Abstract

The carbon cycle and land-atmosphere water and energy exchanges are influenced by the timing, rate and duration of vegetation phenology events. The Vegetation Optical Depth (VOD) parameter from satellite passive microwave remote sensing provides a unique phenology signal responsive to changes in canopy water content and biomass. The VOD signal is insensitive to atmospheric and solar illumination effects, and provides high spatial and temporal fidelity at moderate (25-km resolution) spatial scales. We used VOD retrievals from AMSR-E 10.7 GHz, V and H polarization brightness temperature series with TIMESAT to classify vegetation start of season (SOS) phenology metrics over a four year record (2003-2007) for North America at the Level III Ecoregion scale. The VOD SOS phenology metric at the ecoregion scale was strongly correlated (R=0.66-0.89) with MODIS NDVI and LAI Greenup Date and SOS derived from tower eddy covariance CO2 flux measurements of gross primary productivity (R=0.80) and ecosystem respiration (R=0.68). In some regions microwave VOD displayed a temporal shift (SOS bias) relative to the optical IR based Greenup Date that followed geographic patterns of climate constraints (temperature and water) on net primary productivity. The SOS bias is attributed to temporal differences in seasonality between canopy greenness versus canopy water content or biomass changes. The results indicate that the VOD signal captures changes in canopy water content and biomass, independent of NDVI greenness, which can better inform regional to global scale carbon, water and energy cycle models.

This work was conducted at the University of Montana and Jet Propulsion Laboratory under contract to NASA (NNX07DA001A-TE).

Acknowledgements & References

We thank the tower site principal investigators for the La Thala Flumen Database used in this study. The MODIS for NASA MODIS swath and MOD03QKM Collection 5 products were acquired via the ftp://ladsweb.nascom.nasa.gov site. We also thank Lars Eklundh and Peter Herbst for providing the free TIMESAT software package and the NASA Terrestrial Ecology Program for funding this research.


[Image 0x639 to 926x1589]