



Understanding the biogeochemical buffering
capacity of estuaries relative to climate change and
anthropogenic inputs

Report 2

Installation of the water quality online monitoring station in the Ria Formosa



Partners



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Abstract

This report describes the design and installation of the water quality online monitoring station in the Ria Formosa. This station is equipped with an YSI EXO 2 multiparameter probe, which measures water temperature, conductivity, pH, dissolved oxygen, turbidity and chlorophyll *a*, and an OBSERMET OMC-045-III data logger, for data acquisition and transmission. This monitoring station is under operation since May 26, 2017.

Keywords: Online data acquisition and transmission, Chlorophyll *a*, Turbidity, pH, Dissolved oxygen, Conductivity, Water temperature

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1. Introduction

This report describes the design and installation of the water quality online monitoring station in the Ria Formosa, which was installed by the Laboratório Nacional de Engenharia Civil (LNEC) and the Universidade do Algarve within the scope of the project UBEST - Understanding the biogeochemical buffering capacity of estuaries relative to climate change and anthropogenic inputs (PTDC/AAG-MAA/6899/2014). This project aims at improving the global understanding of the biogeochemical buffering capacity of estuaries and its susceptibility to future scenarios of anthropogenic inputs and climate change, to effectively support the short and long-term management of these systems. UBEST scientific goals will be achieved by the deployment of “observatories” in two Portuguese case studies: the Tagus estuary and the Ria Formosa, a coastal lagoon.

The water quality online monitoring station is one of the components of the Ria Formosa observatory and was installed on May 2017. This report describes the design and installation of that monitoring station and the procedures relative to its verification and maintenance.

The structure of the report reflects the contents mentioned above. The design and installation of the monitoring station are described in Chapter 2. Some final considerations are presented in Chapter 3.

2. Design and installation of the monitoring station

2.1 Location

The water quality monitoring station is located in the Ria Formosa (South coast of Portugal) in the Cais do Combustível of the Port of Faro (37°00'9.92" N, 7°55'16.28" W; Figure 2.1), which is an old and disabled fuel dock under the administration of the APS - Ports of Sines and the Algarve Authority.

The Cais do Combustível is located in one of the main channels of the western sector of the Ria Formosa, the Faro channel. Since about 90% of the water volume is exchanged in the western sector of the lagoon (Pacheco *et al.*, 2010), this location was selected aiming to be representative of the water quality in one of the main channels of the Ria Formosa. The selection of this site took also into consideration other criteria, namely access to essential infrastructures (e.g., GSM/GPRS connectivity), ability to obtain permission to install the equipment and protection from vandalism (Caradot, 2012).

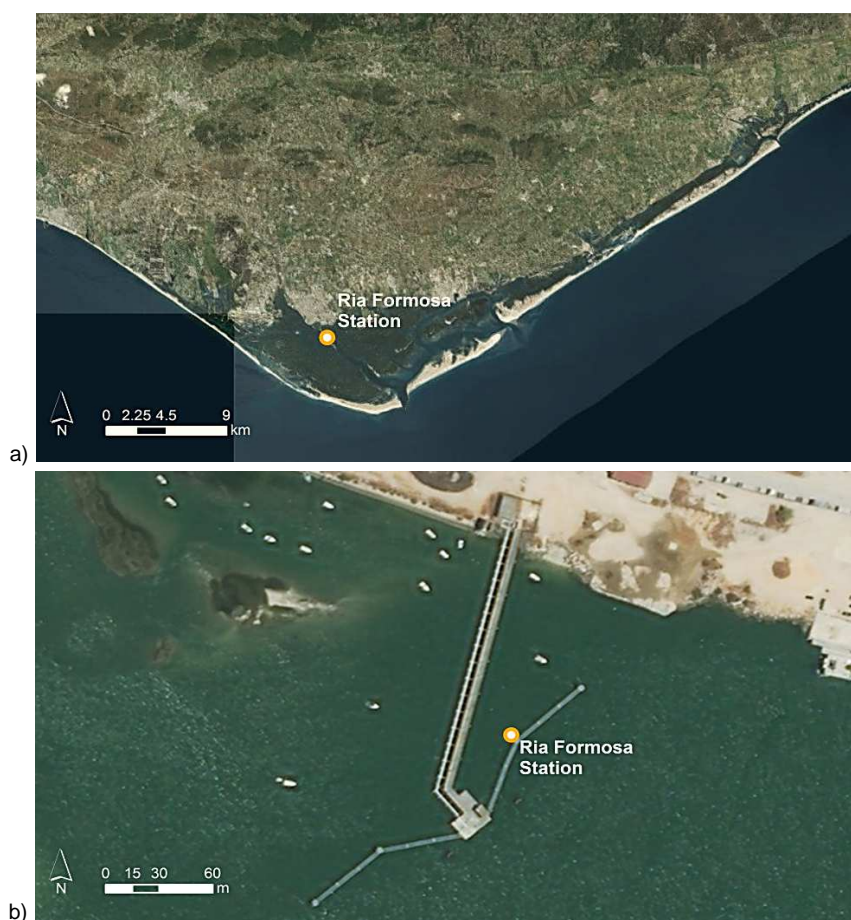


Figure 2.1. Location of the water quality online monitoring station in the Ria Formosa: general (a) and detailed (b) views. Background image from ESRI basemap

2.2 Equipment and supporting structures

The water quality online monitoring station is equipped with an YSI EXO 2 multiparameter probe (Figure 2.2). This probe includes sensors to measure water temperature, conductivity, pH, dissolved oxygen, turbidity and chlorophyll *a*. The probe is also equipped with copper-alloy sensor guard and an anti-fouling wiper to reduce the biofouling in the sensors.

Data acquisition and transmission is performed using an OBSERMET OMC-045-III data logger (Figure 2.3), which includes a GSM/GPRS modem. Data is transferred through the internet, from the remote site to LNEC's premises, using the FTP protocol. The transmission procedure happens each hour, producing a new csv formatted file encompassing the data sampled/acquired in that period.

The probe is supported and protected by a PVC tube, while the data logger is protected by an environmental shelter (Figure 2.3, Figure 2.4, Figure 2.5). The power supply to the operation of the mutiparameter probe and of the data logger is provided by solar panels (Figure 2.4, Figure 2.5).



Figure 2.2. YSI EXO2 multiparameter probe.

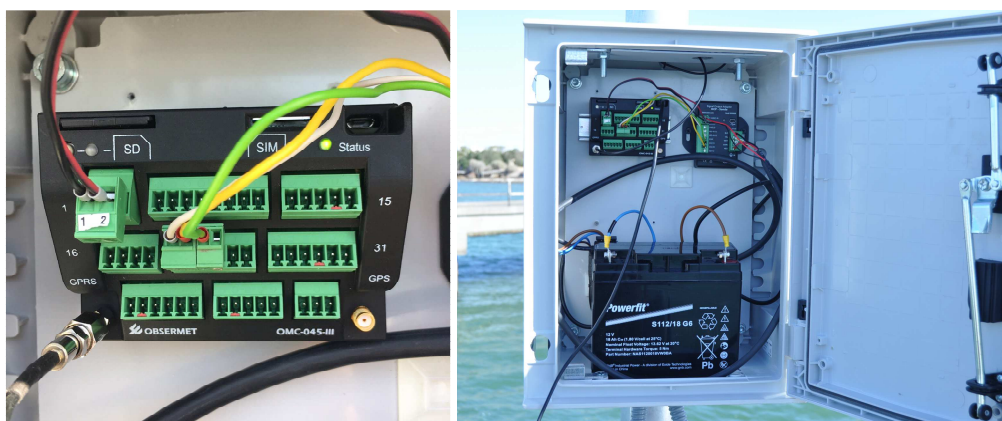


Figure 2.3. OBSERMET OMC-045-III data logger and environmental shelter.

The multiparameter probe is under operation since May 26, 2017, while the online data transmission system is under operation since June 29, 2017. Data are measured continuously at the monitoring station with 15 minutes intervals. Measured data, transmitted hourly, is stored in a data repository developed for the UBEST project, and will be accessible in the web platform.

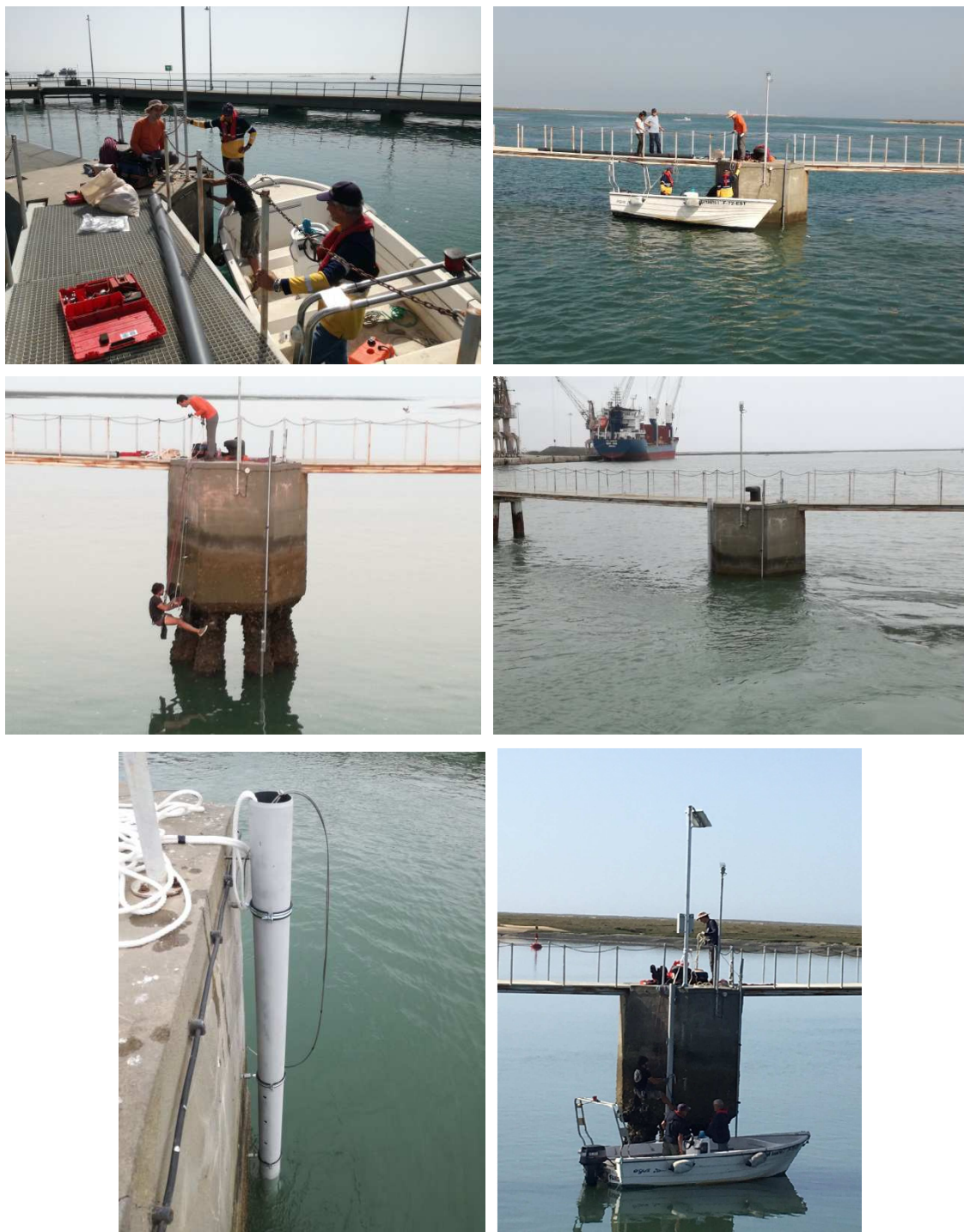


Figure 2.4. Installation of the online monitoring station: May 25 and 26, and June 23.

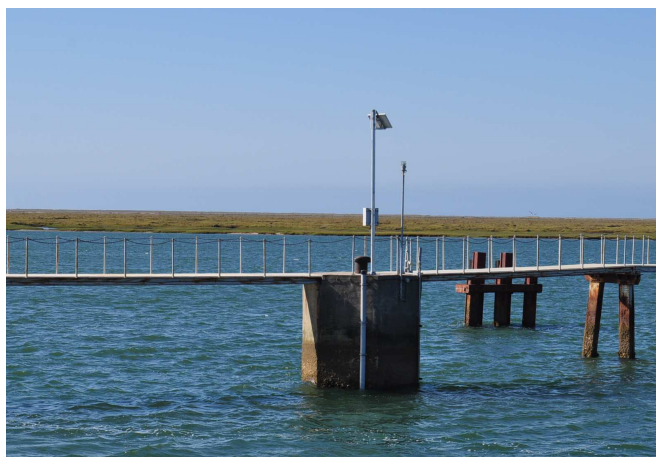


Figure 2.5. General overview of the Ria Formosa monitoring station.

2.3 Verification and maintenance

Maintenance procedures were established and implemented to guarantee the continuous acquisition of the data, the safety of the multiparameter probe and the quality of the data. At the Ria Formosa station, these procedures are performed by the members of UAIG's team with the support of APS - Port of Faro, which provides the access to the place where the probe is installed, as shown in Figure 2.3.

Two levels of maintenance procedures are considered:

- Periodic cleaning, verification and inspection – procedures of visual inspection and manual cleaning of the probe, verification and/or calibration of sensors. These procedures are performed with a periodicity of one to two weeks during the first two months of operation of the probes to ensure the quality of the acquired data. After this period it is expected that these procedures will be performed with the periodicity of one month. For safety reasons at least two technicians are required;
- Out-of-schedule inspection – supplementary procedures for inspecting the probe may be undertaken when needed (e.g., lack of communication from the probe, observation of out of the range measurements).

During the first month of operation of the probe five maintenance visits were performed on June 2017, on the following days: 7, 13, 20, 23 and 29 (e.g. Figure 2.6). During these visits, the visual inspection of the probes and supporting structures was performed. Measured conductivity, pH and turbidity were verified using several calibration solutions. Conductivity was calibrated against a standard solution (1-point) of 50000 $\mu\text{S}/\text{cm}$, pH by 3 different standard solutions (3-point calibration: pH 4, 7, 10) and turbidity by 2 standard solutions (2-point calibration): distilled water (0 NTU) and 12.7 NTU. Dissolved oxygen was calibrated at 100% air saturation every each visit (1-point calibration). Chlorophyll a was calibrated during the first day of deployment, at 1-point (0 $\mu\text{g}/\text{L}$) based on distilled water, while on the June 23 a 2-point calibration was performed using distilled water (0 $\mu\text{g}/\text{L}$) and the results of a

laboratorial analysis of *in situ* water sample collection. The results of calibrations, as expected, suggest a good performance of the sensors.



Figure 2.6. Periodic maintenance and verification procedures.

3. Final considerations

In the scope of the FCT UBEST project an online monitoring station was installed and is under operation in the Ria Formosa, in the Faro channel, since May 2017.

The Ria Formosa station is equipped with an YSI EXO2 multiparameter probe, which measures water temperature, conductivity, pH, dissolved oxygen, turbidity and chlorophyll a, and an OBSERMET OMC-045-III data logger, for data acquisition and transmission.

During the first month of operation of this monitoring station the maintenance and verification procedures implemented suggest that the water quality probe is performing well, within the expected, although some further verification tests are still ongoing to evaluate the quality of the measured data and the data transmission procedures.

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