

GEOSPATIAL POINT CLOUDS GENERATED FROM IMAGES TAKEN WITH UNMANNED AERIAL SYSTEMS AND APPLIED DIREKT (PPK) METHOD FOR GEOREFERENCING: ASSESSMENT OF ACCURACY FOR A TEST AREA IN THE PLANA MOUNTAIN, BULGARIA

Davis Dinkov (BG)

ABSTRACT

The use of unmanned aerial systems (UAS) for remote sensing is becoming increasingly applicable in land cover and topographic mapping research. UAS equipped with user cameras can easily capture high-resolution images, allowing the generation of a geospatial point cloud, followed by the creation of a three-dimensional surface model and orthophoto mosaics. In photogrammetry using the SfM-MVS image processing method, indirect georeferencing of digital data using ground control points (GCP) is usually applied. But choosing, marking, and coordinating GCPs in hard-to-reach areas is laborious, time-consuming, and in some cases dangerous or impossible. The main purpose of this research is to evaluate the accuracy of geospatial point clouds as a major product of photogrammetric processing by the SfM-MVS method. The images were georeferenced using the PPK (Post-Processing Kinematic) method to calculate the coordinates (X_0 , Y_0 , Z_0) of the projection centers of the camera lens used to obtain UAS imagery. For this purpose, a test area was captured in a mountainous area using three different camera/UAS configurations. The direct and indirect method for georeferencing of digital products are compared. The mean square error (RMSE) in the position of a point in dense cloud structures was calculated using validation points (VP) with precise field measurements of coordinates. The analysis is based on a statistical evaluation of experimental data obtained from a TAROT X6-based hexacopter equipped with two different image sensor configurations: 1) Sony RX0 action camera and 2) The Sony A6000 mirrorless camera, as well as a DJI Phantom 4 Pro quadcopter with an integrated additional GNSS module for direct georeferencing via PPK method. Analyzing the accuracy of the digital point clouds obtained with the experimental UAS/camera configurations for the test area, the present study shows that the UAS-PPK-SfM workflow can provide quality data with centimeter accuracy of photogrammetric products.

KEYWORD: UNMANNED AERIAL SYSTEMS (UAS); SFM-MVS; DIRECT GEOREFERENCING, POINT CLOUDS, PPK, CLOSE-RANGE PHOTOGRAMMETRY

AUTHOR:

Eng. Davis Dinkov, PhD

National Institute of Geophysics, Geodesy and Geography – Bulgarian Academy of Sciences

e-mail: davis.dinkov@gmail.com