Dependence of atmospheric electric field on solar activity

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The vertical atmospheric electric field variations depend on the state of the global circuit. Under the fair weather condition, atmospheric electric field directs vertically downward. The direction is due to the electric potential in the ionosphere and the Earth's surface. Thus ionospheric state seems to affect atmospheric electric field.
Kleimenova et al. [2010] examined atmospheric electric field at the time of substorms. They concluded that the deviations of Ez at high latitudes are the result from an enhanced polar convection or change in the ionospheric potential.
Since the report was established based on high-latitude data, we focused on low-latitude atmospheric electric field variation related with ionospheric state. In this study we analyzed the low-latitude atmospheric electric field Ez at KAK (G.G. Lat.: 36.2 N, G.G. Lon.: 140.2 E) and solar F10.7 index which is derived from solar radio flux at a 2.8 MHz. The solar F10.7 flux is well known that related with ionization in the ionosphere through solar extreme ultraviolet (EUV) emission. Daily Ez amplitude for high solar-activity (F10.7 > 100) periods shows higher value than that for low solar-activity (F10.7 < 100) periods. The tendency is predominant in July and August. When solar EUV flux is intense, ionization in the ionosphere are promoted and ionospheric potential becomes higher. We, therefore conclude that potential difference between the ionosphere and the Earth's surface becomes larger and the atmospheric electric field is enhanced during high solar-activity periods.

Keywords: atmospheric electric field, solar activity

