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What does reflection from cloud sides tell us about vertical distribution of cloud droplets?

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In order to accurately measure the interaction of clouds with aerosols, we have to resolve the vertical distribution of cloud droplet sizes and determine the temperature of glaciation for clean and polluted clouds. Knowledge of the droplet vertical profile is also essential for understanding precipitation. So far, all existing satellites either measure cloud microphysics only at cloud top (e.g., MODIS) or give a vertical profile of precipitation sized droplets (e.g., CloudSat). What is if one measures cloud microphysical properties in the vertical by retrieving them from the solar and infrared radiation reflected or emitted from cloud sides? This was the idea behind CLAIM-3D (A 3D - cloud aerosol interaction mission) recently proposed by NASA GSFC.

This presentation will focus on the interpretation of the radiation reflected from cloud sides. In contrast to plane-parallel approximation, a conventional approach to all current operational retrievals, 3D radiative transfer will be used for interpreting the observed reflectances. As a proof of concept, we will show a few examples of radiation reflected from cloud fields generated by a simple stochastic cloud model with prescribed microphysics. Instead of fixed values of the retrieved effective radii, the probability density functions of droplet size distributions will serve as possible retrievals.