Effects of cloud, lightning activities and snowfall on atmospheric electric field using 95-GHz cloud radar FALCON-I

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It is known that cloud-to-ground lightning and precipitations generated from thunderclouds are a generator of global electric circuit (e.g., Williams, 2009). In the fair weather, the atmospheric electric field is generally downward (positive). However, the correlations between the atmospheric electric field and cloud parameters have not been revealed yet. In this study, we investigate the effects of cloud, lightning activities and snowfall using a field mill, the 95 GHz cloud radar, FALCON (FMCW Radar for Cloud Observations)-I, all-sky camera, and X-band radar. We have observed the atmospheric electric field with a Boltek field mill, cloud reflectivity and the Doppler velocity with the FALCON-I, and cloud cover with an all-sky camera in Chiba University, Japan, (CHB, 35.63N, 140.10E). At about 10 km southeast from the CHB, a phased array X-band radar operated by Japan Radio Corporation have observed precipitations/cloud. During snowfall of 23-24 November, 2016, periodic oscillations in the atmospheric electric field with periods of 70-90 min. were observed at 4 observation sites; CHB, Kakioka (KAK, 36.23N, 140.19E), Tokyo Gakugei University (KGN, Kokubunji, Tokyo, 35.71N, 139.49E), and Seikei High School (MSN, Musashino, Tokyo, 35.72N, 139.57E). The distances of CHB-KAK, CHB-KGN, and CHB-MSN are 64.8 km, 55.9 km, and 49.0 km, respectively. At the end of snowfall, the periods of the oscillations became shorter to be 20-50 min. at all sites. Based on the FALCON-I observations, we found that the reflectivities of the cloud and snowfall had the same period of about 70 minutes at 1-2 km heights during the snowfall. In addition, the long-period oscillations of the atmospheric electric field would be associated with the streak structures observed by the X-band radar. In the presentation, we will show correlations between the atmospheric electric field and cloud parameters, diurnal UT variations and variations during lightning activities in the atmospheric electric field.

