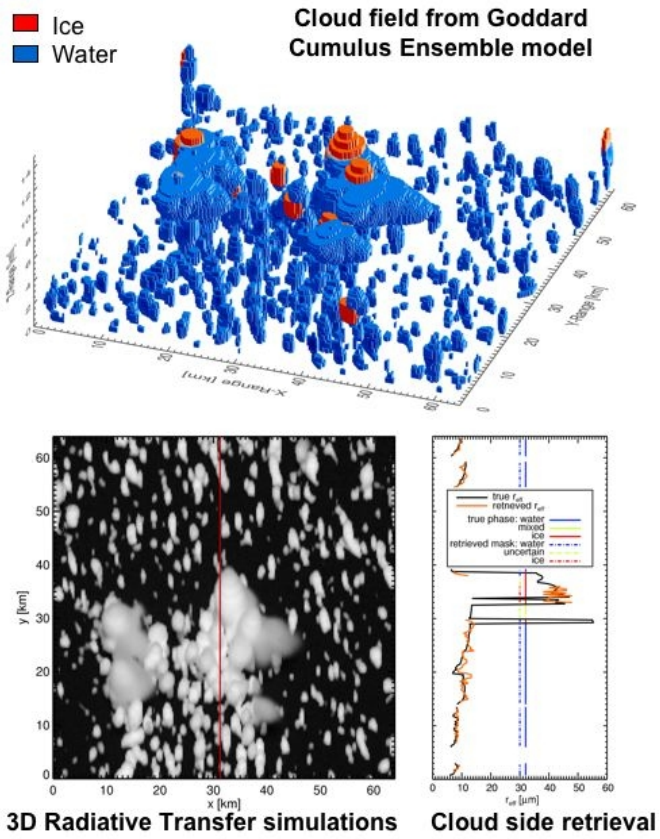
Remote sensing of cloud sides of deep convective clouds



CLAIM 3D -- the three-dimensional cloud and aerosol interaction mission proposal -- is a satellite sensor combination proposed by scientists from NASA's Climate and Radiation Branch and the University of Maryland Baltimore County. It combines measurements of aerosol characteristics in the vicinity of clouds and profiles of cloud microphysical characteristics. Such a set of collocated measurements will allow new insights into the complex field of cloud-aerosol interactions affecting directly the development of clouds and precipitation, especially in convection. A core instrument is the Cloud Scanner (see October 21, 2007 Image of the Week) which measures radiance reflected or emitted by cloud sides at several wavelengths. A profile of cloud phase and particle size on a high spatial resolution of a few hundred meters will be retrieved from these measurements. For this sensor an experimental retrieval was developed and successfully tested. The retrieval accounts statistically for the complexity of cloud structures and 3D radiative transfer at high resolution. These figures present the test of the proposed retrievals using a completely synthetic test bed. Cloud fields from the Goddard Cumulus Ensemble model (top image) were used as input to a 3D radiative transfer model which simulates the cloud scanner observations (bottom left image). The Bayesian retrieval of particle size distribution was then applied to the simulated data. The retrieved vertical profiles of cloud particle size and cloud phase were compared with the "true" data from the cloud model. The bottom left image shows the simulated observation for the cloud structure above looking on the cloud scene at 60 degrees from the "south" of the scene. The plot on the right shows the true and retrieved cloud properties along the red line in the left image. Mostly cloud sides are observed showing small (up to 12 µm) water droplets and much larger (> 30 µm) ice particles. The results of comparison are very encouraging showing that the method is clearly capable of retrieving the cloud properties along the profile with a high accuracy.

Tobias Zinner, Alexander Marshak and Vanderlei Martins