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The WAVY drifters – Sensor and data validation

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***Abstract* – The WAVY family of drifters, developed in the EU H2020 project MELOA, range from small drifters suitable for beach and surf zone studies to somewhat larger drifters, tailored for coastal and long-term open ocean observations, and consists of five members, namely the WAVYs Basic (WB), Littoral (WL), Ocean (WO), Ocean-plus (WP) and Ocean-Atmo (WA). The WB and WL are currently at TRL 8, having been validated and used in real operational environments in a series of demonstrative use cases; the WOs are currently at TRL6 and undergoing use cases designed to bring them to TRL8. This paper presents the latest work done in the validation of three capabilities of the drifters: tracking of the ocean's surface currents; measurement of wave parameters and measurement of sea surface temperatures.**

Keywords *- Ocean currents, Ocean waves, Sea Surface Temperature, Ocean observation, Lagrangean current meters, surface drifters, near real-time in-situ data, data validation.*

I. INTRODUCTION

Project MELOA (Multi-purpose/Multi-sensor Extra Light Oceanography Apparatus) developed a family of low-cost, easy-to-handle, wave resilient, multi-purpose, multi-sensor, extra light surface drifters for use in all water environments, the WAVYs. Their main attributes are the small size and low weight, optimized buoyancy to reduce the wind "sail effect" and minimized pendular motion, to keep the internal antennae as much as possible above water.

The research and development focused on achieving sturdiness of the casing, to allow applications in rough environments, such as the surf zone and rugged littorals; the implementation of an inertial motion sensor (IMU), to compute wave parameters, and finally energy harvesting, for extended battery life at sea. Other challenges were addressed as well, such as resistance to shock, balance between autonomy and weight, placement of the required antennae versus the desired behaviour of the spherical drifter (minimizing the wind exposed surface), electromagnetic interference between components, balance of on-board computing power and data storage capacity, development of communication protocols and other minor issues.

The following sections cover recent achievements in the validation of data along three main features: tracking of surface currents; measurement of waves; measurement of near-surface sea temperatures.

II. OBSERVATION OF SURFACE CURRENTS

The ability of the WAVY drifters to correctly track surface currents has been demonstrated many times during the field campaigns carried out in the MELOA project. Figure 1 illustrates the trajectories observed by WL in the nearshore and coastal waters off Portugal and at a beach in Vilanova i la Geltrú, Spain, as seen in the WAVY Operation Software, the tool developed to manage campaigns and deployments and available to all users. Other field tests currently ongoing use fixed ADCP to measure surface velocities that are then compared to those observed by the drifters in the vicinity.

III. OBSERVATION OF OCEAN SURFACE WAVES

This is done by processing the accelerations measured by the on-board IMU. Three main types of validation experiments have been performed in multiple occasions: 1) direct comparison with other wave sensors (DataWell Waveriders and upward looking ADCPs with surface following mode); 2) validation in a Ferry Wheel used for Waverider calibration and 3) validation in a wave tank under controlled and known wave fields. Figure 2 shows examples of wave parameters (left) and the spectrum (right) measured against a Waverider and in a wave tank (the Lir NOTF in Cork, Ireland); in this latter

case, the drifters were moored with a very light configuration but, nonetheless, their behaviour is affected by it. The wave extraction algorithm used in MELOA shows a good ability to depict the waves observed in situ.

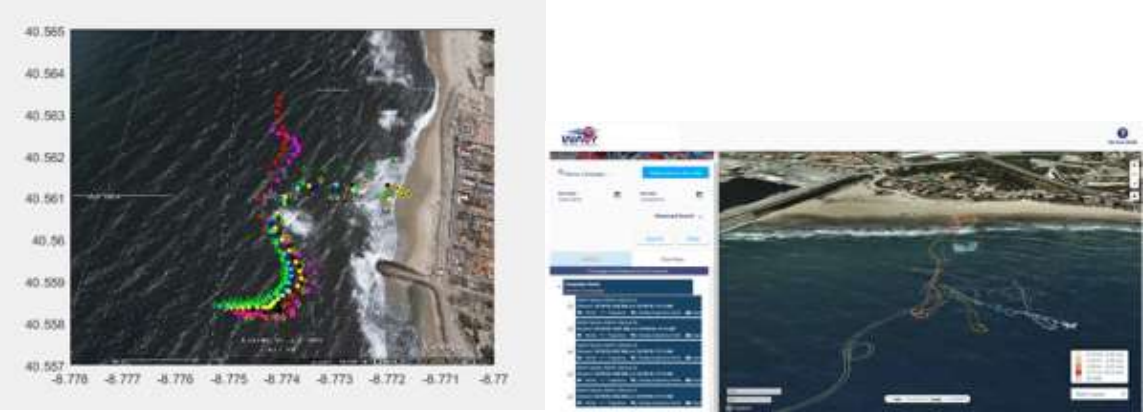

Fig 1. Trajectories of WL in a beach in Portugal, 2019 (left) and in Vilanova i la Geltrú, Spain, 2019 (right). The dots shown in the left correspond to successive positions of the drifter and depict wave-induced currents. The drifters shown on the right were launched from the beach by beachgoing citizens. Regular lines further offshore are trajectories of a RIB after recovery of the drifters.

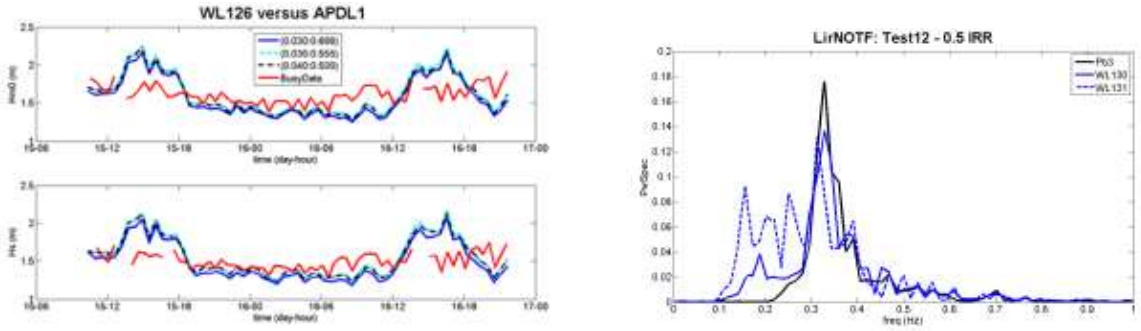

Fig 2. Example of wave parameters as measured by WLs, compared against a Waverider (left) and in controlled conditions (wave test tank, right), showing low frequency effects of the mooring used to keep the drifter on station, possibly (under investigation).

IV. OBSERVATION OF SEA SURFACE TEMPERATURES (SST)

Observations of SST are done by the on-board thermistors. Sensor validation is achieved through calibrated temperature baths and field experiments. One such campaign was carried off the Portuguese West coast with a WB. Figure 3 shows results obtained in the latter case, clearly capturing the good response of the sensor when the drifter was placed in the water (~14:07) and then later removed (~14:50). Work is ongoing to obtain more validation data and fine-tune the calibration procedure for the thermistors.

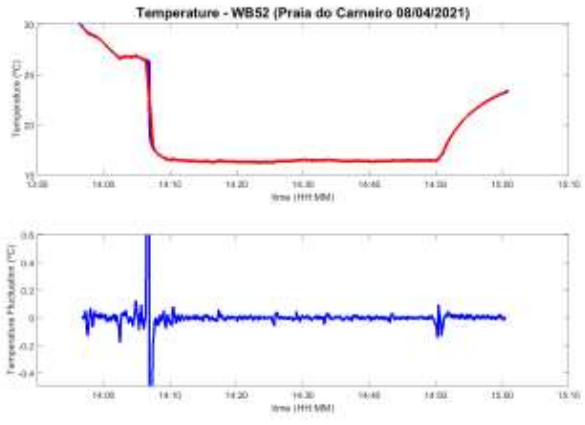

Fig 3. Temperature measurement with a WB at Praia do Carneiro, Portugal.

V. ACKNOWLEDGMENTS

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