# INTEGRATION OF RADARSAT-2 SCANSAR AND AWIFS FOR OPERATIONAL AGRICULTURAL LAND USE MONITORING OVER THE CANADIAN PRAIRIES

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Abstract

Agriculture plays an important role in Canada's economy. Annual information on agricultural land use (crop inventory) would permit more efficient and effective delivery of agricultural programs and environmental sustainability of the agricultural sector. The Canadian agricultural community would benefit from annual crop inventory information. The remote sensing team at Agriculture and Agri-Food Canada's (AAFC) Research Branch conducted a crop inventory project using optical and radar for crop species identification. This completed multi-year (2004-2007) project defined a methodology to integrate radar (RADARSAT-1, ASAR) and optical satellite (Landsat, SPOT-4) data for successful crop classification (McNairn et al., 2008; Shang et al., 2008). This approach has some limitations, including the limited spatial coverage of SPOT and Landsat data to capture Canada's vast agricultural land comprehensively. Results indicated that when available, multi-temporal (2-3 scenes acquired at different growth stages) optical data are ideal for crop classification. However optical data during key growth stages may not be available due to cloud cover given the 16-day repeat cycle of Landsat TM. SPOT data can be acquired more frequently due to off-nadir pointing capabilities, but the small swath size means that multiple images must be acquired in order to get the same coverage as Landsat. For operational crop inventory at the national scale, satellite data with wide swath and moderate spatial resolution are needed to obtain both crop detail and large coverage.

The Indian Space Resource Organization Satellite Resourcesat-1 (IRS-P6) provides multi-spectral Advanced Wide Field Sensor (AWiFS) data with a more frequent repeat cycle which will greatly increase the potential for successful acquisition of cloud-free optical data at a slightly reduced spatial resolution (56m at nadir). An earlier study by the same AAFC team has compared the use of AWiFS data with traditional optical sensors such as Landsat-TM and SPOT for crop mapping over three Canadian agriculture sites in Eastern Ontario, Manitoba, and Saskatchewan (Champagne et al., 2007). The study reveals that the use of AWiFS data leads to a slight reduction in accuracy over traditional optical sensors. The use of AWiFS 56m resolution data reduces spatial details; however this slightly reduced accuracy is offset by the benefits of AWiFS wide swath (370 km per quadrant) particularly for the purpose of annual national operational crop mapping. AWiFS 56m spatial resolution is well suited for field sizes found in Canada's Prairie regions. The province of Manitoba was selected as a pilot site for the 2008 year. Multi-temporal AWiFS data have been acquired throughout the growing season. In addition, multi-temporal dual-pol (VV, VH) RADARSAT-2 ScanSAR Narrow data were also acquired. This RADARSAT-2 beam mode offers comparable spatial resolution (50 m) and swath coverage (300 km) to AWiFS. Combining the two sensors will create a synergistic effect hence improving crop identification. Supporting field surveys were made with over 1000 fields visited multiple times during the growing season. Preliminary results indicate that multi-temporal AWiFS data can produce an adequate crop classification, with an overall accuracy of 83%. The addition of radar improves the

overall classification accuracies. The contribution of radar is more pronounced earlier in the growing season. The addition of one RADATSAT-2 ScanSAR scene (July 31) to two early AWiFS scenes (June 19 and July 9) improved the overall accuracy by 8%. In particular, significant increase of accuracies at the crop level was observed for pasture, flax, and corn (12%, 12%, and 40% respectively). This paper will present detailed crop classification results obtained from the Manitoba site using various combinations of AWiFS and RADARSAT-2 ScanSAR data. This paper will also address the issues related to the wide incidence angles (20-46°) of the RADARSAT-2 ScanSAR and their impact on classification performance.

Bibliography:

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