ID22- SPOT AND GPRS DRIFTING BUOYS FOR HF RADAR CALIBRATION

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Abstract
Traditional drifting buoys have been designed to measure the surface currents at a nominal depth of 15m with drogues of 6m height. Herein, in order to assess the performance of HF Radars two designs of Lagrangian drifting buoys have been developed and targeted to provide the vertically averaged velocity of the currents in the first 2 and 0.5 meters of the water column. These are the layer heights of the HF Radars of RAIA observatory. The buoys were made with standard materials and off-the-shelf electronics, to keep costs as low as possible.

Keywords
Drifting Buoy, HF Radar, Observing System.

RADAR ON RAIA HF Radar network and drifting buoys for antenna calibration

The INTERREG V-A Spain-Portugal (POCTEP) project RADAR_ON_RAIA has established a cross-border network of HF Radar antennas from Leça de Palmeira to Cabo Prior [1]. This observatory consists of 5 antennas (Leça, Silleiro, Fisterra, Prior and Vilán) working at 5Mhz and 13.5MHz that sense the currents in the first 2 meters of the water column on shelf overlapping areas. In addition, in the Ría de Vigo another HF Radar system using two antennas (Toralla and Cíes) working at 42.6MHz is providing high-spatial resolution observations of surface velocities in the first 0.5m of the water column.

These antennas are routinely calibrated with transponders to get their correct Antenna Pattern Measurement (APM) for correcting the signals received at each station [2]. However, external calibration with another source of velocity observations is advisable in order to assess the quality of the data gathered by the antennas. One of the best options to undertake such a task is the use of drifting buoys [3].

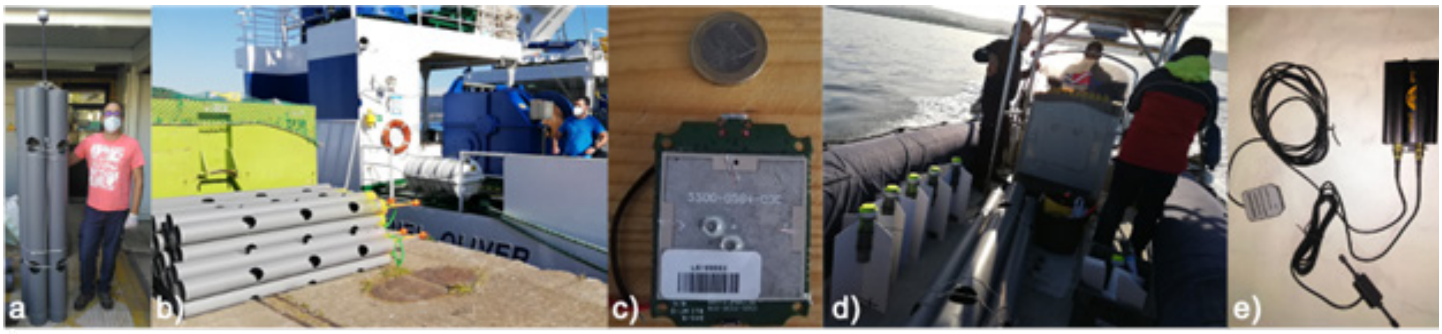
In Spain, there is some tradition in the construction and use of drifting buoys [4, 5] although based on the classic buoy design for the WOCE/TOGA Surface Velocity Program [6, 7, 8]. The SVP based buoys consist of two parts: a 6m height drogue centred at 15m depth and a surface sphere providing buoyancy and hosting sensors and communication electronics. But, for calibrating the HF Radars the drifters must follow the currents in the upper 2m of the off-shelf waters and the 0.5m of the interior Ría de Vigo waters.

The communication capabilities needed and layer height targeted defined the key design parameters of two new models of drifting buoys, named i) SPOT and ii) GPRS, developed at IIM-CSIC. Both models present high aerial to underwater surface ratios (both greater than 45) to avoid direct wind drag on buoys as much as possible. Also, both were made with standard PVC materials and off-the-shelf GPS/communication electronics to keep the costs as low as possible.

SPOT buoy

The SPOT drifting buoy (Fig. 1a) uses the SPOT TRACE satellite tracking device (https://www.findmespot.com/en-gb/products-services/spot-trace). This device has a dedicated and standard (no RTK) GPS to fix its geographic position and the Globalstar Satellite Network to transmit the GPS coordinates to the www.findmespot.com internet service where the user can download the tracking records. The internal electronics (Fig 1c) of the SPOT TRACE were installed in a small PVC cage on the top of the aerial part of the buoy (Fig 1a). The main buoy body consists of a 2m height PVC central cylinder, enclosing rechargeable batteries and providing buoyancy to the whole system, surrounded by another 5 PVC open cylinders which augment the water drag area in the submerged volume of the buoy (Fig 1a, b). Once drifting free, the buoy stands vertical and the top of the PVC cylinders keeps level with the sea surface, only the antenna with the SPOT electronics is in the air.

a) First 2.5m height SPOT buoy prototype made
b) seven SPOT buoys ready to get on board R/V Miguel Oliver during IEO Pelacus campaign
c) Spot-Trace device electronics used in the SPOT buoy
d) GPRS buoys ready for deployment
e) TK103B electronics for GRPS buoy.



GPRS buoy

The GPRS buoy relays in a commercial car tracker, the GPS tracker TK103B which includes a standard (no RTK) GPS and a 3G GPRS modem (Fig 1e). The electronics were configured to stream the positions to the IIM-CSIC servers using the UDP protocol. This small (0.5m height) buoy consists of a central PVC cylinder that provides buoyancy, houses the rechargeable batteries and the TK103B and supports the drogue made with two perpendicular low-density PVC planes (Fig 1d).

CONCLUSIONS

In collaboration with MyCOAST and MELOA projects during the Caminha 2020 Oil Spill Exercise two SPOT drifters were released on 22 Sep 2020, one of them lasted more than 170 days recording positions every 3 minutes. Other 7 SPOT buoys were released during the IEO Pelacus campaign in April 2021, six of them seemed to be run over by merchant ships in the Finisterre corridor. The field experiments with GPRS buoys are planned for September 2021, only a short release (2h) was made in the Ría de Vigo in March 2020.

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