TEXTURE FREE RADARGRAMMETRIC PROCESSING OF OPPOSITE-VIEW TOMOSAR DATA FOR DEM ESTIMATION

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In the present work a new methodology to retrieve the absolute digital elevation model (DEM) of a scene from Tomographic SAR (TomoSAR) [1] data is proposed. First of all, two 3D images of the scene are generated from TomoSAR data acquired from opposite views. Tomographic data are phase calibrated with Phase Center Double Localization algorithm, that jointly estimates platform positioning errors and elevation of the targets in the scene [2]. From the two opposite view 3D images, two DEMs of the same area are thus obtained as corresponding to the surface layer location. The two DEMs obtained are affected from different low pass undulations corresponding to the null space of the calibration problem [2], which consists of a different residual rotation for each along track position of the sensors. For every azimuth, a pair of rotations can thus be fixed by maximizing the correlation between the elevation profiles resulting from the opposite views as a function of the pair of correction rotations applied. This step is analogous to the coregistration step of radargrammetric processing [3]; in this case, however, no scene texture is required, since surface elevation profiles obtained from TomoSAR are coregistered instead of 2D intensity images. This methodology is thus particularly useful in the case of scenes lacking features for the application of texture tracking techniques, such as land ice. Moreover, it exploits the accuracy of interferometric processing combined to the precise stereo localization of opposite-view radargrammetry for rotational ambiguity solving. The methodology can be applied even starting from partial topographic information. An absolute DEM in georeferenced coordinates may finally be obtained by fusing the two corrected DEMs. The methodology is illustrated and tested on real data from ESA IceSAR 2012 campaign [4] and lidar data for comparison [5].

Figure 1. An example of the proposed methodology. Upper panel: tomographic profiles for the two opposite views (in red and green respectively) in the azimuth-elevation plane (x and z respectively) before correcting residual rotations from phase calibration. Lidar elevation is plotted as a blue dashed line (lidar coverage is limited with respect to the imaged scene). Lower panel: the same image after correcting for residual rotations. It can be noted that the overall agreement between tomographic profiles and lidar is good.
REFERENCES


