Anthropogenic Signals in Magnetic Timeseries

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New observatory magnetometers can measure with a 1 Hz sampling rate or higher, enabling the investigation of fast geomagnetic field changes. Because the frequency spectrum of the geomagnetic field decays as 1/f, anthropogenic disturbances (e.g., grounding currents, power lines, etc...) can become an issue at higher frequencies. Two magnetic observatories in Austria are ideally suited to investigate anthropogenic disturbances. The Cobenzl Observatory (WIK) is located close to the city of Vienna and therefore particularly disturbed. The newly built Conrad Observatory (WIC) on the other hand, is located in a mountain far from urban areas and other potential noise sources. Parallel operation of the two observatories, which are only ~45 km apart, enabled us to accurately compare two nearly identical records of the geomagnetic field and extraction of the anthropogenic noise signature.

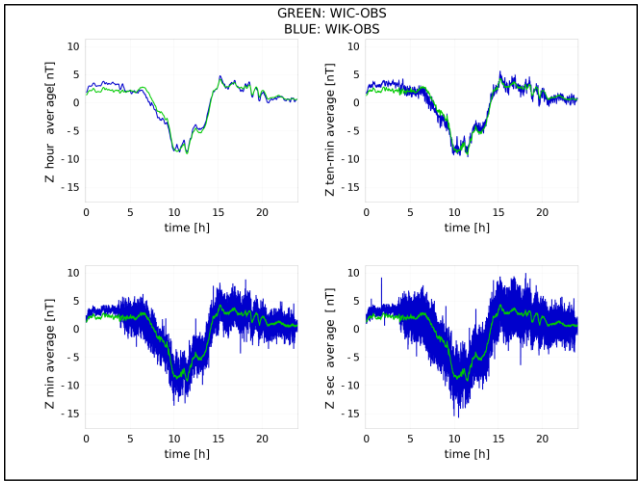

Figure 1: Vertical components timeseries
Blue: WIK-OBS, Green: WIC-OBS

WIK noise is directly visible in quiet day records between 4:00 am and 12:00 pm local time starting from hour means- down to one-second- data (see Fig. 1). Frequency spectra of the two observatories show that main WIK noise contributions extend from 0.01 Hz to 1 Hz (Fig. 2). Higher frequencies are dominated by sensor noise. A characteristic peak at 0.013 Hz and its first harmonic are clearly distinguishable. Bandpass-filtered timeseries for the frequency ranges A and B revealed no major correlation between frequency distributions, hence the source of those frequency distributions must be different. A two component geoelectrical recording system was temporarily installed at the WIK-OBS sampling the self-potential of the north and east component of the local geoelectrical field. With this additional dataset a magnetotelluric survey revealed astonishing similarities of the magnetic and self-potential spectra (see Fig. 3). Further efforts to investigate the local phase impedance tensor are now in progress and could be used in the future to evaluate new possible observatory site locations.

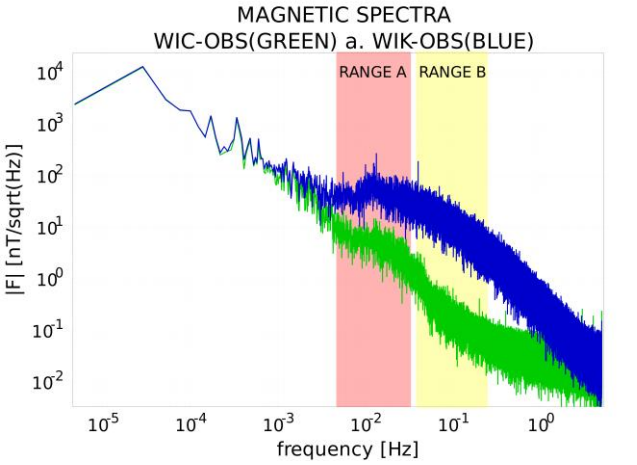

Figure 2: Spectra - WIK OBS and WIC OBS

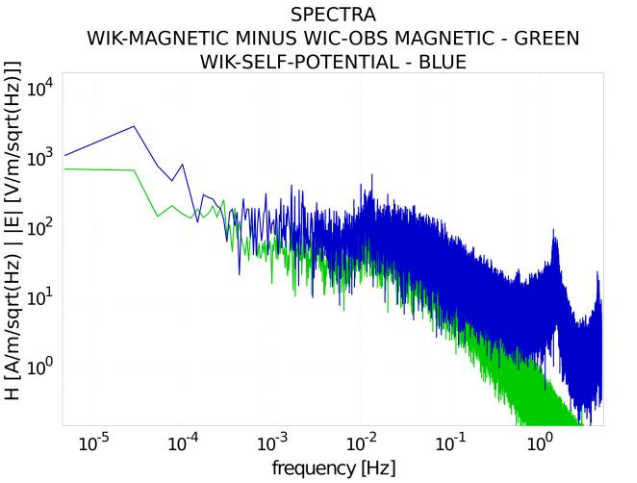

Figure 3: local magnetic -and local self-potential- spectrum

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