Rapid Environmental Assessment Conference

Coastal process: Challenges for monitoring and prediction

Measuring waves in the surf/swash zone using video/image processing methods

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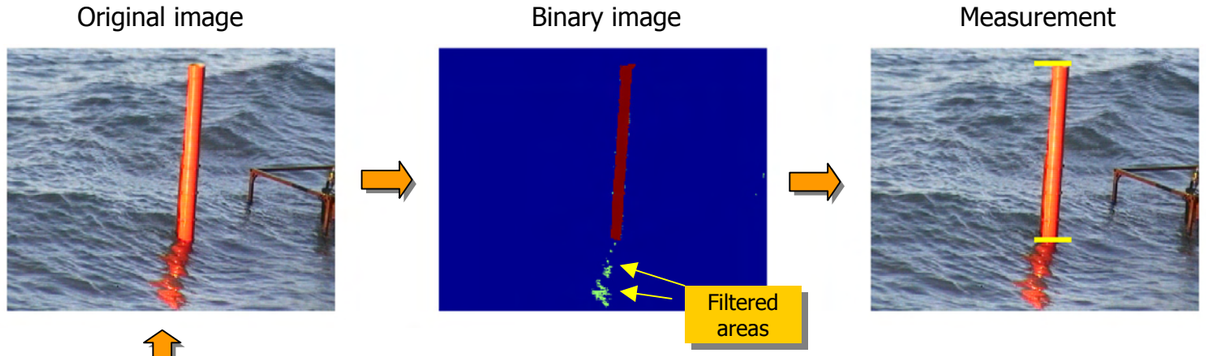
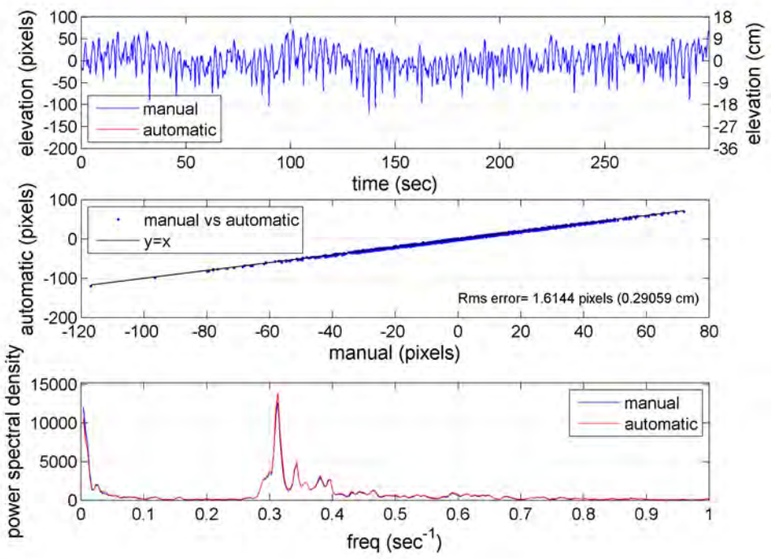
High-frequency sea-surface and wave run-up elevation time series are obtained using video-image processing techniques. The general principle is simple: videos of the processes are obtained from fixed cameras and after scaling and lens distortion aspects are taken into account, the image frames are exported. In the following step, image processing techniques are applied to identify bodies on each frame that can result to the final measurement.

Sea surface elevation

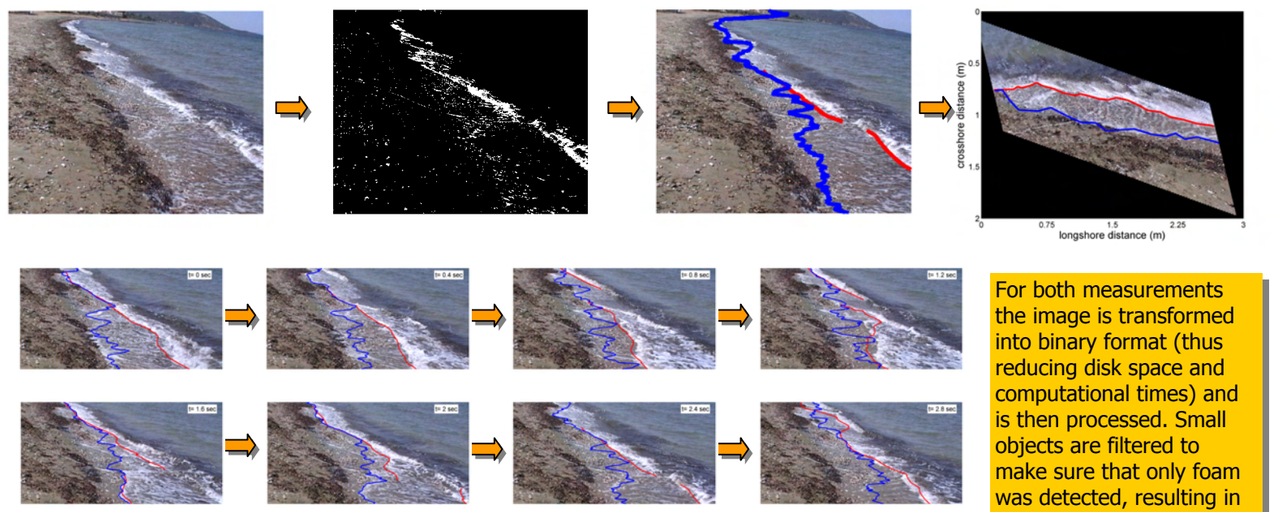


10 cm diameter red poles are installed and their free (dry) sections (see upper and lower limits) are identified on the frame. Sea surface elevation measurement is obtained through estimating the vertical length of the exposed pole.

The method is successfully validated by manual optical measurements, as also shown by the time series, the scatter plot and the wave spectra. Comparison with pressure sensor data was also satisfactory.

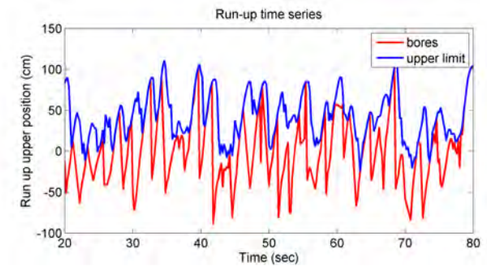


Wave run up position



For both measurements the image is transformed into binary format (thus reducing disk space and computational times) and is then processed. Small objects are filtered to make sure that only foam was detected, resulting in the tracking of the propagating bores. Motion detection algorithms are used to trace the upper run-up limit.

Eventhough the method is tested on a beach with unfavourable conditions (compared to more homogenous, sandy beaches), the results obtained are still satisfactory. The presence of many features (e.g. note the white pebbles and the *Posidonia oceanica*) made the measurement more difficult, but also demonstrate the high potential of the video techniques.



Required pre-processing steps include image normalization and geo-rectification, as well as 'sampling' to set the necessary pixel intensity thresholds.

The method is low-cost (commercial video cameras are used), direct (measuring directly the desired quantity), and in the case of swash motion measurements, non intrusive, allowing continuous (both in time and 2D space) measurements.

Moreover, it has a lot of potential since, combined with other datasets (e.g. of bed pore pressure, flow velocities and suspended sediment concentration), can provide an almost complete picture of the conditions in the nearshore zone. Finally, it can contribute significantly to our, currently limited, understanding of swash zone processes.