

An integrated biogeochemistry observation system at Besòs estuary

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I. ABSTRACT

Estuaries are coastal indentations where freshwater mixes with seawater (Pritchard 1967), and are found everywhere in the world. Moreover, the estuarine ecosystems are usually characterized by high biological productivity and great biodiversity. However, these characteristics are very sensitive to the climate regime, the geological environment and the hydrological quality. In metropolitan environments with high social, urban and economic complexity, river flows usually play an important role in the regulation of estuary biochemistry, and therefore their control is essential.

Such estuary, is the one generated by the Besòs river, located in the north of Barcelona, where the management of the water cycle of its riverbed and its mouth is a shared strategy for the development of the territory between the municipality of Sant Adrià del Besòs, the town hall of Badalona, the Consorci del Besòs, the Polytechnic University of Catalonia and the b_TEC Foundation. These institutions share the Territorial Specialization and Territorial Competitiveness Project (PECT) of the Besòs Sustainable Territory coast, where one of its objectives is the improvement and use of water and coastal resources in the Besòs environment. In this framework, it is intended to reduce the impact of heavy rain scenarios and frequent sewer overflows, which involve poor water quality scenarios on the beaches near the river mouth, through the use of surplus groundwater to improve the water quality of the riverbed, instead of being sent to the sewer.

To evaluate the degree of improvement provided by this solution, in the Besòs estuary it has been deployed and installed a new integrated biogeochemistry observatory that includes (a) a coastal buoy with a multi-sensor system and (b) a riverbed platform with a multi-sensor system as shown in Figure 1, that provide long series of real-time data.

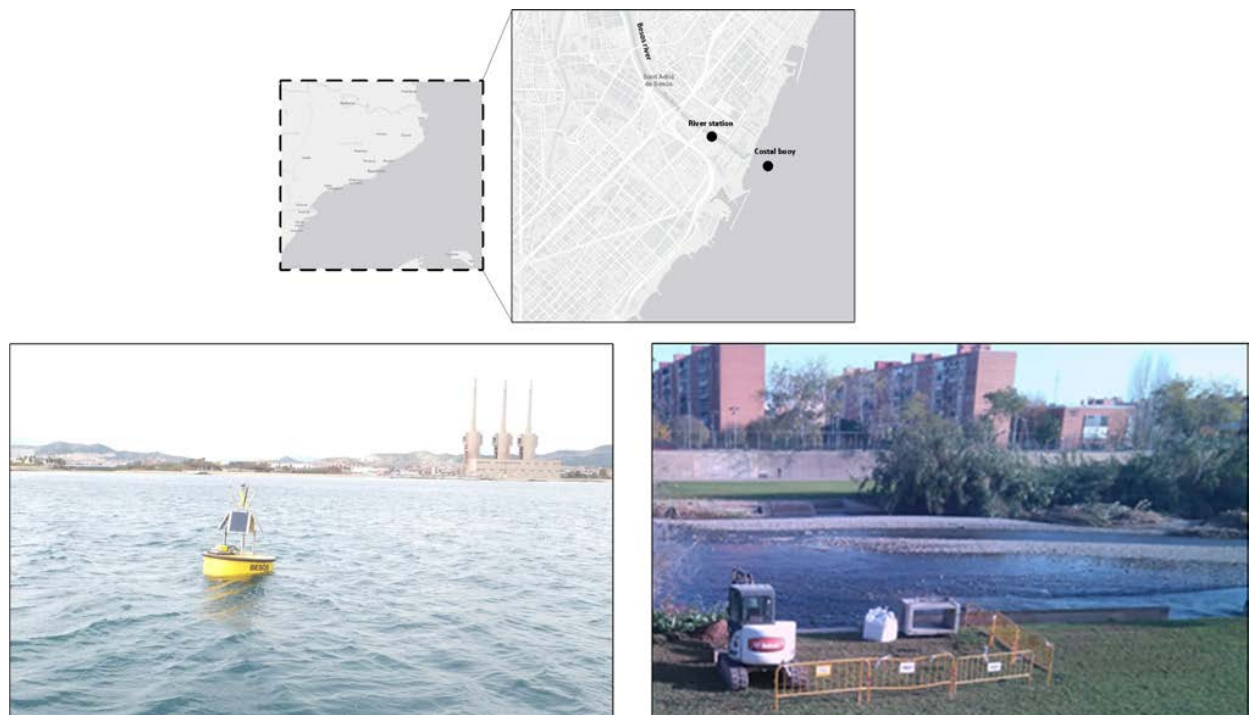


Figure 1 Map of study area with 2 stations in the Besòs river and Catalan coast. Coastal buoy deployed in front of the Besòs river mouth. Riverbed station.

Description of costal buoy monitoring platform (a)

This monitoring platform uses a surface buoy located at 544 m in from the mouth of the Besòs river (41°24'59.87 "N; 2°14'20.25" E). The buoy is moored at a depth of 13 m using a galvanised chain and two deadweights. The buoy has solar panels and batteries needed to power the submerged measurement instruments and the acquisition and communication system, located on surface. The surface system is composed by a router with wireless communications (GSM), weather station and control electronics in charge of the data acquisition of the instruments. The installed instruments are a B&C Electronics multiparameter probe and a Turner Designs C3 fluorometer. Since November 2019, the costal buoy is providing in real-time biogeochemical data such as dissolved oxygen, pH, concentration of coloured dissolved organic matter (CDOM), turbidity (NTU), oxidation reduction potential, refined oil and fluorescein. Moreover, the buoy provides physical parameters such as sea water conductivity, temperature and pressure. All these parameters are acquired for approximately 10 minutes with a rate between 1 hour to 3 hours.

Description of riverbed monitoring platform (b)

To deploy the measuring probe of different biogeochemical parameters for the evaluation of Besòs riverbed water, a manhole has been placed next to the inflatable dam on Avenida de la Catalana 171 in Sant Adrià de Besòs, and closed with a metal lid to protect against vandalism. The manhole and the river are connected with a PVC tube, through which the water from the river circulates to the measuring probe and returns to the riverbed.

Inside the manhole is the hydraulic system, with a water pump responsible for providing the river water samples to the probe, the multiparametric probe and the acquisition and communication system. The multiparameter probe is the same as the the probe installed in the costal buoy (a) and provides biogeochemical observations such as dissolved oxygen, pH, turbidity (NTU) and oxidation reduction potential and physical parameters such as temperature and conductivity. These parameters are acquired for approximately 10 minutes every 3 hours.

The data acquisition system of the two platforms is based on a generic software for sensor web enablement following the OGC standards. Through the SWE Bridge generic software (Martínez et al., 2017), the data is directly inserted into a centralised SOS (Sensor Observation Service) server (Bröring et al., 2012; 52 North SOS 2.0 implementation) and into a laboratory monitor system (Zabbix LabMonitor) for recording events and alarms. Based on the SensorML description of each instrument, the generic software for sensor web enablement can automatically connect to a real-time data stream, parse the data stream and generate transaction compliant with Observation & Measurement standard 2.0 which are directly injected in the OGC SOS server (<https://obsea.es/data/pect.php>).

II. ACKNOWLEDGEMENT

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