M3 ADVANCES IN INSTRUMENTED LAGRANGIAN BUOYS

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Abstract
Since2005 the ICM-CSIC has designed, built and tested surface drifting buoys for the measurement of several oceanographic parameters, mainly temperature and salinity. These prototypes have evolved and been adapted to different sampling needs and strategies. We present here the main characteristics and capabilities of these last developments.

Keywords – Oceanographic instrumentation, Lagrangian buoys, surface drifters, salinity, temperature

In the context of preparatory activities for the Soil Moisture and Ocean Salinity (SMOS) space mission, it was necessary to design a validation strategy for satellite surface salinity products that would include the measurement of temperature and salinity as close to the sea surface as possible. The best option was the use of surface buoys capable of recording data at a few centimetres below the surface, similar to the SVP drifters largely used to measure temperature and surface currents. However, such an instrument able to measure near-surface salinity was not easily available in the market. In 2005 the Oceanographic Instrumentation Service and the Department of Physical Oceanography of the Marine Sciences Institute in Barcelona (ICM-CSIC) started the design and construction of prototypes to fulfil the required measurement characteristics. The basic set-up was a 40 cm propylene sphere containing the batteries, electronic controller and satellite transmitter, coupled to a SeaBird 37CT probe, and a holy sock drogue 10 m long when the device was to be used as a surface drifter. Some units were tested in 2007 in moored coastal deployments for several months and evidenced a satisfactory behaviour and long time endurance. Prototypes were also built and tested in the open ocean for subsurface measurements with the CT probe at 100-150 m. Different transmission and data compression systems, alternative sensors for conductivity and additional parameters, as well as smaller drifters for short term applications have also been tested.
From the experience gained in building about hundred units of oceanographic buoys, used in 14 different research projects, we describe here the advancements in simplex (ARGOS and GLOBALSTAR) and duplex (IRIDIUM) satellite communication systems, as well as new positioning systems. We first introduce the satellite networks available for real time oceanographic applications, including a detailed description of the Low Earth Orbit (LEO) systems, namely ARGOS, GLOBALSTAR, IRIDIUM and ORBCOMM. We describe the tests performed with each one of these systems and analyse the results obtained for specific applications.

Fig. 1. A search and rescue exercise using an ICM built prototype of small buoy (PK-1).

We then present the characteristics of the WOCE standard drifting buoys that we have taken as basic model for our drifters, including dimensions, geometry and different drogue systems. We also discuss the design of small buoys that can be deployed from an aircraft for surface current studies, and that can also be used to locate sediment trap moorings, to track dangerous drifting devices or in search and rescue operations (Figure 1).
We also describe the new technologies in satellite positioning systems, able to add up the three present constellations (GPS-GLONASS-GALILEO). This strategy allows a higher satellite availability to increase the position accuracy and decrease the time to obtain valid locations, and also the possibility of using a new 72-hours forward Keplerian prediction system that drastically reduces power consumption.
Finally a highly stable bi-buoy system (Figure 2) is presented. It is aimed at measuring in the ocean-air interface, with the capability of hosting sensors both atmospheric and submerged. We specifically describe a unit recently used in the SPURS-MIDAS oceanographic cruise in the North Atlantic that measures salinity at three different depths close to the surface (10, 25 and 50 cm).

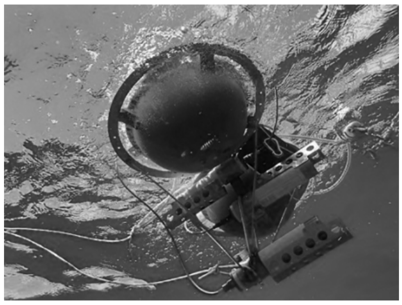

Fig. 2. Bi-buoy system hosting three SeaBird 37 CT probes at different depths.

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