Estimation of electric charge structure in cumulonimbus in ULAT project in Philippines

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Hard disturbance of convective cells in growing cumulonimbus has small time and spatial scales (5-10 km, 30-60 min, respectively), so the time and spatial resolution of existent AMeDAS and observation networks of weather radar are not always enough to capture such activity. Spatial distribution and transfer of electric charges in cumulonimbus is expected to reflect such convective activity, though their detailed relationship has not been examined. In this research, amount of electric charge and its three-dimensional spatial distribution in cumulonimbus will be estimated by using multi-points observation of vertical quasi-electrostatic field change by lightning discharge on the ground.
Previous study have tried multi-points observation using field mills (Workman et al., 1942; Jacobson and Krider, 1976), but this method is hard to be developed macro observation network because of cost and maintenance of device. Observation using capacitive antennas (Krehbiel et al., 1979; Baranski et al., 2012) have been low cost of device, but this method has a problem in accuracy for electric charge estimation because it’s difficult to calibrate sensitivity difference between observation points. To solve these problems, it is required to establish a calibration method with high-time resolution using low-cost and easy electric filed sensors.
Electric charge estimation has tried by 7 plate-type electric field sensors and a field mill being set up at interval of 4 km in 7 km x 7 km area around Mt. Yatsugatake (Japan) in 2013 (Sakai, 2013). This observation achieved 10-100 times higher resolution of electric charge estimation than previous researches (Krehbiel et al., 1979; Baranski et al., 2012). The purpose of this present work is to establish the high-resolution estimation of electric charge structure in cumulonimbus, applying and improving this method. We are going to use a new observation network with 50 plate-type electric field sensors to be installed at an interval of about 5 km in the metropolitan area of Manila, Philippines. This plan is part of ULAT (Understanding Lightning and Thunderstorm) project, one of the SATREPS programs.
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