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Geo-electromagnetic Signal Analysis prior to the Kythira M_w 6.9 Earthquake on January 2006

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This research work considers the modelling and analysis of electromagnetic data and in particular the study of an electric potential anomaly observed in the electric field, recorded by the MVC-2DS recording station of the Seismoelectromagnetic Network of Crete, for the case of Kythira Island earthquake in Greece (occurred on 8th of January 2006, N36.31˚, E23.25˚, MW 6.9, depth 60 km), and also outlines the recording station's characteristics.

The MVC-2DS recording station was designed and developed by the Institute of Terrestrial Magnetism, Ionosphere and Radio-wave Propagation, Saint Petersburg Filial (SPbF IZMIRAN), Russian Academy of Sciences, under the INTAS-99-1102 project titled 'Study of the ULF electromagnetic phenomena related to earthquakes (SUPRE)'. The MVC-2DS recording station [1] has been operating since 2001.

Regarding the analysis of the recorded electric potential anomaly observed in the electric field two modelling approaches are utilized:

(a) Hybrid Adaptive Neuro-Fuzzy Inference Systems, and

(b) Stochastic modelling and analysis based upon Functional Series (FS) Time-dependent (T) AutoRegressive (AR) models with eXogenous (X) input(s) (FS-TARX) models.

- Neuro-fuzzy models are neural networks with intrinsic fuzzy logic abilities where each layer of the network emulates the input membership functions (MFs), rules, output MFs, and defuzzification function of a fuzzy inference system, respectively [2].

The use of Hybrid Adaptive Neuro-Fuzzy Inference Systems aims for the recovery of the possible EEP signature from the electric field background [3,4], which enables significant information to be extracted regarding its nature and possible association with the accompanying main seismic event.

- FS-TARX models provide an important generalization of their stationary ARX counterparts, as their parameters may vary in time with a deterministic manner, thus being suitable for the representation of a wide range of non-stationary and/or non-linear phenomena [5].

The use of FS-TARX models for signal representation and analysis, along with appropriate fault detection and isolation schemes [6,7], allows for the distinction between "normal" (healthy) system operation and its various "faulty" modes.

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