
Abstract

Investigating the temporal and spatial pattern of landscape disturbances is an important requirement for modeling ecosystem characteristics, including understanding changes in the terrestrial carbon cycle or mapping the quality and abundance of wildlife habitats. Data from the Landsat series of satellites have been successfully applied to map a range of biophysical vegetation parameters at a 30 m spatial resolution; the Landsat 16 day revisit cycle, however, which is often extended due to cloud cover, can be a major obstacle for monitoring short term disturbances and changes in vegetation characteristics through time.

The development of data fusion techniques has helped to improve the temporal resolution of fine spatial resolution data by blending observations from sensors with differing spatial and temporal characteristics. This study introduces a new data fusion model for producing synthetic imagery and the detection of changes termed Spatial Temporal Adaptive Algorithm for mapping Reflectance Change (STAARCH). The algorithm is designed to detect changes in reflectance, denoting disturbance, using Tasseled Cap transformations of both Landsat TM/ETM and MODIS reflectance data. The algorithm has been tested over a 185 × 185 km study area in west-central Alberta, Canada. Results show that STAARCH was able to identify spatial and temporal changes in the landscape with a high level of detail. The spatial accuracy of the disturbed area was 93% when compared to the validation data set, while temporal changes in the landscape were correctly estimated for 87% to 89% of instances for the total disturbed area. The change sequence derived from STAARCH was also used to produce synthetic Landsat images for the study period for each available date of MODIS imagery. Comparison to existing Landsat observations showed that the change sequence derived from STAARCH helped to improve the prediction results when compared to previously published data fusion techniques.