

## Surfing the biggest waves – geomagnetic storms boost magnetotelluric data quality at both long and short periods

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### SUMMARY

A series of powerful geomagnetic storms (Kp index 5-9) hit our planet from 10-13 May 2024 and brought parts of human infrastructure such as power grids in Europe close to failure. The event between 11-12 May was classified as storm of the highest class G5 reaching a Kp = 9.

In parallel, we carried out a magnetotelluric (MT) survey in the German Kupferschiefer district close to the city of Spremberg and the Welzow-Süd open-pit coal mine in the framework of the EU funded project VECTOR. The region is affected by strong electromagnetic noise from various sources including mining activities and associated dense railway networks, power lines and the city of Spremberg. From 06 – 15 May 2024, we deployed 22 MT stations along two profiles of 10 and 5 km lengths, respectively. Time-series data were sampled continuously with 1.25 kHz and additionally for 10 mins at 0:00 and 2:00 UTC with 6.25 and 25 kHz. Throughout the field survey, data were recorded using the same sampling scheme at a permanent remote reference station operated by GFZ Potsdam, approximately 220 km NE of the survey area.

First results using the robust remote reference technique in combination with notch filters (for 50 Hz signal and harmonics) show reasonable data quality which is restricted to a period band from  $10^{-4}$  to 1 s for the geomagnetically quiet times. During the storms, quality of the transfer functions is generally much higher. In particular, good quality curves can be obtained for two more decades, to periods of 100 s. But even for the shortest periods between  $10^{-4}$  and  $10^{-3}$  s, the transfer functions are smoother.

We demonstrate the influence of the solar storm on the data quality, analyse spectral properties in stormy and quiet times, discuss the importance of the reference site and general aspects of data processing in noisy environments.

**Keywords:** magnetotellurics, geomagnetic storm, data processing

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