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# Correlation between atmospheric electric fields and cloud cover using a field mill and cloud observation data

Kota Nakamori (1), Yasuki Suzuki (1), Hiroyo Ohya (1), Toshiaki Takano (1), Yohei Kawamura (1), Hiroyuki Nakata (1), and Kozo Yamashita (2)

(1) Graduate School of Engineering, Chiba University, Chiba, Japan, (2) Salesian Polytechnic, Tokyo, Japan

It is known that lightning and precipitations of rain droplets generated from thunderclouds are a generator of global atmospheric electric circuit. In the fair weather, the atmospheric electric fields (AEF) are downward (positive), while they are upward (negative) during lightning and precipitations. However, the correlations between the AEF, and the cloud parameters such as cloud cover, weather phenomenon, have been not revealed quantitatively yet. In this study, we investigate the correlations between the AEF and the cloud parameters, weather phenomenon using a field mill, the 95 GHz-FALCON (FMCW Radar for Cloud Observations)-I and all-sky camera observations.
In this study, we installed a Boltek field mill on the roof of our building in Chiba University, Japan, (Geographic coordinate: 35.63 degree N, 140.10 degree E, the sea level: 55 m) on the first June, 2016. The sampling time of the AEF is 0.5 s. On the other hand, the FALCON-I has observed the cloud parameters far from about 76 m of the field mill throughout 24 hours every day. The vertical cloud profiles and the Doppler velocity of cloud particles can be derived by the FALCON-I with high distance resolutions (48.8 m) (Takano et al., 2010). In addition, the images of the clouds and precipitations are recorded with 30-s sampling by an all-sky camera using a CCD camera on the same roof during 05:00-22:00 LT every day. The distance between the field mill and the all-sky camera is 3.75 m.
During 08:30 UT – 10:30 UT, on 4 July, 2016, we found the variation of the AEF due to the approach of thundercloud. The variation consisted of two patterns. One was slow variation due to the movement of thunderclouds, and the other was rapid variation associated with lightning discharges. As for the movement of thunderclouds, the AEF increased when the anvil was located over the field mill, which was opposite direction of the previous studies. This change might be due to the positive charges in the upper anvil more than 14 km altitude. As for the rapid variations of the AEF, 12 peaks of the AEF coincided with the occurrence of the lightning within 37 km.
Moreover, we developed the automatic procedure to estimate the cloud cover from cloud optical images using the RGB color values. We estimated the correlation between the cloud cover and the AEF during June - November, 2016. The AEF decreased with increasing the cloud cover. This trend may be caused by the dielectric polarization due to the insert of the dielectric clouds into the global condenser. The standard deviation of AEF was small when the cloud cover increased.
In this session, we will show the variations in the AEF during usual precipitations and snowing.