Exploring the potential of Sentinel-1 InSAR for Pleistocene glacier reconstruction at Rumija, Montenegro

Document Version
Final published version

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Download date: 29. Mar. 2020
Exploring the potential of Sentinel-1 InSAR for Pleistocene glacier reconstruction in Montenegro

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Background
Significant variation in the timing and presence of Pleistocene glacialiation has emerged with the application of advanced dating techniques, both within and between regions of the Mediterranean (Hughes and Woodward 2016). In order gain a better understanding of the causes, we must look to obtain a more complete record of Mediterranean glacialiation. Some areas, such as Rumija in littoral Montenegro, are yet to be explored for evidence of Pleistocene glacialiation.

Digital Elevation Models (DEMs) offer a method of identifying glacial geomorphology (Smith, Rose and Booth, 2006). But for most areas in the Mediterranean, only a 30m resolution Shuttle Radar Topography Mission (SRTM) DEM is freely available, which is too coarse grained for some landforms.

Initial research has highlighted the potential of Sentinel-1 derived DEMs as an alternative to the SRTM DEM (Nikolakopoulos and Kyriou, 2015).

Study Aims
To generate a DEM using Sentinel-1 interferometry and critically assess this against the SRTM 30m DEM. Use the DEM to carry out geomorphological mapping of Rumija and reconstruct Pleistocene glacialiation.

Methodology

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Results
A DEM was successfully created which captures the large scale hydrological network of the surrounding Albanian Alps (Figure 2). Elevation is overestimated by up to 200m in low elevation ranges, with rough and uneven terrain displayed at a known flat polje floor. This is attributed to low coherence in these areas.

Root Mean Square Error shows an average vertical error of 67.5m. There is a negative logarithmic trend between elevation error and SRTM elevation, where the Sentinel-1 DEM overestimates elevation in Lowlands and underestimates in Uplands (Figure 4).

Conclusion
There is scope for using Sentinel-1 to create DEMs. However improvements of the DEM quality and accuracy are required. The Sentinel-1 DEM was suited to geomorphological mapping in the uplands of this region.

Evidence of glaciation at Rumija has been established, making it one of the lowest mountains glaciated during the Pleistocene in the Mediterranean.

References

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