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Localized brightness–shape–moisture soil parameterization for improved PROSAIL-5 canopy simulation

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The mapping and modeling of canopies is important for the understanding, monitoring, and management of vegetation systems. To effectively model or simulate canopy spectra at the hyperspectral level, background soil spectra must first be simulated accurately. Spectrometer data simulation such as this will become increasingly relevant as newer imaging spectroscopy missions such as PRISMA and AVIRIS-NG start to produce more data sets. In this study, the brightness–shape–moisture (BSM) radiative transfer model (RTM) with localized parameter distributions was used in conjunction with the PROSAIL-5 RTM to simulate canopy spectra for different biomes in the semiarid regions of Southern Africa as captured with PRISMA or AVIRIS-NG sensors. It is hypothesized that a PROSAIL-5 RTM with biome-specific BSM parameters can more accurately simulate PRISMA and AVIRIS-NG spectra than a PROSAIL-5 model simulated with the default soil spectrum, as represented by lower relative root mean square error (RRMSE) values against actual spectra. It is demonstrated that the PRISMA and AVIRIS-NG canopy spectra are more effectively simulated using their respective biome-specific BSM parameter regimes, with RRMSE improvements from 14.56% to 13.91% and from 13.64% to 10.71% for two tested images captured with these sensors.