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Preliminary study of an Electromagnetic Wave Rain Gauge for small areal precipitation measurement

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Measuring accurate precipitation is an important factor in understanding weather phenomena that are closely related to human life. Humankind has been constantly striving to develop more efficient and accurate measurement methods. There have been some advances to automate the measurement of rainfall collected by sensors and various electronic circuits, but the underlying principles of fundamental precipitation observations have not improved. In the case of conventional rain gauge, it is difficult to represent the area because it only observes the spot rainfall in its installed location. In addition, existing methods interpolate the measurements of each rain gauge at a distance of several tens of kilometers to calculate the areal precipitation, thus Observation error is big as far as the place where the rain gauge is installed. Among the methods of calculating the area precipitation, there are technologies using the weather satellite and the weather radar as the most advanced technology. These techniques are useful for observing the area distribution and mobility of precipitation, but there is a limit to temporal resolution and low altitude observation. In addition, it is difficult to observe urban areas with complex environments where high-rise buildings are scattered, and there is a disadvantage that it takes a lot of installation and operation costs. We are researching and developing an electromagnetic wave rain gauge (EWRG) in order to satisfy the area representative of the rain gauge, ease of installation and operation, and to measure more accurate precipitation on the ground surface. EWRG measures the density and velocity of precipitation falling on the surface of the earth using electromagnetic waves covering a few kilometers of radius, unlike conventional precipitation measuring methods. Therefore, it is possible to immediately collect the area distribution of the precipitation and the velocity immediately before reaching the surface in the spatio-temporal high resolution. In order to improve the performance and rainfall observation accuracy of the prototype of EWRG, we have conducted field tests in various environments. As a result of analyzing the rainfall data using EWRG, we confirmed that the radio precipitation system can observe area precipitation with high sensitivity even in very weak rainfall events. We are planning to develop an accurate quantitative precipitation estimation(QPE) model for our EWRG by analyzing the field test results. And we expect to be able to play a role as a new and high-performance precipitation observation technology and as the gap filler for satellite and weather radar observations.