Investigating Historical Fire Scars using Polarimetric SAR

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The boreal forest covers 11 percent of the world's landmass, contains 20 percent of the world's fresh water, and has a strong influence on climate weather patterns. In Canada, more than 53 percent of the land mass is covered by the boreal forest, most of which is isolated and undeveloped. Satellite radar remote sensing of the boreal forest is necessary to monitor forest health and natural disturbances, such as fire under all weather conditions. Fire is an intrinsic part of the boreal forest life cycle and plays an important role in carbon cycling directly affecting the atmospheric carbon balance.

Previous studies by the authors have demonstrated the ability to map a 50-year old historical fire scar using airborne Convair580 C-Band SAR data at a 51° incidence angle near Hinton, Alberta. More recent work has focused on the Chinchaga fire, which burned for 5 months and consumed 1.7 million hectares of the boreal forest of northern British Columbia and Alberta in 1950. Multi-date PALSAR L-Band and Radarsat-2 C-band quad-pol data have been acquired over the boundary areas of the Chinchaga fire in fall of 2008 and spring of 2009. This area has an extensive fire history with multiple fires in every decade since 1950. The Alberta government has maintained an extensive database of all fires since 1950, which has provided valuable resources for validating the observations that have been made with the SAR data.

Research has demonstrated that the majority of polarimetric decomposition parameters are sensitive to recent fire disturbances. The focus has been to elucidate the age of fire disturbances by evaluating the effect with new decomposition software and deriving physical explanations of how this effect is manifested in the polarimetric SAR backscatter. Further, this study will report on the effect of the season of data acquisition, incidence angle, and wavelength to optimize the detection and mapping of historical fire scars. The ability to map historical fire scars would provide valuable information on the changes in the fire history with time, the changes in growth and yield in the disturbed areas, and the impacts on aboveground carbon storage.