Comparing Change Detection methods and Disturbance Algorithm in Forests and Rangelands Landscape using Remote Sensing Time Series Data

**Abstract**

The landscape pattern of forest/vegetation structure is shaped in part by the history, ecology of disturbance, and recovery processes. Recently, there has been major growth in the Earth observation dataset, increased availability of cloud computing resources, and the development of change detection /disturbance algorithms that are critical to identifying underlying patterns and understanding vegetation dynamics. Though many of the individual change detection algorithms and their applications tend to be tested and well documented in certain environments, mostly in the forest landscapes, however, a comparison of the sensitivity and ability of different approaches to detect changes in pixel signals and opinions on their practical use differ widely mixed with noise, varying seasonal amplitudes, and disturbance size, severity, and timing of broad and subtle changes of different landscapes are unclear. This study reviews and analyses numerical simulation data influenced by different biophysical driving processes and events with different types of plant responses to examine the effectiveness and ability of different trend and disturbance algorithms in detecting different magnitudes of disturbances in vegetation over different time periods across different landscapes (Rangelands, forests, and plantation) in unambiguous and controlled conditions. Specifically, we evaluated eight change detection algorithms’ sensitivity to (1) detect gradual, abrupt, and seasonal changes with different amplitudes (2) detect broad and subtle changes with different values of magnitudes (severity, size) (3) distinguish the abilities of the algorithms to detect trends and changes in time series with signal contaminations and noise values (4) quantify how observation frequency impacted the detection of changes in short and long temporal time intervals (5) Test if our estimates with simulation data compare well with remote sensing data (6) In addition to using simulated data, as a form of validation, determine the extent to which coarse-resolution remote sensing data can accurately capture spatial and temporal patterns of disturbance (7) determine if data from Landsat and MODIS fusion contributed to an improvement in characterizing changes over either sensor alone.

***Keywords****:*Trends; Simulation; Disturbances; Seasonality; Time series; Change detection