

Network of small buoys tested and data recorded

Final version June 2023
Deliverable number 5.4.2.

Project Acronym	STREAM
Project ID Number	10249186
Project Title	Strategic Development of Flood Management
Priority Axis	2 – Safety and Resilience
Specific objective	2.2 – Increase the safety of the Programme area from natural and man-made disaster
Work Package	Number 5
Work Package Title	Pilot projects
Activity Number	5.4
Activity Title	Venezia Pilot Site
Partner in Charge	LP
Partners involved	City of Venice
Authors	Cristian Tommasi*, Raffaele Olmi* (*ETG srl – contracted company), Marco Favaro**, Alvise Papa** (**Centro Previsione e Segnalazione Maree - City of Venice)
Status	Final
Distribution	Public

Table of contents

Introduction	4
CHAPTER 1 - Analysis before installation	5
CHAPTER 2 - Verification and testing.....	6
CHAPTER 3 - Installation	7
CHAPTER 4 - Data transmission, acquisition, display and management methods.....	11
Conclusion.....	13

Introduction

This action involves in the installation of two oceanographic buoys (Cavallino and Malamocco) that can measure in real time weather and marine parameters as, for example, wind speed and direction, sea currents, etc. The two buoys were also equipped with an intelligent anchoring system attached to one dead body, formed by connecting cable that can measure water temperature in intermediate point. Data acquired from the buoys and smart anchor system, then, are sent through satellite modem, either to the manufacturer's platform and to a specialized module made by contracted company (ETG) and integrated into the reused and open-source platform called WinNET7.

CHAPTER 1 - Analysis before installation

During the design phase, it was defined how to create the mooring system. It was decided that it should have a substantially neutral weight in water and allow the buoy freedom of movement with waves up to 20 meters high and currents up to 2 meters per second. We thought about how to make the joints between the various cables using metal parts of the same material to avoid the onset of corrosion phenomena. We have considered an adequate radius of movement of the buoy around the dead body to guarantee maintenance of the position identified for installation with the sea conditions indicated above. Considering the site we hypothesized that the maximum depth of the dead body could be between - 10 and -15m.

Below is a significant image of the type of anchoring required.

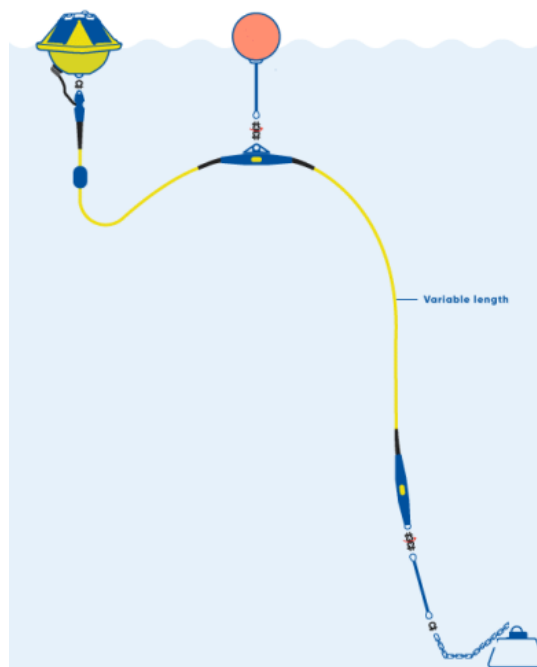


Fig 1 Type of anchoring

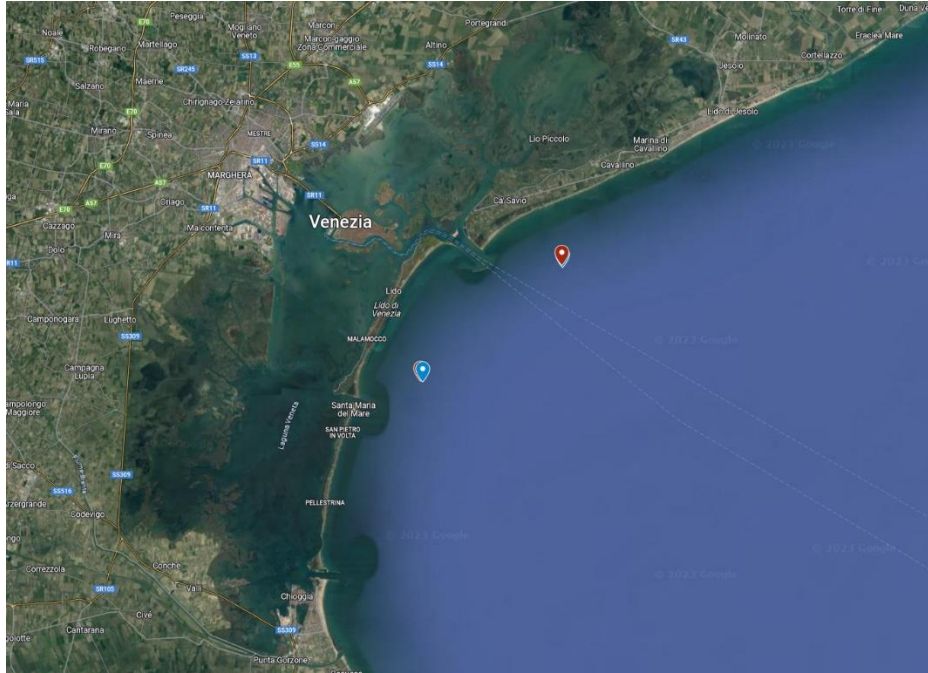


Fig 2 Installation sites

CHAPTER 2 - Verification and testing

The instrumentation was checked and tested by the appointed company before commissioning. Below are some significant photos.

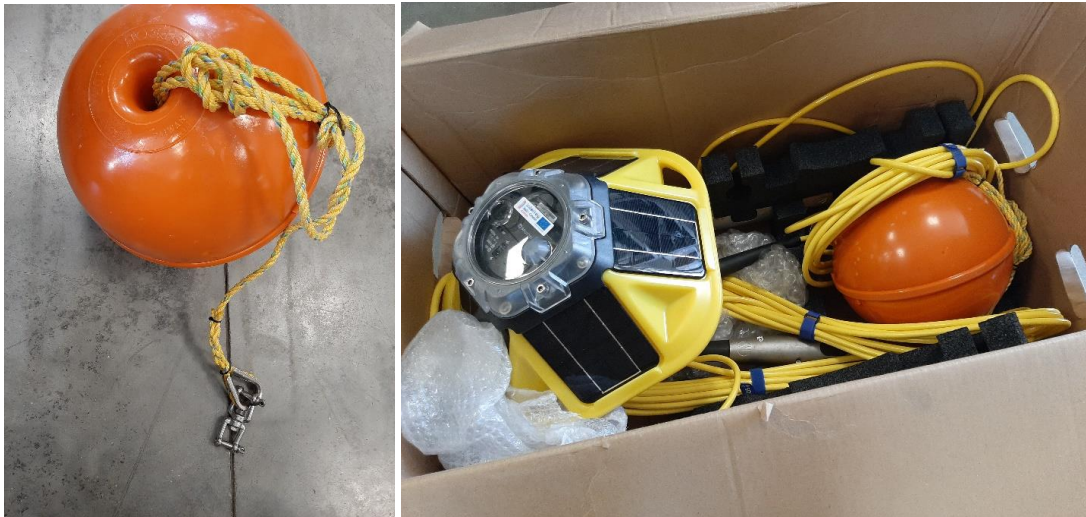


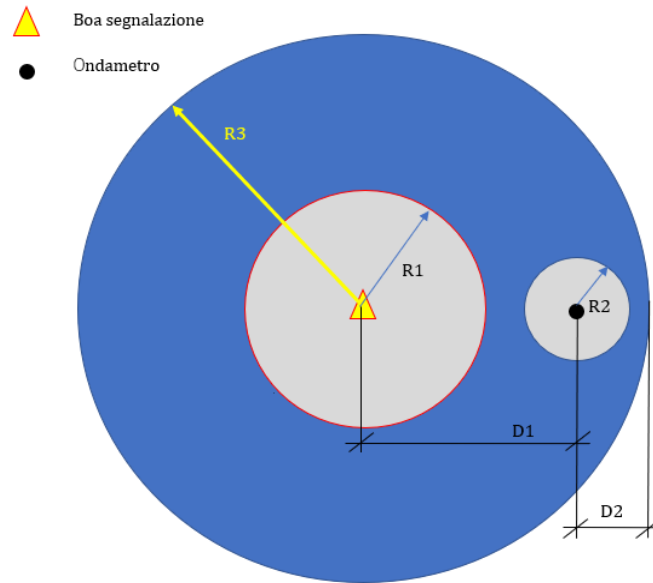


Fig 3 Testing

The junctions between the cables were checked and a functional test of the instrumentation was carried out with verification of data transmission.

CHAPTER 3 - Installation

With reference to the nautical chart (provided by the customer), the wave buoys (wave meters) were positioned in the vicinity of signal buoys already present and owned by the Veritas SpA company (owned by the Municipality), and precisely in the area between the R1 radius and R3 in the figure below.



Dove: $R1=60m$, $R2=25m$, $D1=130m$, $D2=70m$, $R3=D1+D2=200m$

Fig 4 Positions for installation of new buoys

Existing Veritas buoys are positioned at the following coordinates:

MALAMOCCO BOA LIDO - ALBERONI: North $45^{\circ} 20.783''$ East $12^{\circ} 23.042''$

CAVALLINO TREPORTI: North $45^{\circ} 24.841''$ East $12^{\circ} 30.119''$

Hypothesized buoy installation coordinates:

MALAMOCCO BOA LIDO – ALBERONI $45.34679, 12.38248$

CAVALLINO TREPORTI $45.41511, 12.50138$

Actual buoy installation coordinates (installed on 6/16/2022):

MALAMOCCO BOA LIDO - ALBERONI (ref. S/N SPOT-1671): $45.34650^{\circ}N 12.38176^{\circ}E$

CAVALLINO TREPORTI: (ref. S/N SPOT-1674): $45.41512^{\circ}N 12.50282^{\circ}E$

In both sites a 25m total length anchor cable was installed at a bathymetric depth of approximately -13m. For dead weight we installed a dead weight of 60Kg in water.

Below are some photos of the installation where you can see the dead body, the wavemeter, the wavemeter installed together with the mooring buoy and the Veritas buoy.

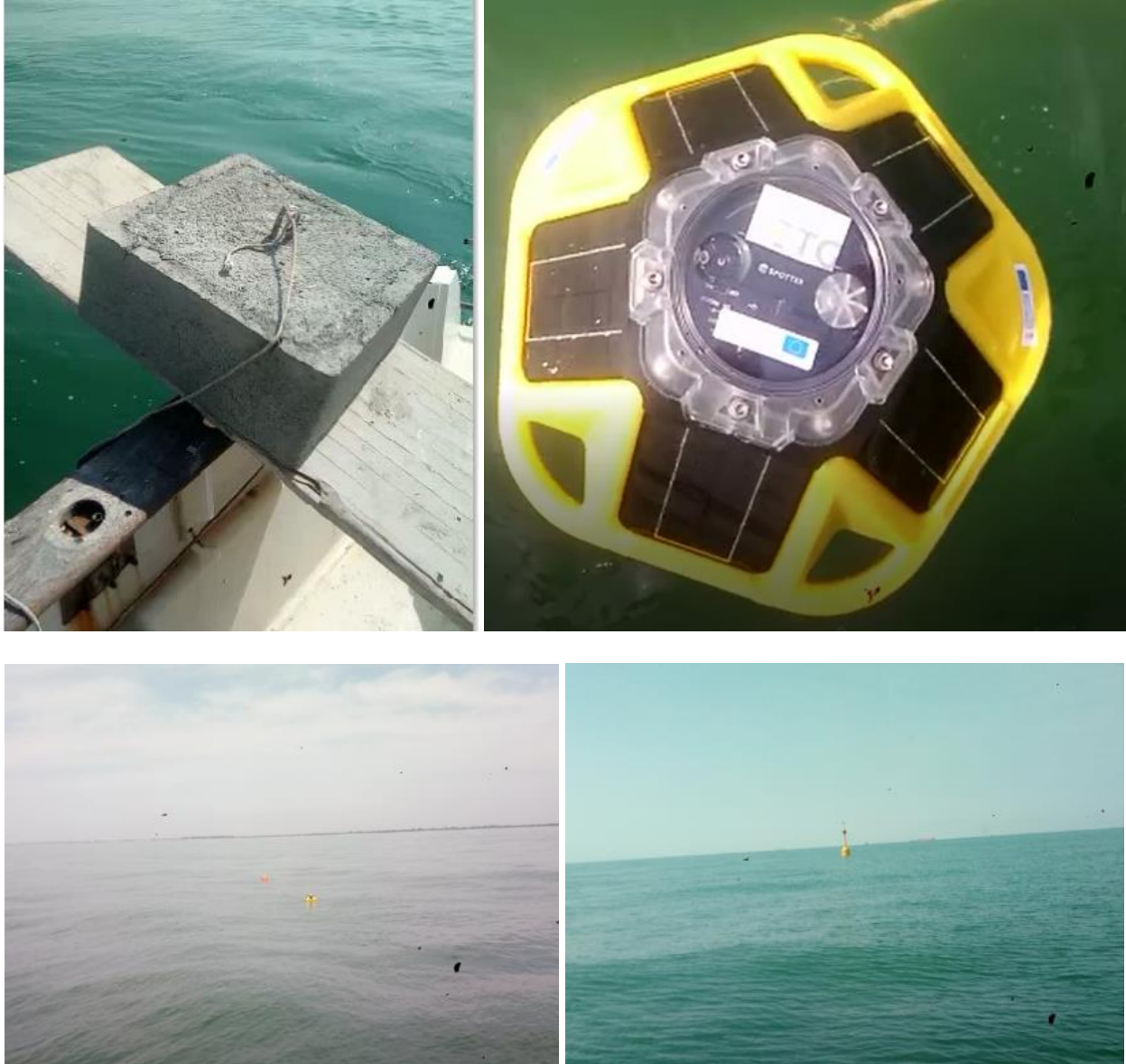


Fig 5 Buoy Cavallino

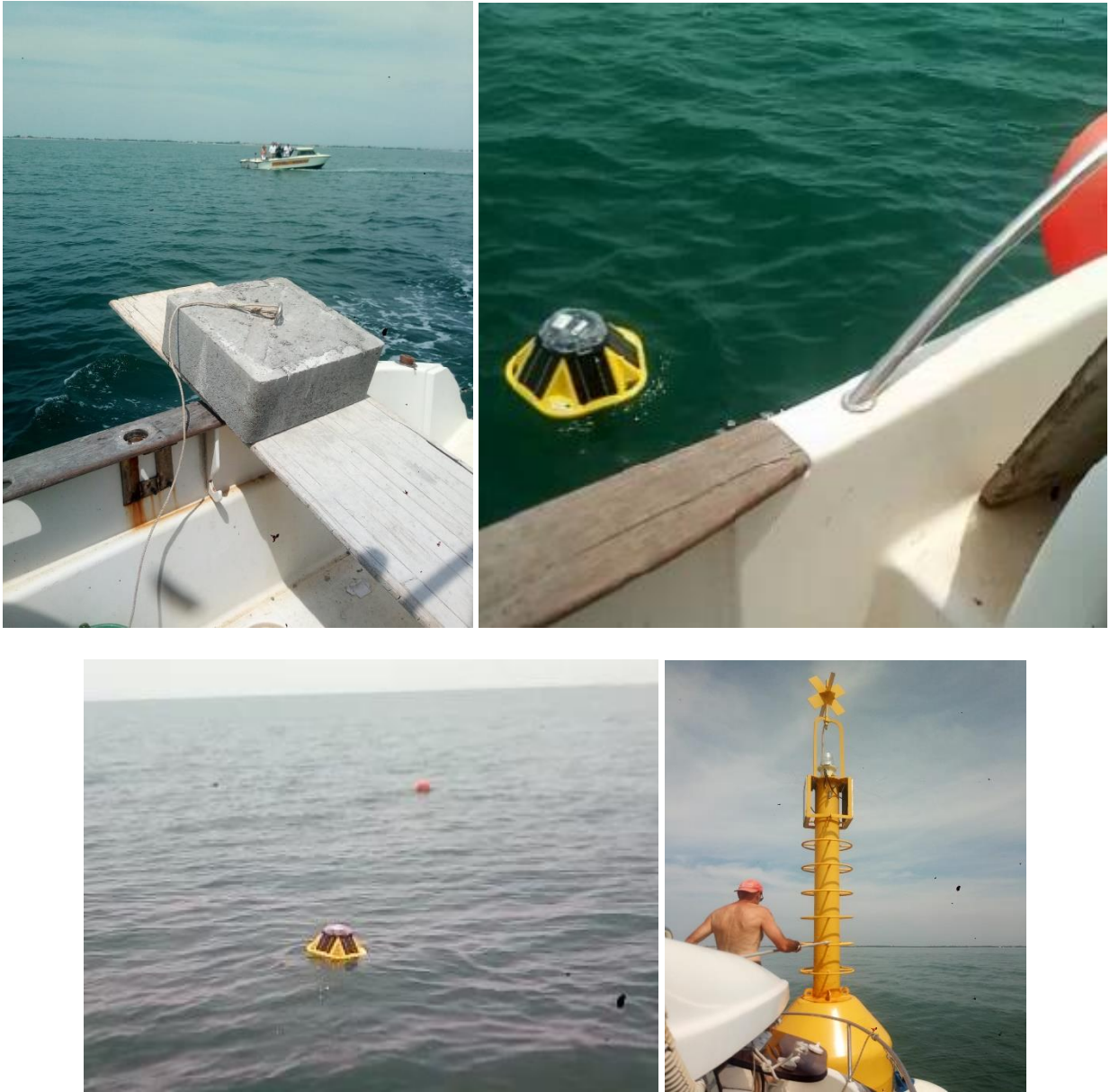


Fig 6 Buoy Malamocco




CHAPTER 4 - Data transmission, acquisition, display and management methods

Each buoy is equipped with an Iridium SBD satellite modem capable of guaranteeing access to data from the field in real time. The data is shared through the Boa dashboard and through the relevant software module integrated into WinNET7. The data will then be stored on the database used by the WinNET7 platform for other network data.

For further details, please consult the manual and the product datasheet (see attachments).

Data Outputs

* Can derive from SD card data.

	 Standard mode	 Spectrum mode	 On device
Significant wave height	x	x	x*
Peak period	x	x	x*
Mean period	x	x	x*
Peak direction	x	x	x*
Mean direction	x	x	x*
Peak directional spread	x	x	x*
Mean directional spread	x	x	x*
Variance density spectrum		x	x
Directional moments (a1, b1, a2, b2)		x	x
3D displacement time series @ 2.5 Hz (x,y,z)			x
Sea surface temperature	<i>Not available with Smart Mooring units.</i>		
Wind speed	x	x	
Wind direction	x	x	x*
Drift speed			x*
Drift direction			x*
Geographical coordinates (lat, lon)	x	x	x*

Below, two platforms that are currently used are presented, with which to view the data and the positioning of the buoys over time.

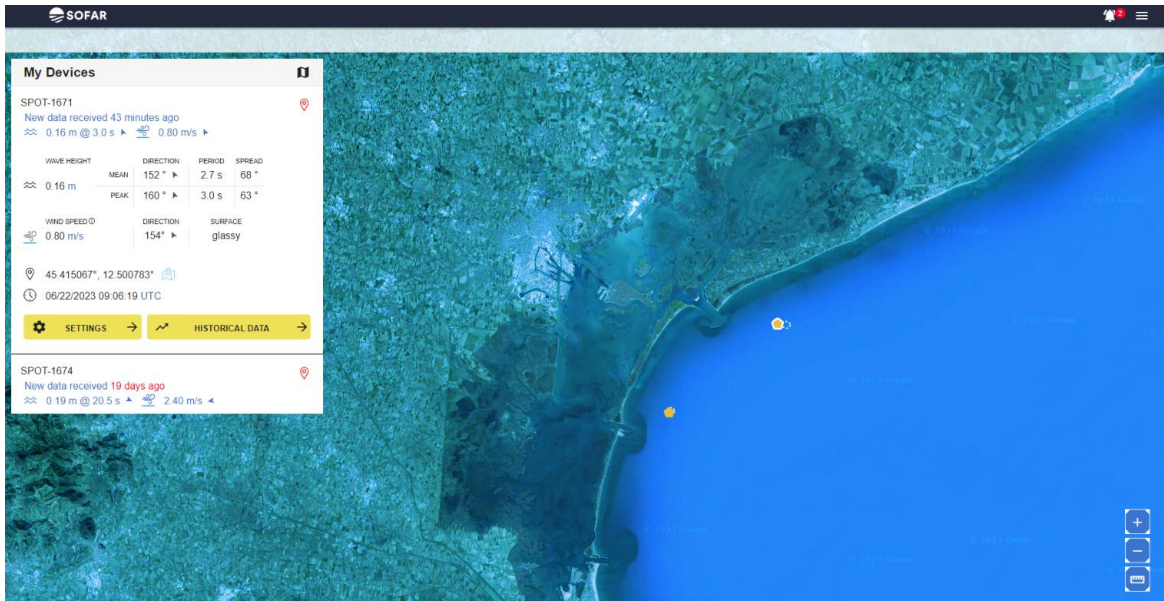


Fig 6 SOFAR platform

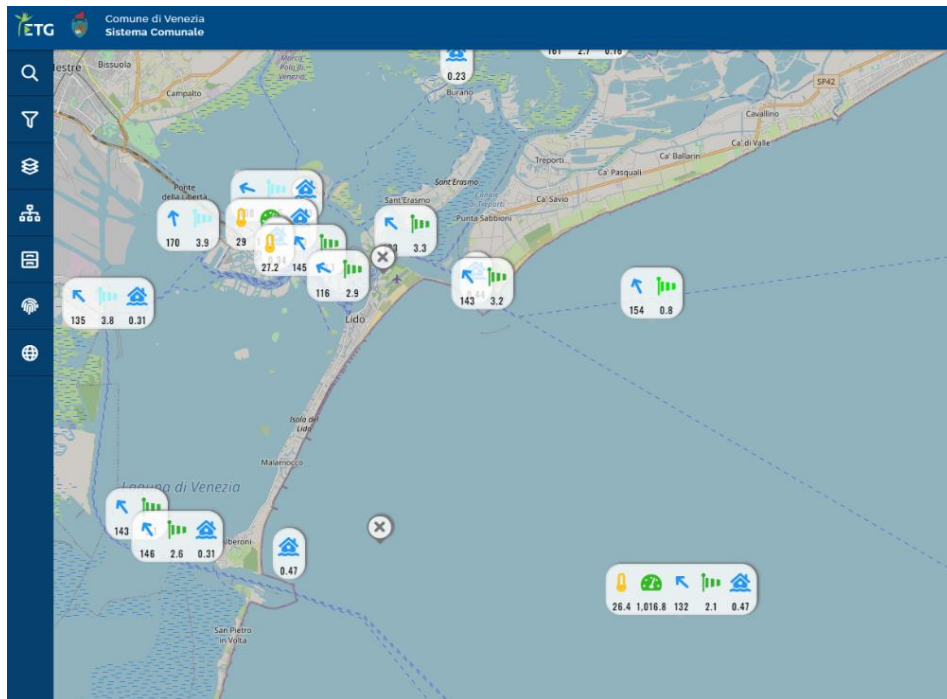


Fig 7 BOE WinNET7 module

Conclusion

With these platforms, it will be possible not only see the buoys condition and relative data, but also GPS position, useful to understand in every time the position of each buoy. The action, include also the maintenance activity and the hosting of satellite fee, important for data transmission.