Evaluation of Nearshore Sea State by Using Remote Sensing Tools

M. Said Parlak[1], Agnese Baldoni[1], Luciano Soldini[1], Matteo Postacchini[1], and Maurizio Brocchini[1]

1. Department of Civil Engineering, Construction and Architecture, Università Politecnica delle Marche, Ancona, Italy. m.s.parlak@univpm.it

Nearshore sea state has a crucial importance for coastal activities and marine environment (e.g., harbors, coastal resilience, etc.). Hydrodynamic and morphodynamic processes are mostly driven by nonlinear mechanisms in this region. Waves are one of the main triggers of these processes and have a direct influence on the sea state. In-situ data collection of waves is a tough task due to the complex physical interactions and cost-wise limitations. Remote sensing tools are judicious alternatives since they have larger coverage area, and they are fairly easy to maintain. The mostly used two remote sensing tools are Video Monitoring (VM) system and X-Band Radar (XBR) to study nearshore hydrodynamics and morphodynamics. The study site is Senigallia, a maritime city in central Italy and accommodates a small harbor, Misa River estuary and sandy beaches. Strong interactions are observed during energetic seasons, therefore, VM and XBR have been deployed for monitoring purposes. Raw XBR data is treated as image intensity and sequential scans are converted to time-stacks. Time-stacks are used in cBathy software to evaluate the bathymetry, dominant frequencies and wavenumbers. The performance of cBarhy is controlled by comparing bathymetry results to observations. Then, the outputs are used to reconstruct nearshore sea state such as significant wave height, peak period, peak wavelength, and peak celerity. Promising results are obtained when they are compared with a validated SWAN model. Ongoing studies are focused on enhancing the methodology and studying nearshore wave processes (e.g., elevations, breaking) by combining VM, XBR, and model chain (SWAN, FUNWAVE).

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