Meteorological and diurnal variation of the vertical conduction current density and fair weather E-field in the Negev desert, Israel

Roy Yaniv[1], Yoav Yair[2], Colin Price[1]

[1] *Department of Geophysics, Atmospheric and Planetary Sciences, Tel Aviv University, Israel*
[2] *Department of Life and Natural Sciences, The Open University of Israel, Israel*

We investigate changes that impact the global electrical circuit and present preliminary results showing the diurnal changes of Ez and Jz in fair weather days that are used for establishing a background diurnal spectrum for the Jz and a Carnegie style curve for the Ez. We show the different impacts of local meteorological parameters on the Jz and Ez values near ground, as well as several special cases of severe weather including dust storms.

1. General

The global electric circuit (GEC) on earth is driven by electrified shower clouds and thunderstorms that act as current generators. The current flows up to the ionosphere and returns back to earth far away from the severe weather in areas known as fair weather regions. The vertical conduction current density (Jz) is of typical value of ~2 pA m-2 pointed downward and is one of the parameters that are measured, along with the vertical electrical field (Ez) and the atmospheric conductivity, to investigate the GEC. The Ez was found to be of typical value between 100-300 V/m near ground and shows a behavior that correlates with the diurnal global thunderstorm activity in what known to be the Carnegie curve [1].
The GDACCS developed by the University of Reading, UK, for measuring the various types of currents (vertical conduction current density and the displacement current density) is using two charge-collecting plates of different geometry [2]. An identical system was installed at the Wise observatory in Mitzpe Ramon, Israel (30.6N, 34.76E) to measure the Jz and detect the impact of solar events (e.g CMEs, solar proton events) on the global electric circuit. Additionally, a new CS110 electric field meter instrument (Campbell Scinetific) was installed to measure the vertical changes in the Ez near the ground.

2. References

[1] M.J Rycroft, K.A Nicoll, K.L Aplin, R.G Harrison, Recent advances in global electric circuit coupling between the space environment and the troposphere, Journal of Atmospheric and Solar-Terrestrial Phyiscs 90-91, 198-211, 2012.

[2] Bennet A.J, Harrison R.G, Surface measurement system for the atmospheric electrical vertical condution current density, with displacement current density correction, Journal of Atmospheric and Solar-Terrestrial Phyiscs 70, 1373-1381, 2008.