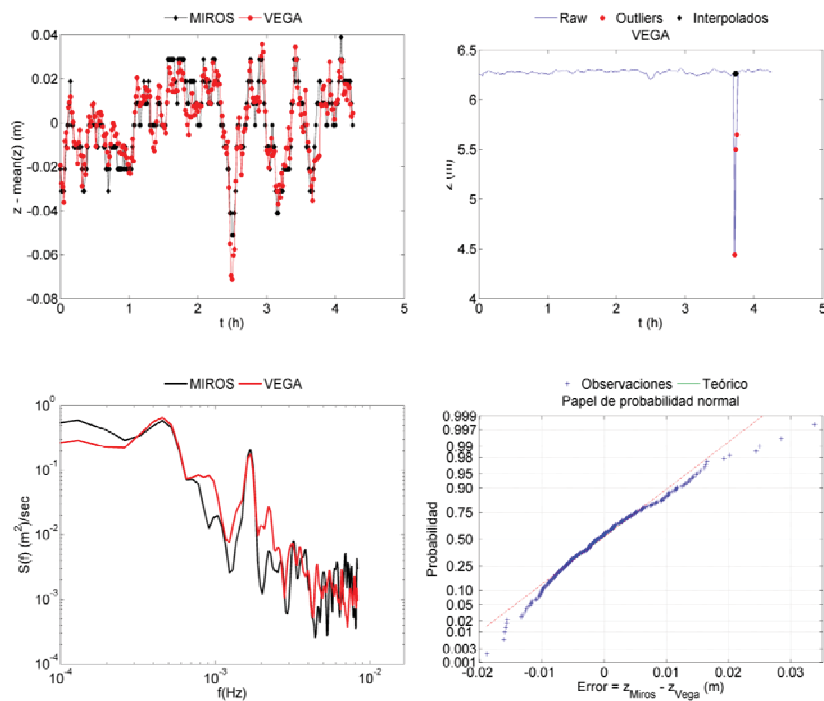


Figure 2. Comparison of MIROS Range Finder and Vega Puls 62 measuring together during a maintenance service.

The directional wave sensor inside each Triaxys buoy is comprised of three accelerometers and three rate sensors that ultimately measure the total displacement

along the three orthogonal axes of the floating platform, x, y, z or HNE. In addition, this sensor is equipped with a gimballed fluxgate compass to measure true magnetic direction. These sensors use proprietary software developed by the National Research Council of Canada for data processing within the sensor, and all sensors have the option of onboard data logging of both the raw collected data and the final processed data.

Currently, each buoy samples wave motion for 24 minutes each hour, processes it and it is wirelessly delivered to the data logger (a plain PC running Windows XP and a special software written by Axys). This PC is connected to the Internet and sequentially emails the data to the central processing system in Puertos del Estado.

The tasks performed by SIDMAR range from buoy maintenance (including a six-monthly refurbish or replacement, sensor, power consumption and telemetry channels check, battery replacement and hull/dome reparations), deployment line design, final installation and action on buoy drifting emergency scenarios. SIDMAR knows on real time where each buoy is and whether it is properly working inside the tide ellipsis so that Puertos del Estado can serve the data to each port authority in Spain on real time.

4. Conclusions

In the last decade, SIDMAR has been maintaining and managing more than 40 tide gauges and 9 buoys for wave measuring in Spain. Through these years different tide measuring technologies has been tested being the MIROS Range Finder the preferred one by the Port Authorities in Spain. This sensor allows accurate water level measurements on a broad frequency spectrum that ranges from capillary waves to astronomical tides. The Triaxys directional wave buoys has been found reliable on very different wave and current scenarios. At SIDMAR a group of five technicians is full time dedicated to maintenance tasks.

5. References

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