ANERIS

Operational Sensing Life Technologies for Marine Ecosystems

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Milestone M20 – New instruments deployed and working in operational mode in EMSO-OBSEA

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Preface

This document is a Milestone for the ANERIS project, funded under the European Union's Horizon Europe Research and Innovation Action under grant agreement No. 101094924.

This milestone documents the deployment of the UVP6 (LOV) and the Cytosub (CytoBuoy) in operational mode in EMSO-OBSEA.

1. Deployment of the UVP6 at EMSO-OBSEA

1.1 Summary

On February 2024, during the first year of the ANERIS project, SARTI-UPC researchers together with researcher from the Laboratoire d'Océanographie de Villefranche (LOV) have deployed an Underwater Vision Profiler at the OBSEA observatory. The Underwater Vision Profiler or UVP (CNRS patent) is designed to study large (>100 µm) particles and zooplankton simultaneously and to quantify them in a known volume of water. The UVP system makes use of computerized optical technology with custom lighting to acquire digital images of zooplankton IN SITU down to depths of 6000m.

1.2 Content

ANERIS project aims to put in place an automatized data pipeline for data generated by the Underwater Vision Profiler by deploying two UVP6-LPs on EMSO moorings, one at the OBSEA cabled observatory off the Vilanova coast in Spain, and one at the SmartBay cabled observatory in Galway Bay, Ireland (not yet deployed). These cabled observatories will generate high frequency images (an image at least every minute) for a scientifically exploitable time series, which will be visualizable in near real-time via a web application.

The UVP collects in-situ images, counts and sizes all particles larger than ~100µm, and extracts regions of interest (ROIs) for large particles (>~1mm). The counting, sizing, and image segmentation are done by the instrument itself. This pre-processed data is stored in the application EcoPart (~25K profiles and ~2K time series samples of marine particles) and the ROIs are sent to EcoTaxa for taxonomic identification. EcoPart structures its information by size and export depth-resolved particle size spectra, and also retrieves the taxonomic identifications from EcoTaxa to export concentrations for the taxonomically identified particles (including plankton).

Because of the size of the datasets generated by UVPs on cabled observatories, such as those planned for OBSEA and SMARTBAY, ANERIS aims to more fully automatize this pipeline by 1) rewriting and issuing a new version of EcoPart, including basic quality control checks; 2) adding an Application Programming Interface (API) to EcoPart to enable machine-to-machine interactions; 3) training deep learning classifiers to be deployed as a dedicated service for image classification; and 4) defining periodic validation procedures to control the performance of those classifiers in subsets of the data.

During the first year of the ANERIS project, the UVP6 was integrated to OBSEA network, fully tested in a pressure tank at UPC facilities and deployed at 18 meters depth with the LOV researcher's supervision. For this version, a custom UV-C light was designed with the support of Hydroptic company to be efficiently utilized to later better protect the UVP6 camera porthole from biofouling.

1.3 Material

Link to the pictures: https://photos.app.goo.gl/bavBXBiSePTJngHD7

Figure 1: *Deployment of the UVP6 at EMSO-OBSEA*

2. Deployment of the Cytosub at EMSO-OBSEA

2.1 Summary

On April 2024, during the first year of the ANERIS project, SARTI-UPC researchers together with researcher from the Institut de Ciències del Mar (ICM) and engineers from CytoBuoy have deployed the CytoSub at the OBSEA observatory. This instrument offers solutions for analysis and classification of microorganisms and particles in water and complex media. It provides a more holistic view on the dynamics of the microworld by combining speed, information and size range.

2.2 Content

The CytoSub is an imaging flowcytometer. The CytoSub analysis microorganisms and particles in water, like Phytoplankton. It collects in depth information on microbe communities and diversity, viability, germination, physiology. It can detect changes and notice trends. It monitors abundance and growth of phytoplankton or zooplankton, Harmful algae blooms. The instrument can run autonomously for multiple months on a set schedule to measure. The output of the measurements are single particle footprints and images. Unique for the CytoSub is the wide particle range that can be measured. For the Aneris Project one of the outputs are the images that will be used for the datapipeline developed by Vlaams Institute for the Sea (VLIZ) in their AIES-PHY, Automatic Information Extraction System for PHYtoplankton images.

During the first year of the ANERIS project, the CytoSub was integrated to OBSEA network, fully tested in a pressure tank at UPC facilities and deployed at 18 meters depth with the CytuBuoy

engineer's supervision. On the May 9th and 10th, coinciding with the UN Ocean Decade, an on-site training was conducted at UPC facilities to train its researchers in the use, maintenance, and exploitation of data provided by CytoSub. Subsequently, on May 11th, the instrument was successfully deployed at a depth of 18 meters connected to the OBSEA observatory, which provides power and real-time data. Since that day, the instrument has been continuously measuring particles present in the area with a 3-hour cycle.

2.3 Material

PICTURES: https://photos.app.goo.gl/atX669Ctga6U5CXo8

Summary video:
https://photos.google.com/share/AF1QipNBZAwLVVYc8a9CN6pxMIkVdpgx5cDRvcKtjecTtSboZq_kuiNAakf02Dcyt6QGWw/photo/AF1QipMimqQPSO-KjZGir2e6b9WOZ82of8343eQtnFAg?key=bDNGNlFxS1INR21pLW03dnFFcVp4UkNUV3NzS3Fn

RAW videos:
https://drive.google.com/drive/folders/1ePXp99NQAbGkY-peCXlLdBwBhUKgGXkK?usp=sharing

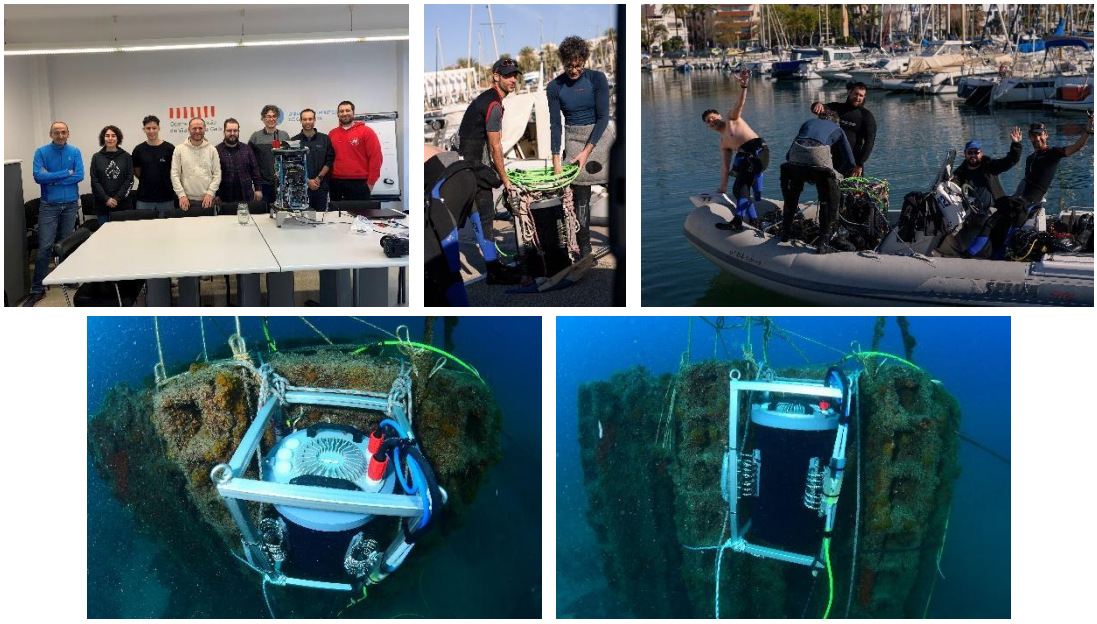

Figure 2: *Deployment of the Cytosub at EMSO-OBSEA*