# Bathymetric Evaluation by Remote Sensing Tools at an Energetic Estuary

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## 1 Introduction

The water depth has a great influence on physical processes in the relatively shallow waters. Therefore, the collection of bathymetry data is essential to investigate hydro-morphodynamic interactions. Remote sensing tools (RSTs) are tempting alternatives for bathymetric evaluation due to continuous data collection and low operational costs. Two RSTs were exploited to obtain bathymetry at an energetic estuary and compared to surveys. It has been found that RSTs are not only a good alternative to evaluate bathymetry but also hydrodynamic assessments.

## 2 Methodology

A multi-camera monitoring system (SGS) and an X-Band RADAR (XBR) were deployed at the study site, Misa River Estuary (MSE), at the Adriatic coast of central Italy. The MSE has a complex dynamic environment, e.g., strong sea-river interactions and severe flooding events [1].

The XBR signals were processed and converted to greyscale images [2]. The images from the SGS were orthorectified based on a field survey. Then, both datasets were analysed on the cBathy toolbox to obtain bathymetry results [3]. The performance of the approach was determined by comparing it to in-situ surveys. After obtaining a reliable performance, wave characteristics were extracted to resolve sea state.

## 3 Results

The SGS and the XBR collected suitable data on 16th April 2024. After preprocessing datasets, the bathymetry results were obtained by analysing with cBathy (Figure 1-a, b). The bathymetry survey, done in December 2024, was selected for comparison (Figure 1-c). Although the survey is from a different time instance, our primary aim is to observe the trends of the results regarding the fact that the morphodynamic evolution time scale is relatively large.

The statistical analyses have been conducted to evaluate the performance of the approach and are demonstrated in Figure 1 (d, e, f). The SGS gave better performance than XBR, although they showed similar trends. Promising results were obtained when the XBR-derived wave characteristics were compared to validated SWAN model. The peak parameters were successfully resolved, such as direction, period, and wavelength. The performance on the significant wave height was relatively moderate, and it is aimed to improve it.

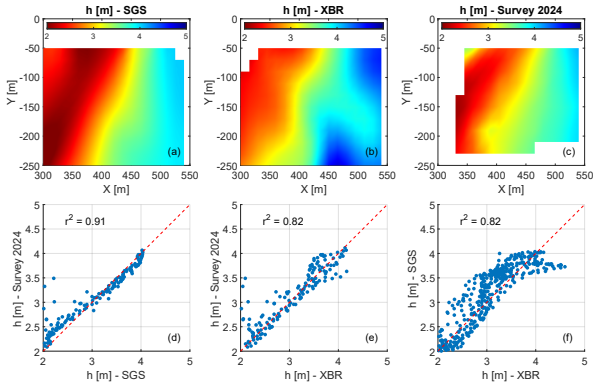


Figure 1: Upper panels: The bathymetry maps from the SGS (a), the XBR (b), and the survey (c). Lower panels: The statistical comparison between SGS-Survey (d), XBR-Survey (e), and SGS-XBR (f).

## 4 Conclusion and Ongoing Work

The preliminary results showed that the RSTs can be exploited to collect morphodynamic and hydrodynamic information at a chosen location. Due to dense data sampling from a relatively large spatial area, it allows for further investigation on the estuarine dynamics.

Ongoing work is focused on coupling information between the RSTs, numerical models and field observations to create a framework for estuarine and nearshore dynamics.

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