EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Applications and Economic Benefits (5)

Author: Dr. David G. Goodenough
Pacific Forestry Centre, Natural Resources Canada, Canada, dgoodeno@nrcan.gc.ca

Mr. Hao Chen
Pacific Forestry Centre, Natural Resources Canada, Canada, hchen@nrcan.gc.ca
Mr. Ashlin Richardson
Natural Resources Canada, Canada, arich@nrcan.gc.ca
Dr. Shane Cloude
AEL Consultants, United Kingdom, aelc@mac.com
Dr. Belaid Moa
University of Victoria, Canada, bmoa@cs.uvic.ca

APPLICATION OF POLARIMETRIC SAR FOR HISTORICAL FOREST FIRE SCARS AND BIOMASS

Abstract

Canada contains 11 percent of the world's forest cover. Advanced polarimetric SAR is necessary to monitor forest biomass and natural disturbances in a timely fashion under all weather conditions. Canada's and Japan's polarimetric SARs provide full scattering matrix- (quad-pol) data. Previous research has focused on backscatter values as the primary discriminator of forest classes and forest biomass. The use of polarimetric information has revealed new forest applications, such as the ability to map historical fire scars and more accurate forest classification.

This paper focuses on utilizing the phase information contained in polarimetric SAR data to increase the sensitivity of SAR measurement for fire scar detection and forest biomass estimation. Multi-date PALSAR L-Band and Radarsat-2 C-band quad-pol data have been acquired over our study areas in Key River, BC and Hinton, AB during 2009. The data sets were first corrected for any Faraday rotation. To reduce topography relief effects on the polarimetric SAR data, polarization orientation shifts introduced by terrain slopes in azimuth direction were detected and corrected to generate reflection symmetry in a coherency matrix of the polarimetric SAR data for the next stage of analysis.

Combining modeling and polarimetric decompositions, it was possible to detect fire scars up to 60 years old and to estimate the ages of detected fire scars. A new data-driven clustering approach to detect clusters of fire scars for polarimetric SAR has been implemented. In addition, new parameters, which were not sensitive to topographic features, were employed to illustrate the potential of the new methodology to discriminate forest fire scar from other landcover types in a low dimensional space. For the biomass application with polarimetric SAR, two coherent models, a Random Volume Over Ground (RVOG) and Oriented Volume Over Ground (OVOG) model, were tested to estimate maximum surface to volume ratio that was critical for the estimation of forest biomass. This paper reports on the results of these experiments and the benefits for aboveground carbon mapping.