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Normalization and processing of VLF signals for the detection of seismic-ionospheric precursor phenomena using the Empirical Mode Decomposition Method and Neural Networks.

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This paper investigates a normalization method for enhancing the detection abilities of seismic-ionospheric precursor phenomena using VLF radio signals.
To this purpose, for every received signal the reported characteristics of the transmitter as well as its location are correlated. Taking into account these data, the theoretical transmission loss is calculated. Thus, the free space path loss of the signal together with the ionospheric losses is calculated. Then, the received power density of the signal is calculated taking into account the overall path loss, the transmitted power and the effective area of the receiving antenna. Finally, the amplitude of the electric field of the received signal is estimated. The signal level of each station is then used in order to bring the received signals of all radio stations in use into the same scale and then to point out the disturbances detected by a particular receiver. The normalized signal is then processed using the Empirical Mode Decomposition Method (EMD) and the disturbances that are being detected on the receiver are better accentuated.

The normalization procedure described is applied across the received VLF signals and a comparison is made between diagrams where the normalization method is used and diagrams produced without using this method, in order to exhibit the efficacy of the process.

Additionally the application of neural networks is investigated in order to further clarify the improvement that the normalization method has attributed to the processed signals, as well as to explore the possibility of automatic prediction of future seismic precursor phenomena or at least provide a preliminary discrimination among the received disturbances.