

Software package SCIATRAN 2.1 - New developments in the radiative transfer modeling and the retrieval technique.

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The SCIATRAN 2.1 software package comprises an optimized up-to-date radiative transfer model coupled with a new retrieval block originally developed to retrieve vertical distributions or column amounts of atmospheric species. The retrieval block incorporates various inversion techniques such as the Optimal estimation, Tikhonov regularization, and Information operator approach, and can be adapted to solve various inverse problems arising in the remote sensing of the Earth's atmosphere. One of the retrieval block extensions already implemented in the inversion procedure is a retrieval of the cloud top height using satellite measurements of the backscattered solar radiation in the oxygen absorption band.

Generally, to find a solution of an inverse problem, the weighting functions of the atmospheric parameters of interest are required. Therefore, besides the usual atmospheric parameters, such as atmospheric trace gas number densities, pressure, temperature, Rayleigh and aerosol scattering, the new version of the model is linearized with respect to diverse cloud parameters, such as optical and geometrical thickness, cloud top and bottom height, liquid water content as well as an effective radius of water droplets. Further developments of the radiative transfer model include among others an extension of the Discrete Ordinate solver to the pseudo-spherical atmosphere using an efficient exponential parameterization of the spherical transmission function. Solving the radiative transfer equation in the vertically inhomogeneous atmosphere in the framework of the Discrete Ordinate method, a speed up factor up to 10 can be achieved employing a newly developed adaptive grid technique which automatically minimizes the number of the altitude layers in the forward model.

Similar to the precursor version, the new model is freely available for non-commercial use via the web page of the University of Bremen.