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On the use of stereo-video data for 3D sea surface reconstruction measurements in shoaling and surf zones

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In the outer surf zone, classical instrumentations, such as wave gauge, give reliable data. However, in the inner surf zone, the quasi-hydrostatic hypothesis is not applicable anymore and the wave shape is not well reconstructed. Moreover, wave gauge gives sea surface height for a single point location. Recently, new devices such as hyperspectral imagery from drones, laser scanning and 3D sea surface reconstruction by stereo video system have shown reliability to explore nearshore hydrodynamics. Those are promising tools, capable to measure the surface elevation in a high spatial and time resolution, in a wide-ranging of conditions. Stereo video data has given trustful results in open ocean. This technique covers a wide zone; each pixel from the reconstructed surface could be assimilated to a wave gauge. Nevertheless, because of accessibility issue in the surf zone, the reliability of stereo video system has not been extensively evaluated. In this study, an innovative technique is proposed using zoom lens allowing a deployment of the stereo-video system upstream a cliff, overlooking the surf zone of a small-scale embayed beach. The cross-shore wave propagation has then been investigated by the means of stereo video imagery and wave gauges. A sea surface of 1000 m^2 is reconstructed in 3D, from the outer to the inner surf zone. A validation of the stereo video data is done by comparing the data with different wave gauges deployed on the bed floor. The strengths and weaknesses of each technique is detailed according to the experimental conditions. In particular, the stereo-video system is shown to be useful to measure the asymmetry of the waves, responsible for the direction of sediment transport on many sandy beaches. The long-shore variability of the breaking is also visible and quantifiable, bringing new perspectives for nearshore observations.