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Comment on angeo-2021-7

Anonymous Referee #1

Referee comment on "Revisiting the long-term decreasing trend of atmospheric electric potential gradient measured at Nagycenk, Hungary, Central Europe" by Attila Buzás et al., Ann. Geophys. Discuss., https://doi.org/10.5194/angeo-2021-7-RC1, 2021

This paper is a significant contribution to the evaluation of the long series of Potential Gradient measurements made at the Istvan Observatory in Hungary. The question of the shielding effects from the trees has previously been investigated by modelling and measurements, but it was not adequately resolved. From this study it is concluded that the previous reference measurements were themselves affected to a greater degree than then assumed, and the follow-up modelling neglected important local factors. Since the previous work, more data from more sites has become widely available, allowing a fuller comparison.

The attention to detail in the current study is impressive, with deep knowledge of the site evident. It is valuable as it includes a more accurate representation of the site, to account for the changes which have occurred there, and it should ultimately be published. A problem, however, with the current manuscript is that various uncertainties in the data are incompletely considered. This is important, as after all the corrections, users will want to know what level of accuracy can be assumed in the final corrected PG. And, following the points made in the conclusions about the need to understand a site fully, can the authors indicate how detailed a knowledge of a site is needed to obtain e.g. 10% or 1% accuracy? Another point is that the method of data selection is not to use the independent fair weather definition, but to select on the magnitude of the data following the long term conventions at the site. This may be a fundamental difficulty. Will the variations in this sampling between years also introduce further uncertainties?

Major points

L195. Add the uncertainty to the experimental points. Derive the mean (red line) from the

data by allowing for the uncertainty rather than just removing the data from 4th Aug. Through doing this more rigorously it may become clear that the experimental values are not inconsistent with the model. Merely excluding the inconvenient data is unsatisfactory.

L260 (and Table 3). Uncertainties on the annual percentage changes, propagated through, would be useful. Convention for p values is just to give an inequality and one significant figure (e.g. $p<0.05$, $p<0.001$).

L276 The PG and aerosol number concentration are generally found to be positively correlated. It may be that there is an aerosol size effect here and/or a number concentration effect. More explanation is needed.

L355. One important implication of this work is that local, site-specific effects may have a large influence on PG measurements and can entirely suppress global signals. How should this be considered in general? The need to see similar variations at displaced sites would seem important. On what timescales could this be expected?

Minor points

L12. Start the sentence differently "In this work it is found..."

L125. Fig2. The repeated points as stripes are confusing. Average them into a single value, with an uncertainty range. Also, the axes would be easier to read if the units were V/m.

L143 arose --> arise

L145 (and fig2). The calibrations on different days have different uncertainties. It is worth deriving them and including them on the plot, particular because of the apparently anomalous 4th Aug data in fig 1a.

L154 What is the basis for the 1m uncertainty in annual tree height?

L235 Table 1. It is likely that the precision given is too great. It should be based on an assessment of the combined uncertainties in the calibration, and the validity of the model.

L285 Conditions local to the site are likely to be the cause. However, it does suggest some doubt about what the absolute value should be at either site.

L355. This is too general a statement as written, as it does not consider the timescales that are relevant. What is probably meant here is on long timescales. But even so these are used for comparison with the KSC and Swider data.

Fig 6. What is the aerosol size? The change in aerosol size with time (as well as number) will also affect the conductivity.

L308. Describe winter as "December, January, February"

L309. Replace " This behavior is in agreement with the general theory of atmospheric electricity" with "This is frequently found at continental sites".