Optical properties of canopies of the tropical seagrass *Thalassia testudinum* estimated by a three-dimensional radiative transfer model

Hedley, J., and S. Enríquez

Limnol. Oceanogr., 55(4), 2010, 1537-1550 | DOI: 10.4319/lo.2010.55.4.1537

ABSTRACT: Three-dimensional models of seagrass canopies were constructed by treating leaves as flexible strips that fall under their own weight into naturalistic canopy structures. Canopy structures incorporated shoot density, canopy height, and physical and along-length optical characteristics of leaves from an empirical data set of six seagrass canopies from a reef lagoon in Puerto Morelos, Mexico. Multiple runs of a radiosity method radiative transfer model elucidated the dependence of various canopy optical properties on incident radiance zenith angle, such as within-canopy diffuse attenuation, the absorption of photosynthetically active radiation (PAR) by different canopy-complex components, along-leaf variation in PAR absorption, and canopy bidirectional reflectance distribution functions (BRDFs). Intersite variation in mean PAR absorption by green leaf sections was primarily associated with leaf area index (LAI). Variation in PAR absorption with incident radiance angle was generally small for incident angles within Snell's window (< 49°). Within canopies, absorption by water itself had a negligible effect. Canopy BRDFs were not Lambertian and exhibited features related to canopy architecture. Model outputs validated well in terms of energy conservation and empirical measurements of within-canopy PAR attenuation. The model framework has clear applications to improve understanding of seagrass canopy light harvesting and photosynthetic carbon fixation and to aid the development of quantitative biooptical remote sensing methods for seagrass beds.

Article Links

Download Full-text PDF

Return to Table of Contents

Please Note