

Use of NDVI to Simulate Actual Evapotranspiration and Plant Production in Grasslands

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Abstract

Extensive new research shows that MODIS NDVI is strongly correlated to daily actual evapotranspiration (AET) and net carbon uptake (NEE) in grasslands and that cumulative growing season NDVI is well correlated to annual above ground plant production (ANPP). The strong relationship of NDVI to NEE, AET and ANPP is a result of the high correlation of NDVI to live plant biomass. This talk will show how simple models based on land surface environmental factors and remotely-sensed NDVI explain a large portion of the variability in NEE and AET patterns for the semiarid shortgrass steppe in Colorado. These simple models predict daily AET and weekly NEE as a function of observed NDVI and measured soil water content (0-15 cm depth) with R^2 values > 0.60 . This talk will also describe how the AVHRR NDVI data has been used to estimate annual changes in ANPP for all of the Great Plains grasslands counties (Texas to North Dakota) from 1982 to 2019 and the strong correlation of annual changes in grassland ANPP to cumulative April to July cumulative AET. In all but the eastern most counties of the Great Plains, AET was more strongly correlated to cumulative growing season NDVI than precipitation. Next we will describe how DayCent ecosystem was used to simulate historical annual changes in growing season AET for all of the Great Plains counties from 1900 to 2019. Finally, we will demonstrate how the extensive NDVI datasets and DayCent-simulated AET have been used to develop the Grass-Cast model which predicts ANPP for ranchers at the 10-km grid scale (<http://grasscast.agsci.colostate.edu/>) in the Great Plains on a biweekly basis from April through August.