Detection and Validation of Forest Disturbances using RADARSAT-2

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ABSTRACT

RADARSAT-2 SAR data was used to develop a monitoring program for Canadian forest lands with the aim to provide information on forest harvesting. Study sites in British Columbia and New Brunswick Canada were selected. RADARSAT-2 MultiLook Fine mode, acquired from mid-June through mid-September, from 2011 to 2015, was analyzed with the aim to detect forest disturbances.

Due to large data volumes and the need for efficiency, an automated end-to-end solution was implemented. The automated solution included image coregistration, temporal filtering, detection of forest disturbances, and delineation of the disturbances. To mitigate false positives, a non-forest mask was developed that entailed a combination of CanVec data that delineated areas such as water bodies, roads, and urban/industrial areas and SAR-derived information such as layover and scattering from urban areas.

To assess the performance of the change detection algorithm, the RADARSAT-2 changes were compared to tree-loss information from the Canadian Forest Service (CFS). Since CFS information was representative of annual changes, but the RADARSAT-2 derived changes were representative of summer-only changes, there were discrepancies between the RADARSAT-2 data and the CFS data. Notwithstanding these discrepancies, the detection performance, based on the RADARSAT-2 and CFS changes overlapping by at least 50%, was better than 76%, with one exception at 62%.

The tree-loss area from the CFS and the RADARSAT-2 data was calculated and based on the sum of all the individual changes detected for the entire spatial extent of the RADARSAT-2 image. In general, there was good agreement between the RADARSAT-2 and CFS tree-loss area. Of note were the results for BC: in 2013 there was a 7% difference between the RADARSAT-2 area and the CFS area, and for 2015, a 3% difference. Considering that the RADARSAT-2 change-area estimation was automated, the generally good agreement was encouraging. In addition to the area, the trend, i.e. area increase or decrease per year, was the same for RADARSAT-2 and CFS. Follow-on work will focus on the use of machine learning to further automate and increase accuracy.