Scientific report of the Short Term Scientific Mission (STSM)

STSM title: Measurements of atmospheric potential gradient in Israel

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Grantee: Dr. József Bór, Geodetic and Geophysical Institute, Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, Hungary

Host: Prof. Colin Price, Tel Aviv University, Israel

Purpose of the STSM

The electric potential gradient (PG) measured near the surface of the Earth is a fundamental parameter of the global electric circuit (GEC) and is measured at several locations in Europe as well as worldwide. The physical environment and the type of the applied measuring device, however, can be rather different at different measuring sites. This STSM was planned to establish an initial network of matched PG measurements including three permanent PG measuring sites. With this purpose, the STSM supports one of the primary aims of the Action, i.e., to establish networked operation and joint processing of the running measurements of atmospheric electricity including PG measurements. That way, local effects could be separated from global trends in the observations and so large-scale processes linked to atmospheric electricity could be studied more effectively.

The three measuring sites involved in this STSM are the WISE observatory in the Negev desert near Mitzpe Ramon (MR) in Israel (30.6 N,34.8 E, 862 m m.s.l.), the Mt Hermon Cosmic Ray Observatory (HCRO), Israel (33.3 N, 35.8 E, 2047 m m.s.l.), and the Széchenyi István Geophysical Observatory near Nagycenk (NCK), Hungary (47.6 N, 16.7 E, 159 m m.s.l.)

The concept was to make parallel PG measurements at each site with the local (fixed) PG measuring device and a portable PG instrument (the same device in each case) at a constant height above the ground. Then, the transfer function between the data from the local instrument and the portable instrument can be determined and the transfer functions at each site can be used later to match the measurements in joint data analysis and so instrumental effects and the effect of the height of sensor installation can be eliminated.

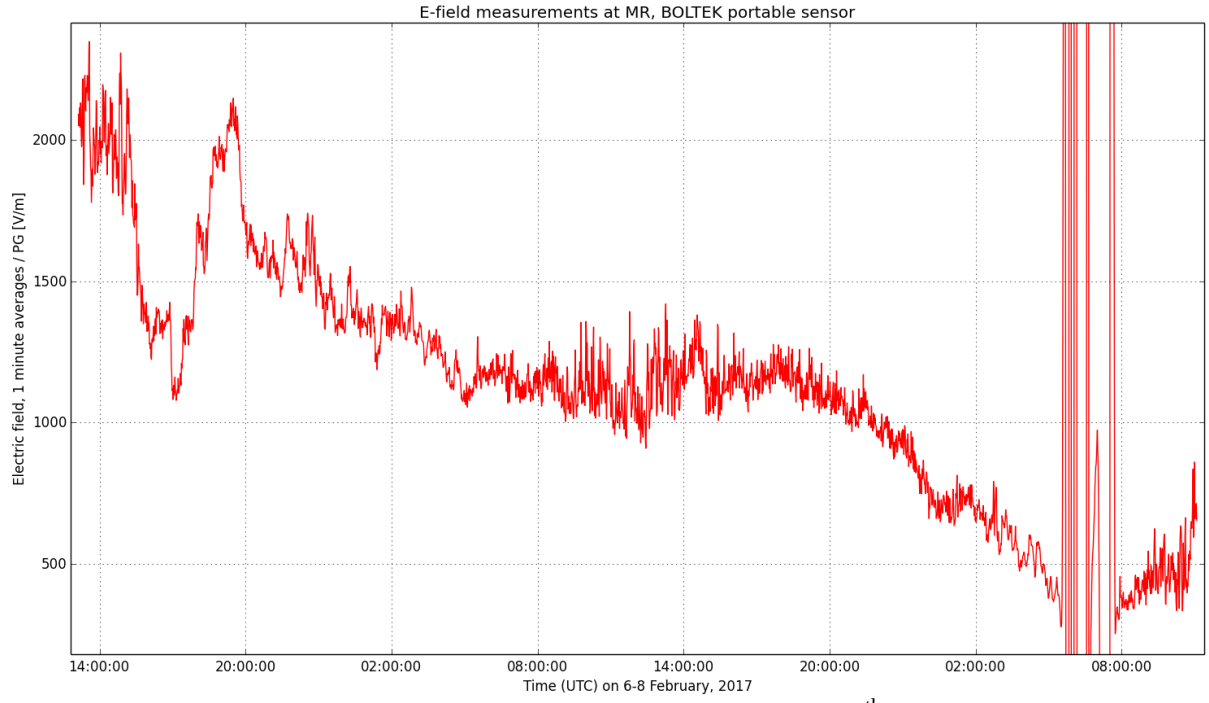
In addition to making simultaneous PG measurements at two atmospheric electricity monitoring sites in Israel, the portable instrument was planned to set up inside Tel Aviv city to examine the effect of an urban environment on the PG measurements.

I used the opportunity of being in Israel at the right time to participate on The Batsheva de Rothschild Seminar on the Atmospheric Global Electric Circuit which was held in Mitzpe Ramon.

The work carried out during the STSM

The aims of the STSM were fulfilled as almost two days of continuous simultaneous PG measurements were done in MR at a sampling rate of ~2 Hz.

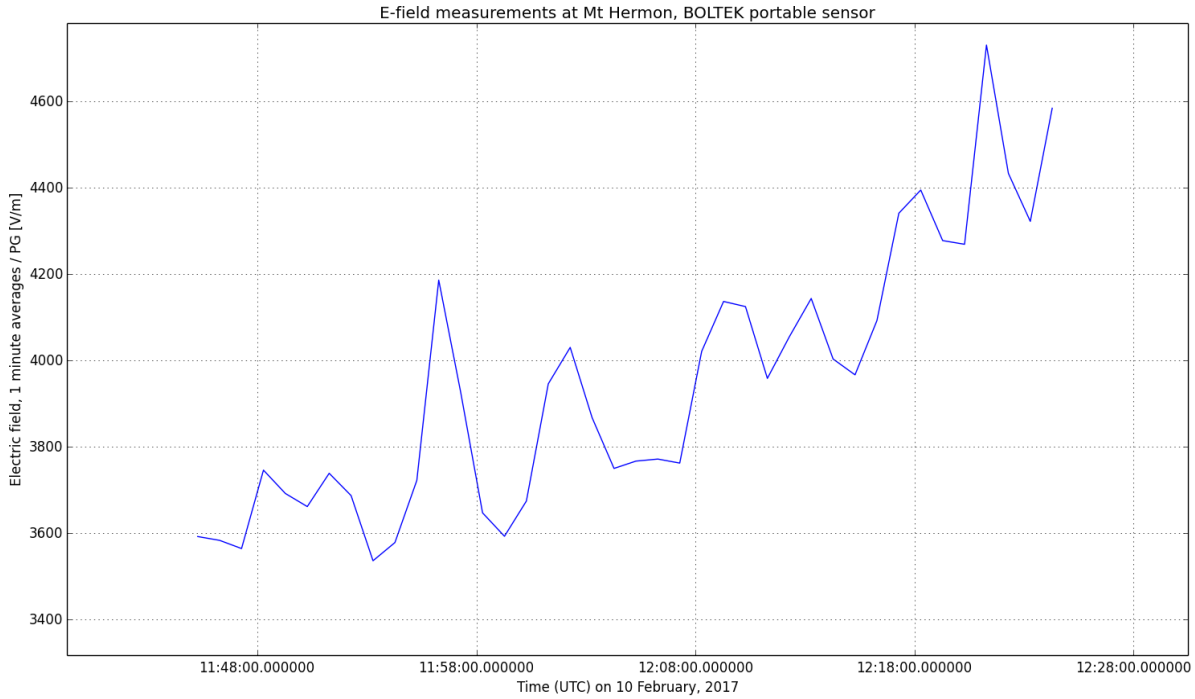
PG measurement in the WISE Observatory, MR



High electric field variations between ~6:00-8:00 hours UTC on 8th February indicate locally disturbed conditions for the measurements. The origin of these disturbances is currently unknown. Relatively high fields were detected despite of the calm measuring conditions. This experience underlines the need for careful comparison of the measuring setups.

PG measurement on Mt Hermon at the HCRO

About 40 minutes of simultaneous PG measurements were made at HCRO. There was no more time available for longer measurements at HCRO as the site is on top of Mt Hermon, close to the Syrian border in a military zone and access to the area is limited. Fair weather conditions were prevalent during both parallel measuring sessions so the transfer functions will be most suitable for handling fair weather observations.

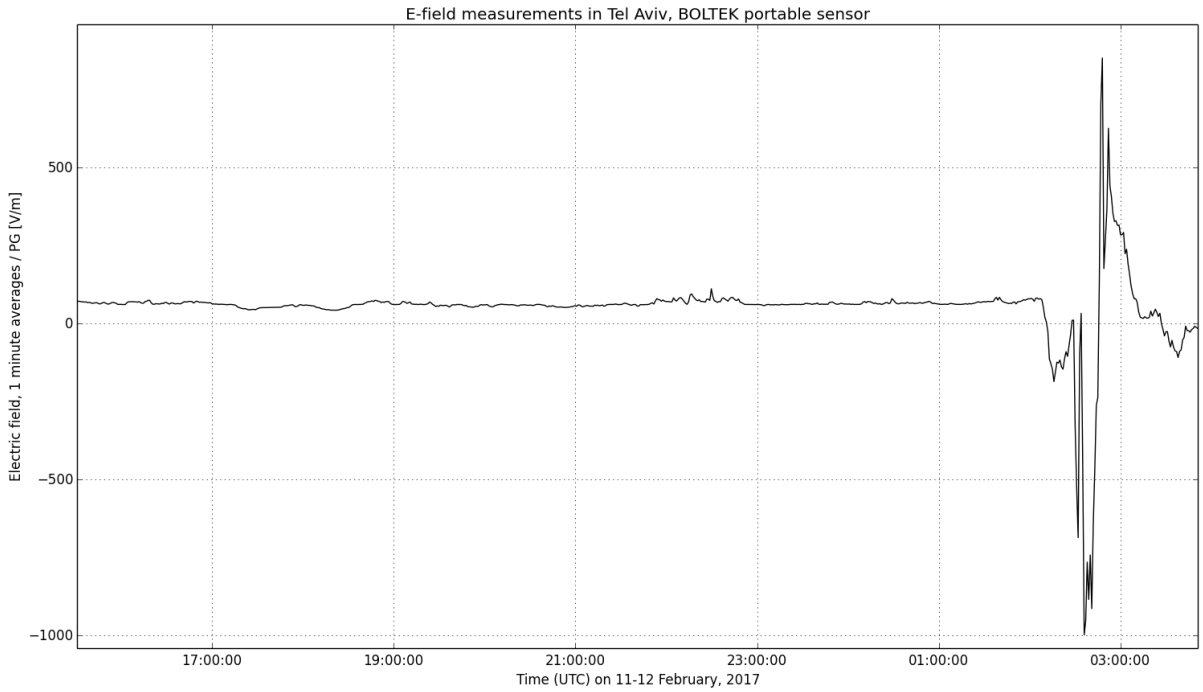


Despite of the relatively short recording period, a clear trend in the variation of the local field can be identified.

One night of PG observations were made in Tel Aviv city.

PG measurement in Tel Aviv

During the time of observations, a thunderstorm with explicit lightning activity has passed over the city in the night time / early morning hours after 02:00 UTC and so those records don't correspond to fair weather conditions.



I attended also the international atmospheric electricity seminar and discussed the scientific background of this STSM as well as possible options of future co-operation with expert researchers of the field from Brazil, Israel, Japan, Poland, Russia, UK, and the US.

Planned further work associated to the STSM

The transfer functions between the local (fixed) instruments and the portable PG sensor are yet to be determined. The data from the fixed instruments are not accessible online. The data is collected monthly and data from the time interval of our interest is not available yet. Once the transfer functions are produced, they will be used to match PG observations from the three stations for selected time intervals in order to test the performance and reliability of the converted data.

Regarding the PG measurements in Tel Aviv city, sudden PG variations in the recorded time series will be compared to lightning data from independent lightning detection networks to find out how the combination of the two dataset can be used to extend the characterization of the lightning activity and cloud electrification in the thunderstorm.

Experiences gained during the STSM and the results of the planned comparative analyses are planned to be disseminated in appropriate scientific journals.

Acknowledgements

The grantee thanks Prof. Colin Price his great help in the realization of the STSM. The grantee is grateful to the MC and STSM committee of the Action for supporting his application.

Sopron, Hungary, 7th March, 2017.

József Bór