



Cloud Microphysical Characteristics over East Asia

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A survey of the existing literature on in-situ measurements of cloud-precipitation microphysical properties was undertaken. Then, a database was established to contain microphysical properties for raindrop, cloud droplet, fog, ice nuclei (IN), snow crystal, as well as the relationship between radar reflectivity (Z) and rainfall rate (R). The time span of the in-situ probe measurements ranges from 1960 to 2008 over East Asia and from 1940 to 2008 in the other regions (which is defined as those include the Americas, Europe, and Australia). From the datasets, dividing the data coverage into East Asia and the other regions, several parameters are presented, including mean concentration of hydrometeor particles, liquid water content (LWC), as well as functional fit parameters of particles size distributions.

The main properties of hydrometeor particles were presented, and the functional fitted parameters of particle size distributions over East Asia have been compared with those over the other regions. Note that the all measurements taken in other regions do not mean that all cloud systems in the other regions are similar. Our main method of the present study is to put all measurement results taken in different regions over the world together. If the cloud systems over East Asia have their own characteristics, it will be grouped together. Thus, the difference between East Asia and other regions is readily discernible.

The results show that there are differences, sometimes even large differences, between East Asia and the other regions in terms of these cloud-precipitation microphysical characteristics. More specific conclusions are as follows:

(1) Both exponential- and gamma-size distributions are used to fit RSD of rains originating from stratiform clouds. Average intercept N_0 of exponential-size distribution over East Asia is one order of magnitude smaller than that over the other regions, and average slope λ is slight smaller. As for gamma-size distributions, the range of parameters in East Asia is narrower than those in the other regions.

(2) Average cloud droplet number concentration (N_c) in stratiform clouds over East Asia is slightly smaller than that in the other regions, and cloud LWC is 0.089 g m^{-3} lower. Average fog drop concentration is a little higher than that in the other regions and the overall average fog LWC is approximately 1.5 times as high as that in the other regions.

(3) There is a higher average IN concentration (22.9 L^{-1}) in East Asia, compared that (2.4 L^{-1}) in the other regions.

(4) The exponential size distribution has goodness-of-fits with snow-crystal size distributions. Average value of the parameter N_0 is one order of magnitude smaller than that in the other regions, and λ is slightly smaller.

(5) The relationship between radar reflectivity (Z) and rainfall rate (R) can be expressed as $Z=aR^b$. The mean value of Z in East Asia is slightly larger than that in the other regions for the same R, and the distribution range Z of is narrower in East Asia than that in the other regions.