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

**Abstract**

The landscape pattern of vegetation structure and composition is shaped in part by the history, ecology of disturbance, and recovery processes. The frequency and severity of disturbances and reduced ability to recover put pressure on resilience and the functionality of the ecosystem. Recently, there has been major growth in the Earth observation dataset, increased availability of dense and long-term time series, cloud computing resources, and the development of change detection /disturbance algorithms that are critical to identifying and understanding underlying vegetation patterns and 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 ability of different approaches and their sensitivity to disturbances, the influence of the environment, data characteristics are unclear and opinions on their practical use differ widely. There is no comparative study that tests the limitations and evaluates the performance of the different methods to quantify their reliability to identify the disturbances based on the trend, magnitude, severity, and timing of broad and subtle changes using simulated time series data. This study reviews and analyses a range of different disturbance algorithms and apply them to different simulation time series comparable to the original satellite time series to examine their effectiveness and limitations in the typical vegetation undergoing changes and experiencing disturbances in unambiguous and controlled conditions. Specifically, we used eight change detection algorithms on multiple simulation data to (1) evaluate their sensitivity to gradual, abrupt, and seasonal changes (2) evaluate their effectiveness to detect broad and subtle changes with different values of magnitudes (severity, size, disturbance timing and recovery time) (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

# Introduction

# Methods

# Results

# Discussion

# Conclusion