

## High temporal resolution observations of Precipitation cores with Dual polarized phased array weather radar

H. Kikuchi<sup>(1)</sup>, Kai Oikawa<sup>(1)</sup>, Kento Nakamura<sup>(2)</sup>, Shuhei Uchida<sup>(2)</sup>, Tomoo Ushio<sup>(3)</sup>, and Yasuhide Hobara<sup>(1)</sup>

(1) The University of Electro-Communications, Chofu, Japan,

e-mail: hkikuchi@uec.ac.jp; oikawa.soramame@gmail.com; hobara@ee.uec.ac.jp

(2) Tokyo Metropolitan University, Hino, Japan;

e-mail: nakamura-kento@ed.tmu.ac.jp; uchida-shuhei@ed.tmu.ac.jp

(3) Osaka University, Suita, Japan,

e-mail: ushio@eei.eng.osaka-u.ac.jp

The 40 X-band multi-parameter (e.g. dual polarized) weather radars, which consists of a parabolic antenna, have been operating around the urban area, such as Tokyo and Osaka, in Japan. The observation network is called ‘the extended radar information network; XRAIN’. The five X-band phased array weather radars (PAWRs) have also been operating in Japan since 2012. The PAWRs give us a high temporal resolution and high-density observations for precipitations at high altitude as compared with the XRAIN. As a next weather radar development project, a dual polarized phased array weather radar; DP-PAWR, which is also termed as multi-parameter phased array weather radar; MP-PAWR, has been developed. It can provide dual polarized parameters that reveal detailed microphysics of storms in addition to accurate the precipitation estimation. The DP-PAWR, which simultaneously transmits pulses of horizontal and vertical polarized radiation, has been developed and installed in December 2017, at the Saitama University, Japan, as shown in Fig. 1. The center of frequency and observation range are 9.43 GHz and 80 km, respectively. The DP-PAWR has a scanning scheme similar to the PAWR, which uses the mechanical and electronic scanning in azimuth and elevation angles, respectively. The DP-PAWR provides the polarized precipitation measurements in three-dimensional volume scanning in less than 30 or 60 seconds in a range of 60 or 80 km in real-time, respectively. The 114 samples are observed from 0 deg to 90 deg in elevation angles. The spatial resolution for the elevation angles is about 0.8 deg. For azimuth angles, the spatial resolution is 1.2 deg. Consequently, the rapid scanning and high-density observations are simultaneously achieved with the DP-PAWR.

In this presentation, we will show the observation results including a hydrometer classification for an thunder storm. We focus on the heavy rain case occurred in Tokyo area on August 5, 2019. The results of the hydrometer classifications indicated that the cores of the high density graupel and hails are generated at the high altitude in the thunder storm before the heavy rain on the ground. Using three-dimensional data at every 30 seconds with the DP-PAWR, the temporal relationship between the amount of the hydrometeor types at the high altitude and the rain rate on the ground is discussed. Furthermore, we will show an adaptive signal processing for the DP-PAWR to suppress the ground clutter echoes, which is one of the significant problems for the precipitation observations with DP-PAWR.

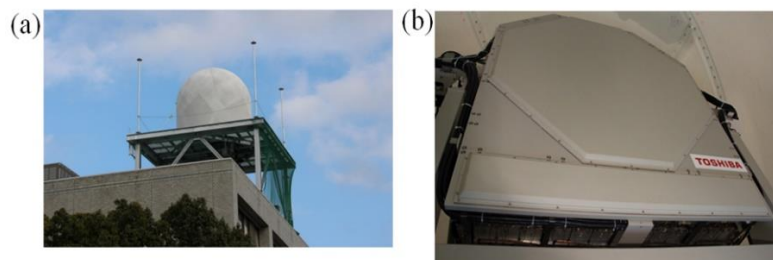


Fig. 1 Photos of X-band Dual polarized phased array weather radar.