

A novel measurement system for thermodynamic environment by using radio astronomy technology

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In order to prevent meteorological disasters such as local heavy rainfall, significant tornado, and heavy snowfall, a novel method of short-term forecasting and nowcasting is required. To solve this issue, we propose a novel measurement system which high-frequently observes microwave radiation intensity and estimates atmospheric thermodynamic environment.

We have been developed such a radiometric measurement system based on the technology for the radio astronomy. There are absorption characteristics by water vapor and liquid water at the frequency of 20-30 GHz. The radiometric observation at these frequencies has been used for the retrieval of vertically integrated water vapor and liquid water. Recent studies have applied the radiometric observations at another frequency band of Oxygen molecule absorption (50-60 GHz) to the retrieval of vertical thermodynamic profiles such as atmospheric temperature and water vapor. A key to achieve a high-quality and high-frequently radiometric observation is maintenance of cold condition, e.g., 20 Kelvin, for a cold amplifier. It results in low noise condition of the radiometer. Application of the radio astronomy technology naturally achieves this because cooling of the receiver is the popular technique. In particular, mechanical refrigerator on the high-speed rotation system, which is the patent pending technology by authors, realizes the high-speed scan of the sky.

We will present an outline of this project as well as status of its prototype system at 22 GHz band. The plan for 3-dimensional mapping of the atmospheric water vapor and for retrieval of cloud microphysics properties such as snow water path will be discussed, too.

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