INTEGRATED VIDEO-SEDIMENT TRACER TECHNIQUE FOR SAND TRANSPORT MEASUREMENTS

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Paper topic: Laboratory and field observations and techniques

1. Introduction

Within the project Hydralab IV, joint research action WISE (Water Interface Sediment Experiments), a new set of laboratory experiments have been performed at LNEC's large-scale irregular wave flume (with dimensions 73x3x2 m), modelling erosive wave conditions over an initially planar beach profile. A 1:10 uniform sloping beach was set up, composed by 0.35mm (D50) sand, following scaled conditions of the Hannover wave flume tests (within the same project). A horizontal-to-vertical distorted model was adopted, with vertical length-scale of 1:4 (lab:prototype). In this paper a novel sand transport measurement technique is presented and preliminary results are discussed.

2. Methodology

A new optic measurement technique for sediment transport in wave flume is presented, based on analyzing digital images of the facility's lateral glass windows. Red- and blue-coated sand rectangular-sections were placed into the beach profile, amongst the natural colored sand, and their displacements were digitized by video-recording and, subsequently, identified through a developed color detection algorithm in Matlab environment.

At the start, a procedure to paint sand grains with coated pigment was carried out, in order to obtain new colored sand with the same or approximate grain-size distribution of the original one. In particular, red and blue pigments were selected because they provided the best color contrast in relation to the natural sand grains.

Subsequently, images were obtained from two digital-cameras placed about 1.3 m away, looking sideways at two of the wave-flume lateral windows, monitoring the swash and the breaking zones, respectively. Each camera was set-up and focused to acquire images of the sediment-water interface. The video devices recorded, at 25 Hz frequency, the sediment-water interface (beach profile) evolution during the whole generated wave sequence.

In the end, periodic, selected images through the whole experiment where post-processed in order to detect the location of the coated grains in each frame. Several color model detections were tested, founding CIELab color scale the more suitable for the aim. A Matlab code was developed, aiming at detecting the colored sand regions and measuring their properties (such as number of non-connected closed zones, and individual areas and centroid positions of each of them).

3. Results and Discussion

Figure 1 shows a comparison between the initial and middle stages of the bed profile evolution and coloured sand locations, within an experiment. From the left to the right panels, one observes erosion

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at the sea-bed, with seaward movement (directed to the right of the picture) of the red-colored sand, under the breaking region. The lower plots show the final images after applying the red-detection algorithm, allowing to determine the exact position of the red-colored sand, and thus the time-averaged sediment transport rate. Preliminary results confirm the suitability of this technique for sediment transport evaluation. These results will be further discussed in the final paper.

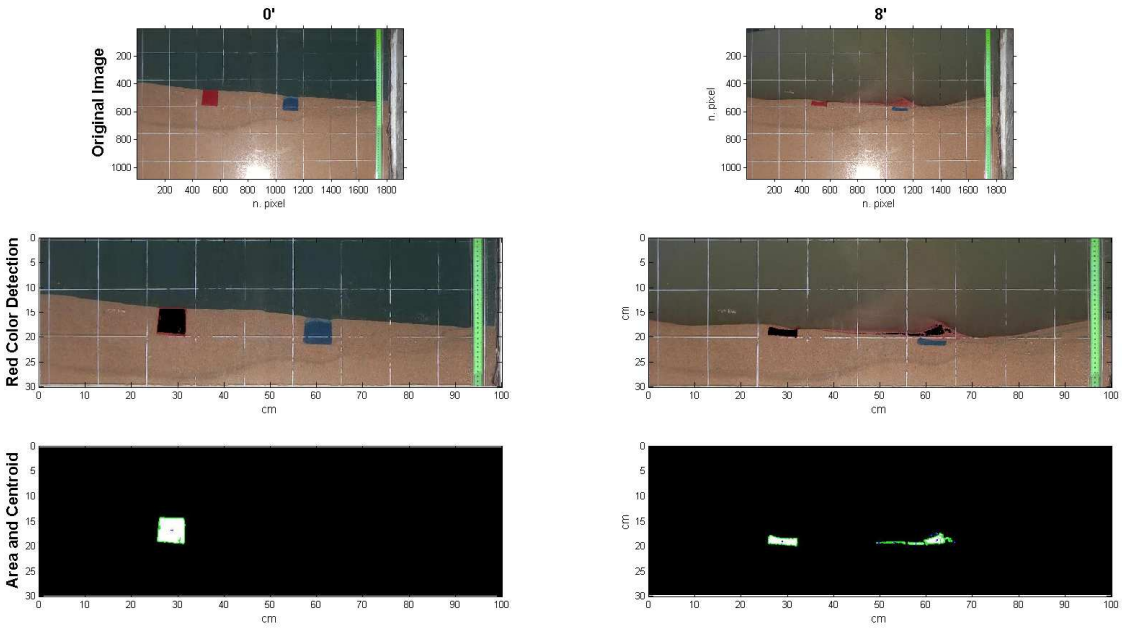

Figure 1: Example of raw images (top row) and colored sand detection post-processed images (middle and lower rows).

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