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稠密GNSS受信ネットワークを用いた可降水量の時間・空間変動特性に関する研究
Characteristics of time and spatial variations of precipitable water vapor observed with a dense GNSS receiver network

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According to the IPCC report, the number of localized torrential rain is projected to increase recently because of global warming, which sometimes gives serious weather hazards to our society. It is requested to establish an early warning system for severe rain events. Although a meteorological radar and surface rain gauge (AMeDAS) can detect rain clouds and precipitation, respectively, they can only detect rain clouds after their formation. We aim at developing an observation system to monitor the behavior of water vapor before it condenses to form a cloud, by employing the GPS meteorology technique.

We estimate PWV (Precipitable Water Vapor) from the radio propagation delay of GPS signals. We deployed a dense GNSS receiver network in Uji for this study using 15 receivers with 1-2 km horizontal spacing. We obtained the GNSS data from April 2011 to March 2013. We also downloaded the surface precipitation data observed at AMeDAS station in Nagaoka-city.

We computed PWV at every observation points, and analyzed time and spatial variations of PWV.We compared these parameters with the AMeDAS data. In order to investigate a relationship between PWV and local torrential rain, we analyzed PWV on 40 days when much precipitation was found in the AMeDAS data. In particular, we selected three cases on August 13, 18 and September 15, 2012. We found both the averaged PWV value and the variance of PWV between GNSS points increased before a passage of a rain cloud which was detected by the meteorological radar. When more precipitation occurred, both the averaged PWV value and the PWV variance increased more rapidly, suggesting their positive correlation.

We analyzed the 40 cases statistically. Then the maximum value of the average PWV and the amount of precipitation show a linier relationship. In addition, we noticed that precipitation occurred when the variance of PWV between observation points was large. Thus, we consider that we have to analyze both the averaged PWV value and the variance of PWV, therefore, the dense GNSS network is useful for forecasting a local heavy rain.

キーワード: GPS, 可降水量, 宇治稠密観測
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