

Interactive comment on “Singular variations in geomagnetic disturbance content at auroral latitudes” by Abraham Abraham et al.

Anonymous Referee #2

Received and published: 7 August 2018

1. Introduction

The authors justify the motivation for their work on the basis that “geomagnetic disturbances induce currents in technological systems such as power grids . . . etc”. That is correct but is not relevant to the analysis conducted in this paper. The analysis involves short-term (one-minute) fluctuations in the earth’s magnetic field. These small variations do not induce significant currents in long power lines, or long pipelines. Large DC currents in the auroral electrojet and equatorial electrojet induce ground currents, and currents in long conductors on the ground (eg oil pipelines in Nigeria and Alaska, long power-lines under the auroral electrojet current. Fluctuations in B that are relatively small magnitude are not significant. My point is that the calculated values are not relevant to the stated goal. There may be another application but it is not clear what

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this might be.

2. Methodology and 3. Analysis.

There is nothing intrinsically incorrect with the methodology in the calculation of the authors’ “VV” index. It simply involves using successive differences between magnetic field values each minute. Presumably the one minute time step was chosen because that was available from the data-base. It is not clear to me how this VV index relates to physical processes.

3.1 Mean Value Analysis and Validation and 3.2 Spatial disturbance marking Line 4 page 5: Should “aa index” be “AE index” ?

Auroral zone stations experience, on average, greater magnetic disturbances (DC and AC variations). The auroral current systems moves to lower latitudes in response to solar activity and changes in the Bz component of the IMF field. Thus it is not surprising that mid-latitude stations also experience magnetic field variations. Contrary to the statement given by the authors, the solar wind speed is not the prime driver of geomagnetic disturbances. The solar wind speed is one of many variables that affect observations. It is also not surprising that equatorial stations show minimal 1-minute fluctuations.

3.3 Threshold latitude and 4. Discussion

The 50 degree latitude, above which, B fluctuations are bigger than lower latitudes. This is addressed above. The authors suggest the ‘knee’ latitude provides insight into why there is an “increased geo-electric risk” at higher latitudes. This is an erroneous conclusion because the short-term B variations do not induce currents in ground conductors. It is the large DC currents that induce currents. The long oil pipeline in Nigeria has large induced currents due to the equatorial electrojet, but as the authors have pointed out, there is minimal B fluctuation at these low latitudes.

Other Comments

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Table 1. There are two columns labels "GG". Should be "GG" and "GL" ??

Title: What does the word "Singular" mean in the context of this paper?

Page 5 line 17: Pearson is not referenced.

IN SUMMARY: I can not recommend publication and I am unable to see how minor or major changes might make it acceptable.

There is no explanation why this VV index has any merits as compared to other magnetic indices. The VV index is not related to any "geo-electric" effects suggested by the authors.

Interactive comment on Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2018-62>, 2018.