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A new method to calibrate fine scale InSAR derived digital elevation models

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Digital elevation models (DEMs) are essential in environmental, geological and morphological studies. DEMs are obtained from a variety of sources and generated in several ways. Nowadays, several elevation data sets are available for free (e.g., Shuttle Radar Topographic Mission (SRTM), ASTER. However, the proposed spatial resolution (~30 m) is coarse for studies at fine scale (agriculture, mining activities, hydrology etc.). Synthetic aperture radar interferometry (InSAR) is a well-established technique for measuring the topographic profile of earth surface using a pair of SAR images acquired from slightly different angles for the same area. The phase information contained in SAR images is used to derive the tri-dimensional information of the target. Compared to other remote sensing techniques, InSAR has the advantage to be used day and night independently of weather conditions. However, in addition to the limitations caused by baseline errors and atmospheric effects the feasibility of an interferometric measurement depends enormously on the coherence between the selected image pair. Thus, while conventional, InSAR has proven very effective in building DEMs in regions of good coherence, it is clear that if the surface is vegetated or is prone to snow coverage, the scattering properties change with time and result in temporal decorrelation. Temporal and spatial coverages of earth's surface are being considerably improved by numerous current and forthcoming spaceborne sensors (Radarsar-2, Sentinel-1, and the near-future RADARSAT constellation), thus offering more possibilities to improve the quality of available DEMs. However, with repeat-pass SAR data, important temporal decorrelation is expected, especially for vegetated and snow covered areas. Thus, the use of these data for producing accurate and high resolution DEMs should not be straightforward. In this research work, a simple new method combining InSAR-derived elevation data with SRTM is proposed in order to produce an accurate and fine scale DEM. SRTM and Sentinel-1 SAR datasets (~5 m spatial resolution) were used to generate a DEM over Malartic city (QC). Results show that the produced fine-resolution DEM present a good spatial correlation (R=0.98) and low height (RMSE=1.10 m) compared to 236 reference point well distributed over the study site.

Biography

Najib Djamai is a Post-doctoral Researcher with the Centre d' Application et de Recherche en Télédétection, Université de Sherbrooke (Sherbrooke, QC) in cooperation with Corriveau JL & Assoc. Inc. (Val d'Or, QC). He has received his Engineering degree in Hydrometeorology from École Nationale d'Ingénieurs de Tunis (Tunisia) (2008), an MSc degree in Geomatics from Université Laval (Quebec, QC) (2010), and PhD degree from Université de Sherbrooke (Sherbrooke, QC) in 2015. His research interests focus on geomatics applied to the environment and natural resources: GIS, image processing, interferometric synthetic-aperture radar, LIDAR, geophysical parameter estimation from spatial data (optical data, infrared, radar and passive microwave), assimilation and hydrological and climatological modeling.

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