

Ann. Geophys. Discuss., referee comment RC1
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Comment on angeo-2021-27

Anonymous Referee #1

Referee comment on "Seasonal features of geomagnetic activity: a study on the solar activity dependence" by Adriane Marques de Souza Franco et al., Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2021-27-RC1>, 2021

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.

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

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.

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).

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.

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.

Finally, I think that the questionmark 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.

Please also note the supplement to this comment:

<https://angeo.copernicus.org/preprints/angeo-2021-27/angeo-2021-27-RC1-supplement.pdf>