Geophysical Research Abstracts
Vol. 19, EGU2017-802-3, 2017
EGU General Assembly 2017
© Author(s) 2016. CC Attribution 3.0 License.

Leaf Surface Effects on Retrieving Chlorophyll Content from Hyperspectral Remote Sensing

Feng Qiu (1), JingMing Chen (1,2), Weimin Ju (1), Jun Wang (1), and Qian Zhang (1)

(1) International Institute for Earth System Science, Nanjing University, Nanjing, China (qiufeng6165@gmail.com), (2) Department of Geography and Program in Planning, University of Toronto, Toronto, Canada (jing.chen@utoronto.ca)

Light reflected directly from the leaf surface without entering the surface layer is not influenced by leaf internal biochemical content. Leaf surface reflectance varies from leaf to leaf due to differences in the surface roughness features and is relatively more important in strong absorption spectral regions. Therefore it introduces dispersion of data points in the relationship between biochemical concentration and reflectance (especially in the visible region). Separation of surface from total leaf reflection is important to improve the link between leaf pigments content and remote sensing data. This study aims to estimate leaf surface reflectance from hyperspectral remote sensing data and retrieve chlorophyll content by inverting a modified PROSPECT model. Considering leaf surface reflectance is almost the same in the visible and near infrared spectral regions, a surface layer with a reflectance independent of wavelength but varying from leaf to leaf was added to the PROSPECT model. The specific absorption coefficients of pigments were recalibrated. Then the modified model was inverted on independent datasets to check the performance of the model in predicting the chlorophyll content.

Results show that differences in estimated surface layer reflectance of various species are noticeable. Surface reflectance of leaves with epicuticular waxes and trichomes is usually higher than other samples. Reconstruction of leaf reflectance and transmittance in the 400-1000 nm wavelength region using the modified PROSPECT model is excellent with low root mean square error (RMSE) and bias. Improvements for samples with high surface reflectance (e.g. maize) are significant, especially for high pigment leaves. Moreover, chlorophyll retrieved from inversion of the modified model is consequently improved (RMSE from 5.9-13.3 ug/cm^2 with mean value 8.1 ug/cm^2, while mean correlation coefficient is 0.90) compared to results of PROSPECT-5 (RMSE from 9.6-20.2 ug/cm^2 with mean value 13.1 ug/cm^2, while mean correlation coefficient is 0.81). Underestimation of high chlorophyll content, which is due to underestimation of reflectance in the visible region of PROSPECT, is partially corrected or alleviated. Improvements are particularly noticeable for leaves with high surface reflectance or high chlorophyll content, which both lead to large proportions of surface reflectance to the total leaf reflectance.