REMOTE SENSING OF LIGHT ENVIRONMENT ACROSS MULTIPLE SCALES FROM LEAVES TO CANOPIES AND STANDS

Abstract

Intensity of solar radiation at leaf level is among climate variables that most directly control the dynamics of terrestrial vegetation carbon. Light environment of an individual leaf results from interaction of solar radiation with the vegetation at different scales. For example, the light environment of a needle in coniferous canopies is determined by needle optical properties, shoot structure and the shoot light environment. The latter depends on the distribution of shoots within crown and crown light environment which in turn is a function of tree distribution within the stand and atmospheric conditions which determine the incoming radiation. To quantitatively predict vegetation -atmosphere interactions and/or to monitor the vegetated Earth from space it is important to specify and measure those variables that determine the shortwave energy conservation in vegetation canopies which describes how the fractions of radiation scattered by different canopy components are related to the structural and optical properties of canopy and background. It has been documented that a small set of well-defined measurable wavelength-independent parameters specify an accurate relationship between the spectral response of a vegetation canopy to incident solar radiation at the leaf and the canopy scales and allows for a simple and accurate parameterization for energy conservation law. The set includes the canopy interceptance, recollision and escape probabilities. The objective of this proposal is (i) to investigate the feasibility of reliably retrieving the full set of canopy parameters from multi-angle and hyperspectral data; (ii) to generate and validate time series of the vegetation parameters over selected sites in Northern Eurasia; and (iii) to explore the potential for deriving new information on the 3D canopy structure for use in process-oriented models through novel combinations of the canopy parameters, e.g., sunlit and shaded leaf area indices, aspect ratio.