

CG lightning activities and GPM/DPR flagHeavyIcePrecip during heavy rainfall events

*Kenji Suzuki¹, Rimpei Kamamoto¹, Yuki Kaneko², Katsuhiro Nakagawa³

1. Yamaguchi University, 2. Japan Aerospace Exploration Agency, 3. National Institute of Information and Communication Technology

It is well known that the lightning activity is closely related to the convection. However, the heavy rain does not always occur accompanying lightning. In the record-breaking heavy rain that occurred in the western part of Japan in 2018, the lightning was rarely observed. In this study, we examined the cloud-to-ground (CG) lightning during the heavy rainfall events using the Global Precipitation Measurement Mission (GPM) a dual-frequency precipitation radar (DPR) and the X-band Multi-Parameter (MP) Radar (XRAIN) by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT).

The CG lightning data in the present study were observed by the Lightning Location System (LLS) operated by the Kyushu Electric Power Co., Inc. and the Lightning Detection Network System (LIDEN) operated by the JMA. The LLS utilizes a combination of the magnetic direction-finder method and the time-of-arrival method and provides information on the location (latitude/longitude), time, polarity and current of lightning strikes. In addition, the JMA composite radar-echo product and the XRAIN data were used for the analysis to examine the horizontal and temporal distribution of the heavy rain system.

In the July 2018 Western Japan heavy rainfall event, the GPM core satellite passed over the western part of Japan at 00:38 JST on 7 July 2018. The GPM/DPR product used in this study is DPR Level-2. The “flagHeavyIcePrecip” variables in the Classification module are used. The flagHeavyIcePrecip is defined as precipitation consisting of ice particles by strong radar reflectivity above the -10°C level. It indicates the existence of solid hydrometeors such as graupel and large snowflakes. In this case, no flagHeavyIcePrecip was almost detected (figure). It was considered that there was no active solid hydrometeor formation process that produce the CG lightning. The JMA radars and XRAIN also confirmed that deep convections were not dominant in the July 2018 Western Japan heavy rainfall. On the other hand, at 21:51 JST on 20 June 2016, GPM/DPR passed over the western part of Kyushu area. In this case, a lot of CG lightning were observed and the flagHeavyIcePrecip was detected.

Keywords: CG lightning, GPM DPR, flagHeavyIcePrecip, heavy rainfall

