

Systematic errors in UAS Mapping – Doming Effect

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Abstract:

UAS mapping is a state-of-the-art tool for generating 3D point cloud, DSM and orthorectified mosaics. It has been widely accepted in many industries such as geospatial engineering, surveying, civil engineering, agriculture, mapping, to name but a few. The aerial images acquired by UASs with consumer grade cameras are typically processed using UAS photogrammetry software packages, e.g. Pix4Dmapper. In-flight calibration is usually done within the bundle adjustment, which may lead to inaccurate camera calibration if the flights are not planned properly including the distribution of GCPs. Systematic errors for height measurement of the point cloud could exist due to inaccurate radial distortion calibration and unstable internal geometries of the camera. This has been observed in a number of UAS mapping projects (Yilmaz, 2015), where the heights of the point cloud derived from UAS mapping have been found to be always higher than those obtained from GNSS-RTK within the same datum. The height differences are larger as a function of distance from the GCPs. This is the so-called “doming effect”. A number of researchers have investigated the theoretical impact of the doming effect on stereo images (Fryer and Mitchell, 1987), terrestrial close range photogrammetry (Wackrow and Chandler, 2011, Markus Rumplera, 2014) and computer simulated photogrammetry (James and Robson, 2014). In this presentation, we look into this matter from a practical UAS mapping perspective with a view to evaluate the scale of the systematic errors and to suggest approaches to minimising the effect of such a systematic error.

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