Development of novel ground-based microwave radiometer for earth science -results of the first measurements-

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We have started to develop a next-generation microwave radiometer to be used in millimeter-wave spectroscopy for the high-resolution and high-precision monitoring of water vapor behavior. The new radiometer will be suitable for not only space geodetic techniques such as VLBI and GNSS, but also field measurements to monitor, for example, volcanic activities and cumulonimbus cloud generation. The planned front-end system for our new microwave radiometer has a wide bandwidth feed of 20–60 GHz. A signal from the feed is separated into two linear orthogonal polarized signals using an orthomode transducer (OMT); one is in the 20–30 GHz feed and the other is in the 50–60 GHz feed. We are now planning to cool the wideband feed, OMT, and LNA for each signal at 77 K using a Stirling cryocooler to improve the signal-to-noise ratio. We assembled a room-temperature 20–30 GHz receiver without the cooling system until the middle of 2019 as a first step of our development. We implemented the new receiver into the 3.7 m dish at Okinawa Electromagnetic Technology Center, National Institute of Information and Communications Technology (NICT), and carried out the first measurements using this receiver for validation tests in October 2019. Quick-look data obtained by the new receiver shows good power signals for the expected receiving band of 18–28 GHz. We are now developing another receiver for a higher band of 50–60 GHz, and we are going to implement the second one into the new prototype radiometer by the end of this fiscal year.

