[EE] Evening Poster | M (Multidisciplinary and Interdisciplinary) | M-IS Intersection

[M-IS04]Thunderstorms and lightning as natural hazards in a changing climate

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Lightning and thunderstorm are markers of severe weather, often accompanied by precipitation, hail and strong winds that can create significant natural hazards, especially in disaster-prone area. Lightning is also a strong indicator of convection, with tropical storms (typhoons and hurricanes) being of major importance. As the climate warms in the first decades of the 21st century, the intensity and frequency of thunderstorms is projected to increase. The need for detecting and monitoring the development of thunderstorms and lightning activities on local and regional scales is therefore clear and urgent.
This session seeks observational and theoretical contributions on thunderstorm microphysics and dynamics, convective systems and tropical storms. Present patterns and distributions of lightning and extreme weather events derived from the ground-based networks and satellites, as well as forecasts of future trends, are also of interest. Lightning detecting and monitoring system performance and validation, and early-warning schemes are requested, either in operational or planning phase. The session will highlight regional and global lightning and atmospheric electricity networks and invites contributions on technological innovations in this field.

[MIS04-P02]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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References

Baranski P., Loboda M., Wiszniowski J., Morawski M., 2012, Evaluation of multiple ground flash charge structure from electric field measurements using the Local Lightning Detection Network in the region of Warsaw, *Atmos. Res.*, 117, 99-110, doi: 10.1016/j.atmosres.2011.10.011.
Jacobson, E. A., and E. P. Krider, 1976, Electrostatic field charges produced by Florida lightning, *J. Atmos. Sci.*, 33, 103-117.
Krehbiel, P. R., M. Brook, and R. A. McCrog, 1979, An Analysis of the charge structure of lightning discharge to the ground, *J. Geophys. Res.*, 84, 2432-2456.
Workman, E. J., R. E. Holzer, and G. T. Pelsor, 1942, The electrical structure of thunderstorms, *Aero. Tech. Note 864*, pp. 1-47, *Nat. Advan. Comm.*, Washington D. C.