

## Reply to the comments by Anonymous Referee #1:

We would like to thank the Referee #1 for carefully reading the manuscript and giving valuable comments and suggestions. We greatly appreciate your detail markups in the original manuscript. All your comments and suggestions are now incorporated in the revised manuscript.

I have read the manuscript “Seasonal features of geomagnetic activity: evidence for solar activity dependence?”. The authors present an extended analysis of the semi-annual variation occurrence in various solar wind parameters, geomagnetic indices and the occurrence rates of storms with various magnitudes, substorms and HILDCAAs. Nevertheless, there are points in the manuscript that need further clarification and, moreover, there are certain aspects of the statistical analysis which need further testing. Therefore, my suggestion is major revision.

- Thank you.

Even though all my comments are included in the attached pdf, I’m pointing out some important comments below.

- Thank you. We have carefully gone through your comments/suggestions included in the annotated pdf, and incorporated all of them in the revised manuscript.

1) Even though it is not adequately explained, the reader understands that the authors use the monthly mean of the occurrence rate of substorms, HILDCAAs, etc. to perform statistics. If indeed the authors are using monthly mean of the occurrence, it could introduce several artifacts in the results due to very low values. For example, in figure 1, the occurrence of HILDCAAs or super storms take only a couple of values (0, 1, 2). It would be helpful to provide the same results using the total occurrence rate per month instead of the mean. Another option would be to normalize the monthly occurrence rates with respect to the maximum occurrence for the whole dataset.

- Thank you for the comment. We are sorry for the confusion. In fact, we use the monthly means of  $F_{10.7}$ , Dst, ap, AE,  $B_0$ ,  $V_{sw}$ ,  $D_{500}$ ,  $VB_s$  and  $\epsilon$ , and the monthly numbers of substorms, HILDCAAs and magnetic storms of varying intensity. This is now made clear in the revised manuscript.

2) The significance level in the Lomb periodogram, as a statistical metric, is much affected by the strongest periodicity (e.g. 11 years). This could result to artifacts when discussing much lower periodicities which statistically be weaker and probably showed below this confidence level. One way to overcome this feature is to filter the time-series in the desired period range (either way the 11 years periodicity is well known and of no importance for the present work). Another way is to limit the Lomb periodogram in the desired range (for example 3 - 24 months).

- Thank you very much for the suggestion. We now show the periodograms based on the original database of 1 month resolution (see above), as well as the periodograms after filtering out the dominating ~11-year periodicity from the data.

3) The authors should further discuss the reason why the occurrence of substorms exhibits the semi-annual variation, while the AE index, which is a proxy for substorm activity, does not.

- This is now discussed in the text, as suggested.

4) The authors should discuss the discrepancies between odd/even and strong/weak cycles after they have clearly stated what a strong/weak cycle is.

- Thank you for the comment. The strong/weak cycles are defined in section 2, and the discrepancies are now discussed.

Finally, I think that the question mark in the title of the manuscript is contradicting. If the conclusions of this work are indeed correct, then there is a dependence in Solar activity.

- Thank you. The question mark is now removed.