Remote sensing of vegetation based on canopy spectral invariants

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The concept of *canopy spectral invariants* states that simple algebraic combinations of leaf and canopy spectral transmittance and reflectance become wavelength independent and determine a small set of canopy structure specific variables. This set of structural variables specify the spectral response of a vegetation canopy to the incident solar radiation and allow for a simple and accurate parameterization of the partitioning of the incoming radiation into canopy transmission, reflection and absorption at any wavelength in the solar spectrum [1].

The theoretical basis and applicability of the *recollision probability* for use in physically based optical remote sensing of vegetation was investigated in the SPRINTER project. The recollision probability (p) is one of the canopy spectral invariants, and can be defined as the probability that a photon after being scattered from a leaf (needle) in the canopy will interact within the canopy again. The beauty of this parameter lies in that, knowing p, the canopy scattering coefficient (*albedo*) at any wavelength can be expressed as a simple function of the leaf (needle) albedo at the same wavelength. Parameter p depends on the structure of the canopy at a variety of scales and a main goal of the project was to derive specific relationships between p and basic structural characteristics of forests, including the leaf area index (LAI) [2]. Furthermore, as p only allows prediction of total canopy scattering, methods to divide the scattered radiation into reflected and transmitted fluxes were developed [3].

Results from the SPRINTER project provide an effective tool for incorporating the effect of canopy structure at different hierarchical levels in forest reflectance models and, conversely, for extracting canopy structural characteristics from the remotely sensed multispectral signal when leaf albedo is known.

References

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