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# Hybrid inverse adaptive filtering (HIAF) for the minimisation of magnetotelluric disturbances from electric field recordings

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Prior to an earthquake, there is energy storage in the seismogenic area, the release of which results in a number of micro-cracks, producing an electric signal. According to the scientific literature [1,2] the whole process lasts in the order of several tens of minutes, and the resulting electric signal is considered as an electric earthquake precursor (EEP). Such EEPs appear on recordings of the Earth's electric field ($E$). When a magnetic storm, which usually lasts for several tens of minutes, occurs at an observation point, significant disturbances are induced in the Earth's magnetic field ($H$). Since the electric and magnetic fields are directly proportional in the frequency domain, such magnetotelluric disturbances in the magnetic field give rise to anomalies in the electric field, thereby greatly complicating the automatic recognition of EEPs within the recorded electric field signal [2]. In many cases, when an EEP occurs during a magnetic storm the disturbances on the electric field are so severe that recognition of the EEP is not possible. This paper presents the Hybrid Inverse Adaptive Filtering (HIAF) method, a two-step process incorporating neuro-fuzzy technology trained to minimise the effect of magnetotelluric anomalies present within the recorded electric field signals, mainly induced by magnetic storms. An adaptive neuro-fuzzy inference system [3] trained as an adaptive filter has been developed to remove any significant distortions from the equivalent magnetic field signal, as retrieved from the original electric field signal by inverting the magnetotelluric method. Testing the system with further

unseen data verifies the reliability of the model and demonstrates the effectiveness of the HIAF method.

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