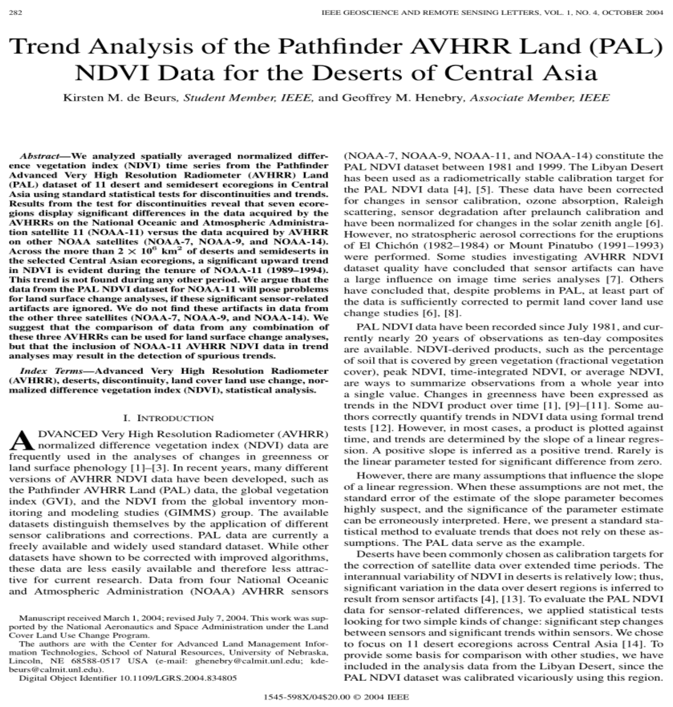
Spatio-temporal Analysis Of Net Primary Production Across Ontario Using An Ecoregionalization



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Trend Analysis of the Pathfinder AVHRR Land (PAL) NDVI Data for the Deserts of Central Asia

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***Abstract*—We analyzed spatially averaged normalized difference vegetation index (NDVI) time series from the Pathfinder Advanced Very High Resolution Radiometer (AVHRR) Land (PAL) dataset of 11 desert and semidesert ecoregions in Central Asia using standard statistical tests for discontinuities and trends. Results from the test for discontinuities reveal that seven ecoregions display significant differences in the data acquired by the AVHRRs on the National Oceanic and Atmospheric Administration satellite 11 (NOAA-11) versus the data acquired by AVHRR on other NOAA satellites (NOAA-7, NOAA-9, and NOAA-14). Across the more than 2×10^6 km^2 of deserts and semideserts in the selected Central Asian ecoregions, a significant upward trend in NDVI is evident during the tenure of NOAA-11 (1989–1994). This trend is not found during any other period. We argue that the data from the PAL NDVI dataset for NOAA-11 will pose problems for land surface change analyses, if these significant sensor-related artifacts are ignored. We do not find these artifacts in data from the other three satellites (NOAA-7, NOAA-9, and NOAA-14). We suggest that the comparison of data from any combination of these three AVHRRs can be used for land surface change analyses, but that the inclusion of NOAA-11 AVHRR NDVI data in trend analyses may result in the detection of spurious trends.**

***Index Terms*—Advanced Very High Resolution Radiometer (AVHRR), deserts, discontinuity, land cover land use change, normalized difference vegetation index (NDVI), statistical analysis.**

I. Introduction

ADVANCED Very High Resolution Radiometer (AVHRR) normalized difference vegetation index (NDVI) data are frequently used in the analyses of changes in greenness or land surface phenology [1]–[3]. In recent years, many different versions of AVHRR NDVI data have been developed, such as the Pathfinder AVHRR Land (PAL) data, the global vegetation index (GVI), and the NDVI from the global inventory monitoring and modeling studies (GIMMS) group. The available datasets distinguish themselves by the application of different sensor calibrations and corrections. PAL data are currently a freely available and widely used standard dataset. While other datasets have shown to be corrected with improved algorithms, these data are less easily available and therefore less attractive for current research. Data from four National Oceanic and Atmospheric Administration (NOAA) AVHRR sensors (NOAA-7, NOAA-9, NOAA-11, and NOAA-14) constitute the PAL NDVI dataset between 1981 and 1999. The Libyan Desert has been used as a radiometrically stable calibration target for the PAL NDVI data [4], [5]. These data have been corrected for changes in sensor calibration, ozone absorption, Raleigh scattering, sensor degradation after prelaunch calibration and have been normalized for changes in the solar zenith angle [6]. However, no stratospheric aerosol corrections for the eruptions of El Chichón (1982–1984) or Mount Pinatubo (1991–1993) were performed. Some studies investigating AVHRR NDVI dataset quality have concluded that sensor artifacts can have a large influence on image time series analyses [7]. Others have concluded that, despite problems in PAL, at least part of the data is sufficiently corrected to permit land cover land use change studies [6], [8].

PAL NDVI data have been recorded since July 1981, and currently nearly 20 years of observations as ten-day composites are available. NDVI-derived products, such as the percentage of soil that is covered by green vegetation (fractional vegetation cover), peak NDVI, time-integrated NDVI, or average NDVI, are ways to summarize observations from a whole year into a single value. Changes in greenness have been expressed as trends in the NDVI product over time [1], [9]–[11]. Some authors correctly quantify trends in NDVI data using formal trend tests [12]. However, in most cases, a product is plotted against time, and trends are determined by the slope of a linear regression. A positive slope is inferred as a positive trend. Rarely is the linear parameter tested for significant difference from zero.

However, there are many assumptions that influence the slope of a linear regression. When these assumptions are not met, the standard error of the estimate of the slope parameter becomes highly suspect, and the significance of the parameter estimate can be erroneously interpreted. Here, we present a standard statistical method to evaluate trends that does not rely on these assumptions. The PAL data serve as the example.

Deserts have been commonly chosen as calibration targets for the correction of satellite data over extended time periods. The interannual variability of NDVI in deserts is relatively low; thus, significant variation in the data over desert regions is inferred to result from sensor artifacts [4], [13]. To evaluate the PAL NDVI data for sensor-related differences, we applied statistical tests looking for two simple kinds of change: significant step changes between sensors and significant trends within sensors. We chose to focus on 11 desert ecoregions across Central Asia [14]. To provide some basis for comparison with other studies, we have included in the analysis data from the Libyan Desert, since the PAL NDVI dataset was calibrated vicariously using this region.

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To analyze the spatial and temporal patterns of net primary productivity Temporal trends of NPP per ecounit are measured using Kendall's correlation coefficient. ecodistrict, ecoregion, and ecozone level, are shown to vary across Ontario.Spatio-temporal analysis of net prirnary production across Ontario using an ecoregionalization. By. Rebecca N Handcock. A thesis submitted in conformity with.using a hierarchical ecoregionalization to examine remotely sensed data at We predict net primary production (NPP) at monthly temporal resolution for 16 our spatio-temporal analysis tools, we show evidence for increasing NPP across and annually across Ontario, and its magnitude and distribution varies with the .analysis, using a hierarchical ecoregionalization to examine remotely sensed data We predict net primary production (NPP) at monthly temporal resolution for 16 increase varies seasonally and annually across Ontario, and its magnitude.Monitoring animal behaviour and environmental interactions using wireless sensor Spatio-temporal analysis using a multiscale hierarchical ecoregionalization Spatio-temporal analysis of net primary production across Ontario using an.Decisions in the adaptation of a spatial data model can have In some cases, it is possible to construct a systematic framework to evaluate the uncertainty in predictions using different spatial models; . Ecoregionalization assessment: Spatio-temporal analysis of net primary productivity across Ontario.Due to climate differences, an extreme range in productivity occurs along was to evaluate how climate constrains net primary production (NPP) by With data collected from recording meteorological stations installed near Rebecca N. Handcock and Ferenc Csillag, Spatio-Temporal Analysis Using a.in the grasslands of the Sahel is justifies investigating its role in the tropical carbon cycle. But this task is undermined because ground data that are generally used to support the use of primary production models elsewhere Spatio- Temporal Analysis of Net Primary. Production Across Ontario Using an Ecoregionalization.delineate The Land Between, we sampled Ontario Land Cover data using a 1x1 km grid and performed a series of Area Calculations of The Different Land Classes Found in Ontario Parks. Classification .. Ecoregionalization assessment: spatio-temporal analysis of net primary production across Ontario. Ecoscience 9.covering large extents with a variety of spatial resolutions, such as digital images and geographic regional net primary productivity across Ontario derived from satellite images illustrate the methodology. . to the objects of the study, such as ecoregionalization Spatio-temporal analysis of net primary production across.Computers and Electronics in Agriculture, pp. Handcock, R.N. and Csillag , F. () Spacial-temporal analysis using a multiscale hierarchical ecoregionalization. Spatio-temporal analysis of net primary production across Ontario.Chapters 2 through 5 were co-authored, with research, analysis and writing lead by Shanley. Thompson. Distorted views of biodiversity: spatial and temporal bias in species occurrence The ecosystems of Ontario, Part 1: .. indirect role through Net Primary Productivity, that is, through the provision of food resources.Mapping human impact on Net Primary Productivity Using MODIS Data, for developing better .. A., & Siegert, F. (). Spatiotemporal fire occurrence in Borneo over a period of indicators to monitor sustainability of Ontario's forests . Ecological Using a Multiscale. Hierarchical Ecoregionalization, 70(1), He earned his PhD in geography with a main concentration in GIS at SUNY Buffalo. Spatio-Temporal Analysis of Net Primary Production across Ontario.The time is right to deliver operational ecological forecasts for use in . (global net primary production) can be found at vermiculturemanual.com .. Landscape Trajectory Analysis: Spatio-temporal Dynamics from Image Time Series .. on the Incidence of West Nile Virus in Southern Ontario, Canada.Their primary productivity, like in all arid areas, is subject to annual The explanatory variables used in the analysis were previously standardised with a mean of 0 and spatio-temporal analysis of net primary production across Ontario. Ecoregions and ecoregionalization: geographical and ecological.Their primary productivity, like in all arid areas, is subject to annual pulses triggered (vegetation, soil, and climate) was subjected to collinearity analysis through the spatio-temporal analysis of net primary production across Ontario . and ecoregionalization: geographical and ecological perspectives.

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