3D TOPOGRAPHY AND FOREST RECOVERY FROM AN L-BAND SINGLE-PASS AIRBORNE POLINSAR SYSTEM

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Abstract

Polarimetric interferometry (Pol-InSAR) [1], [2] has shown considerable progress in recent years in a variety of applications. One of the applications of interest is the extraction of bare-earth DEMs beneath forest canopy in addition to the canopy height itself. The use of L-Band data is of particular relevance since it has reasonable forest penetration capability [3] while being less restricted by bandwidth licensing restrictions than longer wavelengths. Thus it is being considered for satellite platforms of the future. However the interferometric phase response recorded from typical forest environments is a mixture of ground and forest contributions. The potential of Pol-InSAR, together with an appropriate model such as the Random Volume Over Ground (RVOG) model, has demonstrated significant success for the recovery of canopy height and, to a lesser extent, ground elevation beneath canopy, as has been documented in the literature. However, most of the L-Band experience to date has been obtained with repeat-pass Pol-InSAR, so that temporal de-correlation as well as residual motion remains an issue. For this reason, an experimental single-pass airborne L-Band, fully polarimetric InSAR system has been developed [4] to assess performance in forest conditions in the absence of temporal de-correlation and residual motion issues.

In this paper, we show results from recent tests using this newly-developed single-pass system. A series of tests were carried out over the period December 2007 – June 2008 in western Canada. In the early part of the series, only a portion of the swath was available due to multi-path problems. After multi-path mitigation efforts, the test areas were revisited and part of these results are reported here.

The particular test results presented include those from a forested areas in the Fraser Delta area of British Columbia, Canada. The forest samples are mainly deciduous species with canopy heights ranging from 15 to 45 meters. Ancillary data for analysis purposes

included high resolution color air-photos plus lidar ground and feature data and X-Band DSM and ORI data acquired independently a few months earlier. The test area comprises both flat and sloping terrain. Homogeneous forested areas tend to be small and merge quickly from one type to another.

The RVOG model is applied to the calibrated Pol-InSAR data using optimization techniques including both phase [5] and magnitude diversity [2]. Topics addressed in the paper include the accuracies achieved for the bare-earth DEMs and forest heights extracted as a function of forest height and other parameters. Canopy height based upon certain X-band assumptions estimates are also included for comparison.

References:

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