

Statistical analysis of Abnormal Phase Shift Solar Quiet (APSQ) days in a mid-latitude region during solar cycle 24: case of Hermanus magnetic observatory (HER)

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1. Background

The daily geomagnetic field variations when there are no solar activities that influence the near Earth's environment are called solar quiet (sq.) field variations. They are mainly due to the dynamo flowing currents in the Earth's ionosphere. These variations have an identifiable pattern with its maximum peak around local solar time noon. And for low and mid latitude geomagnetic stations, the peak is between 10:30 and 13:30 local time (e.g., Bhardwaj et al., 2015). It has been observed that some quiet days would have their peaks shifted from few minutes to few hours outside this time interval, and the cause of this peak position shift is still under investigation in the scientific community. These quiet days are called Abnormal Phase Shift Solar Quiet (APSQ) days.

2. Method

2.1 Select solar quiet days between December 2008 and December 2019 (period of solar cycle 24) with the help of SYM-H index (<https://wdc.kugi.kyoto-u.ac.jp/aeasy/index.html>).

2.2 Download Hermanus magnetic observatory (HER) 1-min data from the INTERMAGNET website (https://imag-data.bgs.ac.uk/GIN_V1/GINForms2).

2.3 Convert the time stamp of data (UTC) to local solar time (<https://gml.noaa.gov/grad/solcalc/>).

2.4 Select APSQ days from the selected solar quiet days.

2.5 Perform a statistical analysis of the distribution of APSQ days over the entire solar cycle 24, and discuss the findings.

3. Data and tools

3.1 HER 1-min definitive data from the INTERMAGNET website (https://imag-data.bgs.ac.uk/GIN_V1/GINForms2) and SYM-H index from the Kyoto university website (<https://wdc.kugi.kyoto-u.ac.jp/aeasy/index.html>).

3.2 Excel or a programming language (e.g., Python, IDL, etc.) will be used to analyse data and make plots.

4. Aim of the project

To shed light on the occurrence of APSQ days at a mid-latitude geomagnetic station like Hermanus, and find out the possible pattern of the observed distribution of these events over the entire solar cycle 24.

References

Bhardwaj, S.K., Rao, P.B.V.S. & Veenadhari, B. Abnormal quiet day variations in Indian region along 75° E meridian. *Earth Planets Space* 67, 115 (2015). <https://doi.org/10.1186/s40623-015-0292-1>