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Title: Formation Process and Structure of Cumulonimbus Clouds Developed over Plain in Summer

Abstract: In summer, a large amount of rainfall are brought by cumulonimbus clouds in a plain which local thermal circulations develop. It is noticed that the cumulonimbus clouds result in the water circulation process associated with local thermal circulations. Therefore, the investigation of the formation process and structure of cumulonimbus clouds which develop over the plain is important for the elcidation of the water circulation process. In this study, formation process and structure of cumulonimbus clouds developed over the Noubi Plain on July 4, 2000, are investigated. The Noubi Plain is located to the southwest of the central mountain region of Japan and abuts on the Ise Bay in the southward. The Pacific Ocean extends to the south of Ise Bay. We used the data of Doppler-radar observation at Nagoya University and Gifu University, Automated Meteorological Data Acquisition System (AMeDAS), and precipitable water vapor (PWV) retrieved from dense network of global positioning system (GPS) operated by Geographical Survey Institute (GSI) of Japan. In the day, no synoptic-scale disturbance was present over Japan. A cold air was present over Japan and the atmosphere was convectively unstable. Vertical wind shear of the environment was directed from west to east. Two type of cumulonimbus clouds whose formation process was different were observed over the Noubi Plain. One type occurred when the sea breeze from the Pacific Ocean arraived at the center of the Noubi Plain. The other type occurred along the convergence line between the sea breeze and the outflow from cumulonimbus clouds developed in association with the local thermal circulation developed over the mountain. The former type developed stationary for an hour. Echo top height was about 10 km above sea level (ASL) and maximum radar reflectivity was over 45 dBZ. Many convective cells were generated at 6 km ASL and anvil extended eastward. The generation of the convective cells has no ordinality. Their lifetimes were 20 to 30 minutes. The cumulonimbus clouds were the non-organized multicell storm. The latter type developed along the convergence line. The cumulonimbus clouds moved southeastward with a gustfront. Echo top height was about 13 km ASL and maximum radar reflectivity was over 45 dBZ. The anvil extended eastward. Many developing convective cells aligned in the east-west direction. They developed and decayed in short, from 15 to 20 minutes, and moved southeastward. New convective cells formed to the south of old convective cell. The cumulonimbus clouds were similar to an organized multicell storm from the behavior of convective cells. It is considered that both type of cumulonimbus clouds made a large amount of rainfall in the plain in the water circulation process. Then, from the differences of the formation processes and structures, it is considered that the different water circulation process in association with the local thermal circulation operated. Acknowledgment: We used the GIPSY/OASIS II software package developed by JPL/NASA for the analysis of GPS data.

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