M2 NEW DESIGNS OF SEA CURRENT TRACKING BUOYS

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Abstract
The development of a series of new compact and easy to use lagrangian drifting buoys for coastal and open ocean sea surface current tracking is presented.

Keywords - Drifting buoy, drifter, sea surface current, tracking

I. INTRODUCTION.

Understanding ocean currents is essential to address different objectives like predicting weather phenomena, modelling dynamics of ocean-atmosphere interaction and bio-chemical processes and tracking debris, accidents or oil spills. Scientists use drifting buoys or 'drifters' that provide a lagrangian trajectory from which ocean currents can be inferred. The trajectory of a drifter depends basically on a combination of two main factors: geostrophic (coriolis and pressure) and wind forcing [1]. Drifters have at least a positioning system and a communication system, while some models have sensors to measure properties such as sea surface temperature, salinity, wind speed, and atmospheric pressure.

As a result of the Surface Velocity Program (SVP) of the World Ocean Circulation Experiment (WOCE) the design, dimensions and materials are standardized to allow scientist to have comparable data from drifters manufactured by different companies or research institutions. These drifters are based on a 40cm diameter sphere drogued at 15 meters depth and are best suited for open ocean current tracking. One important feature of the design is that, in order to reduce wind effect on the measurements, a drogue area ratio of 40:1 is used between drag area of the drogue and non-drogue elements.

The Coastal Ocean Dynamics Experiment (CODE) [2] was performed by a second standard drifter model based on a cylindrical body drogued at 0,75 meters depth, being most well suited for coastal current tracking.

II. DRIFTER DEVELOPMENT

Three new designs of drifter have been developed and tested. These have been based on safety, user friendliness and affordability factors.

II.1 Coastal Drifters

A first objective was to develop a small and compact surface drifter (MiniDrifter MD03) to track sea currents based on SMS (short message system) and GSM communication network with a similar performance in current tracking to the CODE based drifters.

Electronics were designed to include a GPS positioning module and a GSM modem module, sensing water temperature and battery level. The sampling and transmission frequency can be configured in real time. Mechanical design is based on a sealed hull covered with a flexible polyethylene closed cell foam buoyancy, resulting in an overall small diameter of 10 cm and a height of 28 cm, and a weight of just 1,5 kg. making the whole system intrinsically safe and very user friendly. Its autonomy of 7-14 days makes it ideal for coastal short term scientific missions, oil spill tracking and search and rescue operations.

II.2 Ocean Drifters

As a result of the ease of use of the MD03 drifters, but with an underlying need of a longer communication range from coast, a new electronics system was developed based now on Iridium, a global full ocean coverage bidirectional satellite communication network.

This new drifter (iridium MiniDrifter MD03i) has a similar mechanical design as the MD03 but being slightly higher, with a height of 32 cm, and a weight of just 1.7 kg, keeping the flexible polyethylene foam buoyancy. Internal structure is modified to fix new electronics, modules and antennas.

Electronics in this version have a GPS positioning system and a Iridium satellite communication system (SBD, short burst data). The circuit board is prepared to be adapted to future needs and includes digital inputs and outputs, analog inputs and serial port. Sampling and transmission frequencies are independently configurable. It has an autonomy of 14-21 days makes it ideal for short term scientific missions, oil spill tracking and search and rescue operations.

MD03i drifters are near surface current tracking devices, similar in performance to CODE drifters, when a small flexible nylon drogue is attached, anchored at 0,75 meters depth.

Fig. 1

Being aware of the desire of part of the scientific community to have a drifter comparable in data results to an SVP model, a third drifter model (OceanDrifter iridium ODi) has been developed.

The standard SVP drifters are usually intended to be at sea during about two years. This feature makes the drifter hull of a minimum size that makes the holeysock drogue quite big if the 40:1 drogue area ratio is to be kept.

ODi objective was to result in a small and compact surface drifter but comparable to SVP standards. Electronics system is exactly the same as MD03i model, but in order to reduce battery size, a solar power charging module has been included in the latest version.

Mechanical design is based on a two identical halves spherical buoy, sealed with an O-ring. It has a small diameter of 20 cm, about 5 litre external volume and a weight in air of slightly less than 2 kg. This allows to ballast the drifter to user specified height, and it allows to attach a holeysock drogue 15 meters depth anchored following 40:1 drag area ratio.

III. CONCLUSIONS

Three different versions of compact and easy to use surface drifters have been presented in this article, describing main features and applications.

MD03 model has been tested and used in Atlantic, Baltic and Mediterranean sea by different scientists to track near surface coastal currents for more than four years. MD03i model has been used to track near surface ocean currents since 2012, and ODi drifters have been used for oil spill tracking experiments from 2012 and are actually being used for ocean current tracking in Mediterranean and Atlantic sea by different research institutions.

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