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Underlying Microphysical Processes in the Melting Layer during Moderate Precipitation: Evidence from Ground-Based Data

Abstract

This study performed a detailed analysis of ground-based data to investigate changes in the morphological properties, temperature dependencies, and particle size distribution of precipitation particles, calculating the melted diameter and liquid water fraction of the individual particles as they fall through the melting layer (ML). In July 2013, the author started continuous precipitation monitoring in Sapporo with a two-dimensional video disdrometer, an electrical balance-type snow gauge, and an X-band marine radar. They used data collected from 0943 to 1040 Japan standard time (JST) 10 March 2015 for analysis, when the bright band progressively descended to the ground surface and precipitation intensity was moderate and approximately steady.

They found that the aggregation of aggregates in the upper half of the ML did not necessarily result in large raindrops. Almost all of the snow particles with a melted diameter (Dm) ≥ 4 mm broke up before they melted into raindrops of equivalent size. The apparent one-to-one relationship between melting snow particles and raindrops held for particles with 2 < Dm < 3 mm. Most small raindrops were generated by the successive breakup of melting particles in the lower half of the ML. The successive breakup of melting snow particles in the ML is the key process for the transition from a Gunn-Marshall (G-M) PSD to Marshall-Palmer (M-P) PSD when precipitation rate is moderate.

Keywords

Melting Layer (ML)
Morphological variables

Reference

Fujiyoshi, Y., 2023: Underlying Microphysical Processes in the Melting Layer during Moderate Precipitation: Evidence from Ground-Based Data. *J. Atmos. Sci.*, **80**, 1381–1400, https://doi.org/10.1175/JAS-D-22-0183.1.