MAPPING ABRASION MANIFESTATIONS USING UNMANNED AERIAL VEHICLES AND UNMANNED LASER SCANNING

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Introduction

The aim of the project is to verify the possibilities of mapping and monitoring abrasion on water reservoirs using UAV aerial imaging and laser scanning. The objective will be achieved by repeated scanning of the banks at the Dlouhé Stráně – lower reservoir. Photogrammetric processing methods will be tested on images taken with a small DJI Mavic 2 Enterprise drone equipped with an RGB camera with a resolution of 12 MPix and laser scanning with a large DJI M600 Pro drone carrying a GeoSLAM Horizon laser scanner (Fig. 2,3).

The aforementioned reservoir is located at an altitude of 824 m and has a total volume of 3,405,000 m³ and an area of 16.3 hectares. You can see the placement of the reservoair in Fig.1. The entire pumped storage plant is used to regulate the power grid. The fluctuations in the level of the lower reservoir result in bank erosion and significant abrasion, which is exacerbated by the shape of the banks, which have a pronounced slope exceeding 45° in some places.



Fig. 1 - Map of the reservoir



Main aims of the project

- . Develop a methodology for regular monitoring of abrasion
- Create a 3D model of the banks

Fig. 2,3 - DJI M600 Pro drone carrying a GeoSLAM Horizon laser scanner.

Data processing

Photogrammetric processing

- AGISOFT Metashape Professional software (Fig. 5)
- Control points traced on the images, coordinates inserted
- photogrammetric point cloud, digital surface model created using Structure from Motion algorithm

Processing of the laser scanner data

- GeoSLAM Hub, GeoSLAM Draw software
- Cloud placed in a coordinate system based on the tracing of control points and the input of coordinates was done
- The comparison of the models, calculation of changes performed in

Methodology

- . Necessary to choose the optimal method of permanent stabilization of the so-called control points at the edges of the mapped area
- Control points oriented in the local coordinate system using a total station from the opposite side of the reservoir from permanent sites
- Points are also used for coordinate attachment of images and point clouds for subsequent comparison
- Neither imaging nor scanning was dependent on the growing season, the banks are devoid of vegetation due to surface movements



Cloud Compare software (Fig. 4)



Fig. 5 - Sample point cloud from GeoSLAM Horizon scanner in Agisoft Metashape environment

Fig. 4 - Example of a section through the resulting point cloud (left photogrammetry, right laser scanning)

Preliminary results

- Both methods are suitable for mapping abrasion manifestations
- Advantage of laser scanning over photogrammetric processing is the ability of laser pulses to penetrate vegetation
- For both methods, the appropriate placement of the insertion points is crucial. Quantification of abrasion symptoms will only be possible after a repeat scan, which will take place by the end of 2022

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