ID36 ANERIS PROJECT: OBSEA'S CONTRIBUTION TO MARINE BIODIVERSITY MONITORING

MARC NOGUERAS CERVERA[116], MATIAS CARANDELL WIDMER[115], DANIEL MIHAI TOMA[117], MARC PICHERAL[145], CATINA GESELSCHAP[146], DOMINIC STUART[147] AND JOAQUIN DEL RIO FERNÁNDEZ[18]

Abstract

This article outlines the contribution of the Expandable Seafloor Observatory (OBSEA) from the Universitat Politècnica de Catalunya (UPC) to the ANERIS project coordinated by the Consejo Superior de Investigaciones Científicas (CSIC). The ANERIS project will serve to deal with the loss of marine biodiversity by creating tools and technologies for the monitoring, research and management of life, and by introducing the concept of Operational Marine Biology (OMB). OBSEA's involvement in ANERIS is particularly focused on the integration of two innovative imaging technologies: the CytoSub and the UVP6, each of them included in the AIES-PHY (Automatic Information Extraction System for PHYtoplankton images) and AIES-ZOO (Automatic Information Extraction System for ZOOplankton images) in combination with dedicated software for real time WEB data products.

Keywords – OBSEA, ANERIS, AIES-PHY, AIES-ZOO.

INTRODUCTION

The Expandable Seafloor Observatory (OBSEA) is a cabled observatory located 4 km off the coast of Vilanova i la Geltru within a protected fishing area. Operated by the Universitat Politècnica de Catalunya (UPC), OBSEA [1] is an integral part of the European Multidisciplinary Seafloor and water-column Observatory (EMSO) network [2]. This observatory not only contributes to advancing our understanding of marine environments but also plays a crucial role as a testbed for the development of new marine sensors and technologies. Equipped with various oceanographic instruments, OBSEA gathers essential data for scientific exploration and environmental monitoring The OBSEA observatory is a very useful infrastructure for both research and marine innovation thanks to its location near the coast. The observatory actively engages in collaborative projects, such as the ANERIS project [3], aimed at addressing challenges related to marine biodiversity loss. In this participation, OBSEA will serve as a tesbed for two recent imaging instruments: the CytoSub and the UVP6.

AIES-PHY Technology Integration. CytoSub: The Underwater Flow Cytometer [4][5][6]

The AIES-PHY component involves the integration of the CytoSub sensor developed by CytoBuoy. CytoSub is a submersible flow cytometer designed for underwater use in sea, lakes, and ponds.

Because of their submersible design, CytoSubs provide high-definition, high-frequency microscopy images of remote locations. The images serve to study both phytoplankton and zooplankton in their natural environment without the deformation caused by the capture nets and the manipulation of the samples.

CytoSub offers new possibilities for various applications, including operational oceanography monitoring, coastal observing networks, lake and river in-situ monitoring, aquatics and ecosystem bio-engineering, restoration control, early warning for sensitive ecosystems, and depth profiling.

Fig 1. CytoSub instrument

AIES-ZOO Technology Integration. Automatic Information Extraction System for ZOOplankton Images from UVP6 [7][8]

The AIES-ZOO technology focuses on streamlining the information extraction process for large particulate matter abundance and size and selected images of zooplankton and aggregates as the current process involves separate applications. To address this, ANERIS will develop AIES-ZOO. Included within AIES-ZOO there is the creation of APIs for communication between applications, the training of AI classifiers for image sorting, the establishment of a validation process and the creation of a WEB application for quasi real time visualisation of the processed data.

The specific contribution of OBSEA to AIES-ZOO consists in the integration of the UVP6-LP sensor manufactured by Hydroptic in the OBSEA observatory. The UVP6-LP acquires images to study large particles (>100 µm) and zooplankton simultaneously in a delimited volume of water using custom illumination technology. This integration will serve for large-scale data processing and automated classification of zooplankton images. A UVP6m developed by LOV and targeting smaller targets will later be added reusing all tools developed for the UVP6-LP.

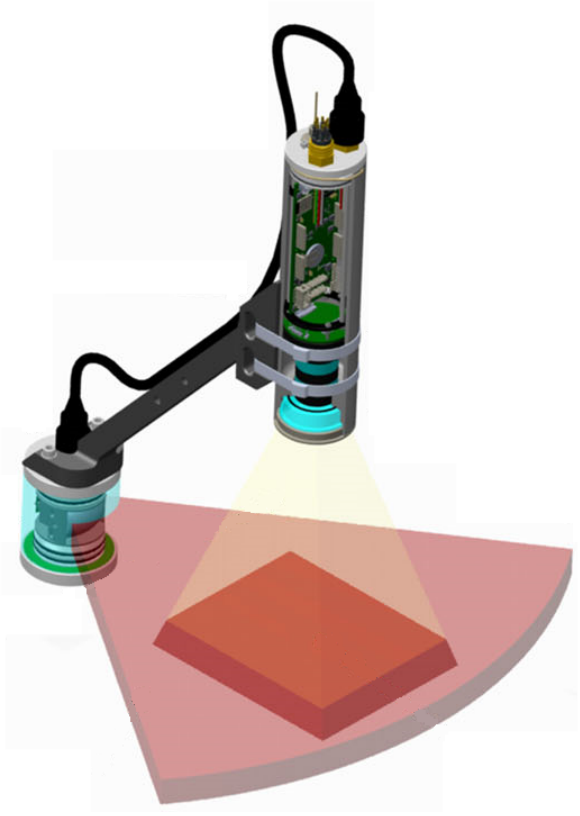

Fig 2. UVP6-LP instrument

TASK DESCRIPTION

Over the coming months, the seafloor observatory will serve as a testbed for the installation and evaluation of the AIES-PHY (Automatic Information Extraction System for PHYtoplankton images) and AIES-ZOO (Automatic Information Extraction System for ZOOplankton images) technologies. This collaborative effort involves the integration of sensors provided by Cytobuoy and the Laboratoire d'Océanographie de Villefranche. As a result, by the time of the congress, researchers will have the opportunity to present preliminary findings and insights gained from the real-world deployment of these innovative sensors at the OBSEA observatory. This pivotal phase not only demonstrates the practical applicability of the developed technologies but also signifies OBSEA's crucial role as a live testing ground for advancing marine sensing capabilities within the broader scope of ANERIS. LOV and OBSEA intend to extend the acquisition of data by the UVP6 and the UVP6m far longer than the duration of the ANERIS project in order to provide time series of the observed variables.

CONCLUSIONS

The ANERIS project has emerged not only as a beacon of collaboration but also as a catalyst for technological innovation and knowledge advancement. The collaborative efforts between diverse institutions, including OBSEA, Cytobuoy and the Laboratoire d'Océanographie de Villefranche, have played a pivotal role in fostering a collective endeavour to push the boundaries of marine research. Through ANERIS, these institutions have seamlessly integrated their expertise, resources, and technologies, resulting in the successful development of ground-breaking solutions such as the AIES-PHY and AIES-ZOO. This collaborative synergy has not only propelled the field of marine sensing forward but has also significantly contributed to the collective knowledge base of the participants. The exchange of ideas, methodologies, and insights has been instrumental in expanding our understanding of marine ecosystems. As a testament to the project's success, ANERIS stands as a model for effective cross-institutional collaboration, where shared goals have led to the creation of new technologies and a profound deepening of knowledge within the marine sciences.

ACKNOWLEDGMENTS

This work has been financially supported by the European Commission's HORIZON-INFRA-2022-TECH-01-01 under the ANERIS project (grant agreement 101094924).

REFERENCES

[1] J. Del-Rio et al., "Obsea: A Decadal Balance for a Cabled Observatory Deployment," IEEE Access, 2020.

[2] J. J. Dañobeitia et al., "Toward a Comprehensive and Integrated Strategy of the European Marine Research Infrastructures for Ocean Observations," Front. Mar. Sci., vol. 7, p. 180, 2020.

[3] "ANERIS Project," 2022. [Online]. Available: https://aneris.eu/. [Accessed: 01-Jan-2024].

[4] CytoBuoy, "CytoSub: the under water flow cytometer." [Online]. Available: https://www.cytobuoy.com/products/cytosub/. [Accessed: 01-Jan-2024].

[5] A. T. Greer et al., "High-Resolution Sampling of a Broad Marine Life Size Spectrum Reveals Differing Size- and Composition-Based Associations With Physical Oceanographic Structure," Front. Mar. Sci., vol. 7, Dec. 2020.

[6] M. Ruiz-Villarreal et al., "Novel Methodologies for Providing In Situ Data to HAB Early Warning Systems in the European Atlantic Area: The PRIMROSE Experience," Front. Mar. Sci., vol. 9, Apr. 2022.

[7] M. Picheral et al., "The Underwater Vision Profiler 6: an imaging sensor of particle size spectra and plankton, for autonomous and cabled platforms," Limnol. Oceanogr. Methods, vol. 20, no. 2, pp. 115–129, Feb. 2022.

[8] Hydroptic, "UPV6 Specs," 2024. [Online]. Available: http://www.hydroptic.com/index.php/public/Page/product_item/UVP6-LP. [Accessed: 01-Jan-2024].