



## Characterization of sub-ionospheric VLF/LF waveguides for seismic event studies during solar minimum

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In this study we present measurements and simulations of mid-latitude sub-ionospheric propagation paths between several VLF/LF transmitters and the Graz seismo-electromagnetic receiver facility (Schwingenschuh et al, 2011) during the current solar minimum condition. The upper D/E-region boundary of the waveguide is stable during the low solar activity in the years 2018 and 2019, i.e. measured VLF/LF amplitude and phase variations are mainly due to natural excitations from the lithosphere, atmosphere, and man-made disturbances. In particular, this period gives a baseline to characterize VLF amplitude and phase modulations in the waveguide cavity related to seismic activity over Europe. In addition, this opportunity let us probe the signal threshold and feed-back into waveguide simulation models. We conclude, proven long-term VLF/LF measurements, the continuous monitoring of the cavity, could be valuable in the assessment of seismic hazard scenarios.

Ref:

Schwingenschuh, K., Prattes, G., Besser, B. P., Mocnik, K., Stachel, M., Aydogar, Ö., Jernej, I., Boudjada, M. Y., Stangl, G., Rozhnoi, A., Solovieva, M., Biagi, P. F., Hayakawa, M., and Eichelberger, H. U.: The Graz seismo-electromagnetic VLF facility, *Nat. Hazards Earth Syst. Sci.*, 11, 1121–1127, <https://doi.org/10.5194/nhess-11-1121-2011>, 2011.