Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

AAS24-06 Room:105 Time:May 21 10:45-11:01

A Real-time Monitoring System of Precipitable Water Vapor (PWV) Using a Dense GNSS Receiver Network

TSUDA, Toshitaka[1*], SATO, Kazutoshi[2], REALINI, Eugenio[1], YABUKI, Masanori[1], OHIGAWA, Masanori[1], IWAKI Yuya[1]

[1]RISH, Kyoto University, [2]CPIER, Kyoto University

Because of on-going global warming, frequency and intensity of abnormal weather are projected to increase, resulting in serious hydrological hazards, such as a land slide, an unexpected increase of river level and so on. A torrential rain in urban area is becoming a serious problem, which is caused by a strong thunderstorm abruptly developing associated with a sudden heavy rainfall.

Horizontal scale of a local heavy rainfall is as small as a few kilometers, which is difficult to predict with a current numerical weather forecast. A weather radar can detect a cloud only after the event becomes evident. It is required, therefore, to develop an observation system to monitor the behavior of water vapor in advance to formation of clouds.

A Global Navigation Satellite System (GNSS), represented by GPS, is now widely used for precise determination of coordinates. The ultimate error in the satellite positioning comes from the propagation delay of the GNSS radio signal within the atmosphere. The delay can, however, be related to the accumulated water vapor along the ray path, which can be mapped onto the vertical detection to estimate the precipitable water vapor (PWV). This is the basic concept of GPS Meteorology.

In a conventional method of GPS Meteorology, all available GPS satellites seen above an elevation angle of 5-10 degrees are used to estimate PWV, therefore, the horizontal resolution of GPS-PWV is as wide as about 20 km. We here propose to use GNSS satellites at high elevation angle only, then, the horizontal resolution of the PWV estimates is significantly improved. In particular, we will employ Quasi-Zenith Satellite System (QZSS), launched in September 2010 by JAXA. One of QZSS satellites stays overhead of Japan continuously for about eight hours each day, so, it is suitable to monitor PWV with a better horizontal resolution.

We have installed a dense GNSS receiver network (10-17 QZSS receivers) with the horizontal spacing of 1-2 km near the Uji campus of Kyoto Unviersity. In this paper, we report initial results of PWV measurements focusing on the horizontal inhomogeneity of water vapor distribution, and its application for now-casting of a cloud development.

Keywords: GNSS, Precipitable Water Vapor (PWV), QZSS, real-time, dense network, ionosphere