Spatial Representativeness and Scaling of Spectral Vegetation Indices Across Landsat, MODIS, and VIIRS

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A large number of tower sites are equipped with optical sensors, acquiring high-quality, continuous remote sensing data. High-temporal resolution vegetation index (VI) time series data are often derived from these near-surface remote sensing data and used for characterizing seasonal changes in site-level leaf area index and evaluating the quality of satellite products such as land surface phenology or VIs by inter-comparison of their temporal trends. One issue associated with these inter-comparisons is the spatial representativeness of in situ (Tower) VI data. Tower optical sensors' field-of-views (FOVs) are often smaller than the spatial resolution of coarse resolution satellite sensors, such as Moderate Resolution Imaging Spectroradiometer (MODIS) and Visible Infrared Imaging Radiometer Suite (VIIRS). Likewise, "ratio-based" VIs such as the normalized difference vegetation index (NDVI) are not scale-invariant as they involve a non-linear transformation of band reflectances. In this study, we assessed the spatial representativeness and scaling uncertainty of Tower VI data for their inter-comparisons with MODIS and VIIRS VI time series data. Two contrasting AmeriFlux sites in terms of vegetative cover conditions were selected, for which Landsat Operational Land Imager (OLI) data were obtained along with USGS National Land Cover Data (NLCD). The OLI image data and NLCD land cover data were spatially aggregated to produce VIs and major vegetation cover types, respectively, at various pixel sizes, including Tower ground FOV footprint, 250 m, 375 m, 500 m, 750 m, and 1 km. Several statistical measures were employed to quantify the spatial representativeness of Tower VIs for MODIS and VIIRS pixels and to quantify the magnitude of VI scaling uncertainties across these pixel sizes. Preliminary results of the analysis will be presented.

Keywords: NDVI, EVI, EVI2, scaling uncertainties, spatial representativeness

