Analysis of cloud and precipitation microphysics: from A-train to EarthCARE

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We introduce recent improvement of suits of algorithms for cloud detection, cloud particle phase and cloud microphysics from synergy use of A-train data and also from EarthCARE. The improvement was achieved by using the following new inputs; (1) Ground-based multiple-field-of-view multiple scattering polarization lidar, (2) High spectral resolution lidar, (3) Non-sphericity of ice particles, (4) revision of surface reflectance in radar and (5) Physical Model for lidar signals. For (1) and (2), we demonstrated that the space-borne lidar signals can be simulated by using the new instruments so that evaluation of the algorithms can also be possible (Okamoto et al., 2016). New method in (4) related to the normalized surface scattering cross section based on synergy use of radar and lidar improves the retrieval of estimation of PIA and retrievals of precipitation microphysics. Physical Model (PM) approach in (5) can simulate space-borne lidar signals much faster than Monte Calro approach and for the first time, it can also simulate depolarization signals. It opens the way to implement the retrieval algorithms. JAXA-ESA joint mission EarthCARE will carry cloud profiling radar (CPR) with Doppler function, high spectral resolution lidar (ATLID), multi-spectral imager (MSI) and broad-band radiometer (BBR). The new functions from the EarthCARE will certainly improve the classification of ice and precipitation particle type and better retrievals of cloud and precipitation microphysics might be possible (Okamoto and Sato 2018). Evaluation of the EarthCARE algorithms is planned by using collocated 94GHz Doppler radar, multi-wavelength high spectral resolution lidar, multiple field of view multiple scattering polarization lider and Doppler lidar. Mass flux of clouds and vertical air motion expected from EarthCARE will enhance our capability to evaluate/improve cloud parameterization schemes and cloud feedbacks.

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