

Development of next-generation 1.3 GHz wind profiler radar

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Wind profiler radar (WPR) is an instrument that measures height profiles of vertical and horizontal wind in the clear air. The echo source for WPR is irregularities of the radio refractive index with a scale half of the radar wavelength (i.e., Bragg scale). Turbulence generates the irregularities of the radio refractive index by producing perturbations of temperature and humidity. WPR is used both for atmospheric researches and for weather monitoring and forecast.

Though WPRs have been used as a useful means for measuring wind profiles in the clear air, its measurement resolution and quality of wind products can be further improved. In order to realize a breakthrough in wind and turbulence measurements by WPR, next-generation 1.3 GHz WPR has been developed. Range imaging (RIM), which uses multiple frequencies and adaptive signal processing, is a means for enhancing vertical resolution. By using oversampling (OS), measurement accuracy of RIM is able to be gained. Adaptive clutter suppression (ACS), which controls antenna side lobe by using subarray antennas and adaptive signal processing, is a means for mitigating contamination of undesired echo (i.e., clutter). In order to implement RIM, OS, and ACS capabilities in existing WPRs, a unique digital receiver using software-defined radio technique has been developed. Currently, RIM, OS, and ACS capabilities are implemented in a 1.3 GHz WPR operated by NICT and a 1.3 GHz boundary layer radar operated by DPRI, Kyoto University. At the meeting, overview and current development status of next-generation 1.3 GHz WPR are presented.

Acknowledgment:

Part of the development of next-generation 1.3 GHz WPR has been supported by KAKENHI Grant Number 26281008, 15H05765, and 16K12861 funded by the Japan Society for the Promotion of Science.

Keywords: wind profiler radar, wind, turbulence, radar imaging, clutter mitigation