Cirrus optical properties analysis based on EarthCARE observation

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Cirrus clouds play an important role in the energy budget of the Earth-atmosphere system by their effects on the transfer of radiative energy through the atmosphere. Low clouds have a cooling effect on solar radiation by scattering. On the other hand, the high thin cirrus clouds scatter a small amount of solar radiation and absorb a large quantity of outgoing long-wave radiation from the Earth and its atmosphere. The overall effect of the high thin cirrus clouds is heating on the Earth-atmosphere system.
Cirrus clouds are prominent and yet uncertain components in weather and climate studies because of high location and composed of almost exclusively nonspherical ice crystal of various shapes, such as bullet rosetts, plates, and columns. Progress in numerical model of climate change prediction require improved representations of cloud processes and decreased uncertainties in parameterizations of cloud radiation interactions. Cloud parameterizations in numerical climate models need to define the temporal and spatial distributions of high cloud optical properties. EarthCARE (Earth Clouds, Aerosols and Radiation Explorer) is one of the future Earth observation joint mission of Japanese (JAXA) - European (ESA). EarthCARE satellite aims at understanding of the role that clouds and aerosols play in reflecting incident solar radiation back into space and trapping infrared radiation emitted from the surface in order to improve the numerical climate prediction models. The satellite payload is composed of four instruments; an Atmospheric backscatter Lidar (ATLID), a Cloud Profiling Rader (CPR), a Multi-Spectral Imager (MSI), and a Broad-Band Radiometer (BBR). The EarthCARE orbit is sun-synchronous with an altitude of around 393 km and 14:00 mean local time of the descending node. The MSI will provide Earth images over a swarth width of 150 km with a spatial resolution of 500×500 m in 7 spectral bands; one visible (0.67 um), one near infrared (0.865 um) and two shortwave infrared (1.65, 2.21 um) channels capturing reflected solar right on the day-side of the orbit, and three thermal infrared (8.80 10.80, 12.00 um) channels measuring the emitted thermal radiation from the Earth.
We develop an algorithm to derive cirrus clouds optical properties from MSI Level 2 radiance data as a research product of EarthCARE project. In this study, we modified MWP (Multi-wavelength and multi-pixel) method [M. Hashimoto et al., in revision] to derive cirrus clouds optical properties and operation tests of modified algorithm were performed in using MODIS/Aqua radiance data for the first time.

キーワード：EarthCARE、巻雲
Keywords: EarthCARE, cirrus

