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Land-product validation of the MODIS derived FAPAR product over the tropical dry-forest of Santa Rosa National Park, Guanacaste, Costa Rica.

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In the field of remote sensing, ensuring the accuracy of remotely sensed products, specifically satellite products, remains an issue; especially for those phenological variables such as the fraction of Photosynthetically Active Radiation (FAPAR). FAPAR, which is considered an essential climate variable by the Global Terrestrial Observation System (GTOS), utilizes the 400-700nm wavelength range to quantify the total amount of solar radiation for photosynthetic use. This variable is strongly influenced by the seasonal, diurnal, and optical properties of vegetation, which ensures its capability for monitoring vegetation health, and responses to climatic events. Ground-based measurements of FAPAR can be completed using a combination of flux towers complimented by a limited number of wireless ground sensors. These systems are finite in number and location though. Therefore many research initiatives elect to use the Moderate Resolution Imaging Spectroradiometer (MODIS) FAPAR product, which through the use of a radiative transfer model converts Leaf Area Index (LAI) to a FAPAR value through the employment of Beer's Law. Production of FAPAR values is done using this method, despite disagreement on whether this is the best methodology to use for all ecosystems and vegetation types. Of concern, is one particular ecosystem where limited studies have been undertaken to determine the accuracy of MODIS derived FAPAR products. These are the Tropical Dry Forests (TDFs) of Latin America. It is an ecosystem that undergoes drastic seasonal changes from leaf off during the dry season to green-up during the wet seasons. Testing the congruency between MODIS derived FAPAR values and ground-based FAPAR values about growing season length, growing season start and end dates, peak and mean FAPAR values, and overall growth/phenological trends utilizing data collected from the Santa Rosa National Park Environmental Monitoring Super-Site (SR-EMSS) is the aim of this study.
Stationed at the SR-EMSS exists the largest and only wireless sensor network (WSN) on TDFs worldwide. At the SR-EMSS, each WSN node (50+) measures transmitted PAR, temperature, relative humidity, and soil moisture over custom time intervals. FAPAR data at the site has been collected from 2013-2017 allowing for a long-term comparison between ground-derived FAPAR measurements and MODIS-derived FAPAR products at the SR-EMSS. Time-series for four WSN locations distributed throughout the SR-EMSS are analyzed and compared with the MODIS C6 Terra, Aqua, and Combined 4-day FAPAR products over this period. Due to WSN size (largest is 300m2) Landsat 8 ETM+ pixels are utilized to up-scale WSN-derived FAPAR products and aggregated to create spatially comparable FAPAR products with that of the 500m MODIS pixel. At 36 periods between 2013-2017, the hybridized ground-based WSN-Landsat 8 ETM+ FAPAR map of the SR-EMSS site will be compared to that of the MODIS-derived FAPAR maps produced. Comparing both the complete time-series, and the FAPAR maps for the SR-EMSS, the first study of its kind will demonstrate how accurate and reflective the MODIS derived FAPAR product is of TDF phenology and ground-based measurements in this environment.