New perspective in clouds, aerosols and vertical air motion by EarthCARE

Hajime Okamoto*, Kaori Sato and Hengheng Zhang

Research Institute for Applied Mechanics, Kyushu University, ASA Goddard Institute for Space Studies, 2880 Broadway, New York, NY 10025, USA

**Presenting author (okamoto@riam.kyushu-u.ac.jp)*

Earth Clouds, Aerosols and Radiation Explorer (EarthCARE) is a JAXA and ESA joint satellite mission launched in May 29 2024. Active sensors onboard EarthCARE bring new perspective of cloud properties and climate system.

Main aim of the EarthCARE is to understand aerosol cloud interactions and relation between vertical air motion and cloud microphysics and radiative properties. There are four sensors on board EarthCARE; Cloud Profiling Radar with Doppler velocity measurement capability (CPR), ATmospheric LIDar with high spectral resolution function (ATLID), Multi-Spectral Imager with seven channels (MSI) and Broad Band Radiometer (BBR).

We developed JAXA standard level 2 cloud algorithms; CPR-only algorithm (CPR_CLP), ATLID and CPR synergy algorithms (AC_CLP) and ATLID, CPR and MSI synergy algorithms (ACM_CLP). Cloud mask, cloud particle type, cloud particle category (cloud phase and ice particle orientation), cloud category (ice particle habit), ice and water cloud microphysics, terminal velocity and vertical air motion. ATLID-only (ATL_CLA and ATL_ARL) and ATLID and MSI synergy algorithms (AM_ARL) were also developed for radiative properties of aerosols and clouds. The aerosol algorithms identify aerosols and clouds, aerosol and cloud particle type, boundary layer height. The algorithms further retrieve extinction coefficients for aerosol types and aerosol mode radii for dust and fine mode aerosols and extinction for dust, sea-salt, light absorbing and water-soluble aerosols. These retrieved properties have been evaluated by comparing with in-situ data and ground-based remote sensing instruments.

We discuss how information from synergetic use of ATLID, CPR and MSI improves cloud and aerosol microphysics and show how to utilize EarthCARE data to bring new insights for cloud properties in relation to climate system. The combined products of clouds and aerosols are also planned to be released from JAXA.