DELIVERABLE 3.3.4

Proposal for improving the existing ocean stations network (IOF, UNIVPM). Based on the results of the all three activities in WP3, the most critical locations for the new ocean stations over the Adriatic regions will be examined and proposed

Let's be reSEAlient!

Project key facts

Priority:	2. Safety and resilience
Specific objective:	2.1 Improve the climate change monitoring and planning of adaptation measures tackling specific effects in the cooperation area
Acronym:	**RESPONSe**
Title:	**Strategies to adapt to climate change in Adriatic regions**
ID request:	10175714
Lead Partner:	INFORMEST
Duration:	01.01.2019 30.04.2022

Deliverable information

WP 3	Harmonization of the climate exchange analysis and monitoring systems
Act 3.3	Analysis, enhacement and integration of existing climate and oceanographic monitoring systems
Issued by:	**Partner n° 7 – IOF**
Reviewed by:	**Partner n° 3– UNIVPM**
Partners involved:	**IOF, UNIVPM, DHMZ**
Status:	Final
Distribution:	Public
Date:	04.2022.

Document history

Version	Date	Author	Description of changes
V 1.0	28.04.2022	IOF	Final version

Table of contents

1 PLANNED ACTIVITIES

1.1 Meteorological and oceanographic buoys

Thanks to the newly established METMONIC project (Modernization of the National Weather Observation Network in Croatia), it is planned to install several meteorological and oceanographic buoys, as well as several sensors to measure sea surface temperature in the Adriatic Sea (Figure 1). By establishing these measurements, the necessary data for initialization and control of the meteorological-oceanographic forecast system for the needs of early warning of hazardous weather conditions will be provided. This component will also contribute to the development of an adaptation system to the expected climate change as well as the protection of marine ecosystems.

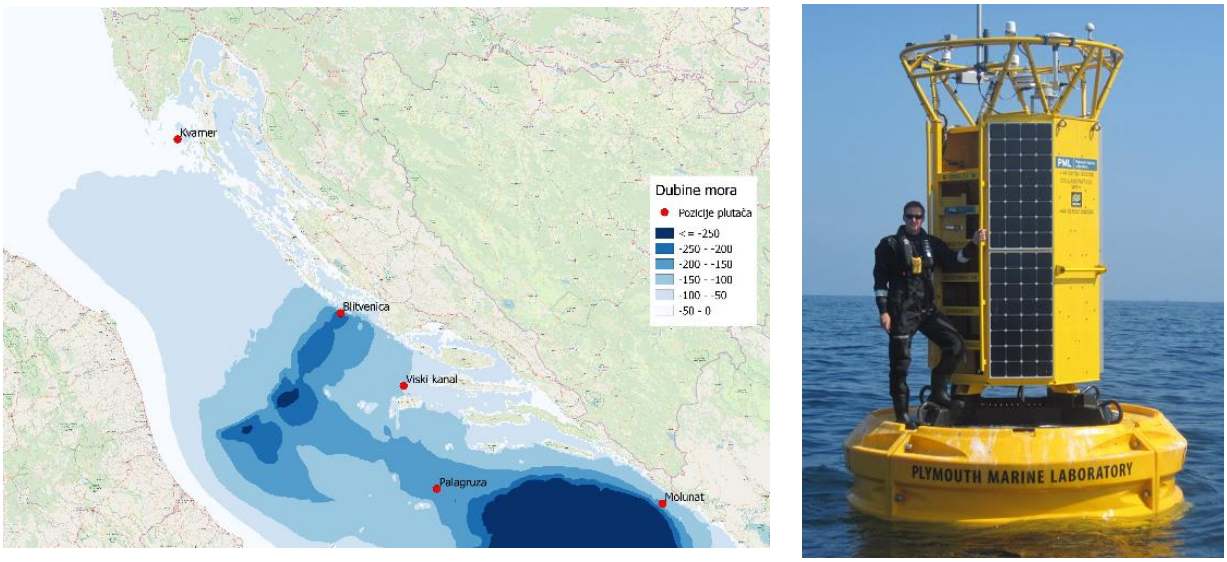

Figure 1. Locations of the meteorological-oceanographic buoys (source: METMONIC project; Croatian Meteorological and Hydrological Service).

In addition to meteorological parameters, sea temperature, salinity and oxygen will be measured at standard oceanographic depths. The direction and speed of the currents will also be measured.

1.2 Establishment of new measurements in the river Nertva witihin the Interreg project AdriaClim

As part of the AdriaClim project funded by the Interreg program, a Meteo-oceanographic station will be set up in the Neretva River, as well as five autonomous sensors for measuring temperature, salinity and oxygen to monitor saltwater intrusions into the river (Figure 2). Measuring the intrusion of a seawater wedge in the Neretva area, together with the results of the climate model, will allow the assessment of salinization risk in a future climate. This is a good basis for critically evaluating existing climate change adaptation plans and proposing additional measures. Slano bay is an embayment under elevated anthropogenic pressure within an otherwise oligotrophic karstic coastline. This pilot activity will record oceanographic and ecological parameters to assess the climate change related threat scenarios for the embayment and to elaborate an integrative adaptation plan for the location.

Measures will contain:
- improving knowledge of possible intrusion scenarios
- warning of possible adverse events based on meteorological forecast
- proposal for adaptation measures
- a comparison of climate change impact predictions and results along the north south gradient included in this project will result in a sound prognosis and case study report.

Figure 2. Planned locations for autuonomus sensors (rgange dot) and Meteo – ocean station (green) in the river Neretva

1.3 New multiparameter oceanographic probe for vertical measrements

As part of the RESPONSe project, a valuable multi-parameter CTD probe has been acquired that will significantly improve instrumentation at the Physical oceanography laboratory of the Institute of Oceanography and Fisheries in Split. This sophisticated instrument measures the vertical structure of seawater temperature and salinity and dissolved oxygen "in situ" by being lowered from a ship at the position of an oceanographic station (Figure 3).

In this way, we are continuing the long-standing series of high-precision measurements of temperature and salinity, the classic measurements of which began in the Adriatic Sea in the 1950s and are still being carried out continuously today. In an era of climate change and environmental extremes, the accuracy and precision of measurements is a prerequisite for obtaining a better picture of the marine ecosystem. The probe provides high accuracy and resolution, reliability and ease of measurement for a wide range of scientific research, monitoring and engineering interventions. It is possible to lower the probe to a depth of 2000 m, so you can reach the deepest parts of the Adriatic Sea. Due to the peculiarities of measuring geophysical properties of the environment, oceanographic gauges are extremely accurate and precise, measuring "by immersion in the sample" (instead of isolating it), with physical parameters, mostly chemical and sometimes biological, depending on the complexity of the gauge and built-in sensors. In the mid-1990s, classical measurements with Niskin pumps at standard oceanographic depths were replaced by sophisticated methods for measuring temperature and salinity. CTD probes were acquired that provided insight into the entire vertical structure of the water column.

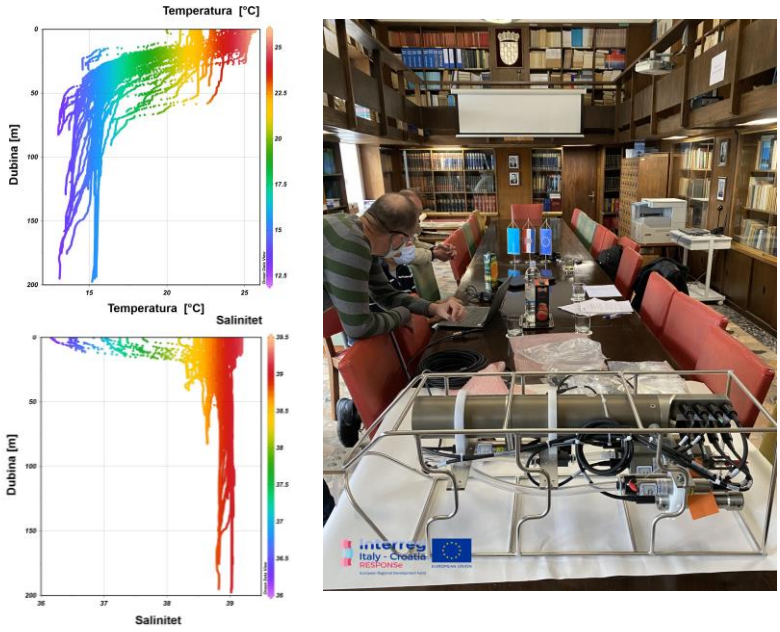

Figure 3. SBE 25plus CTD probe and measurements graphically presented

2 PROPOSAL FOR IMPROVEMENTS

Based on the above plans for installing new stations, it is clear that measurements in the Adriatic sea will be significantly improved in the near future.
However, what would be useful is to improve the measurements of the vertical profiles with CTD instruments.
In order to create a complete picture of the process of upwelling and sinking of water masses in the central Adriatic, more precisely in the wider waters of the islands of Jabuka and Blitvenica, which are a significant process due to the transfer of nutrients in the sea, a cooperation was established between the Faculty of science, Department of Geophysics (University of Zagreb), Croatian Meteorological and Hydrological service and Institute of Oceanography and Fisheries.
The collaboration was realized within the project MAUD (Middle Adriatic Upwelling and Downwelling), funded by the Croatian Science Foundation.
Among other empirical studies and numerical modeling, intensive measurements of hydrographic properties with high spatial resolution were carried out from the surface to a depth of 50 meters using a Department of Geophysics owned undulator upgraded with an IOF-owned CTD probe. Thanks to such a device, it is possible to record the basic properties of the sea in a relatively large area with a much better spatial resolution (about 200 m) than with the classical method (typically 2 km and more) (Figure 4). Therefore, it is possible to study structures in the ocean such as fronts, eddies, and river discharges that can be missed or only hinted at by the classical method.
Due to the significant advantages of this measurement method and the fact that the Institute of Oceanography and Fisheries and the Faculty of science Zagreb have gained experience in organizing and conducting such very useful measurements through previous collaboration, we propose to conduct measurements of this type more frequently.

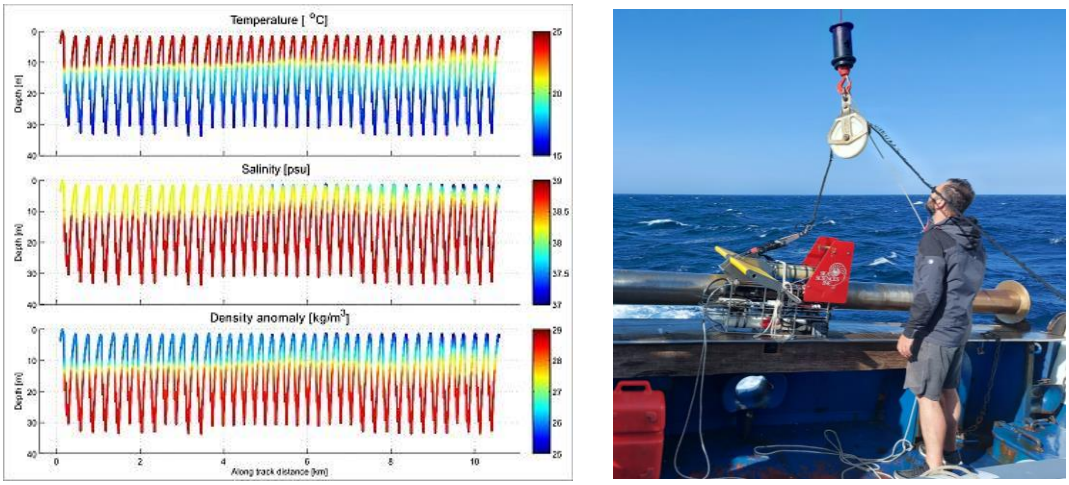

Figure 4. SBE 25 probe connected with undulator and measurements graphically presented.

LITERATURE:

- Interreg AdriaClim Application form
- Webpage: https://www.pmf.unizg.hr/geof/znanost/oceanografija/maud/o_projektu
- (Accesed on 30. April 2022.)
- Webpage: https://www.pmf.unizg.hr/oldwww/geof/znanost/oceanografija/undulator (Accesed on 30. April 2022.)