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<th>Scientific and Integrated Research by In-situ Campaign Observations Synchronizing Polarimetric Radar with Video-Sonde</th>
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Kyoto University
1. INTRODUCTION

Recently, disaster due to localized heavy rainfall is noticeable under climate change and urbanization. Although prediction accuracy of heavy rainfall in large spatial scale is getting higher and higher, it is still difficult for localized heavy rainfall in smaller spatial scale to be even reproduced. Moreover, earlier detection and prediction of localized and suddenly generated heavy rainfall (so called guerrilla heavy rainfall) are very important, even if the time lag is five to ten minutes. Also, prediction and early warning of flash flood are expected. Under these circumstances, this scientific integrated research aims to execute in-situ campaign observations of precipitation using a video-sonde synchronized with the latest polarimetric Doppler radar which is expected to be effective in the rainfall estimation and prediction. Also, this research aims to develop methodologies for reducing water related disaster.

Japan is monitored by the 26 C-band operational radars which can transmit single polarized wave only. In 2010, the test operating of 11 X-band polarimetric radars with a quite high dense network started in July by Ministry of Land, Infrastructure, Transportation and Tourism (MILT). Polarimetric radar has an advantage over conventional non-polarimetric systems because they measure some parameters related to the shape and the forms of any kind of precipitation. Moreover, in 2011, the additional 15 X-band polarimetric radars will be installed at some another areas in Japan. Also, some of C-band operational radars will upgraded into the dual-polarization in near future.

2. CAMPAIGN OBSERVATION SYNCHRONIZING POLARIMETRIC RADAR AND VIDEO-SONDE

In such the latest situation with a high dense radar network, two campaign observations are carrying out as our current activity in Disaster Prevention Research Institute (DPRI), Kyoto University. One observation is the synchronization of C-band polarimetric radar with the video-sonde which can measure the real particle images from a video camera as shown in Fig. 1. This campaign was carried out in Okinawa Island in fall 2007, Baiu 2008, Baiu 2009, spring 2011, Baiu 2011, and Baiu 2012.

The purposes of this project are 1) Improving meso-scale atmospheric model by sophisticating the cloud microphysical processes, 2) Developing assimilation methodology by establishing a polarimetric radar distinction algorithm of co-existing hydrometeors, 3) Completing rainfall estimation procedure for operational use, 4) Developing earlier detection and prediction methodologies of guerrilla heavy rainfall, and 5) Improving warning system of flash flood. The other campaign will be carried out in

Fig. 1 How to synchronize video-sonde with radar, and schematic image of the campaign observation.
Osaka area in summer 2011, and summer 2012 as shown in Fig. 2. The purpose of this campaign is to measure the early stage of cloud which would cause a heavy rainfall disaster using X-band & C-band polarimetric radars, Ka-band radar, Doppler Sodar, Raman lidar, GPS precipitable water vapor, and the some satellite with a rapid scanning.

**Campain observation over urban area**

![Image of campaign observation over urban area]

**Fig. 2 Campaign observation over urban area.**

### 3. EXPECTED RESEARCH ACHIEVEMENTS AND SCIENTIFIC SIGNIFICANCE

1) The first synchronized observation in the world. 2) Sophistications of the models of cloud physics, atmospheric, and rainfall prediction. 3) Reducing water related disaster such as flash flood.

![Image of strategy of the project]

**Fig. 3 Strategy of the project.**

### 4. CO-EXISTING HYDROMETER CLASSIFICATION

Development of hydrometer classification is one achievement of the project (Nakakita et al., 2009). Co-existing state is considered in the methodology as shown in Fig. 4. Also, quantitative precipitation estimation using polarimetric radar is improved compared with the previous method as shown in Fig. 5.

![Image of co-existing hydrometer classification by polarimetric radar compared with video-sonde]

**Fig. 4 Co-existing hydrometer classification by polarimetric radar compared with video-sonde.**

![Image of QPE using Polarimetric radar]

**Fig. 5 QPE using Polarimetric radar.**

### REFERENCES:
