Multiple Remote Sensing Indicators for Understanding Spatiotemporal Trends Across a Changing Landscape in North and South America.

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Identifying and understanding the nature of changing landscapes is one of the great challenges in a time of intense Earth observation. There are abundances of remotely sensed data and computing capacity now available to researchers, which enables moving beyond the use of one or a few sensors or datasets for the generation of static or limited land cover/land use products. Using multiple time series datasets at complementary spatial, temporal, and spectral scales to study land surface dynamics should improve the detection and interpretation of complex processes; the result should be a more accurate and detailed analysis of landscape trends, including the distribution and severity of changes and their possible causes and potential consequences. Therefore, we have conducted an analysis based on a variety of remote sensing products covering North and South America across an approximately fifteen-year period with spatial resolutions extending from 500m to 1 degree, including (1) NBAR-based vegetation indices, albedo, land surface temperature, and evapotranspiration from MODIS, (2) air temperature, water vapor, and vegetation optical depth from AMSR-E and AMSR2, (3) surface air temperature, water vapor, and relative humidity from AIRS, and (4) surface shortwave, longwave, and total net flux from CERES. We applied the non-parametric Seasonal-Kendall trend test to these time series, both annually and on a seasonal basis (summer & winter), to identify hotspots of significant change. We partitioned the data by indicators of human impact and ecoregion, such as the Human Influence Index, Anthropogenic Biomes, and Ecoregions of the World.
We formulate our question as a suite of testable hypotheses about changes in the vegetated land surface, as follows:
(H1) Areas of significant positive change occur in areas of moderate human impact, due predominantly to agricultural land uses;
(H2) Areas of significant negative change that occur in areas with low human impact, arise predominantly from forest pests and forest fires; and
(H3) Areas of significant negative changes that occur in areas with high human impact, appear predominantly associated with the expansion of human settlements, particularly cities.
The results indicate significant benefit from the multiple data stream approach to studying land surface dynamics.

Keywords: Global Change, MODIS, AMSR, Human Influence, Ecoregions, Anthromes

