EGU22-1416, updated on 20 Aug 2022
https://doi.org/10.5194/egusphere-egu22-1416
EGU General Assembly 2022

Extraction of ground magnetic signatures from solar quiet current systems in sub-auroral regions

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In order to monitor space weather events and their impacts, ground magnetic field data has proven to be a long-lasting and powerful source of information. For the determination of space weather effects, it is essential to extract and understand the evolution of the quiet-time magnetic field. However, the data shows a high degree of complexity since the Earth's magnetic field is a superposition of sources that cover a broad amplitude and frequency spectrum. In sub-auroral regions, it is well understood that the solar quiet current system contributes to the quiet signal with smooth patterns that depend on season and local time, having distinct periods of 24 hours and beneath.

In this work, we apply signal filtering techniques on time-series magnetic data from ground observatories in sub-auroral regions. In order to extract the solar quiet current contributions, we use its specific periods of 24h and beneath and analyse the results with respect to season, local time, and day-to-day variability between 1991 and 2019. Careful investigations and interpretation of the contributing sources are given, confirming the main contribution to the filtered signal is the solar quiet current system. This implies that the filter approach is able to extract the quiet magnetic field variations and due to its simplicity may be used for real-time determination of the quiet magnetic field, including magnetic baselines.