

Relationships among Rainfall Distribution, Surface Wind, and Precipitable Water Vapor derived from GNSS during Localized Heavy Rainfall in Tokyo in Summer

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In recent years, short-term heavy-rainfall events that have caused various damages such as flooding have frequently occurred in the Tokyo Metropolitan area in summer. This study aims to clarify the evolutionary process of short-term heavy rainfall as a contribution to short-range forecasting of heavy rainfall that occurs locally.

The relationships between the occurrence of intense rainfall and the convergence of surface winds and water vapor concentration for typical heavy-rainfall cases were examined using data from July to August in 2011–2013 obtained from high-density meteorological observations in Tokyo, Japan. Additionally, the differences in the temporal variations in wind convergence and water vapor between days with and without heavy rainfall events were compared.

Corresponding to the heavy-rainfall area, the convergence of surface winds tended to increase for several tens of minutes prior to the heavy rainfall. The peak of convergence was observed 10–30 min before the heavy-rainfall occurrence, and increasing of convergence continued for approximately 30 min until the convergence peak time. Around the heavy-rainfall area, the increase in the water vapor concentration index was observed coincide with the increasing of convergence. From these results, by monitoring the temporal variations and distributions of these parameters using a high-density observation network, it should be possible to predict the occurrence of heavy rainfall rapidly and accurately.

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