



LABORATÓRIO NACIONAL
DE ENGENHARIA CIVIL

ONLINE MONITORING IN THE TAGUS ESTUARY: PARQUE DAS NAÇÕES STATION

**Installation and operation between January 2016
and February 2017**



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

BINGO: Bringing innovation to ongoing water management – a better future under climate change

Lisbon • March 2017

R&D HYDRAULICS AND ENVIRONMENT

REPORT 131/2017 – **DHA/NEC**

The UBEST project (PTDC/AAG-MAA/6899/2014) has received funding from the Fundação para a Ciência e a Tecnologia.

FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

The BINGO project has received funding from the European Union's Horizon 2020 Research and Innovation programme, under the Grant Agreement number 641739.



Title

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Installation and operation between January 2016 and February 2017

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Report 131/2017

File no. 0604/111/19764, 0602/111/1976401, 0604/111/1911001, 0602/111/1911003

ONLINE MONITORING IN THE TAGUS ESTUARY: PARQUE DAS NAÇÕES STATION

Installation and operation between January 2016 and February 2017

Abstract

This report describes the design and installation of the Parque das Nações online monitoring station and the procedures relative to its maintenance and data verification undertaken between January 2016 and February 2017. This station is equipped with a SEBA MPS D3 multiparameter probe, which measures water levels, conductivity and water temperature, and a SEBA Slimcom2 data logger, for data acquisition and transmission. The data acquired during the period to which this report refers are also briefly presented. This monitoring station is under operation in the scope of the projects H2020 BINGO and FCT UBEST.

Keywords: Tagus estuary / Monitoring / Water levels / Conductivity / Temperature

MONITORIZAÇÃO EM TEMPO REAL NO ESTUÁRIO DO TEJO: ESTAÇÃO DO PARQUE DAS NAÇÕES

Instalação e operação entre janeiro de 2016 e fevereiro de 2017

Resumo

Este relatório descreve a conceção e instalação da estação de monitorização em tempo real do Parque das Nações e os procedimentos relacionados com a sua manutenção e verificação dos dados no período compreendido entre janeiro de 2016 e fevereiro de 2017. Esta estação está equipada com uma sonda multiparamétrica SEBA MPS D3, que permite a medição de níveis, condutividade e temperatura, e um *data logger* SEBA Slimcom2 para a aquisição e transmissão dos dados. Os dados adquiridos no período a que este relatório reporta são também apresentados sumariamente. Esta estação de monitorização encontra-se em operação no âmbito dos projetos H2020 BINGO e FCT UBEST.

Palavras-chave: Estuário do Tejo / Monitorização / Níveis / Condutividade / Temperatura

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1 | Introduction

An online monitoring station was installed in the upstream area of the Tagus estuary and is under operation in the scope of the projects BINGO - Bringing innovation to ongoing water management – a better future under climate change (Horizon 2020 Research and Innovation Programme, Grant Agreement number 641739) and UBEST – Understanding the biogeochemical buffering capacity of estuaries in a context of climate change and anthropogenic inputs (Fundação para a Ciência e Tecnologia, PTDC/AAG-MAA/6899/2014).

This monitoring station was installed in the Marina Parque das Nações in January 2016. This report describes the design and installation of that monitoring station and the procedures relative to its maintenance and data verification undertaken between January 2016 and February 2017. The data acquired during this period are also briefly presented.

The structure of the report reflects the contents mentioned above. The design and installation of the monitoring station are described in Chapter 2, while the operation procedures in the period to which this report refers are presented in Chapter 3. The main conclusions are presented in Chapter 4.

2 | Design and installation of the monitoring station

2.1 Location, equipment and installation

The Parque das Nações monitoring station is located in the Tagus estuary in the Marina Parque das Nações ($38^{\circ}45'15.27''$ N, $9^{\circ}05'34.17''$ W; Figure 2.1). This monitoring station is equipped with a SEBA MPS D3 multiparameter probe, which measures water levels, conductivity and water temperature, and a SEBA Slimcom2 data logger, for data acquisition and transmission (Figure 2.2). The probe and the data logger are supported and protected by a PVC tube, which is located near the gates of the marina (Figure 2.3).

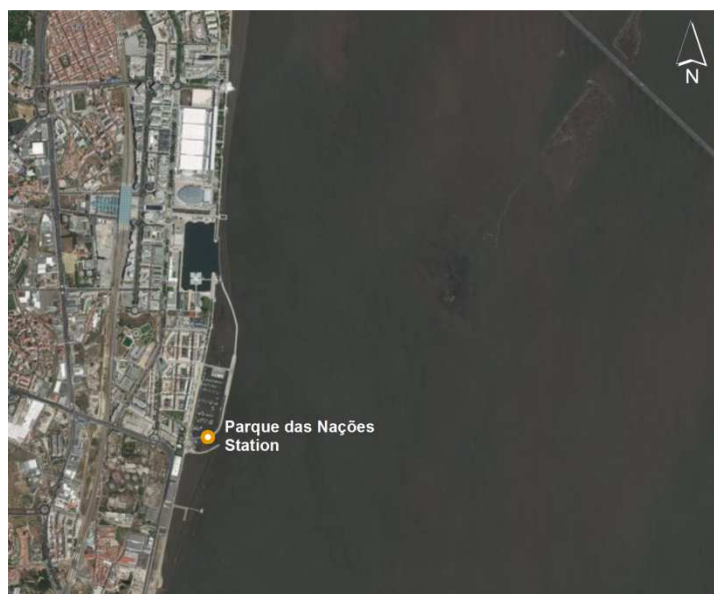


Figure 2.1 – Location of the Parque das Nações monitoring station in the Tagus estuary. Background image from ESRI basemap

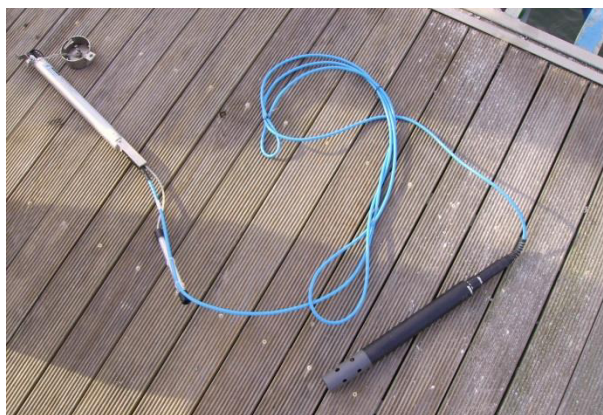


Figure 2.2 – SEBA MPS D3 multiparameter probe and SEBA Slimcom2 data logger



Figure 2.3 – Installation of the probe in the Marina Parque das Nações

This station is in operation since January 14, 2016. Data are measured continuously at the monitoring station with 10 minutes intervals. Measured data are transmitted once a day to LNEC and stored in databases. Data can then be accessed online through Web platforms developed by LNEC (e.g. <http://ariel.lnec.pt/realqual> or <http://ariel.lnec.pt/molines>).

2.2 Data transmission

Data transmission is accomplished using GSM/CSD technology, the predecessor of the GSM/GPRS. Systems employing such technology to communicate create a direct transmission channel between two end points, instead of using the internet as a networking medium. This technology implies the use of GSM/CSD modems on both the probe and a server at LNEC, which use phone numbers as the addressing method, instead of the IP protocol used by the internet and most computer networks nowadays. Since this technology is rarely used outside of very specific systems, mostly on legacy or older ones, it can be difficult to implement and sometimes expensive. In particular, it requires the support of mobile operators, usually not available by default, it depends on ancient modem hardware, hard to get and operate, and it can be very slow, which in this case is not a limitation. Though there are also some upsides. Since this technology is not directly accessible through the internet it is relatively secure.

Specific software is used to assist the data transmission process. The software suite provided by SEBA, specifically the DEMASole Server v1.50.0000 (18.09.2014) is used to schedule the daily transmission of data at a defined period, and the DEMASole Config (same version as the server) is used to manage some aspects of the server.

2.3 Vertical georeferencing

To verify the vertical reference of the water levels measured by the probe a precision topographic measurement of a reference point at the dock and of the water surface was performed, respectively, on February 22, 2016 and February 20, 2017 (Figure 2.4). The measurements were carried out with a DGPS - Differential Global Positioning System (TOPCON, model Hiper Pro) in post-processing mode in the first survey and in real-time kinematic (RTK) in the second. The DGPS consists of two receivers, one in a fixed position (base) and a rover, the data logger and the undercarriages of the base and the rover. The comparison between the water levels measured with the DGPS and with the multiparameter probe on February 20, 2017 is presented in Table 2.1. Results suggest that no calibration is required regarding the vertical reference of water levels measured by the multiparameter probe.



Figure 2.4 – Aspect of the DGPS base during the topographic measurements on February 20, 2017

Table 2.1 – Comparison between the water levels measured with the DGPS and with the multiparameter probe

Topography at the dock (m, ZH)		Water Level (m, ZH)	
Reference ¹	DGPS	Probe	DGPS
5.80	5.97	2.65	2.65
			2.66
			2.66

¹ Value provided by the Marina Parque das Nações

2.4 Maintenance

Maintenance procedures were established and implemented to guarantee the continuous acquisition of the data, the safety of the probe and the quality of the data. These procedures are performed with the support of technicians of the marina, which provide the access by boat to the place where the probe is installed. Two levels of maintenance procedures are considered:

- Periodic cleaning, inspection and batteries replacement – procedures of visual inspection and manual cleaning of the probe, and replacement of the batteries. These procedures are performed with a periodicity of about one to two months, whenever the batteries charge falls below 3.4 V. 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).

3 | Operation and maintenance between January 2016 and February 2017

The verification and maintenance procedures carried out between January 2016 and February 2017 are summarized in Table 3.1. Abnormal temperature values started to be observed in April 2016 and a manual calibration of the probe was performed regarding water temperature and conductivity measurements. This calibration was performed by measuring in-situ water temperature and conductivity with a duly calibrated YSI 556 multiparameter probe and using the software SEBAConfig 0. However, the abnormal temperature measurements remained. In July 2016 damages were observed in the data logger, which prevented the replacement of the batteries, and the probe was removed from the station for subsequent factory repairing. The probe was reinstalled on January 11, 2017 and it is operational since then measuring water levels. The conductivity and temperature sensor is still under testing.

Table 3.1 – Verification and maintenance procedures between January 2016 and February 2017

Date	Description	Observations
January 14, 2016	Installation of the SEBA MPS-D3 multiparameter probe	-
February 22, 2016	Precision topographic measurement of a reference point	-
March 21, 2016	Batteries replacement	-
May 4, 2016	Batteries replacement and in-situ verification of the temperature measurements	The temperature was recalibrated by comparison with in-situ measurements using an YSI 556 multiparameter probe
July 1, 2016	Batteries replacement	The replacement of the batteries was not possible due to damages in the data logger. The probe was removed from the local for subsequent repair.
January 11, 2017	Reinstallation of the multiparameter probe	The probe was reinstalled after repair.
February 20, 2017	Batteries replacement and vertical georeferencing	-

Data acquired between January 2016 and February 2017 are presented in Figures 3.1 to 3.2.

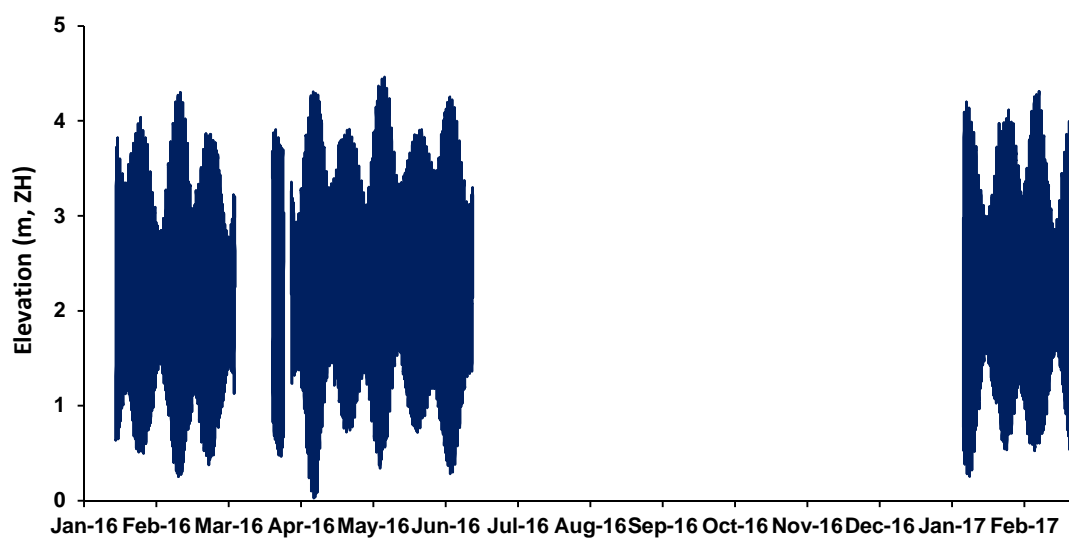


Figure 3.1 – Water levels observed at the Parque das Nações station between January 2016 and February 2017

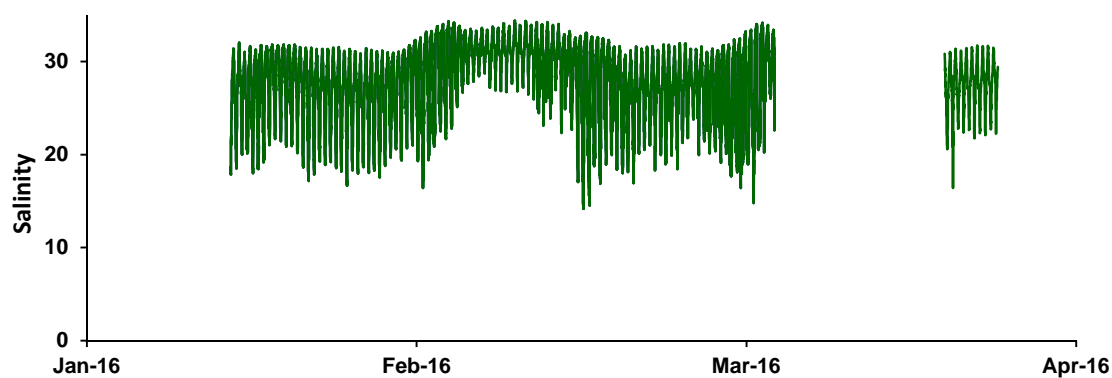


Figure 3.2 – Salinity observed at the Parque das Nações between January 2016 and March 2016

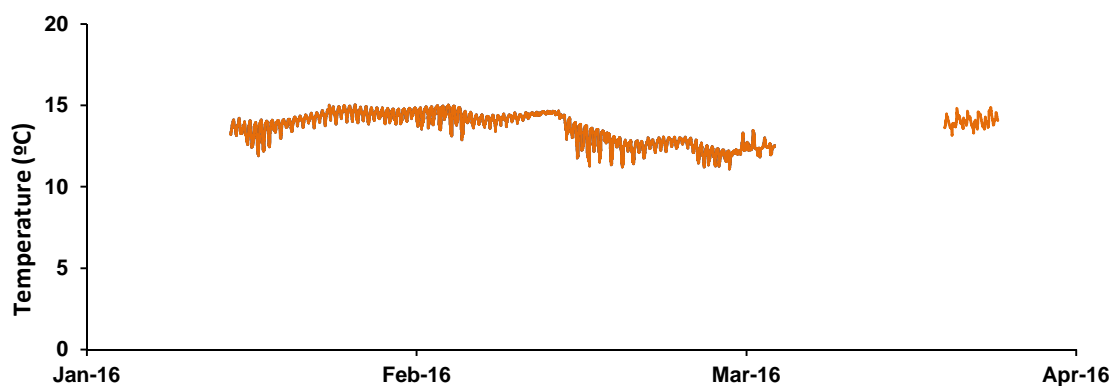


Figure 3.3 – Water temperature observed at the Parque das Nações between January 2016 and March 2016

4 | Conclusions

In the scope of the H2020 BINGO and FCT UBEST projects an online monitoring station was installed and is under operation in the Tagus estuary, in the Parque das Nações area, since January 2016.

The Parque das Nações station is equipped with a SEBA MPS D3 multiparameter probe, which measures water levels, conductivity and water temperature, and a SEBA Slimcom2 data logger, for data acquisition and transmission.

During the period to which this report refers, January 2016 to February 2017, maintenance procedures were undertaken to guarantee the safety of the equipment, the acquisition of the data and their quality. Some damages in the data logger, which required factory repairing, provided the acquisition of data for about half of that period, between July 2016 and December 2016. Moreover, abnormal water temperature values were also observed from April 2016 on, which remained even after the calibration of the sensor. The probe was reinstalled in January 2017, after repair, and is currently measuring water levels. Further verification tests are still ongoing to evaluate the quality of the measured conductivity and water temperature data and the need to replace this sensor.

Lisbon, LNEC, March 2017

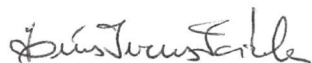
APPROVED

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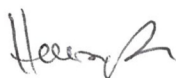
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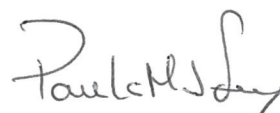
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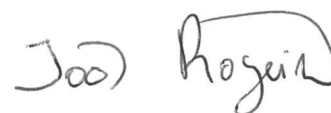
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