Title: Multiscale Opportunistic Fusion of NEON, Landsat TM/OLI, MODIS and VIIRS Data for the Validation of Satellite based Vegetation Index Time Series

Space-borne remote sensing based Vegetation Index (VI) data is an indicator of green vegetation health and productivity. It is also used to support questions related to plant responses to climate change. The VI time series from various Earth Observing Systems is one of the longest data records to date, providing data covering more than 40 years. It is an invaluable time series about ecosystem function and responses to climate and change. Validation of these VI time series from the different satellite sensors (MODSI/VIIRS/AVHRR/LANDSAT etc.) still depends on in-situ approaches to establish the accuracy and errors, notwithstanding their limited footprint and cost. Validation remains a critical endeavor because of issues related to spatial, spectral, temporal resolutions and processing methods differences across these sensors.

Here, we are developing an opportunistic validation approach in support of long-term VI time series data from sensors like MODIS, VIIRS, and Landsat. The approach is based on the opportunistic use of high-resolution data from the National Ecological Observatory Network (NEON) Airborne Observation Platform (AOP) hyperspectral sensor. NEON is an NSF funded effort for tracking and documenting the ecosystem change over 20 eco-climatic domains across the US. In this work, NEON AOP data is assumed to be ground truth, due to its hyperspectral nature, high resolution, and proximity to the ground which eliminates most of the atmosphere the source of most issues in remote sensing.

In this work we have used data from eight NEON sites, representing various types of land cover conditions ranging from dense forest to mixed forest to desert and semi-arid areas. Our validation framework consists of four steps: 1) Spatial and spectral convolution using our lab online NEON tool (VIP NEON-AOP Data Explorer), 2) Statistical analysis to compute uncertainty, precision, accuracy, (UPA) and errors in the data records, 3) Correlation analysis, and 4) UPA and errors spatial remapping using a land cover and ecosystem clustering model.

We have analyzed data obtained from five sites (Santa Rita Experimental Range (AZ), Harvard Forest Site (MA), Bartlett Experimental Site (NH), Jornada LTER Site (NM), Great Smoky Mountains National Park Site (TN) among the selected eight sites till now and found some results. Preliminary results indicate high correlation among MODIS and VIIRS VI data (coefficient of determination~95% and p value <0.01). Our objectives are to expand these efforts and provide a systematic characterization of the VI data record error and uncertainty budget over time and space and from the various synoptic sensors.