Comparative Study on Topographic Plans Using UAVs

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Key words: UAV, GNSS, RTK, control point, camera, topographic plan, Digital Terrain Model.

SUMMARY

1. Objectives:

The comparative study refers to obtaining a topographic plan and a DTM (Digital Terrain Model) using UAV technology.

Basically, in the same area of interest were made GNSS RTK measurements and two flights with two different types of UAV: SenseFly eBee X and DroneZone XF8-CT.

It flew at the same height and with medium resolution cameras (Sony A7R 35mm 36 Mpix and SenseFly Aeria X 24MPix). The GNSS receivers were different. Thus, for DroneZone XF8-CT a GNSS receiver of type u-Blox NEO8M was used, and for SenseFly eBee X a GNSS RTK receiver of type TRIMBLE BD93 and a SenseFly GeoBase base. The verification measurements were performed on different days, using a Leica GS08 Plus GNSS system connected to the National Network of Permanent GNSS Stations (RN-SGP) through the ROMPOS system.

For the flight made with DroneZone XF8-CT, 6 control points were determined.

For the flight made with SenseFly eBee X, only the data taken by the RTK system from the SenseFly eBee X UAV were used.

The data were processed, a Digital Terrain Model was made for each flight. Finally, a comparison was made between the two Digital Land Models to determine the differences between them but also the differences from the RTK verification measurements made with the Leica GS08 Plus GNSS system. For verification, 28 control points were measured on the ground with GNSS

technology.

2. Results:

In table 1 we have:

- In the column noted with 1 the altitudes of the 28 control points determined on the ground as GNSS technology.

- In the column noted with 2 altitudes of the 28 control points extracted from the digital terrain model obtained with the DroneZone XF8-CT UAV.

- In the column noted with 3 altitudes of the 28 control points extracted from the digital terrain model obtained with SenseFly eBee X. UAV.

The following columns are the differences between the altitude of the control points determined in the 3 variants.

A graph of the altitude differences obtained in the 3 variants was made.

3. Conclusions

We start from the hypothesis that the correct altitudes are those determined directly on the ground with GNSS technology using the permanent stations of the National Agency for Cadastre and Land Registration. From the presented values, the altitudes extracted from the model realized with Drone Zone are very close to those determined on the ground. This is because 6 control points were used on the ground, which fixed the digital terrain model.

The altitude values determined with SenseFly eBee X are higher by about 40 centimeters in general.

Table 1 Measurement results

From the graph realized, the smallest differences are those between the column denoted by 1 and the column denoted by 2.

The conclusions is that even if we use a UAV that has a powerful GNSS receiver, it is necessary to takes a few points to get the absolute altitude of the digital terrain model as close to the ground reality as possible.

Graph 1 - differences in

altitude

4. The significance of the work.

Currently, the UAV technology for the realization of topographic plans is increasingly used. UAVs are equipped with GNSS receivers that give the position of the clouds of points with very high accuracy. Often users prefer not to determine control points anymore, considering that the results obtained are correct.

The present paper demonstrates that in order to have a correct topographic plan, close to the reality from the ground, on a flight with UAVs, control points measured on land are required.

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