

Effect of polarization on accuracy of weighting function calculations for limb-viewing geometry

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The radiation field in the atmosphere may be exactly described by the distribution of vector of four Stokes parameters, which characterize the radiance intensity and the radiance polarization. A simplified treatment of light as a scalar value equal to the radiance intensity has only limited accuracy. Energy being brought by second-order and following low-order scattering photons can't be properly approximated by the scalar theory. Therefore, scalar radiative calculations produce large errors in cases with large part of low-order scattering (higher than the first scattering). Previous comparisons of the vector and the scalar radiative models showed that scalar calculations of intensity may be in error by up to 10-15% for many geometries of observations.

Errors in radiative calculations, which are used to infer gas distributions from measurements of scattering radiation, influence on accuracy of gas retrieval. We estimated errors of scalar calculations of the weighting functions and the air mass factors relative to more accurate vector modeling for limb geometry and show wavelengths, observational and solar angles, which are more influenced by modeling errors.