Properties of clouds, aerosols, radiation and vertical velocity using EarthCARE observations

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Earth Cloud, Aerosol, and Radiation Explorer (EarthCARE), a joint Japan Aerospace Exploration Agency (JAXA) and European Space Agency (ESA) satellite mission launched in May 28 2024, carries four sensors: 94 GHz cloud profiling radar (CPR), atmospheric lidar (ATLID), a multi-spectral imager (MSI), and a broadband radiometer (BBR). The CPR uses the same frequency as CloudSat and measures the Doppler velocity in the vertical direction in clouds. The sensitivity of EarthCARE CPR is –36 dBZ, which is greater than that of the CloudSat cloud profiling radar (–30 dBZ) due to the low orbit (about 400 km) of the EarthCARE satellite and large 2.5 m antenna. The 355 nm high-spectral-resolution ATLID will provide extinction and backscattering coefficients with the depolarization ratio.

We develop the JAXA level 2 algorithms for the EarthCARE. Cloud profiling radar (CPR)-only, atmospheric lidar (ATLID)-only, combined CPR–ATLID and combined CPR-ATLID-multispectral imager (MSI) algorithms for the cloud properties are described. The cloud mask and type are first retrieved for cloud products. Then these can be used to derive cloud particle categories and cloud microphysics. Vertical air motion and terminal velocity of cloud particles are retrieved using Doppler velocity and cloud microphysics. ATLID-only and combined ATLID-MSI algorithms for aerosol properties are also developed. Horizontal information of clouds and aerosols are observed by MSI. The retrieved properties of clouds and aerosols are used to estimate radiative flux. The algorithms are developed and evaluated using ground-based data, space-borne data from CloudSat, Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) and MODIS data and simulation data from a Japanese global cloud-resolving model, the Non-hydrostatic Icosahedral Atmospheric Model (NICAM) with Joint simulator.

Preferred mode of presentation: Invited