Water vapor estimation using digital terrestrial broadcasting waves - Results using reflected waves -

*Seiji Kawamura[1], Hiroki Ohta[1], Hiroshi Hanado[1], Masayuki Yamamoto[1], Nobuyasu Shiga[1], Kouta Kido[1], Satoshi Yasuda[1], Tadahiro Goto[1], Ryuuichi Ichikawa[1], Jun Amagai[1], Kuniyasu Imamura[1], Miho Fujieda[1], Kentaro Ishizu[1], Hironori Iwai[1], Shigeo Sugitani[1]

1.National Institute of Information and Communications Technology

We, National Institute of Information and Communications Technology (NICT), are developing a water vapor measurement system using digital terrestrial broadcasting wave. One of our goals is to develop a 2D water vapor monitoring system with distributed many small receivers. Horizontal distribution of water vapor mopnitoring will be contribute to increase the precision of weather forecast with data assimilations. Very precise measurements (at least several tens of pico-second order) are needed for the effective observations. Phase fluctuations of local oscillators at radio tower and receivers are essential error factors. So we measure the propagation delay at two receiving points on the same line including the radio tower. Each result includes phase fluctuations of local oscillators at radio tower and receivers. Phase fluctuation of local oscillator at radio tower will be canceled out by taking the difference. We can estimate water vapor between two receiving points by synchronization between their local oscillators.
We are developing a real-time delay (phase of delay profiles) measurement system with software-defined radio technique. Each TV station has their own local oscillators. Out system is improved and it can measure phase fluctuations of radio waves from whatever TV station stably for a long time. We are planning a proving test for synchronization of local oscillators at different sites.
In this presentation we report a method and results of water vapor measurment without synchronization of local oscillators. We observe phase variations of digital terrestrial broadcasting waves at cartain site. If there is a reflector at the opposite side from the radio tower, we can observe direct waves and reflected waves simultaneously. Measurement is conducted using single local oscillator at the observing point. So we can measure a round trip propagation delay between the observing point and reflector without synchronization of local oscillators. NICT is located at about 29 km westward from the Skytree. A building is located at about 1 km westward from NICT. Both direct and reflected waves can be observed at NICT. We have a groundbase meteorological observatory equipment at NICT. Provagation delay can be calculated using these data on the assumption that these data are representative of the meteorological condition around there (within 1 km). Observed time vriations of propagation delay using digital terrestrial broadcasting waves correspond to the calculation.

Keywords: digital terrestrial broadcasting wave, water vapor

