

Satellite Photogrammetry for DEM Generation Using Stereo Pair and Automatic Extraction of Terrain Parameters

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Abstract : A Digital Elevation Model (DEM) is a simple representation of a surface in 3 dimensional space with elevation as the third dimension along with X (horizontal coordinates) and Y (vertical coordinates) in rectangular coordinates. DEM has wide applications in various fields like disaster management, hydrology and watershed management, geomorphology, urban development, map creation and resource management etc. Cartosat-1 or IRS P5 (Indian Remote Sensing Satellite) is a state-of-the-art remote sensing satellite built by ISRO (May 5, 2005) which is mainly intended for cartographic applications. Cartosat-1 is equipped with two panchromatic cameras capable of simultaneous acquiring images of 2.5 meters spatial resolution. One camera is looking at +26 degrees forward while another looks at -5 degrees backward to acquire stereoscopic imagery with base to height ratio of 0.62. The time difference between acquiring of the stereopair images is approximately 52 seconds. The high resolution stereo data have great potential to produce high-quality DEM. The high-resolution Cartosat-1 stereo image data is expected to have significant impact in topographic mapping and watershed applications. The objective of the present study is to generate high-resolution DEM, quality evaluation in different elevation strata, generation of ortho-rectified image and associated accuracy assessment from CARTOSAT-1 data based Ground Control Points (GCPs) for Aglar watershed (Tehri-Garhwal and Dehradun district, Uttarakhand, India). The present study reveals that generated DEMs (10m and 30m) derived from the CARTOSAT-1 stereo pair is much better and accurate when compared with existing DEMs (ASTER and CARTO DEM) also for different terrain parameters like slope, aspect, drainage, watershed boundaries etc., which are derived from the generated DEMs, have better accuracy and results when compared with the other two (ASTER and CARTO) DEMs derived terrain parameters.

Keywords : ASTER-DEM, CARTO-DEM, CARTOSAT-1, digital elevation model (DEM), ortho-rectified image, photogrammetry, RPC, stereo pair, terrain parameters

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