Characterization of an in-situ fraction of Photosynthetically Active Radiation product for use in validating satellite data.

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In remote sensing, being able to ensure the accuracy of the satellite data being produced remains an issue; this is especially true for phenological variables such as the Fraction of Photosynthetically Active Radiation (FPAR). FPAR, which is considered an essential climate variable by the Global Terrestrial Observation System (GTOS), utilizes the 400–700 nm wavelength range to quantify the total amount of solar radiation available for photosynthetic use. It is a variable that is strongly influenced by the seasonal, diurnal, and optic properties of vegetation making it an accurate representation of vegetation health. Measurements of ground level FPAR can be completed using flux towers along with a limited number of wireless ground sensors, but due to the finite number and location of these towers, many research initiatives instead use the Moderate Resolution Imaging Spectroradiometer (MODIS) FPAR product, which converts Leaf Area Index (LAI) to a FPAR value using Beer's Law. This is done despite there being little consensus on whether this is the best method to use for all ecosystems and vegetation types. One particular ecosystem that has had limited study to determine the accuracy of the MODIS derived FPAR products are the Tropical Dry Forests (TDFs) of Latin America. This ecosystem undergoes drastic seasonal changes from leaf off during the dry season to green-up during the wet seasons.

Prior to comparing in-situ FPAR data with MODIS-derived FPAR data, it is imperative that the in-situ product be of a high-quality. Therefore, an investigation into variables influencing the measurement of in-situ FPAR was conducted. Specifically, this study looked at the influence that factors like the calibration of photosynthetic active radiation sensors, solar zenith angle, wind speed, sky cover, and canopy cover had on the measurement of FPAR during three phenophases: Greenup, Maturity and Senescence. It was determined that measurements taken at a solar zenith angle between 27° and 60° had a higher mean FPAR estimate and a lower variance than estimates made between 0° and 27°. Additionally, estimates of FPAR taken when wind speeds were greater than 5 m/s had an increase in the variance and a decrease in mean FPAR estimates allowing this study to conclude that filters for solar zenith angle and wind speed are necessary for any study utilizing in-situ FPAR in the future.

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