A study of the raised terraces of Kincraig Point using Structure from Motion and GIS analysis

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November 27, 2018

Abstract

Kincraig Point in south Fife displays four clear raised terraces as well as a lower terrace close to current sea level. The terraces are erosional features, as opposed to depositional features which are more abundant across Fife. This study aims to use Kincraig Point as a case study to investigate regional differential uplift which is suggested to have occurred in this area since the Last Glacial Maximum (LGM). Structure from Motion (SfM) has emerged as a useful tool for obtaining low-cost, high resolution digital elevation models and therefore has great potential in the geosciences (Westoby *et al*., 2012). In this study, 398 low-altitude aerial photographs were acquired in nadir perspective, using a <1kg quadcopter unmanned aerial vehicle (UAV). The photographs were processed within Agisoft Photoscan Pro. The images cover an area of 0.196 km^2, with a ground resolution of 2.82 cm/pix and a point density of 314 points/m^2, with the final DEM resolution being 5.64 cm/pix. 3-D Analyst tools within ArcGIS were utilised to create a high resolution DEM, slope map and aspect map (Figure 1), as well as profiles through each of the terraces. The elevations of each terrace at their lower edge have been recorded as 36.3 m, 22.8 m, 13.8 m, 5.3 m and the fifth lower platform close to sea level is measured at 0.2 m. Future work will involve taking soundings along each of the terraces to confirm if the underlying bedrock displays the same slope as the overlying veneer of sediments, and to implement this technique at other key sites. This research explores the use of SfM to aid the understanding of uplift and sea level change at a local scale.
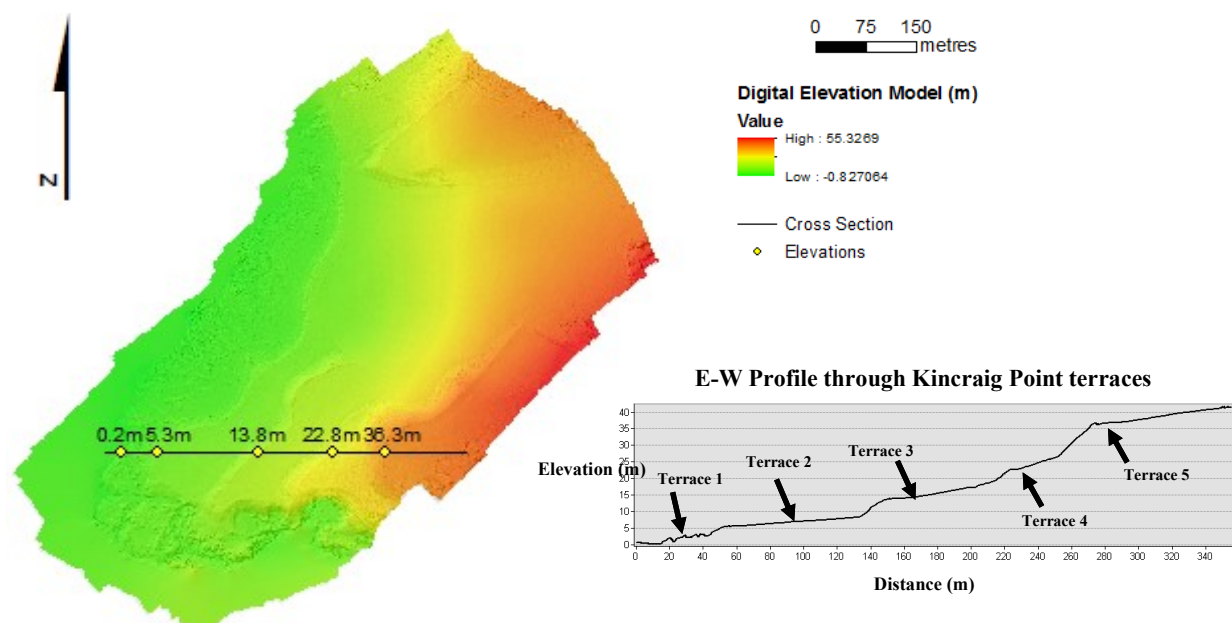
Figure 1: Digital Elevation Model created using Agisoft Photoscan Pro and displayed within ArcGIS. An E-W profile has been displayed.

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References

Westoby, M. J., Brasington, J., Glasser, N. F., Hambrey, M. J., Reynolds, J. M. 2012.'Structure from Motion' photogrammetry: A low-cost, effective tool for geoscience applications. *Geomorphology*, 179, pp. 300-314.