M3 ANERIS: DEVELOPMENT OF AN OCEANOGRAPHIC VERTICAL PROFILER WITH HIGH RESOLUTION AUTONOMOUS SAMPLING CAPABILITIES

N. Pujol[51], J. Piera[10]

Abstract

ANERIS is a multidisciplinary project focused on the design and development of an innovative profiler. As main innovation, the vertical profiler has the capability to obtain microstructure profiles and spectrometric data simultaneously with high resolution in a totally autonomous way.

Keywords – vertical profiler, innovation, autonomous, hyperspectral, CMIMA-CSIC.

I. INTRODUCTION AND MOTIVATIONS

Sea water profilers have been evolving but they still have limitations in high resolution sampling capabilities. One of the main limitations stem from the movement produced by the oceanographic ships and wiring systems added to an inaccurate depth measurement based on pressure sensors. Other limitations are turbulences and mixing effects produced by oceanographic ships and profiler structure itself. This factors difficult data sampling in low-scale studies even with high precision sensors.

ANERIS probe design is focused to minimize actual devices limitations by providing autonomy and accurate positioning system to the device. The final objective is to provide this system of certain intelligence to adapt its performance depending on data collection values.

Currently, the project has concluded its first stage with a preliminary ANERIS prototype. Far from being a real operative device, it will be used to check all the system response and to collect real data to develop the intelligence part of further prototypes.

II. MAIN CHARACTERISTICS

2.1. Structure

ANERIS has been conceived with the idea to be a modular and flexible structure open to future elements and improvements. With the current configuration is easy to add new elements and is flexible enough to introduce some kind of intelligent control algorithms in a future.

For this porpoise the different parts has been developed in independent cylinders: batteries, optic sensors, environmental sensors and motor system. Core is environmental cylinder which is connected to optic sensors cylinder throw TCP/IP and uses serial protocol with motor system cylinder communication. Environmental sensors cylinder and optic sensors cylinder have its own CPU based on PC-104 standard to ensure fast acquisition and storage capability.

2.2. Sensors

Optical system provides information related to water column composition [1]. Spectrometric sensors offer the possibility to better distinguish different groups of phytoplankton [2], which are characterized by a specific pigment composition and therefore by a specific optical signature. In this case, two spectrometers placed in opposite directions perpendicular to water column give us information about absorbance minimizing external factors. Finally, environmental sensors (salinity, chlorophyll, pressure and temperature) add significant information to better distinguish and characterize water composition.

Acquiring system has been designed to take 10 samples per second for environmental sensors and 4 samples per second for optical sensors. This feature, added to speed up and down control make possible to characterize every centimeter of the water column (every 4cm. in optic sensors case).

2.3. Motor system

Autonomous up and down system has been designed to have an accurate position precision (1 cm. approximately). The profiler uses an extra weight to go to marine bottom by itself. Then, a cable is released and the profiler goes up controlled by main CPU. This system is allows to know where the device is in terms of high from bottom.

In the future, with intelligent algorithms on main CPU, system will be able to stop and adapt up and down speed automatically depending of the values of the date acquired. At moment, scientist only can configure some characteristics of the sampling process previously to the profiler deployment.

2.4. Basic operation and deployment

The device has its own software to communicate with it using a personal computer when a magnet switch is turned on. This software allows to configure deployment parameters and to download the data acquired when the mission is finished and the profiler is on the water surface. This communication is possible using a radio link and make profit of internal device network.

Because of the weight of actual prototype a small crane is need for its deployment and collection.

III. FUTURE TASKS AND CLONCLUSIONS

With our first prototype the viability of this kind of devices is proved but still more improvements has to be done to get a really operative device.

The main efforts next years will be test the device in real environments to check the data obtained and get enough data to determine water composition and develop an algorithm to provide adaptive response to the device performance. Volume and power consumption optimization will be important points to develop in the future to get a more effective and operative device and to minimize turbulence effect produced by the device.

REFENCES

[1] E. Torrecilla, S. Pons, I. F. Aymerich, J. Piera, "Characterization of the water optical properties using hyperspectral sensors", in Instrumentation Viewpoint, vol. 4, pp. 48- 49, 2005.

[2] Ismael F. Aymerich, Jaume Piera, Aureli Soria-Frisch, and Lluïsa Cros, "A Rapid Technique for Classifying Phytoplankton Fluorescence Spectra Based on Self-Organizing Maps," Appl. Spectrosc. 63, 716-726, 2009.

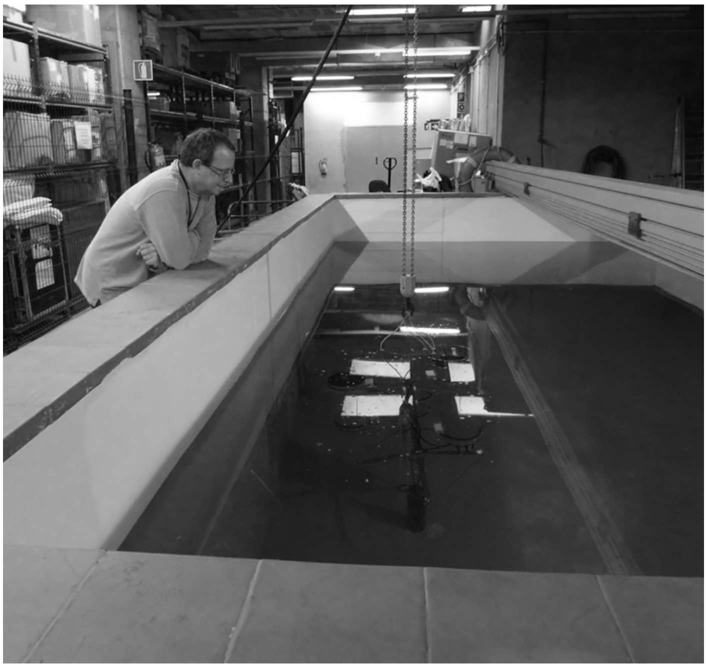

Fig. 1. ANERIS operation tests in CMIMA-CSIC facilities