Vector spherical radiative transfer model MCC++: linearization for surfaces described by polarized BRDF

O.V. Postylyakov

A.M. Obukhov Institute of Atmospheric Physics, Pyzhevsky per. 3, Moscow 119017, Russia, e-mai: ovp(at)ifaran.ru, http://postylyakov.narod.ru

Application of radiative transfer models to optical remote sensing shows that remote sensing problem requires extra characteristics of the radiance field in addition to the radiance intensity itself. Development of retrieval algorithms, analysis of retrieval errors and simulation of spectral measurements are in need of derivatives of radiance with respect to atmospheric properties under investigation. Models, which solve the equation in derivatives of radiance simultaneously with the transfer equation in radiance, have been termed linearized.

The radiative transfer model MCC++ employs Monte Carlo algorithms for multiple scattering simulation and takes into account radiance polarization and sphericity of the atmosphere. It treats also aerosol and molecular scattering, gas and aerosol absorption, and underlying surface described by the polarized Bidirectional Reflectance Distribution Function (BRDF). The polarized BRDF describes dependence of Stokes parameters of radiance scattered by surface from the incident and reflected directions.

In addition to the linearization with respect to the Lambertian surface albedo, a new version of the model becomes capable to calculate derivatives with respect to parameters describing the polarized bidirectional refection distribution function. The new feature of the MCC++ model is significant in modeling of data of nadir-viewing satellite instruments for retrieval of aerosol and surface properties and may be applied for interpretation of backscattered radiance measurements of SCIAMACHY, OMI, GOME2, and polarimetric measurements of POLDER/Parasol. The formalism of the Monte Carlo calculation of the BRDF surface derivatives and examples of the simulated BRDF surface weighting functions for multi-angle measurements are presented.