Abstract Title: A case study on the use of MODTRAN for atmospheric correction of satellite imagery obtained from high spatial resolution pointable sensors over agricultural study sites.

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Abstract: Agricultural regions exhibit highly dynamic reflectance properties on annual and sub-annual timescales. Planting, tilling, and harvesting practices produce large changes in surface reflectance as agricultural regions transition from exposed or plant litter covered soils to mature plant canopies throughout the course of a growing season. Satellite imagery enables effective monitoring of agricultural systems on regional scales. Plant health, soil moisture, and tillage practices can all be assessed via. spectral indices and algorithms derived from multi-spectral surface reflectance imagery. However, spatial and temporal heterogeneity of the atmosphere inhibits the accurate characterization of surface reflectance, and reduces the ability to accurately assess change with multi-date imagery. Ozone, NO_2, CO_2, and water vapor all exert strong impacts on the transmission of light between the Earth's surface and the top of the atmosphere. Atmospheric corrections are needed to control for these factors and convert top of atmosphere radiance (TOA) imagery to surface reflectance imagery effectively.

In this case study, we used surface reflectance Worldview-3 imagery to derive spectral indices for characterizing tillage practices over agricultural study sites on the eastern shore of Maryland. We will discuss how MODTRAN 5.4 was used to process Worldview-3 visible-near infrared (VNIR) and shortwave infrared (SWIR) TOA radiance imagery to surface reflectance. We assess the differences between surface reflectance and TOA reflectance. We also provide a methodology for the use of MODTRAN 5.4 for pointable sensors with off-nadir view angles, both Worldview-3 and SPOT. Lastly, MODTRAN 5.4-corrected surface reflectance imagery is compared to surface reflectance imagery processed with the Simple Model of the Atmospheric Radiative Transfer of Sunshine (SMARTS) and Fast Line-of-sight Atmospheric Analysis of Hypercubes (FLAASH).