Short Research Report

Remote sensing, photogrammetric and their use in estimating losses after storms

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Background. : This study offers the use of photogrammetric and remote sensing tools in forest area research in Poland, from the point of view of calculating losses after the occurrence of an extreme weather phenomenon.

Objectives. verification of the assumed goals

Methods. Theoretical methods (including critical analysis of scientific sources, synthesis, structuring method) and empirical methods (including field tests, experiment based on measurement, participant observation) were used to obtain the research material. The method used is based on the example of French patterns, which are characterized by simplicity, optimality and a high probability indicator. The solution created by the authors to assess the degree of losses resulting from extreme weather events will be a quick help in its estimation

Conclusion. Using simple measurement methods as well as available tools, presented by the authors, they allow you to quickly and accurately obtain the data necessary for carrying out loss analysis. At a time of increasing extreme weather events in Polish areas, this method of developing loss estimates will become a helpful solution in developing such analyses.

In the last few years, there has been a new, interdisciplinary area of science and research construction and practical application of UAV unmanned aerial vehicles in geomatics (Unmanned Aerial Vehicle). Unmanned aerial vehicles make it possible to carry out low-level photo-aviation campaigns ceiling for small areas and quick, multi-time acquisition of high-resolution data imaging in various spectral ranges and potentially data from UAV-laser scanning (UAV-borne Laser Scanning). New data acquisition technique and a wide range of applications possible UAV aircraft in acquiring geoinformation were reflected in the research problem of the ICWG I / V Unmanned Vehicle Systems (UVS) inter-commission working group for Mapping and Monitoring Applications of the International Society for Photogrammetry and Teledection (ISPRS). The paper presents a synthetic overview of the construction of UAV flying machines on example of typical constructions, analysis of sensors installed on their platforms, technologies photogrammetric and remote sensing and types of geomatics applications that use the acquired optical multisensory data and LiDAR data, technical aspects of UAV application, current problems research and development trends of UVS (Unmanned Vehicle Systems).

Objectives

The main assumption of this article is to show the usefulness of remote sensing and photogrammetric tools in the context of loss and damage estimation analysis. The source material of the article consists of the entirety of the authors 'and other entities' projects concerning the estimation of losses in selected regions in Poland after an extreme weather event in the provinces (Śląskie, Pomorskie, Kujawsko-Pomorskie, Wielkopolskie) made on the basis of data made from the air and satellite ceiling.

Results

Striving for substance. Three stages of research can be distinguished in land-use publications, i.e.:

- Identification
- analysis of implementation possibilities,
- implementation adapted to the size of the test area.

Naturally, the method of research and the size of the scale adopted are linked to the size of the test area. It is mainly the use of remote sensing and photogrammetry that gains at the level of regional research, in the case of smaller field units it is necessary to approach the problem classically, that is, to enter into field research.

The project

The following is an example given by the authors of the correct use of remote sensing and photogrammetry when used for loss analysis. At the outset, the authors wanted answers to 3 questions:

1. Where did the destruction take place?
2. What was destroyed?
3. How much was destroyed?

Of the three methods available above, the most authoritative in the case of an inventory of losses after a storm is the execution of new raids by the "amateur" method or on behalf of the land managing authority.

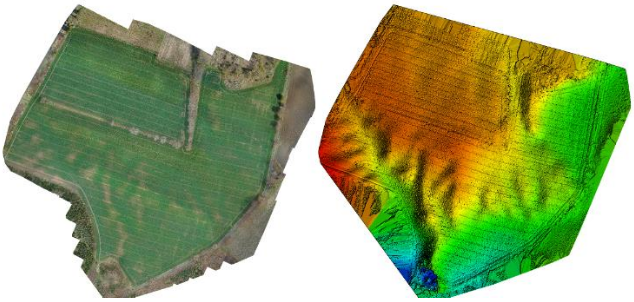
Procedure for estimating damage based on aerial photographs

1. Preliminary inventory (taking pictures).
2. Orthophoto – field pixel 3.5 cm to 10 cm.
3. Making an orthophoto map of areas after disasters.
4. Interpretation of acquired materials on a 3D station.
5. Classification of damage areas according to the accepted division.
6. Development of results based on the richness of the database of the Regional Directorate of State Forests.
7. Verification of results in the field.
8. Create a unique key to assess the degree of damage to the stands.
9. Map printouts – field materials.

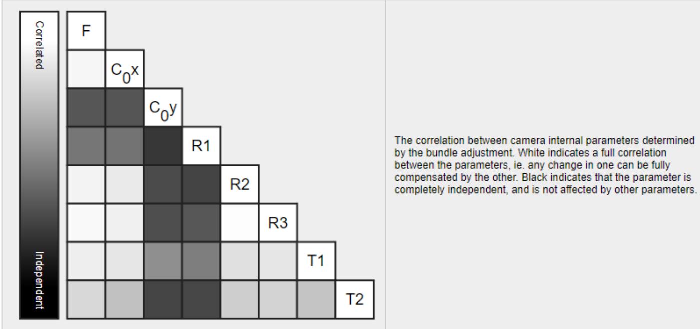
Camera Model Name(s)	L1D-20c_10.3_5472x3648 (RGB)
Average Ground Sampling Distance (GSD)	2.46 cm / 0.97 in
Area Covered	0.547 km^2 / 54.7428 ha / 0.21 sq. mi. / 135.3425 acres
Time for Initial Processing (without report)	27m:04s

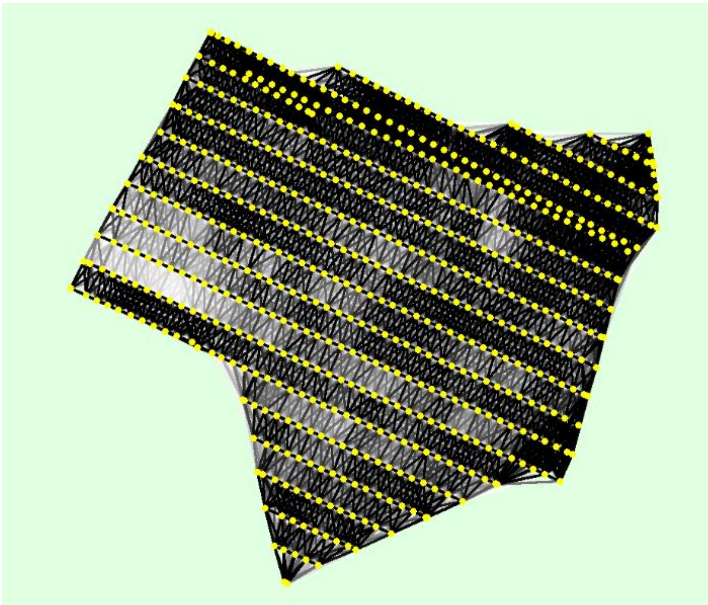
Images	median of 52075 keypoints per image	✓
Dataset	586 out of 586 images calibrated (100%), all images enabled	✓
Camera Optimization	15.27% relative difference between initial and optimized internal camera parameters	⚠
Matching	median of 22138.2 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview



	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	4470.830 [pixel] 10.479 [mm]	2736.000 [pixel] 6.412 [mm]	1824.000 [pixel] 4.275 [mm]	0.009	0.040	-0.050	-0.003	0.002
Optimized Values	5153.635 [pixel] 12.079 [mm]	2734.107 [pixel] 6.408 [mm]	1752.577 [pixel] 4.108 [mm]	0.006	0.071	-0.122	-0.002	0.002
Uncertainties (Sigma)	60.585 [pixel] 0.142 [mm]	2.140 [pixel] 0.005 [mm]	2.567 [pixel] 0.006 [mm]	0.000	0.004	0.009	0.000	0.000





Discussion

The summary of the results obtained allowed to divide the entire area into zones with a certain level of damage. Depending on the four damage classes and defined mass and species criteria, the magnitude of losses for the test areas was determined. Some areas were not difficult to classify, e.g. areas with equal terrain and negligent of damage. Problems were undulations of areas with extensive damage to the stand, hence the requirement of field mirroring.

The result of the analysis is a map of the site surface containing an estimate of losses with the location of all the elements helpful in making decisions regarding the management of stands.

The result is a synthesis map, which can provide the basis for decision-making processes in the rational management of the stand and later in the future develop a concept for the renewal of the surface destroyed after the occurrence of an extreme weather phenomenon. The benefits of this method are very wide. The synthesis map can be success-fully used in any area of many regions of the world.