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Retrieval of warm cloud optical properties using simple approximations

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A new technique relying on simple approximations for cloudy media (SLALOM) for the retrieval of cloud optical and microphysical parameters from optical satellite data during daytime is introduced. The technique is based on simple yet highly accurate approximations of the asymptotic solutions of the radiative transfer theory which have already been implemented in the forward radiative transfer model CLOUD. These approximations enable a solution of the equations of the corresponding backward model during runtime leading to a very fast computation speed. Since these asymptotic solutions are generally applicable to weakly absorbing media only, pre-calculated look-up tables for the reflection function of a semi-infinite cloud (and also the escape function) are used to overcome this restriction within this new retrieval. SLALOM is capable to retrieve the cloud optical thickness, the effective cloud droplet radius, the liquid and ice water paths, the particle absorption length as well as some other properties of water and ice clouds. The comparison of SLALOM with both exact radiative transfer computations and the NASA MODIS cloud property product shows a very good agreement. A Fortran implementation of both CLOUD and SLALOM is available for download under the Creative Commons Attribution-Noncommercial-Share Alike 3.0 license (see $http://creativecommons.org/licenses/by-nc-sa/3.0$) at $http://www.klimatologie.uni-bayreuth.de$).