Natural Hazards
and Earth System
Sciences
Discussions

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

Judith Palacios et al.

jpalacios@leibniz-kis.de

Dear Anonymous Referee #1,

Thanks for your comments. We will be commenting them below.

1. We understand the point that the referee remarks. However, it is a matter of definition on events. The referee assumes that space weather events can be discriminated and counted, but this is not a clear case. In meteorology, it may be clear what a storm is, and using statistics to measure rainfall of more than 10 mm in one hour (this is already a threshold). To discriminate events one needs two previous thresholds: one on geomagnetic field values, and other on time (for the time series), e.g., considering a geomagnetic event only over a threshold and

when the time difference is more than 12h. Here it is where ad-hoc thresholds enter into play, and this is the goal of the manuscript: to set thresholds that may be further used to discriminate events and only then, use the appropriate statistical method, choosing a statistical distribution and computing all the relevant parameters.

2. We are aware of the problems that a whole series use may arise. However, we think this approach is useful, since noise perturbations just above the noise level are actually recorded and they can play a role in space weather (some of them, for example, can be due to solar wind gusts). It is not only a matter of studying the most extreme geomagnetic disturbances by different means (averages or temporal maxima, etc) but having the whole data analyses is interesting and it is something that is not commonly done.

3. We have already made some tests on temporal maxima but the event set becomes very limited, in addition to the previous temporal thresholds that has to be applied. This limitation then gives a guide to fit these data, which is may be poissonian or GEV, but it can add biases. For instance, if you use a Peak over Threshold (POT) to bin your data, the most probable distribution would be a Pareto-like, needing a previous threshold to start with; if one chooses some block maxima, it may be a GEV family distribution member. The way one bins data already influences (or bias) its subsequent distribution. We also are informed of how about these methods are usually applied. Trying the whole pool distribution functions has some advantages, as not having a previous preference or pre-requisite for any function. Sometimes distribution functions are chosen due to some simplification. That bias is useful for simplicity but it can be harmful. We aim to try something different since this article is intended for having some meaningful thresholds. Most of the previous works on thresholds have short series and they not cover these small values, but only the largest geomagnetic storms. And some of them are based on arbitrary percentile choice.

4. Typical H_0 tests relate to the significance of the distribution, but they can actually be useful for reject the hypothesis only, but not for acceptance, as the referee indeed mentions, since caution should be applied when applying p. Then, the Kolmogorov parameter D is just used as a fitting parameter for the whole histograms. And we have to consider that the goal here is not probability estimations or return times, where series maxima are usually handled. The aim is having a geomagnetic estimation of thresholds in a neutral way, without having to set a previous threshold to make statistics.

5. Having this aim in mind, we believe that these threshold investigations are actually suitable for risk studies.

   Best regards,

   The Authors

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