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Ground measurements of the vertical E-field on mountains and the "Austausch" effect

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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 in areas known as fair weather regions. One of the GEC parameters that is routinely measured is the vertical electrical field (Ez) with a typical fair weather value between 100-300 V/m near ground. The Ez was found to correlate with the diurnal global thunderstorm activity in what is known as the Carnegie curve (Rycroft et al., 2012).
Five ground based stations that measure the daily mean variations of the Ez during fair weather are currently operational in Israel and Armenia. The Israeli stations are located in the arid region of Mitzpe Ramon, Negev desert in southern Israel (30.6N, 34.76E, altitude 860 a.s.l) [Yaniv et al 2015] and at the Tel-Aviv University Cosmic Ray Observatory on Mount Hermon, in northern Israel (33.3N 35.78E, 2100 a.s.l). The Armenian stations are located in Yerevan, (40.205N, 44.486E, 1090m a.s.l.) and additional two on Mount Aragats: Nor Amberd (40.37N, 44.26E, 2000m a.s.l.) and Aragats (40.47N, 44.18E, 3200m a.s.l.).
We present preliminary results of the mean daily variations of Ez recorded in these five stations, showing a strong mid-day effect in the mountainous stations (Hermon, Aragatz and Nor Amberd) that is absent from non-mountain stations (Yerevan and Mitzpe Ramon). This strong mid-day local effect in mountainous regions were previously observed by several authors and referred to as "Austausch" – The rising of the boundary layer and the accumulated charge within it due to solar morning heating of the ground. The transport of electrical charge results in an increase of the local Ez [Chalmers 1965, Cobb et al 1967, Israël 1970]. We used monthly averages of the time of increase of the electrical field and correlated these times with the local sun-rise times in the different geograpical locations. Positive correlations were found, indicating that morning solar heating results in the uplift of the charged layer to the mountain tops by anabatic (upslope) winds.