## Characterizing Atmospheric Electric Field Variability and Its Geophysical Significance

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The atmospheric vertical electric field or Potential Gradient (PG) is one of the most important parameters along with atmospheric conductivity and conduction current to study the earth's atmosphere and to understand the Global Electric Circuit (GEC). According to concept of GEC, the Earth and its upper atmosphere are the two plates of a capacitor, with the air column resembling the resistance between the plates and thunderstorms function like batteries to charge the capacitor. During thunderstorms, lightning and electrical discharges create a charge separation, making the ionosphere positive and Earth negative. This generates a potential difference, producing a vertically downward atmospheric electric field (AEF) or potential gradient (PG), defined as PG = −Ez, where Ez is the vertical electric field component. Under fair weather conditions, PG is positive. PG exhibits a unitary diurnal variation, reaching its minimum around 03:00 UT and maximum around 19:00 UT, and this is referred as the Carnegie curve. In our study, we examine the variability of the fair weather PG at Namsai (27.69°N, 95.85°E.~149 m above sea level ) in Arunachal Pradesh, Silchar (24.68°N, 92.76°E, ~35 m above sea level) in Assam, and Shillong (25.56 °N, 91.86°E, 1,520 m above sea level) from 2016 to 2021. Our analysis indicates that the mean diurnal variation of fair weather PG peaks at ∼14:00 UT for all three locations. Seasonal analysis shows that PG values maximized during the winter, followed by the equinox and summer for the Namsai region. We further report a significant variation in PG before the Mw 6.4 earthquake on November 17, 2017, which occurred in a blind fault near the Main Central Thrust. Namsai PG showed a bay-shaped negative anomaly lasting ∼2 h, observed ∼7 h before the event. The anomaly exceeded the $2\sigma$ limit of mean fair weather PG. The earthquake day was devoid of any significant meteorological changes. It is suggested that the PG anomaly was associated with earthquake rather than local weather changes. This study not only provides better insights into the general variability of fair weather PG over this region but also highlights the importance of AEF measurements as a potential indicator of seismic events, sensing as precursory signals several hours ahead.