NHESSD

Interactive
comment

Interactive comment on "Defining scale thresholds for geomagnetic storms through statistics" *by* Judith Palacios et al.

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Received and published: 31 July 2018

Dear Prof. Hapgood (Anonymous Referee #2)

Thanks for all your comments. We reply to them below.

Scales can be effect-based or statistics-based. The scales which appear in this manuscript are defined as statistical but without applied effect basis. These scales are intended for major geomagnetic disturbances in general that can affect any technological system, and not only for geomagnetically induced currents (GIC) production. See references in Introduction, and for instance, Eastwood et al. 2017.

a. At this moment, there are not defined for GICs, since we did not include any

approach in magnetic field component time derivative, but we also computed SYM-H time derivative distribution, since the other indices do not have enough time resolution to perform this direct computation. In any case, always threshold choice and applicability is left to user's criterium. We can set an example on a very recent publication: Oliveira et al. 2018 used a threshold of 100 nT min^{-1}, but only for dB/dt. They show a maximum value of 46 nT min^{-1} for partial ring current index. This figure is not even reached with a central derivative of SYM-H computation in our analysed 15-year dataset (not even one datapoint in 8 million 1-min SYM-H dataset, the maximum obtained is 66 nT min^{-1}). Doing simple running subtraction for B at high and equatorial latitudes instead, may lead to higher values.

b. These thresholds are new, therefore they are not yet applied to any power grid environment. However, they can be useful not only for power grids but also to any other space weather related risk.

c. The derivative of another local index and their related thresholds led to interesting results when they are applied on real conditions on the Spanish power grid. Of course, some interesting result would lead from direct GIC measurements; however, these measurements tend to be very scarce. In addition to that, GIC thresholds are dependent on each national power grid conditions and latitude.

Basically, considering the best fit of these geomagnetic condition distributions would mean having the most proper fit not only for the bulk but also for the tails, since all data are interesting (the lowest values provides some information about noise and the highest values, about the least common occurrences). The idea behind the intersect point is that almost two equally good (or equivalent) distributions may fit also part of the other distribution properly.

Some other comments that are still applicable here can be found as (see specially item 10) at https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2017-367/

nhess-2017-367-AC1.pdf

References

Oliveira, D. M., Arel, D., Raeder, J., Zesta, E., Ngwira, C. M., Carter, B. A., et al. (2018). Geomagnetically induced currents caused by interplanetary shocks with different impact angles and speeds. Space Weather, 16, 636–647. https://doi.org/10.1029/2018SW001880 .

Best regards,

The Authors

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-92, 2018.