Detection and monitoring of watercourses in forest areas using Airborne Laser Scanning

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I. Abstract

Detection and monitoring of watercourses in forest areas is crucial in terms of flood prevention and control translating directly to ensuring safety in catchement areas. Unmonitored watercourses may endanger the natural habitat or highly disturb the economic potential of the region. Should the monitoring be put in place in regular intervals, those hazards might be significantly reduced. The main drawback is the occurrence of the tree canopy that prevents the watercourse identification from eg. aerial photograms. Also, when classic surveying methods are implemented (GNSS or Total Station campaigns), there are still issues of data complexity and classification. In such cases, one of the time and cost effective solutions, providing high spatial resolution and accuracy is near-infrared laser scanning system based on an airborne platform. Based on it's unique capability of virtually unlimited echoes processing allowing potent vegetation penetration, together with reflectance categorization, there is a legitimate possibility to classify spatial data and conduct research in terms of watercourses detection. This poster presents the solution based on LiDAR (Light Detection and Ranging) technology for watercourse designation in highly arboreous areas.

II. Motivation

In Polish coast there are cliffs which require constatnt monitoring. Their degradation can cause serious problems related to the stability of objects which are located near to cliffs. The main factor which cause the degradation is water, that is why so important is to classify its courses. The degradation of the coast is shown in Figure 2.
As it could be noticed in Figure 1 the upper part of the coast is very forested which makes it difficult to determine the course of water in these parts.
Based on that analysis, author decided to proces the method which detect the watercourses and could be a based for monitoring.

Fig. 1 The location of forestry area [source: Google Earth]

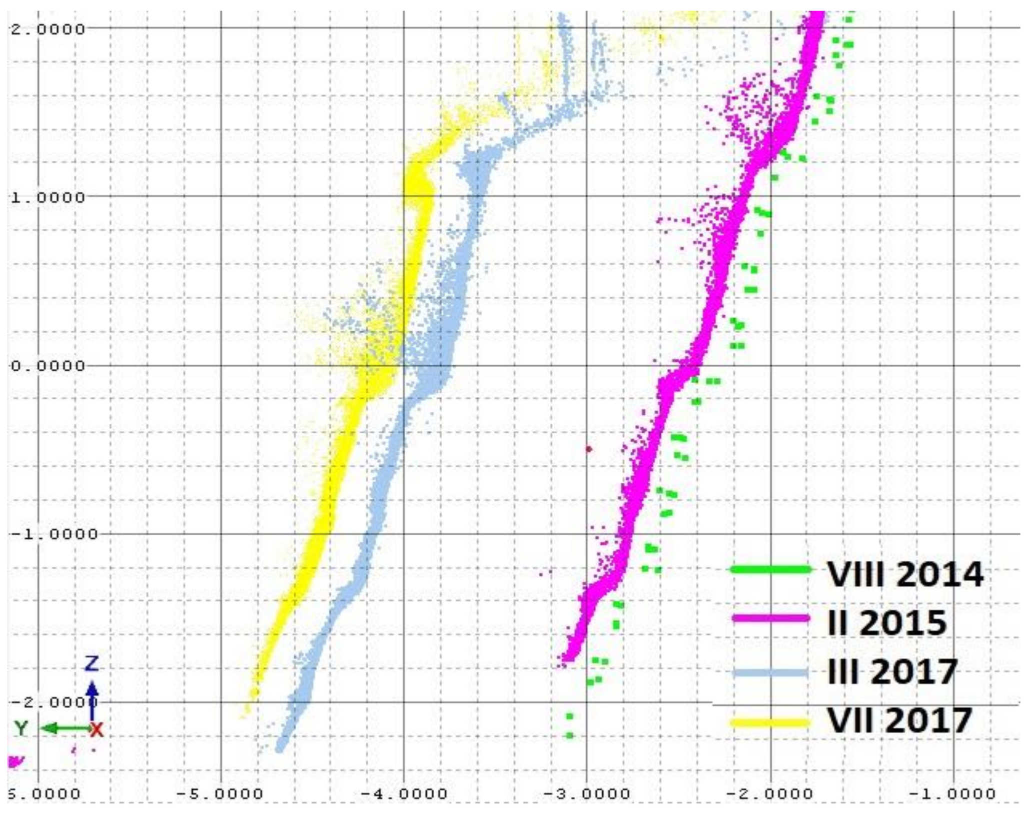

Fig. 2 The degradation of the Polish coast caused by water

III. Post Processing of the data

The post- processing of the data consists of:
1. Data acquisition.
2. Trajectory alignment (results are shown in Fig. 3).
3. Scan alignment (results are shown in Fig. 4).
4. DTM (Digital Terrain Model) creation (results are shown in Fig. 5).
5. Classification based on echoes processing and reflectance categorization (results are shown in Fig. 6).

Should also remember about the study of the stability of reference points for monitoring purposes.

The results data post- processing are crucial in case of precisely determine the watercourses areas.

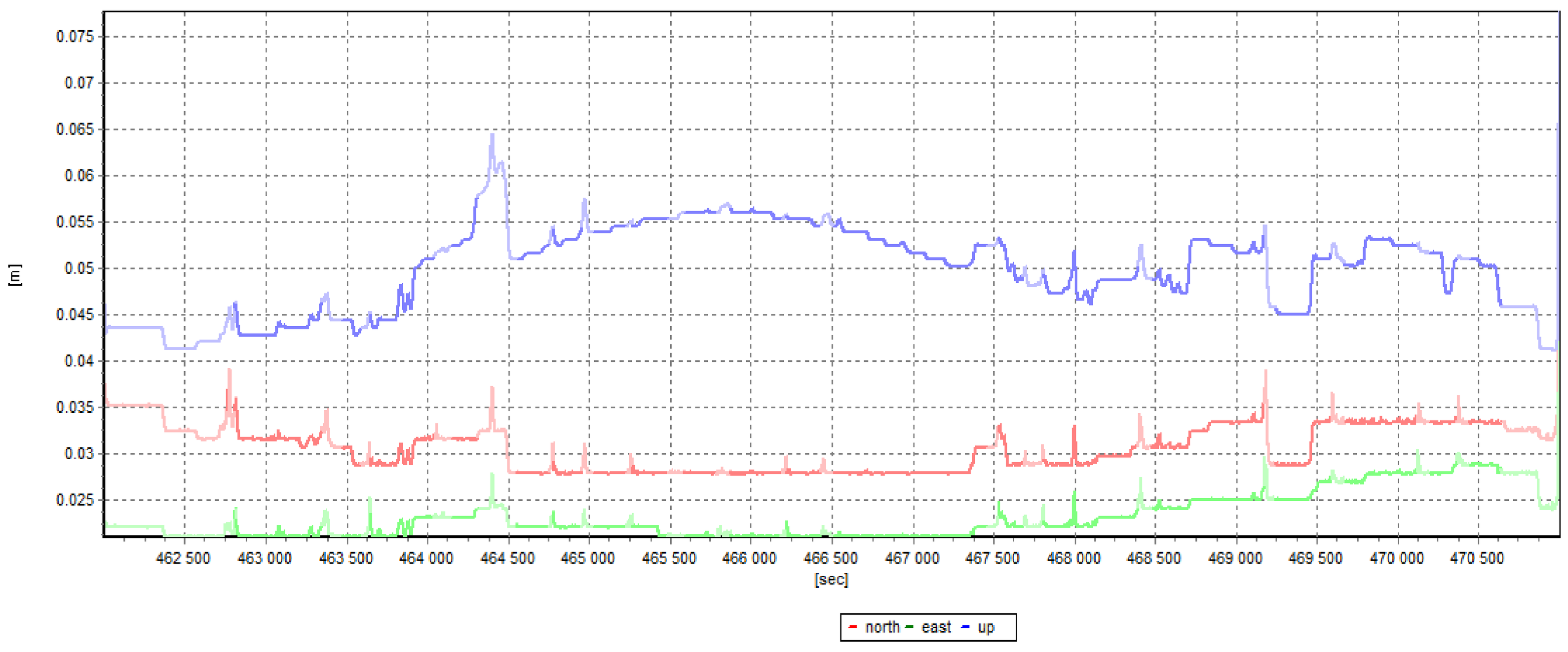

Fig. 3 Trajectory alignment results

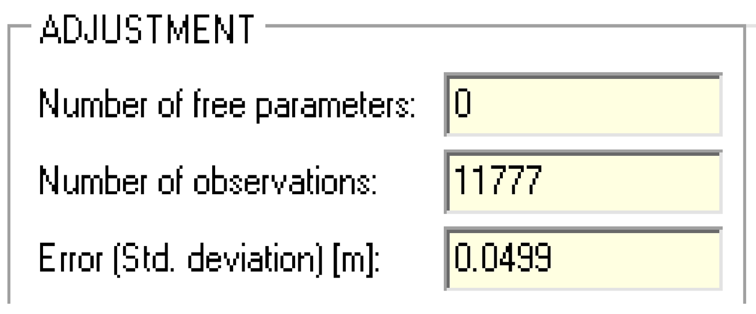

Fig. 4 Scan alignment results

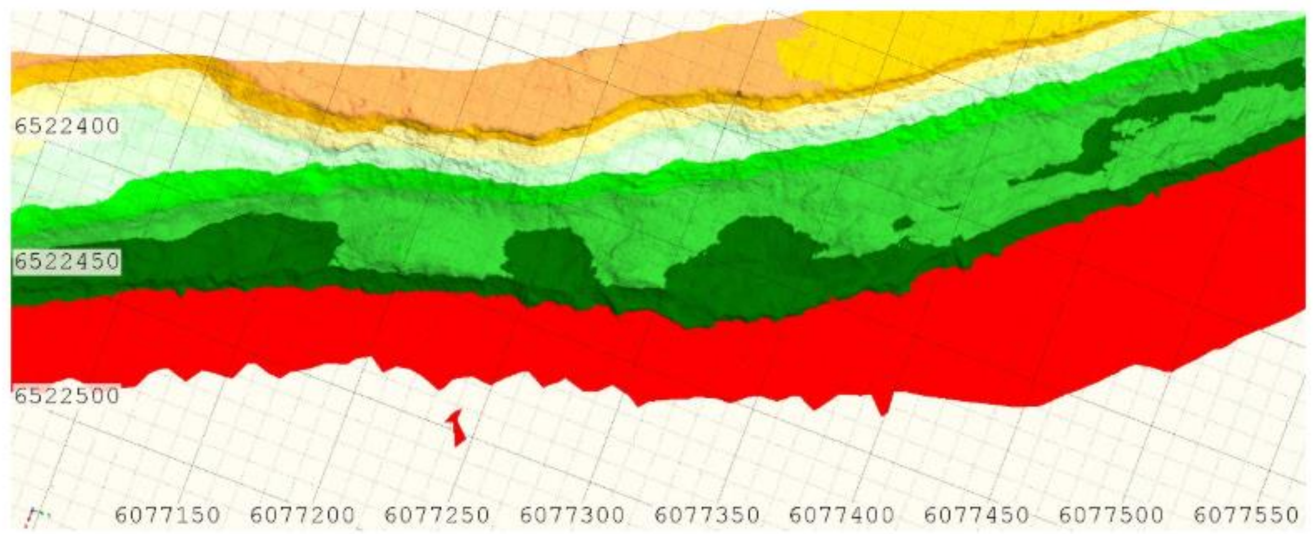

Fig. 5 DTM creation results

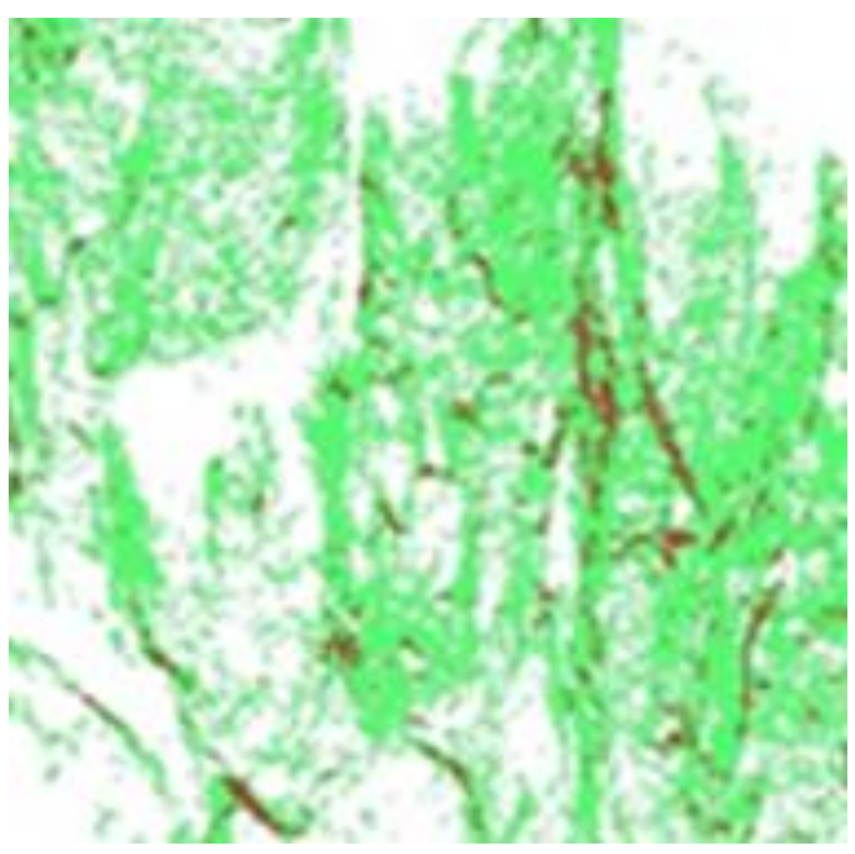

Fig. 6 Classified watercourses presented on DTM

IV. Results and conclusions

The results presented in Fig. 6 are satisfactory for watercourses detecion. Created models allow to develop in a short time even tens of square kilometers areas which gives a significant effect in the form of flood hazard maps, created on the basis of these analyzes. The following poster shows an example of using these method in coastal but it could be implemented in any areas.

Conducting monitoring based on the processed data is necessary to determine the flood hazard of the areas investigated and as in the case shown in this poster landslides risk.

The results clearly demonstrate that the proposed approach could be very useful in creating area development plans, valuation of risk by erosion or preservation of highly appreciated landscape. In addition, the author sees the possibility to further investigate, in terms of the object of interest, the climate and its influence on interests areas.

V. References

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