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Impact of local environmental conditions on atmospheric electrical potential gradient measurements

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The atmospheric electrical potential gradient (PG) is a fundamental parameter of the global electric circuit (GEC) which comprises all large scale quasi-static electrical processes occurring in between the surface of the Earth and the lower ionosphere. The observation of PG near the Earth's surface plays a pivotal role in surveying our atmospheric electrical environment. The PG shows high variability in different temporal and spatial scales and it is especially sensitive to local effects. Therefore, obtaining a PG value which represents the general state of the GEC over a larger area rather than various effects due to measuring site-specific local factors is a challenging task. PG measurements are going on in the Széchenyi István Geophysical Observatory (NCK, 47°38' N, 16°43' E) of the Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences near Nagycenk, Hungary since 1961. PG sensors are set up in NCK in an open area surrounded by buildings and trees within ∼20 m distance. The effect of the changing vegetation on the long-term trend observed in the PG variation at NCK has been subject of debates [1,2,3].
In order to examine the possible bias in the measured PG values due to the relatively close buildings and trees at NCK, two sets of simultaneous PG measurements from two EFM-100 field mills were compared. One field mill was kept at a fixed location while the other was moved to grid points covering the open area around the fixed field mill. The measurement was done in fair weather conditions in summer and was repeated during the winter. The poster demonstrates the performance of this method in surveying the effect of various objects and the state of vegetation on the measured PG values by comparing the measured PG differences to those obtained from electrostatic models calculated by the finite element method using the FEMM 4.2 software package.

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[3] E. Williams, R. Markson and S. Heckman, 2005, Geophysical Research Letters, vol. 32