

Airborne SAR Data Analysis for Impact of Doppler Centroid on Image Quality and Registration Accuracy

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Abstract : This paper brings out the analysis of the airborne Synthetic Aperture Radar (SAR) data to study the impact of Doppler centroid on Image quality and geocoding accuracy from the perspective of Stripmap mode of data acquisition. Although in Stripmap mode of data acquisition radar beam points at 90 degrees broad side (side looking), shift in the Doppler centroid is invariable due to platform motion. In-accurate estimation of Doppler centroid leads to poor image quality and image miss-registration. The effect of Doppler centroid is analyzed in this paper using multiple sets of data collected from airborne platform. Occurrences of ghost (ambiguous) targets and their power levels have been analyzed that impacts appropriate choice of PRF. Effect of aircraft attitudes (roll, pitch and yaw) on the Doppler centroid is also analyzed with the collected data sets. Various stages of the RDA (Range Doppler Algorithm) algorithm used for image formation in Stripmap mode, range compression, Doppler centroid estimation, azimuth compression, range cell migration correction are analyzed to find the performance limits and the dependence of the imaging geometry on the final image. The ability of Doppler centroid estimation to enhance the imaging accuracy for registration are also illustrated in this paper. The paper also tries to bring out the processing of low squint SAR data, the challenges and the performance limits imposed by the imaging geometry and the platform dynamics on the final image quality metrics. Finally, the effect on various terrain types, including land, water and bright scatters is also presented.

Keywords : ambiguous target, Doppler Centroid, image registration, Airborne SAR

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