Water vapor estimation using digital terrestriall broadcasting waves - Simultaneous observation with microwave radiometer -

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1. Introduction

NICT is developing a method that can observe water vapor in a wide area and efficiently. Water vapor is an important quantity along with wind velocity and temperature in the weather prediction. Solid / liquid phase water in the atmosphere can be observed with weather radars, but water vapor, water in gas phase, can not be observed with radars. Water vapor observation methods in a wide area are limited. Currently, GPS / GNSS precipitable water observation which is used as water vapor data in a weather numerical model uses the delay amount of the L-band radio waves from the GPS / GNSS satellites. NICT have demonstrated that similar measurements are possible with the terrestrial digital broadcast wave in UHF [1]. The method is that using delay profile decorded from scattered pilot signals embedded in the terrestrial digital broadcast wave, the reflected wave scattered from the surrounding reflector, building or towers, is separated from the direct wave. By using phase difference between the reflected wave and direct one, the influence of the phase noise of the reference signal at the broadcast station / reception point is canceled, and the propagation delay of the UHF band radio wave is measured with accuracy of picosecond level.

2. Simultaneous observation with microwave radiometer

We installed a microwave radiometer and terrestrial digital broadcasting wave receiver on the roof of the Meteorological Research Institute, Tsukuba, in February 2017, and we are continuing long-term observation. The microwave radiometer is an instrument capable of observing the amount of water vapor accumulated in the vertical direction above the measurement point. On the other hand, water vapor observation by the terrestrial digital broadcast wave means the amount of water vapor along the horizontal direction near surface. These observation volumes are different in size and shape. Therefore, by combining the two sensors, complementary observation of the water vapor amount is expected. In terms of time resolution, the microwave radiometer is not so good as it directs the antenna beams in a plurality of directions and estimates from the received thermal noise powers. In the water vapor estimation by terrestrial digital reception, more than 50 samples are measured per second, and it has a rather high temporal resolution. In this presentation, we will compare the variation of water vapor observed by microwave radiometer and terrestrial digital broadcasting wave for about one and a half years, and introduce the analysis results focusing on the difference in characteristics.

Keywords: water vapor, digital terrestrial broadcasting wave, propagation delay

