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Observational Study on the Supercooled Fog Droplet Spectrum Distribution and Icing Accumulation Mechanism in Lushan, Southeast China

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A fog monitor, hotplate total precipitation sensor, weather identifier and visibility sensor, ultrasonic wind speed meter, an icing gradient observation frame, and an automated weather station were involved in the observations at the Lushan Meteorological Bureau of Jiangxi Province, China. In this study, for the icing process under a cold surge from 20–25 January 2016, the duration, frequency, and spectrum distribution of agglomerate fog were analyzed. The effects of rain, snow, and supercooled fog on icing growth were studied and the icing and meteorological conditions at two heights (10 m and 1.5 m) were compared. There were 218 agglomerate fogs in this icing process, of which agglomerate fogs with durations less than and greater than 10 min accounted for 91.3% and 8.7%, respectively. The average time interval was 10.3 min. The fog droplet number concentration for sizes 2–15 μm and 30–50 μm increased during rainfall, and that for 2–27 μm decreased during snowfall. Icing grew rapidly (1.3 mm/h) in the freezing rain phase but slowly (0.1 mm/h) during the dry snow phase. Intensive supercooled fog, lower temperatures and increased wind speed all favored icing growth during dry snow (0.5 mm/h). The maximum ice thickness at 10 and 1.5 m was 20.7 and 1.2 mm, respectively, while the duration was 102 and 61 h, respectively. The density of icing at 10 m was lower than that at 1.5 m, and the accumulation rate of icing on the tower was closely related to the precipitation rate and microphysical characteristics of supercooled fogs. The ice thickness at 1.5 m was sensitive to daily variations in temperature and relative humidity, indicating diurnal variation. Differences in temperature and wind speed between the two heights were the main reasons for the differences in icing conditions, which indicated that icing was strongly affected by height.