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ALOS DEM quality assessment in a rugged topography, A Lebanese watershed as a case study

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Deriving the morphometric descriptors of the Earth's surface from satellite images is a continuing application in remote sensing, which has been distinctly pushed with the increasing availability of DEMs at different scales, specifically those derived from high to very high-resolution stereoscopic and triscopic image data. The extraction of the morphometric descriptors is affected by the errors of the DEM. This study presents a procedure for assessing the quality of ALOS DEM in terms of position and morphometric indices. It involves evaluating the impact of the production parameters on the altimetric accuracy through checking height differences between Ground Control Points (GCP) and the corresponding DEM points, on the planimetric accuracy by comparing extracted drainage lines with topographic maps, and on the morphometric indices by comparing profiles extracted from the DEM with those measured on the field. A twenty set of triplet-stereo imagery from the PRISM instrument on the ALOS satellite has been processed to acquire a 5 m DEM covering the whole Lebanese territories. The Lebanese topography is characterized by its ruggedness with two parallel mountainous chains embedding a depression (The Bekaa Valley). The DEM was extracted via PCI Geomatica 2013. Each of the images required 15 GCPs and around 50 tie points. Field measurements was carried out using differential GPS (Trimble GeoXH6000, ProXRT receiver and the LaserACE 1000 Rangefinder) on Al Awali watershed (482 km2, about 5% of the Lebanese terrain). 3545 GPS points were collected at all ranges of elevation specifying the Lebanese terrain diversity, ranging from cliffy, to steep and gently undulating terrain along with narrow and wide flood plains and including predetermined profiles. Moreover, definite points such as road intersections and river beds were also measured in order to assess the extracted streams from the DEM. ArcGIS 10.1 was also utilized to extract the drainage network. Preliminary results showed that using Toutin's Model, enabling Wallis filter and specifying high DEM detail, along with restricting the holes filling option gave the best position accuracy and the least number of failure values. This is mainly due to the ruggedness of the studying area. Comparing GPS heights with the extract DEM showed a Minimum and a maximum error of (-11.9 m, 10.56 m), Mean error (1.32 m) and RMSE of (4.7 m). While extracting the drainage lines showed 80 to 90 % of coincidence of the upper water heads and an order of less than one pixel for the main river course and mountainous road intersection.