



## **Utilizing Q-bursts to estimate the attenuation of ELF-band radio waves in the Earth's crust at Matra Gravitational and Geophysical Laboratory**

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Q-bursts are extremely low frequency (ELF, 3 Hz-3 kHz) band radio atmospherics produced by exceptionally powerful lightning strokes. Q-bursts are routinely detected both in the vertical electric and in the horizontal magnetic components of the atmospheric electromagnetic field monitored by the Schumann resonance recording system in the Széchenyi István Geophysical Observatory (NCK, 47°38' N, 16°43' E) near Nagycenk, Hungary. The source lightning stroke of a Q-burst is identified in the lightning database of the World Wide Lightning Location Network (WWLLN) by the matching detection time and direction calculated for NCK station.

ELF band magnetic field measurements have been carried out at Mátraszentimre, in the Mátra Mountains, Hungary, ~240 km from NCK station in two measurement points in two not overlapping time periods. The subsurface observation site of Matra Gravitational and Geophysical Laboratory is in a mine shaft at the depth of 140 m. A surface magnetic observation site has been set up about 200 m away from the surface projection of the subsurface site. Data was recorded in the time periods 22-25 March and 27-30 March in 2018 in the mine shaft and on the surface, respectively.

Q-bursts which were produced by the same lightning source and were detected in the data recorded in Mátra Mountains on one hand and at NCK station on the other hand were identified in the simultaneously recorded time series. Conversion functions between the signals recorded at NCK and the corresponding surface and subsurface signals in Mátra Mountains were deduced from the spectra of the identified Q-burst pairs.

This contribution describes how the deduced conversion functions can be used to characterize the local attenuation of ELF waves in the underlying/overhead andesitic rock.