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Retrieval of cloud top and bottom heights using Advanced Earth Observing Satellite / Global Imager (ADEOS-II / GLI) data.

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It is of great interest to investigate the optical, microphysical, and geometrical properties of clouds that play crucial role in the earth climate system. Water clouds are generally optically thick and consequently have a great cooling effect on earth-atmosphere radiation budget. They usually exist in a lower troposphere where aerosol-cloud interaction occurs frequently, and then cloud droplet size variation influences reflection of solar radiation as well. Further, a cloud layer height is one of the key properties that determine downward longwave radiation and then surface radiation budget. In this study, top height, geometrical thickness and bottom height of a water cloud layer are investigated as the cloud geometrical properties in particular.

Several studies show that observation data of some spectral regions including oxygen A-band, enables us to retrieve the cloud geometrical properties as well as the optical thickness, the effective particle radius. In this study, an algorithm was developed to retrieve simultaneously the cloud optical thickness, effective particle radius, top height, geometrical thickness and then bottom height of a cloud layer with the spectral observation of visible, near infrared, thermal infrared, and oxygen A-band channels.

The algorithm was also applied to Advanced Earth Observing Satellite-II / Global Imager (ADEOS-II / GLI) dataset so as to retrieve global distribution of cloud geometrical properties. The retrieved results around Japan were compared with other observation such as ground-based active sensors and aircraft observation. It was found that the retrieved cloud base height was comparable, but underestimated by a few hundred meters with the ground-based active cloud radar observation even though there possibly existed a drizzling mode in the observed cloud system. The comparison suggests this algorithm work for cloud system over ocean at least, while it is necesasry to make further validation study with other studies such as ground-, space-based observations, and cloud resolving models. Based on this result, the algorithm was further applied to a global dataset and the initial result was obtained. In spite of the short-lived ADEOS-II satellite mission for about nine months in 2003, the global analyses and their validation studies are ongoing so as to contribute to surface radiation budget and cloud physics studies eventually.

Furthermore, the algorithm will be also applicable to dataset observed with Global Change Observation Mission 1st-Climate / Second generation Global Imager (GCOM-C1 / SGLI) that Japan Aerospace Exploration Agency (JAXA) has a plan to launch in a few year later. The operation of GCOM-C1 will be coincident with that of EarthCARE in the latter of 2010s. Accordingly, it is interesting to compare the cloud top and bottom heights retrieved from SGLI to those from EarthCARE mission as a cross validation.