

# MONITORING OF BEACHES AND SAND DUNES USING DIGITAL AERIAL PHOTOGRAPHY WITH DIRECT GEOREFERENCING

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## ABSTRACT:

Beaches in the Portuguese western coast suffer sudden changes due to the action of the sea during winter. Frequent acquisition of digital surface models (DSM) is needed in order to assess volumetric changes. This paper presents a monitoring program carried in an area of 15 km near the city of Porto. Digital aerial photography is acquired twice a year, using a Zeiss-Intergraph DMC camera, with a spatial resolution of 10 cm, by a local company. Images are provided with exterior orientation provided by direct georeferencing equipment. An assessment of the exterior orientation parameters provided was done using field survey points. It could be concluded that positional accuracy of 3D coordinates determined by photogrammetric means using the exterior orientation elements has root mean square errors of 10 to 20 cm, which is within the requirements for this work. This result was valid for three different flights. It was decided not to do any aerial triangulation. DSMs were obtained by stereo-matching (least-squares with region growing) using software BLUH. Sand areas are very bright and many times do not have enough contrast for the matching. Since images have 12 bit grey values, matching results could be improved by choosing, in the conversion to 8 bits, appropriate minimum and maximum values for the bright sand areas. Using a large number of check points the vertical accuracy of the DSMs was found to be 15 cm. This methodology was found to be very efficient for the detection and quantification of volumetric changes of beaches.

**TOPIC:** Change detection and process modelling

**ALTERNATIVE TOPIC:** Geometric modeling