ABSTRACT SUBMITTED FOR CONSIDERATION UNDER THE TOPIC OF SPACEBORNE AND AIRBORNE REMOTE SENSING MISSIONS
OR
IMAGE PROCESSING AND REGISTRATION

PROCESSING OF SCAN SAR MODE DATA FOR RADARSAT

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RADARSAT is an earth observing SAR mission led by the Canadian Space Administration. NASA is participating as a partner and is responsible for the planning, processing, archiving and distribution of data collected both at the Alaska SAR Facility (ASF) as well as other receiving stations. ASF was commissioned back in 1991 to support ERS-1 and later upgraded in 1992 to accommodate JERS-1. It has also been designated to handle RADARSAT data as well. The Jet Propulsion Laboratory has furnished and upgraded SAR processors to ASF for ERS-1 and JERS-1, and again will be developing processors for reducing RADARSAT SAR data into imagery. Unlike previous sensors, RADARSAT utilizes a C-band SAR that operates in a multitude of data taking modes that allow data users high flexibility in selecting between resolution and swath width. Five RADARSAT operating modes: fine resolution beam mode, standard beam mode, extended beam mode, wide swath mode, and scan SAR mode combine to afford an image swath width coverage from a narrow 45 kilometer to a wide 500 kilometer while yielding pixel resolution in the range of 10 meter to 400 meter. Among these five operating modes, scan SAR represents a novel approach in data collection and also presents new and interesting challenges in the image formation process. The scanning beam data taking arrangement utilizes a burst mode radar that can introduce changing radar parameters from burst to burst much like Magellan. However, in the RADARSAT case, successive bursts are now 'scanned' from near to far range; allowing the formation of wide swath imagery of up to 500 km across by combining images from these bursts appropriately. This data taking scheme levies stringent processing requirements on each individual burst in order that the radiometric and geometric distortion tolerances specified for the overall imagery can be satisfied.

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This paper presents some of the analysis and simulation work performed that led to a scan SAR data processor straw-man design. In the design process, critical processing parameters are first derived. Parameters such as along and *cross* track Doppler bounds and drift rates that are dictated by earth rotation effect and expected sensor orbit trajectory and attitude characteristics are determined. Parameter update requirements are then derived based on pixel geometric and radiometric performance requirements as stated in the Science Requirements (Carsey, 1993) . With RADARSAT scan SAR operating in a burst mode fashion much like Magellan, the scan SAR processor blueprints on the existing Magellan processing concept [1,2]. Signal compression algorithms are evaluated based on their throughput potential as well as their ability to accommodate the required parameter update rates. The SPECAN and the deramp-FFT approach are emerging as the leading candidates for range and azimuth processing respectively. Geometric rectification process used in Magellan data processing is modified to better fit the data flow and thereby enhancing its throughput efficiency. Radiometrically, all intermediate processing stages within the processor are designed with a unity gain so as to optimize internal data dynamic range distribution. Also, due to the relatively poor antenna pointing knowledge and the wide swath coverage provided in the scan SAR mode, a new close-loop radiometric compensation strategy is being devised to assure consistent radiometric performance across the swath.

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