

[<https://doi.org/10.69646/aob260912>]

[Lecture]

VLF amplitude noise reductions as earthquake precursors: statistical analysis

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Abstract: Many studies point to the possibility of connecting different types of changes with seismic activity. Their detection before an earthquake is the subject of decades of research that attempts to confirm that they are earthquake precursors. One of the methods of relevant changes detection is the low ionosphere monitoring by radio signals of very low and low frequencies (VLF/LF signals). Several specific changes in these signals are considered as possible precursors of earthquakes (Hayakawa, 2025). Among them is the reduction in the amplitude noise reduction, which was first shown for the Mw 5.4 earthquake that occurred near Kraljevo, Serbia on November 3, 2010 (Nina et al, 2020). Pilot studies have confirmed this change in the case of other earthquakes as well (Nina et al, 2022; Nina, 2024).

In this paper, we present the first statistical study of amplitude noise reductions before earthquakes. We observe the ICV signal emitted in Italy and received in Serbia. The obtained results indicate that the connection between amplitude noise reductions and earthquakes is more pronounced for larger magnitudes, smaller depths of

earthquake hypocentres, and smaller distance of the earthquake epicentres from the signal path. Bearing in mind that these characteristics are expected for changes associated with seismic activity, it can be concluded that the presented statistical analysis confirms the possibility that the amplitude noise reductions are precursors of earthquakes, thus indicating the need to continue their research.

Keywords: earthquake precursors, VLF signal, statistical analysis

Acknowledgement

The authors acknowledge the support of COST Action CA24101 FuSe: Testing Fundamental Physics with Seismology. Aleksandra Nina acknowledges funding provided by the Institute of Physics Belgrade through the grant by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia.

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