ID20 KOSTASYSTEM, A MULTIPURPOSE COASTAL VIDEOMETRY SYSTEM

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ABSTRACT

This contribution presents the KOSTASystem technology, a multipurpose coastal videometry system. It is implemented in 20 operational stations distributed along the Basque Coast (Spain), covering urban and natural beaches, port protection structures and natural coastal stretches. The purpose of this technology is to provide basic quantitative and qualitative data for coastal management applications. The most representative advances are related to the hardware, with the development of autonomous photovoltaic stations, and to the software, developing several tools for the calibration and restitution of the images and for the extraction of the information used in the different applications. In the long-term, within a climate change context, the most essential results have been obtained in the monitoring of beach morphology. In the short-term, the camera network works under extreme wave conditions, monitoring wave overtopping and flooding. Apart from this, it is also used for the daily management of the beaches in the summer season, improving the safety by detecting and predicting rip currents and providing information about beach user density (BUD). Finally, the constant improvement of this technology and its applications help to grow and collaborate within the European framework of the coastal observation network.

Keywords – Coastal videometry, Observing network, Beach morphology, Wave impact, Rip currents, Beach occupancy, Image processing.

INTRODUCTION

The coastal systems play an essential role for human life. The variety and uniqueness of the ecosystems that come together in this area encompass landscape, socio-economic, cultural, and educational values of great importance. The coastal zone is in constant change, and Basque Coast, which is highly populated, anthropized, and very exposed to energetic wave action, there is the need to highlight its vulnerability. Adding the perspectives associated to climate change, it demands special attention.

As such, video remote sensing techniques represent an efficient monitoring tool as they can provide useful data with high spatial and temporal resolution and coverage. In this line AZTI has developed the KOSTASystem technology and works in the generation of different products that transform the images in effective coastal zone management information. The first KOSTASystem station located in Mundaka has been capturing images of the Oka estuary mouth since 2007. Since then, over 20 stations have been installed and put into operation along the Basque Coast covering different coastal systems and key infrastructures.

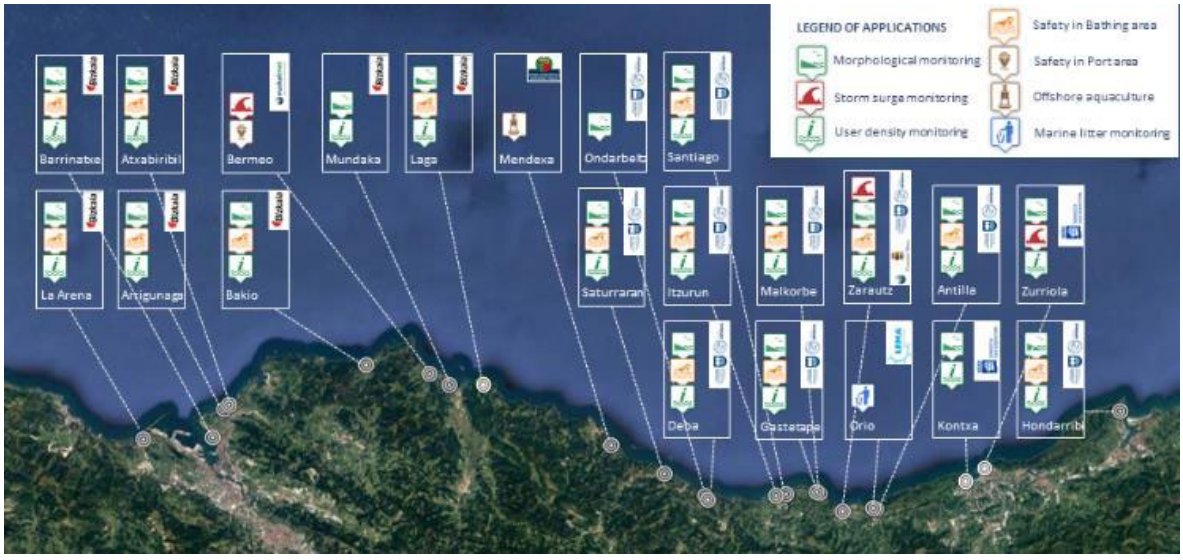

Fig 1. Map of the coastal videometry stations operating in the Basque Country, Spain

HARDWARE AND SOFTWARE

The most important advance has been the design and implementation of photovoltaic autonomous stations. Simplifying installation, reducing costs and the administrative procedures for installation. Another breakthrough has been the installation of intelligent controllers, which allow access to the control of certain parts of the station.

For camera calibration and orthorectification the methodology is based on a two-step calibration [1]: intrinsic and extrinsic. This allows the orthorectification of the images on a uniform z plane or in a predefined digital terrain model grid.

The most used products in coastal videometry are those derived from the temporal processing of images. For this purpose, the open-source SIRENA software is used [2]. SIRENA creates 4 different types of images: snap (instantaneous images), timex (average images), var (variance images) and timestack images (defined profile images).

COASTAL SERVICES

In long-term and climate change contest, monthly representative timex images of mean low tide and high tide are selected. The coastline detection is carried out from these images, and two indicators and derived: i) the beach width at low and high tide and, ii) the intertidal and supralittoral beach areas. These indicators are related with the incident wave energy on the beaches and used to describe the morphological evolution of the beaches and for validation of morphological models that can be used to analyse the future scenarios and associated evolution of the beaches in response to sea level rise [3].

In NRT and wave overtopping and flooding monitoring, timestack and infrared images are used to monitor the wave run up and overtopping along different transects with an automatic overtopping detection tool. Very useful for the Directorate of Emergencies of the Basque Government (EU Interreg POCTEFA Marlit project).

In NRT rip current detection and forecast, a rip current risk assessment tool has been developed. The orthorectified timex images of the beach are sent to an app called BEACHGUARD that is operated by the lifeguards, to have a better monitoring of the breaking zone and associated sandbar morphology. These images are also used to obtain the bathymetry of the shallow areas of the beach which is used to forecast the circulation patterns using numerical models.

In NRT user density monitoring, a beach user density (BUD) tool has been developed using machine learning, providing information about beach users attendance to see indicators that affect tourism. For the COVID-19 context, the network has been adapted to provide real time information about beach occupation to ensure complying with the recommended social distancing [4] and displays the information through a mobile app (Nik Hondartzak).

CONCLUSIONS

Azti is coordinating further developments on hardware and software to improve the capabilities and efficiency of the KOSTASystem technology. Also, other applications as the use of InfraRed cameras and specific algorithms to detect river floating litters will be adapted to be compatible with the hardware of the stations.

AZTI is also working on obtaining hydrodynamic data from timestack images (wave height and flow information). The first version of the algorithm has been developed. The results are promising but further work is needed to get an operational tool and generate another reliable source of data.

All the ongoing works and the integration of the videometry data with modelling tools are opening new forecasting capacities both with long term and short-term applications. A good practice in the implementation of videometry opens up perspectives for European collaboration and integration in the coastal observing network.

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