

Konstantinos Eftaxias

1. Publications (1-18)

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PUBLICATIONS IN FULLY REFEREED INTERNATIONAL JOURNALS

1. Euthymiou, P., **K. Eftaxias**, E. Rammos, C. Ravanos and S. Konstantinides, Temperature dependence of hole mobility in n-type InSb upon electron bombardment, **Solid State Communications**, 28, 989-992, 1978.
2. **Eftaxias, K.**, P. Euthymiou and K. Nomikos, Magnetophotocoductivity of semi-insulating GaAs as a function of etching time, **Solid State Communication**, 29, 629-631, 1979.
3. Grammatikakis, J., M. Lazaridou and **K. Eftaxias**, Bulk modulus of Alkali-Halide mixed crystals **J. Phys. Chem. Solids**, 46, 1243-1246, 1985.
4. **Eftaxias, K.**, J. Grammatikakis and P. Varotsos, Correlation between the self-diffusion coefficient of Lithium and the equation of state, **Physical Review B**, 32, 54625463, 1985.
5. Lazaridou, M., and **K. Eftaxias**, On a connection between vacancy formation parameters and melting process in Rare Gas Solids, **Physica Status Solidi (a)**, 90, 147-149, 1985.
6. Varotsos, C., and **K. Eftaxias**, Connection of activation volume and activation enthalpy with the bulk properties in Olivine, LiBr and CsCl, **Solid State Ionics**, 20, 291-293, 1986.
7. **Eftaxias, K.**, V. Hadjicontis and P. Varotsos, Comments on the analysis of self-diffusion in Li probed by spin-lattice relaxation of ^8Li nuclei,

Journal of Physics F: Metal Physics, 16, 791-794, 1986.

8. Varotsos, P., J. Grammatikakis, **K. Eftaxias** and C. Varotsos,
Electrical properties of non-irradiated and X-irradiated LiH and LiD,
Radiation Effects, 99, 115-120, 1986.

9. Hadjicontis, V., **K. Eftaxias** and P. Varotsos,
Thermodynamic properties of defects in crystals calculated on the basis of the
bulk elastic data,
Physical Review B, 37, 4265-4266, 1988.

10. Varotsos, C., V. Hadjicontis and **K. Eftaxias**,
Interconnection of the individual vacancy formation and pinning
thermodynamic parameters in KCl
Solid State Ionics 26, 11-13, 1988.

11. Hadjicontis, V., C. Londos and **K. Eftaxias**,
Correlation of diffusivities of various elements in Silicon,
Physica Status Solidi (a), 105, 87-92, 1988.

12. **Eftaxias, K.**, C. Varotsos and V. Hadjicontis,
Migration Volumes in PbF₂ from recent elastic and expansivity data,
Physical Review B, 37, 9820-9823, 1988.

13. Varotsos, P., **K. Eftaxias** and V. Hadjicontis,
Comments on the calculation of the thermodynamic properties of metals at
high temperatures,
Physical Review B, 38, p. 4296, 1988.

14. Grammatikakis, J., **K. Eftaxias**, S. Patapis and V. Hadjicontis,
A simple model applied to the elastic properties of the Lead-Thallium and
Magnesium-Lithium Alloys,
J. Phys. Chem. of Solids, 49, 965-967, 1988.

15. Hadjicontis, V., C. Varotsos and **K. Eftaxias**,
Elastic moduli of BCC V-Ti, Mo-Nb and W-Ta alloys,
Journal of Physics F: Metal Physics, 18, 965, 1988.

16. **Eftaxias, K.**, C. Varotsos and V. Hadjicontis,
Cation-vacancy migration entropy of Alkali-Halides,
Physica Status Solidi (b), 147, 83-88, 1988.

17. **Eftaxias, K.**, C. Varotsos and V. Hadjicontis,

Correlation of the individual vacancy formation parameters in NaCl,
Physical Review B, 38, 1548-1549, 1988.

18. Grammatikakis, J., **K. Eftaxias** and V. Hadjicontis,
Interconnection of the diffusion-coefficients of various elements in
Aluminum,
J. Phys. Chem. of Solids, 49, 1275-1277, 1988.

19. Hadjicontis, V., C. Varotsos and **K. Eftaxias**,
Comments on the diffusion of Ni and Ge in Nickel,
Journal of Physics F: Metal Physics, 18, 1635-1640, 1988.

20. Varotsos, C., **K. Eftaxias** and V. Hadjicontis,
Correlation of diffusion-coefficients of various elements diffusing in
ferromagnetic and paramagnetic α -Fe,
Physica Status Solidi (b), 107, 109-114, 1988.

21. Varotsos, P., **K. Eftaxias** and V. Hadjicontis,
Defect -parameters obtained from positron annihilation and self-diffusion
experiments in Silicon,
Physical Review B, 38, 6328, 1988.

22. **Eftaxias, K.**, and V. Hadjicontis,
A comment on self-diffusion data in Vanadium,
Philosophical Magazine Letters, 58, 69, 1988.

23. Varotsos, P., and **K. Eftaxias**,
High temperature vacancy concentration in Cu,
Physical Review B, 40, 9963-9964, 1989.

24. **Eftaxias, K.**, and V. Hadjicontis,
Analysis of self-diffusion data in V and Nb,
Physica Status Solidi (b), 156, p. 389, 1989.

25. Hadjicontis, V., **K. Eftaxias** and C. Varotsos,
Connection between the Birch equation of state and the Shottky formation
volume in NaCl,
J. Phys. Chem. of Solids 50, 1193, 1989.

26. Vassilikou-Dova, A., **K. Eftaxias** and G. Lehmann,
An electrolytically generated localized hole center in Quartz,
Zeitschrift fur Naturforschung, 44a, 278, 1989.

27. Eftaxias, K., P. E. Fielding and G. Lehmann,
Mo⁵⁺ in synthetic zircon crystals,
Chemical Physics Letters, 160, 36, 1989.
28. Eftaxias, K., S. Patapis and V. Hadjicontis,
Estimation of defect-volumes and defect-entropies in Alkaline Earth Fluorides
from the model of Jost,
Solid State Ionics, 37, 97, 1990.
29. Eftaxias, K., and V. Hadjicontis,
Comments on the diffusion of Ga in Ge
Physica Status Solidi (b), 160, K9, 1990.
30. Londos, C., K. Eftaxias and V. Hadjicontis,
Correlation of solubilities of various elements in Silicon,
Physica Status Solidi (b), 118, K13, 1990.
31. Eftaxias, K., V. Hadjicontis and C. Varotsos,
Calculation of diffusion- coefficients of Nitrogen in Vanadium,
J. Phys. Chem. of Solids 52, 523-525, 1991.
32. Vassilikou-Dova, A., and K. Eftaxias,
Paramagnetic defects in Benitoite,
Zeitschrift fur Naturforschung, 46a, p. 579-582, 1991.
33. Eftaxias, K., and A. Vassilikou-Dova,
An E.P.R study of Fe³⁺ in Enstatite,
Applied Magnetic Resonance, 1, 457, 1991.
34. Hadjicontis, V., and K. Eftaxias,
Temperature and pressure variation of self-diffusion of Ge in function of the
bulk properties,
J. Phys. Chem. of Solids, 52, 437, 1991.
35. Varotsos, P., K. Eftaxias and K. Alexopoulos,
Comments on self-diffusion data in Tungsten,
Physical Review B, 43, 5170-5171, 1991.
36. Eftaxias, K.,
Comments on the interpretation of high-temperature experiment on Al in
terms of defect-concentration,
Physica Status Solidi (b), 163, K1, 1991.

37. **Eftaxias, K.**, C. Londos and F. Vallianatos,
An alternative treatment of the problem of image formation of an object
through plane or spherical interfaces,
American Journal of Physics, 58, 771-773, 1991.
38. Vallianatos, F., and K. Eftaxias,
A comment on the pressure dependence of viscosity in the liquid state,
Acta Geophysica, 39/2, 233-238, 1991.
39. Vallianatos, F., and **K. Eftaxias**,
The application of $cB\Omega$ -model for the calculation of the variation of the
activation volume for creep with depth in the earth's lower mantle",
Phys. Earth Planet. Inter., 71, 141, 1992.
40. Vassilikou-Dova, A., and **K. Eftaxias**,
A Naturally Induced Hole Center in the Mineral Hypersthene,
Appl. Magn. Reson. , 3, 165, 1992.
41. Vassilikou-Dova, A., and **K. Eftaxias**,
Electron paramagnetic resonance of Cu^{2+} in descloizite mineral: an unusual
electronic configuration,
Journal of Physics: Condensed Matter, 4, 241-248, 1992.
42. Vassilikou-Dova, A., and **K. Eftaxias**,
Electron Spin Resonance of Mn^{2+} in Hemimorphite,
Cryst. Res. Technol., 27, 117, 1993.
43. Vallianatos, F., and **K. Eftaxias**,
A model of the influence of the local inhomogeneities on the magnetotelluric
variations at two V.A.N stations in Greece
Tectonophysics, 224, 125, 1993.
44. Hadjioanou, D., F. Vallianatos, **K. Eftaxias**, V. Hadjicontis and K.
Nomikos,
Subtraction of the telluric inductive component from V.A.N measurements",
Tectonophysics, 224, 113, 1993.
45. Antonopoulos, G., J. Kopanas, **K. Eftaxias** and V. Hadjicontis,
On the experimental evidence of S.E.S vertical component,
Tectonophysics, 224, 47-49, 1993.
46. **Eftaxias, K.**, and A. Vassilikou-Dova,
EPR Study of Divalent Manganese in Northupite Single crystal,

Cryst. Res. Technol., 1994.

47. Vassilikou-Dova, A., and **K. Eftaxias**.

Paramagnetic Defects in Augelite,
Journal of Magnetic Resonance, 111, 11, 1994.

48. **Eftaxias, K.**, and F. Vallianatos,

A new approach to the optimum wire setting in a Wheatstone-bridge,
Phys. Educ., 29, 320, 1994.

49. Vallianatos, F., and **K. Eftaxias**,

Some thermodynamics aspects of estimation methods for activation volume,
Acta Geophysica, XLII /1, 13-22, 1994.

50. Varotsos, P., **K. Eftaxias**, M. Lazaridou, G. Antonopoulos and J. Makris,
Greek version of earthquake prediction-truth about prediction by geoelectric
current,

Jishin Journal, 17, 18-26, 1994.

51. Varotsos, P., **K. Eftaxias**, F. Vallianatos and M. Lazaridou,

Basic principles for evaluating an earthquake prediction method,
Geophys. Res. Lett., 23, n° 11, 1295-1298, 1996.

52. Varotsos, P., **K. Eftaxias**, M. Lazaridou, E. Dologlou and V. Hadjicontis,
Reply to "Inaccuracies in seismicity and magnitude data used by P. Varotsos
and coworkers" by M. Wyss,

Geophys. Res. Lett., 23, n° 11, 1303-1306, 1996.

53. Varotsos, P., **K. Eftaxias**, M. Lazaridou, E. Dologlou and V. Hadjicontis,
Reply to "Probability of chance correlations of earthquakes with predictions in
areas of heterogeneous seismicity rate: the VAN case" by M. Wyss and A.

Allmann,

Geophys. Res. Lett., 23, n° 11, 1311-1314, 1996.

54. Varotsos, P., **K. Eftaxias** and M. Lazaridou,

Reply I to "VAN: Candidacy and validation with the latest laws of the game"
by F. Mulargia and P. Gasperini

"Precursor candidacy and validation; the VAN case so far" by F. Mulargia and
P. Gasperini,

Geophys. Res. Lett., 23, n° 11, pp. 1331-1334, 1996.

55. Varotsos, P., **K. Eftaxias** and M. Lazaridou,

Reply II to "VAN: Candidacy and validation with the latest laws of the game"
by F. Mulargia and P. Gasperini,
"Precursor candidacy and validation: the VAN case so far" by F. Mulargia
and P. Gasperini.

Geophys. Res. Lett., 23, n° 11, 1335-1338, 1996.

56. Varotsos, P., **K. Eftaxias**, E. Skordas, V. Hadjicontis and M. Lazaridou,
Reply to "Rebuttal to Replies I and II by Varotsos et al." by F. Mulargia, W.
Marzocchi and P. Gasperini.

Geophys. Res. Lett., 23, n° 11, 1341-1342, 1996.

57. Varotsos, P., V. Hadjicontis, **K. Eftaxias**, E. Skordas and M. Lazaridou,
Reply to "Re-Rebuttal to the Reply of Varotsos et al.", by F. Mulargia, W.
Marzocchi and P. Gasperini,

Geophys. Res. Lett., 23, n° 11, 1345-1346, 1996.

58. Varotsos, P., **K. Eftaxias** and M. Lazaridou,
Reply to "The VAN method: Contradictory and misleading results since 1981"
by G. Stavrakakis and J. Drakopoulos,

Geophys. Res. Lett., 23, n° 11, 1351-1354, 1996.

59. Varotsos, P., **K. Eftaxias** and M. Lazaridou,
Reply to "A false alarm based on electrical activity recorded at a VAN-station
in Northern Greece in December 1990"

Geophys. Res. Lett., 23, n° 11, 1359-1362, 1996.

60. Varotsos, P., **K. Eftaxias** and M. Lazaridou G. Antonopoulos, J. Makris,
and J. Poliyiannakis

Summary of the five principles suggested by Varotsos et al [1996] and the
additional questions raised in this debate

Geophys. Res. Lett., 23, n° 11, 1449-1452, 1996.

61. Varotsos, P., **K. Eftaxias**, M. Lazaridou, K. Nomicos, N. Bogris, J. Makris,
G. Antonopoulos and J. Kopanas,

"Recent earthquake prediction results in Greece based on the observation of
seismic electric signals",

Acta Geophysica Polonica, Vol. XLIV, No. 4, 1996.

62. **Eftaxias**, K., and A. Vassilikou-Dova,

Prediction of the thermodynamics parameters of point defects in connection
with bulk properties for diffusion controlled mechanisms of geophysical
interest: a new approach,

Defect and Diffusion Forum, Vols. 143-147, 65-170, 1997.

63. Varotsos, P., **K. Eftaxias**, M. Lazaridou, N. Bogris, and J. Makris,
Note on the extension of the SES sensitive area at Ioannina station, Greece,
Acta Geophys. Polonica, XLVI, No 1, 55-60, 1998.
64. Varotsos, P., N. Bogris, **K. Eftaxias**, V. Hadjicontis, M. Lazaridou and M.
Kefalas,
Additional evidence on the extent of the SES sensitive area around Ioannina,
Acta Geophys. Polonica, XLVI, No 3, 273-275, 1998.
65. Varotsos, P., N. Bogris, **K. Eftaxias**, V. Hadjicontis, M. Lazaridou and M.
Kefalas,
On the extent of the SES sensitive area around Ioannina. Additional evidence
II,
Acta Geophys. Polonica, XLVI, No 4, 411-413, 1998.
66. Varotsos, P., N. Sarlis, **K. Eftaxias**, M. Lazaridou, N. Bogris, J. Makris, A.
Abdulla and P. Kaporis,
Prediction of the 6.6 Grevena-Kozani earthquake of May 13, 1995",
Phys. Chem. Earth (A), 24, 115-121, 1999.
67. Varotsos, P., N. Sarlis, M. Lazaridou, N. Bogris, **K. Eftaxias** and V.
Hadjicontis,
A review on the statistical significance of VAN predictions.
Phys. Chem. Earth (A), 24, pp.111-114, 1999.
68. Varotsos, P., **K. Eftaxias**, V. Hadjicontis, N. Bogris, E. Skordas, P. Kaporis
and M. Lazaridou,
A note on the extent of the SES sensitive area around Lamia (LAM), Greece.
Acta Geophys. Polonica, 47, 435-439, 1999.
69. Varotsos, P., **K. Eftaxias**, V. Hadjicontis, N. Bogris, E. Skordas, P. Kaporis
and M. Lazaridou,
A note on the extent of the SES sensitive area around Lamia (LAM), Greece:
Continuation I.
Acta Geophys. Polonica, 47, 441-442, 1999.
70. Varotsos, P., **K. Eftaxias**, V. Hadjicontis, N. Bogris, E. Skordas, P. Kaporis
and M. Lazaridou,
A note on the extent of the SES sensitive area around Lamia (LAM), Greece:
Continuation II.
Acta Geophys. Polonica, 47, 443-444, 1999.

71. Makris, J., N. Bogris and **K. Eftaxias**,
A new approach in the determination of characteristic directions of the
geoelectric structure using Mohr circles",
Earth Planet and Space, 1059-1065, 1999.
72. **Eftaxias, K.**, Kopanas, J., Bogris, N., Kapiris, K., Antonopoulos, G. and
Varotsos P.,
Detection of electromagnetic earthquake precursory signals in Greece.
Proc. Japan Acad., 76(B), 45-50, 2000.
73. **Eftaxias, K.**, P. Kapiris, J. Polygiannakis, N. Bogris, J. Kopanas, G.
Antonopoulos, A. Peratzakis and V. Hadjicontis,
Signatures of pending earthquake from electromagnetic anomalies.
Geophys. Res. Let., 28, 3321-3324, 2001.
74. Panin, V., Ye. Deryugin, V. Hadjicontis, C. Mavromatou, and **K. Eftaxias**.
Scale levels of strain localization and fracture mechanism of LiF single crystals
under compression,
Physical Mesomechanics, 4, 21-32, 2001.
75. **Eftaxias K.**, Rokityansky I., Bogris N., Balasis G., and Varotsos P.,
Magnetovariational and Magnetotelluric study of Ioannina region sensitive to
Seismic Electric Signals (SES). I
Journal of Atmospheric Electricity, 22, 113-1379, 2002.
76. Balasis G., Bogris N. and **Eftaxias K.**,
Magnetovariational and Magnetotelluric study of Ioannina region sensitive to
Seismic Electric Signals (SES). II
Journal of Atmospheric Electricity, 22, 139-164, 2002.
77. Hadjicontis, V., c. Mavromatou, and **K. Eftaxias**,
Preseismic earth's field anomalies recorded at Lesvos station, north-eastern
Aegean
Acta Geophysica Polonica, 50, 151-158, 2002.
78. **Eftaxias, K.**, P. Kapiris, E. Dologlou, J. Kopanas, N. Bogris,
G. Antonopoulos, A. Peratzakis and V. Hadjicontis,
EM anomalies before the Kozani earthquake: A study of their behavior
through laboratory experiments,
Geophys. Res. Let., 29, 10. 1029, 2002.
79. **Eftaxias, K.**, P. Kapiris, Y. Polygiannakis, Z. Chelidze, D. Ziplitimiani, and
T. Chelidze,

- Seismogenic radio-emission as a signature of the earthquake preparation process,
Journal of the Georgian Geophysical Society - Physics of Solid Earth, 6, 1-14, 2002.
80. Kapiris, P., J. Polygiannakis, A. Peratzakis, K. Nomikos and **K. Eftaxias**,
 VHF-electromagnetic evidence of the underlying pre-seismic critical stage.
Earth Planets Space, 54, 1237, 2002.
81. **Eftaxias, K.**, P. Kapiris, J. Polygiannakis, J. Kopanas, G. Antonopoulos, and D. Rigas,
 Experience of short term earthquake precursors with VLF-VHF electromagnetic emissions.
Natural Hazards and Earth System Sciences, 3, 217-228, 2003.
82. Kapiris, P., **K. Eftaxias**, K. Nomikos, J. Polygiannakis, E. Dologlou, G. Balasis, N. Bogris, A. Peratzakis, and V. Hadjicontis,
 Evolving towards a critical point: A possible electromagnetic way in which the critical regime is reached as the rupture approaches.
Nonlinear Processes in Geophysics, 10, 511-524, 2003.
83. **Eftaxias, K.**, P. Frangos, P. Kapiris, J. Polygiannakis, J. Kopanas, A. Peratzakis, P. Skountzos, and D. Jaggard,
 Review-Model of Pre-Seismic Electromagnetic Emissions in Terms of Fractal-Electrodynamics.
Fractals, 12, 243 - 273, 2004.
84. Contoyiannis, Y., F. Diakonou, P. Kapiris, A. Peratzakis, **K. Eftaxias**,
 Intermittent Dynamics of Critical Pre-seismic Electromagnetic Fluctuations,
Physics and Chemistry of the Earth, 29, 397 - 408, 2004.
85. Kapiris, P., G. Balasis, J. Kopanas, G. Antonopoulos, A. Peratzakis and **K. Eftaxias**,
 Scaling Similarities of Multiple Fracturing of Solid Materials,
Nonlinear Processes in Geophysics, 11, 137 - 151, 2004.
86. Mavromatou, C., V. Hadjicontis, D. Ninos, D. Mastroiannis, E. Hadjicontis, and **K. Eftaxias**.
 Understanding the fracture phenomena in inhomogeneous rock samples and ionic crystals, by monitoring the electromagnetic emission during the deformation,

Physics and Chemistry of the Earth, 29, 353 - 357, 2004.

87. Hadjicontis, V., V. Panin, Y. Deryugin, D. Ninos, C. Mavromatou, and **K. Eftaxias**.

Scale levels of deformation localization and electric signal spectrum on the surface of ionic crystal in compression,
Physical Mesomechanics, 7, 71-77, 2004.

88. Nikolopoulos, S., P. Kapiris, K. Karamanos and **K. Eftaxias**.

A unified approach of catastrophic events,
Natural Hazards and Earth System Sciences, 4, 615-637, 2004.

89. Kapiris, P., **K. Eftaxias** and T. Chelidze,

Electromagnetic Signature of Prefracture Criticality in Heterogeneous Media.
Physical Review Letters, 92(6), 065702, 2004.

90. Contoyiannis, Y., P. Kapiris and **K. Eftaxias**.

A Monitoring of a Pre-Seismic Phase from its Electromagnetic Precursors,
Physical Review E, 71, 061123-1 - 061123-14, 2005.

91. Balasis, G., P. Bedrosian, and **K. Eftaxias**,

A magnetotelluric study of the sensitivity of an area to seismoelectric signals,
Natural Hazards and Earth System Sciences, 5, 931-946, 2005.

92. Karamanos, K., A. Peratzakis, P. Kapiris, S. Nikolopoulos, J. Kopanas, and **K. Eftaxias**,

Extracting pre-seismic electromagnetic signatures in terms of symbolic dynamics,
Nonlinear Processes in Geophysics, 12, 835-848, 2005.

93. Li, X., J. Polygiannakis, P. Kapiris, A Peratzakis, **K. Eftaxias** and X. Yao,

Fractal spectral analysis of pre-epileptic seizures in terms of criticality.
Journal of Neural Engineering 2, 1-6, 2005.

94. Kapiris, P., J. Polygiannakis, X. Li, X. Yao and **K. Eftaxias**.

Similarities in precursory features in seismic shocks and epileptic seizures,
Europhysics Letters 69, 657-663, 2005.

95. Kapiris, P., K. Nomicos, G. Antonopoulos, J. Polygiannakis, K. Karamanos, J. Kopanas, A. Zissos, A. Peratzakis, **K. Eftaxias**,

Distinguished seismological and electromagnetic features of the impending global failure: did the 7/9/1999 M5.9 Athens earthquake come with a warning?

Earth Planets and Space, 57, 215-230, 2005.

96. Balasis, G., I.A. Daglis, P. Kapiris, M. Manda, D. Vassiliadis and **K. Eftaxias**,

From pre-storm activity to magnetic storms: a transition described in terms of fractal dynamics,

Ann. Geophys., 24, 3557-3567, 2006.

97. **Eftaxias, K.**, P.Kapiris, G. Balasis, A. Peratzakis, K. Karamanos, J. Kopanas, G. Antonopoulos, and K. Nomicos,

A Unified Approach to Catastrophic Events: From the Normal State to Geological or Biological Shock in Terms of Spectral Fractal and Nonlinear Analysis,

Natural Hazards and Earth System Sciences, 6, 205-228, 2006.

98. Karamanos, K., I. Kotsireas, A. Peratzakis and **K. Eftaxias**,

Statistical compressibility analysis of DNA sequences by generalized entropy-like quantities: Towards algorithmic laws of biology?

WSEAS Transactions on Systems, 5(11), 2503-2513, 2006.

99. Karamanos, K., Dakopoulos, D., Aloupis, K., Peratzakis, A.,

Athanasopoulou, L., Nikolopoulos, S., Kapiris, P., **Eftaxias, K.**,

Pre-seismic electromagnetic signals in terms of complexity,

Physical Review E, 74, 016104-1/21, 2006.

100. **Eftaxias, K.**, Panin, V.E. and Deryugin Ye Ye,

Evolution-EM signals before earthquakes in terms of meso-mechanics and complexity,

Tectonophysics, 431, 273-300, 2007.

101. Kalimeri, M., Papadimitriou, K., Balasis, G., and **Eftaxias, K.**,

Dynamical complexity detection in pre-seismic emissions using nonadditive Tsallis entropy,

Physica A, 387, 1161-1172, 2008.

102. Papadimitriou, K., M. Kalimeri, and **K. Eftaxias**,

Nonextensivity and universality in the earthquake preparation process,

Physical Review E, 77, 36101, 2008.

103. Contoyiannis, Y., and **K. Eftaxias**,

Tsallis and Levy statistics in the preparation of an earthquake,

Nonlinear Processes in Geophysics, 15, 379-388, 2008.

104. **Eftaxias, K.**, Y. Contoyiannis, G. Balasis, K. Karamanos, J. Kopanas G. Antonopoulos, and C. Nomicos,
Evidence of fractional-Brownian-motion-type asperity model for earthquake generation in candidate pre-seismic electromagnetic emissions,
Natural Hazards and Earth System Sciences, 8 657-669, 2008.
105. Balasis, G., I. Daglis, C. Papadimitriou, M. Kalimeri, A. Anastasiadis, and **K. Eftaxias**,
Dynamical complexity in Dst time series using non-extensive Tsallis entropy,
Geophysical Research Letters, L14102, doi:10.1029/2008GL034743, 2008.
(AGU Editor's Choice: Space Weather -
http://www.agu.org/pubs/journals/virtual/editors_choice/si.shtml)
106. Fytas, N., A. Malakis and **K. Eftaxias**,
First-order transition features of the 3D bimodal random-field Ising model,
Journal of Statistical Mechanics: Theory and Experiment, doi:10.1088/1742-5468/2008/03/P03015, 2008.
107. Balasis, G., and **K. Eftaxias**,
A study of non-extensivity in the Earth's magnetosphere,
European Physical Journal, 174, 219-225, 2009.
108. G. Balasis, I. Daglis, C. Papadimitriou, M. Kalimeri, A. Anastasiadis, and **K. Eftaxias**,
Investigating dynamical complexity in the magnetosphere using various entropy measures,
Journal of Geophysical Research, DOI:10.129, 2009.
109. Koulouras, G., G. Balasis, I. Kiourktsidis, E. Nannos, K. Kontakos, J. Stonham, Y. Ruzhin, **K. Eftaxias**, D. Kavouras and C. Nomikos,
Discrimination between preseismic electromagnetic anomalies and solar activity effects,
Physica Scripta, 79, 45901 (12pp), 2009.
110. **Eftaxias, K.**,
Footprints of nonextensive Tsallis statistics, selfaffinity and universality in the preparation of the L'Aquila earthquake hidden in a pre-seismic EM emission,
Physica A, 389, 133-140, 2009.
111. **Eftaxias, K.**, L. Athanasopoulou, G. Balasis, M. Kalimeri, S. Nikolopoulos, Y. Contoyiannis, J. Kopanas, G. Antonopoulos, C. Nomicos,
Unfolding the procedure of characterizing recorded ultra low frequency, kHz

and MHz electromagnetic anomalies prior to the L'Aquila earthquake as pre-seismic ones. Part I,
Nat. Hazards Earth Syst. Sci., 9, 1953-1971, 2009.

112. **Eftaxias, K.**, G. Balasis, Y. Contoyiannis, C. Papadimitriou, M. Kalimeri, J. Kopanas, G. Antonopoulos, and C. Nomicos,
Unfolding the procedure of characterizing recorded ultra low frequency, kHz and MHz electromagnetic anomalies prior to the L'Aquila earthquake as pre-seismic ones. Part II.,
Nat. Hazards Earth Syst. Sci., 10, 275-294, 2010.

113. Contoyiannis, Y., C. Nomicos, J. Kopanas, G. Antonopoulos, L. Contoyianni, and **K. Eftaxias**,
Critical features in electromagnetic anomalies detected prior to the L'Aquila earthquake,
Physica A, 389, 499-508, 2010.

114. Potirakis, S., G. Minadakis, C. Nomicos, and **K. Eftaxias.**,
[A multidisciplinary justification for traces of the last state of earthquake generation in preseismic electromagnetic emissions"](#),
Nat. Hazards Earth Syst. Sci., 11, 2859–2879, 2011.

115. Balasis, G., I. A. Daglis, A. Anastasiadis, C. Papadimitriou, M. Manda, and **K. Eftaxias**
Universality in solar flare, magnetic storm and earthquake dynamics using Tsallis statistical mechanics
Physica A, 390, 341–346, doi: 10.1016/j.physa.2010.09.029, 2011

116. Balasis, G., C. Papadimitriou, I. A. Daglis, A. Anastasiadis, L. Athanasopoulou, and **K. Eftaxias**
Signatures of discrete scale invariance in Dst time series
Geophysical Research Letters, 38, L13103, doi:10.1029/2011GL048019, 2011
(AGU Editor's Choice: Space Weather -
http://www.agu.org/pubs/journals/virtual/editors_choice/si.shtml)

117. Balasis, G., C. Papadimitriou, I. A. Daglis, A. Anastasiadis, I. Sandberg and **K. Eftaxias**
Similarities between extreme events in the solar-terrestrial system by means of nonextensivity
Nonlinear Processes in Geophysics, 18, 563–572, 2011

118. Balasis, G., I. A. Daglis, C. Papadimitriou, A. Anastasiadis, I. Sandberg and **K. Eftaxias**

Quantifying Dynamical Complexity of Magnetic Storms and Solar Flares via Nonextensive Tsallis Entropy

Entropy, 13, 1865–1881, doi:10.3390/e13101865, 2011

119. Potirakis, S., G. Minadakis, and **K. Eftaxias**

Relation between seismicity and pre-earthquake electromagnetic emissions in terms of energy, information and entropy content.

Nat. Hazards Earth Syst. Sci. 12, 1179-1183, 2012.

120. Potirakis, S., G. Minadakis, and **K. Eftaxias**,

Sudden drop of fractal dimension of electromagnetic emissions recorded prior to significant earthquake,

Nat. Hazards, DOI 10.1007/s11069-012-0262-x, 2012.

121. Potirakis, G. Minadakis, and **K. Eftaxias**

Analysis of electromagnetic pre-seismic emissions using Fisher Information and Tsallis entropy",

Physica A, 391, 300–306, 2012.

122. Minadakis, G., S. M. Potirakis, C. Nomicos and **K. Eftaxias**

Linking electromagnetic precursors with earthquake dynamics: an approach based on nonextensive fragment and self asperity models,

Physica A, 391, 2232–2244, 2012.

123. Minadakis, G, S. Potirakis, J. Stonham, C. Nomicos, **K. Eftaxias**,

The role of propagating stress waves on a geophysical scale: Evidence in terms of nonextensivity,

Physica A, 391, 5648-5657, 2012.

124. **Eftaxias, K.**, G. Minadakis, S. Potirakis, and G. Balasis,

Dynamical analogy between epileptic seizures and seismogenic electromagnetic emissions by means of nonextensive statistical mechanics,

Physica A, 392, 497–509, 2013.

125. **Contoyiannis, Y. F., S. M. Potirakis, and K. Eftaxias**,

The Earth as a living planet: human-type diseases in the earthquake preparation process,

Nat. Hazards Earth Syst. Sci., 13, 125–139, 2013.

126. **Eftaxias, K.**, S. M. Potirakis, and T. Chelidze,

On the puzzling feature of the silence of precursory electromagnetic emissions,

Nat. Hazards Earth Syst. Sci., **13**, 2381–2397, 2013.

127. **Eftaxias, K.**, and S. Potirakis,
Current challenges for pre-earthquake electromagnetic emissions: shedding light from micro-scale plastic flow, granular packings, phase transitions and self-affinity notion of fracture process,
Nonlin. Processes Geophysics, **20**, 771–792, 2013.

128. Balasis, G., R. V. Donner, S. M. Potirakis, J. Runge, C. Papadimitriou, I. A. Daglis, **K. Eftaxias**, and J. Kurths,
Statistical Mechanics and Information-Theoretic Perspectives on Complexity in the Earth System,
Entropy, **15**, 4844-4888, 2013 (Review Article).

129. Potirakis, S. M., A. Karadimitrakis, and **K. Eftaxias**
Natural time analysis of critical phenomena: The case of pre-fracture electromagnetic emissions,
Chaos, **23**, 023117/1-14, 2013.

130. Potirakis, S. M., P. Zitis, and **K. Eftaxias**
Dynamical analogy between economical crisis and earthquake dynamics within the nonextensive statistical mechanics framework,
Physica A, **392**, 2940-2954, 2013.

131. Potirakis, S.M., Y. Contoyiannis, **K. Eftaxias**, G. Koulouras, and C. Nomicos
Recent Field Observations Indicating an Earth System in Critical Condition before the Occurrence of a Significant Earthquake,
IEEE GEOSCIENCE AND REMOTE SENSING LETTERS, **12**, 631-635, 2015.

132. Contoyiannis, Y., S. M. Potirakis, **K. Eftaxias**, and L. Contoyianni,
Tricritical crossover in earthquake preparation by analyzing preseismic electromagnetic emissions,
Journal of Geodynamics, **84**, 40-54, 2015.

133. Potirakis, S.M., **K. Eftaxias**, G. Balasis, J. Kopanas, G. Antonopoulos, and A. Kalimeris
Signatures of the self-affinity of fracture and faulting in pre-seismic electromagnetic emissions,
Nat. Hazards Earth Syst. Sci. Discuss., **2**, 1–33, 2014, doi: 10.5194/nhessd-2-1-2015

134. M. Hayakawa, A. Schekotov, S. M. Potirakis, and K. Eftaxias

Criticality features in ULF magnetic fields prior to the 2011 Tohoku earthquake

Proc. Jpn. Acad., Series B, 91, 25-30, 2015.

135. D. Reik, S. M. Potirakis, G. Balasis, K. Eftaxias, and J. Kurths
Temporal correlation patterns in pre-seismic electromagnetic emission reveal distinct complexity profiles prior to major earthquakes,
Physics and Chemistry of the Earth, in press, 2015.

136. Masashi Hayakawa, Alexander Schekotov, Stelios M. Potirakis, Konstantinos Eftaxias, Qi Li, Tomokazu Asano,
An Integrated Study of ULF Magnetic Field Variations in Association with the 2008 Sichuan Earthquake, on the Basis of Statistical and Critical Analyses,
Open Journal of Earthquake Research 04(03), 85-93, 2015.
DOI:10.4236/ojer.2015.43008, 2015

137. Kalimeris, A., S. Potirakis, K. Eftaxias, G., Antonopoulos, and J. Kopanas,
Multi-spectral detection of statistically significant components in pre-seismic electromagnetic emissions related with Athens 1999, M=5.9 earthquake,
Journal of Applied Geophysics 128, 41–57, 2016

138. Contoyiannis, Y. , S . M. Potirakis, K. Eftaxias, M. Hayakawa, A. Schekotov,
Intermittent criticality revealed in ULF magnetic fields prior to the 11 March 2011 Tohoku earthquake (MW=9),
Physica A, 452, 19-28, 2016.

139. Potirakis, S, K. Eftaxias, A. Schekotov, H. Yamaguchi, M. Hayakawa,
Criticality features in ULF magnetic fields prior to the 2013 Kobe earthquake
Annals of Geophysics, 59, 3, S0317, 1-15, 2016.

140. Hayakawa, M., H. Yamauchi, N. Ohtani, M. Ohta, S. Tosa, T. Asano, A. Schekotov, J. Izutsu, S. Potirakis, Konstantinos Eftaxias,
On the precursory abnormal animal behavior and electromagnetic effects for the Kobe earthquake (M~6) on April 12, 2013
Open Journal of Earthquake Research, doi.org/10.4236/ojer, 2016.

141. Potirakis, S.M., Contoyiannis, Y ,Nikolaos S. Melis, John Kopanas, George Antonopoulos, Balasis, Charalampos Kontoes , Constantinos Nomicos, KonstantinosEftaxias
Recent seismic activity at Cephalonia (Greece): a study through candidate electromagnetic precursors in terms of non-lineardynamics
Nonlin. Processes Geophys., 23, 223–240, 2016

ARTICLES IN BOOKS

1. Kopanas, J., G. Antonopoulos, J. Makris, **K. Eftaxias** and V. Hadjicontis,
Detection of S.E.S vertical component,
In Electromagnetic Phenomena Related to Earthquake Prediction, 25-36
Edited by M. Hayakawa and Y. Fujinawa
Terra Scientific Publising Company, Tokyo, 1994.
2. Varotsos, P., M. Lazaridou, **K. Eftaxias**, G. Antonopoulos, J. Makris and J.
Kopanas,
"Short term earthquake prediction in Greece by Seismic Electric Signals",
in "A Critical Review of VAN - Earthquake prediction from seismic electric
signals, Edited by Sir J. Lighthill, World Scientific Publishing Co.,
Singapore, 29-76, 1996.

CHAPTERS IN BOOKS

1. Nikolopoulos, S., P. Kapis, K. Karamanos and **K. Eftaxias**
A Unified Approach of Catastrophic Events
In Models and Applications of Chaos Theory in Modern Sciences, 742
pages,
Edited by Elhadj Zeraoulia, Science Publishers, 2011.
2. Balasis, G., I. A. Daglis, A. Anastasiadis, and **K. Eftaxias**,
Detection of dynamical complexity changes in Dst time series using entropy
concepts and rescaled range analysis,
In The Dynamic Magnetosphere,
Edited by W. Liu and M. Fujimoto, pp. 211-220, Springer Verlag, 2011
3. **Eftaxias, K.,**
Are There Pre-Seismic Electromagnetic Precursors? A Multidisciplinary
Approach
In Earthquake Research and Analysis - Statistical Studies,
Observations and Planning 460 pages, InTech, March, 2012, ISBN 978-953-
51-0134
4. **Eftaxias, K.,** and S. M. Potirakis,
Contribution of the electromagnetic pre-seismic emissions in the
comprehension of the earthquake preparation process, in Thales, 171-190,
2013

2

INTERNATIONAL CONFERENCES

1. S. Patapis, P.Varotsos and **K.Eftaxias**,
Connection of the static dielectric constant and the defect-volume in alkaline fluorides,
Defects in Solids: Modern Techniques, University of Calambria, p. 458, 1985.
2. **K. Eftaxias** and V.Hadjicontis,
Comments of the elastic properties and the conductivity of mixed alkali halide,
Fifth Europhysical Topical Conference, Lattice Defects in Ionic Crystals, Madrid, Pl. 1, p. 73, 1986.
3. P. Varotsos, K.Alexopoulos, V.Hadjicontis and **K.Eftaxias**,
Thermodynamical aspects related with the calculation of point defect parameters and the analysis of the specific heat data,
Fifth Europhysical Topical Conference, Lattice Defects in Ionic Crystals, Madrid, Pl. 1-2, p. 75, 1986.
4. P. Varotsos, **K. Eftaxias** and V. Hadjicontis,
Comments on the calculation of the specific heats of metals at high temperatures,
31st International Congress of Pure and Applied Chemistry, 3, p. 7, Sofia, 1986.
5. E. Dologlou, **K. Eftaxias**, V. Hadjicontis, A. Androutsopoulou and P. Varotsos,
The installation of a new seismic network in Greece for test ban monitoring,
Conference on Nuclear TestBan Verification p. 61, Linkoping, 1988 (invited paper).
6. V. Hadjicontis and **K. Eftaxias**,
A plausible explanation of the non-Arrhenius behavior of V and Nb,
DIMETA 88, Hungary, 1988.
7. J. Grammatikakis, **K. Eftaxias**, V. Hadjicontis and V. Katsika,
Interconnection of the diffusion-coefficient of various elements in Aluminum,
Conference on Diffusion in Materials, Aussois, 1988.

8. **K. Eftaxias** and V. Hadjicontis,
Electrotelluric field variations preceding earthquakes: Physical model based on pressure stimulated currents and open questions,
International Conference on "Measurement and theoretical models of the Earth's electric field variations related to earthquakes", Athens, 1990.
9. V. Hadjicontis and **K. Eftaxias**,
Point defects parameters of semiconductors as function of bulk properties,
International Conference on Diffusion and defects in Solids-DD91, USSR, 1991.
10. **K. Eftaxias**, V. Hadjicontis and M. Mavromatou,
Comments on the cationic order-disorder transition of a-AgI,
International Conference on Diffusion and defects in Solids-DD91, USSR, 1991.
11. A. Vassilikou-Dova and **K. Eftaxias**,
An EPR study of Cu in tetragonally compressed octahedral symmetry,
BPU-91, Greece, 1991.
12. A. Vassilikou-Dova and **K. Eftaxias**,
Electron Paramagnetic Resonance of Mn in a single crystal of CdBr: A laboratory experiment,
BPU-91, Greece, 1991.
13. **K. Eftaxias**, C. Londos and P. Dovas,
On the number of repetitive measurements in a laboratory experiment,
BPU-91, Greece, 1991.
14. A. Vassilikou-Dova, **K. Eftaxias**, P. Varotsos and D. Kostopoulos,
Thermally stimulated depolarisation current of Kbr doped with LaOCl,
International Conference on: Defects in Insulating Materials, (ICDIM), Paderborn, 1992.
15. **K. Eftaxias** and A. Vassilikou-Dova,
Prediction of the thermodynamic parameters of point defects in connection with bulk properties for diffusion and diffusion-control mechanisms,
European Science Foundation Workshop: Effects of high-pressure on reaction kinetics, mass transport and creep, Bayreuth, 1993.
16. M. Uyeshima, **K. Eftaxias**, G. Antonopoulos, J. Makris and P. Varotsos,

A detailed experimentation towards understanding the SES physical properties,

International Workshop on Electromagnetic Phenomena Related to Earthquake Prediction, 6-8/9/1993, University of Electrocommunications, Chofu, Tokyo Japan, 1993.

17. J. Kopanas, G. Antonopoulos, J. Makris, **K. Eftaxias** and V. Hadjicontis, Detection of the SES vertical component, International Workshop on Electromagnetic Phenomena Related to Earthquake Prediction, University of Electrocommunications, Chofu, Tokyo, Japan, 1993.

18. **K. Eftaxias**, J. Makris, G. Antonopoulos and P. Varotsos, A detailed study close to a site appropriate for collection of Seismic Electric Signals, European Geophysical Society, XIX General Assembly, Grenoble, France, 1994.

19. P. Varotsos, **K. Eftaxias** and M. Lazaridou, Short term earthquake prediction in Greece by Seismic Electric Signals, European Geophysical Society, XIX General Assembly, Grenoble, France, (invited paper) 1994.

20. J. Kopanas, **K. Eftaxias**, G. Antonopoulos, J. Makris, M. Lazaridou and P. Varotsos, Short term earthquake prediction in Greece by detecting Seismic Electric Signals, 12th International Wroclaw Symposium and Exhibition on Electromagnetic Compatibility, Wroclaw Technical University, Institute of Telecommunications, Wroclaw, Poland, 1994.

21. P. Varotsos, **K. Eftaxias**, M. Lazaridou, G. Antonopoulos, J. Makris and J. Polygiannakis, Recent earthquake prediction in Greece based on Seismic Electric Signals, European Seismological Commission, XXIV General Assembly, University of Athens, 1994.

22. P. Varotsos, **K. Eftaxias**, M. Lazaridou, G. Antonopoulos, J. Kopanas and J. Makris, Recent earthquake prediction results in Greece based on the observation of Seismic Electric Signals, International Union of Geodesy and Geophysics (I.U.G.G), XXI General Assembly, U.S. National Academy of Sciences, Boulder, Colorado, USA, 1995.

23. P. Varotsos, **K. Eftaxias** and M. Lazaridou,
Remarks on the Procedure for the Evaluation of the Probability That
Predictions Correlate by Chance with Earthquakes,
International Union of Geodesy and Geophysics (I.U.G.G), XXI General
Assembly, U.S. National Academy of Sciences, Boulder, Colorado, USA, 1995.
24. P. Varotsos, **K. Eftaxias**, E. Dologlou and M. Lazaridou,
Evaluation of the Probability Correlate by Chance with Earthquakes,
American Geophysical Union, San Francisco, 1995.
25. **K. Eftaxias** and A. B. Vassilikou-Dova,
Prediction of the thermodynamic parameters of point defects in connection
with bulk properties for diffusion controlled mechanisms of geophysical
interest: A new approach,
International Conference on Diffusion in Materials, 1996.
26. N. Sarlis, P. Varotsos, **K. Eftaxias**, M. Lazaridou, N. Bogris,
Can some "Logical" Requirements Reject even an Ideally Perfect Earthquake
Prediction Method? American Geophysical Union, San Francisco, 1996.
27. N. Bogris, P. Varotsos, **K. Eftaxias**, M. Lazaridou, N. Sarlis, P. Kaporis,
On the correct application of VAN criteria for the identification of Seismic
Electric Signals,
American Geophysical Union, San Francisco, 1996.
28. M. Lazaridou, P. Varotsos, N. Bogris, N. Sarlis, **K. Eftaxias**, P. Kaporis,
On the Prediction of the 6.6 Kozani Earthquake in Greece,
American Geophysical Union, San Francisco, 1996.
29. **K. Eftaxias**, N. Bogris, J. Makris,
A Possible Explanation for the Emission of pre-Seismic Radioelectric
Disturbances.
IASPEI, Thessaloniki, 1997.
30. **K. Eftaxias**, J. Kopanas, N. Bogris, J. Makris, G. Antonopoulos,
Investigation of the Possibility to Predict the Parameters of an Impending
Earthquake from the Parameters of Radioelectric Disturbances, IASPEI,
Thessaloniki, 1997.
31. J. Kopanas, **K. Eftaxias**, G. Antonopoulos, J. Makris,

Observation and Analysis of the VHF and VLF Electromagnetic Radiation Field Prior to the Earthquake, IASPEI, Thessaloniki, 1997.

32. J. Makris, **K. Eftaxias**, N. Bogris,
Magnetotelluric Study of an Area Sensitive to the Detection of Seismic Electric Signals (SES),
IASPEI, Thessaloniki, 1997.

33. P. Varotsos, N. Sarlis, M. Lazaridou, **K. Eftaxias**, V. Hadjicontis,
A review of the GRL Debate on the Statistical Significance of VAN Predictions,
IASPEI, Thessaloniki, 1997.

34. P. Varotsos, N. Bogris, J. Makris, M. Kefalas, **K. Eftaxias**, M. Lazaridou, A. Abdulla,
A Detailed Experimental Study Aiming at Understanding of the SES Selectivity Phenomenon,
IASPEI, Thessaloniki, 1997.

35. Rokityansky I., Varotsos P., **Eftaxias K.**, Bogris N. and Balasis G., Results of MTS-MVP studies of the conductivity structure in the SES sensitive area around Ioannina, Greece.

14th Electromagnetic Induction Workshop, Sinaia, Romania, 1998.

36. Bogris N., Balasis G. and **Eftaxias K.**,
Magnetotelluric and Magnetic Variation study of Ioannina area, NW Greece.
International Union of Geodesy and Geophysics (I.U.G.G.) XXII General Assembly, Birmingham, U.K., 1999.

37. Balasis G., Bogris N., Abdulla A. and **Eftaxias K.**,
Preliminary Results from an MT-Survey around Ioannina area, NW Greece.
Recent Aspects of Electromagnetic Variations Related with Earthquakes,
Tokyo, Japan, 1999.

38. **Eftaxias K.**, Rokityansky I., Bogris N., Balasis G. and Varotsos P.,
Magnetotelluric and Magnetovariational study of a region sensitive to Seismic Electric Signals (SES). I.
International Workshop on Seismo Electromagnetics, Tokyo, Japan, 2000.

39. **Eftaxias K.**, Rokityansky I., Bogris N., **Balasis G.** and Varotsos P.,
Magnetotelluric and Magnetovariational study of a region sensitive to Seismic
Electric Signals (SES). II.
XV European Geophysical Society (E.G.S.) General Assembly, Nice, France,
2000.
40. **K. Eftaxias**, P. Kapiris, V. Hadjicontis, E. Dologlou, N. Bogris, J. Kopanas,
G. Antonopoulos, A. Peratzakis and D. Ziplimiani,
Electromagnetic anomalies prior to large earthquakes in Greece: a study of
their behavior through laboratory experiments, fault models and the
geotectonic structure of each focal area, (Abstract), EOS, Trans. AGU 2001 Fall
Meeting.
41. **Eftaxias, K.**, V. Hadjicontis, A. Peratzakis, and N. Bogris,
On electrical charge relaxation in conductors,
Asia-Pacific Radio-Science Conference AP-RASC'01, Chuo University, Tokyo
Japan, August, 2001.
42. **Eftaxias, K.**, P. Kapiris, N. Bogris, J. Kopanas, G. Antonopoulos,
Electromagnetic anomalies prior to large earthquakes in Greece: A study of
their behavior through laboratory experiments, fault models and the
geotectonic structure of earth focal area,
EOS, Trans. AGU 2001 Fall Meeting.
43. Polygiannakis, J., P. Kapiris, A. Peratzakis, and **K. Eftaxias**,
Study of Pre-seismic Electromagnetic Signals Using Wavelet Analysis,
European Geophysical Society, XXVII General Assembly, Nice, France,
Abstract # EGS02-A-00421, 2002.
44. Kapiris, P., J. Polygiannakis, G. Antonopoulos, J. Kopanas, A. Peratzakis,
and **K. Eftaxias**,
An observational test of the critical earthquake concept: The electromagnetic
point of view,
European Geophysical Society, EGS XXVII General Assembly, Nice, France,
Abstract # EGS02-A-00554, 2002.
45. Contoyiannis, Y., F. Diakonos, P. Kapiris, A. Peratzakis, and **K. Eftaxias**,
Fingerprints of intermittent and critical behavior of pending earthquake in
electromagnetic anomalies, European Geophysical Society, (EGS) XXVII
General Assembly, Nice, France, Abstract # EGS02-A-00244, 2002.

46. **Eftaxias, K.**, P. Kapiris, J. Polygiannakis, N. Bogris, J. Kopanas, G. Antonopoulos, and A. Peratzakis, Critical behavior in the VHF pre-seismic electromagnetic anomalies associated with the Kozani-Grevena earthquake in Greece,
EOS, Trans. AGU. 2002 Spring Meeting, Abstract: S52A-02.
47. **Eftaxias, K.**, P. Kapiris, J. Polygiannakis, A. Peratzakis, and N. Bogris,
An observational test of the critical earthquake concept in view of electromagnetic precursors,
Progress in Electromagnetic Research Symposium, PIERS 2003, Singapore, January 2003.
48. **Eftaxias, K.**, Hadjicontis, V., Mavromatou, K., and Saraev, A.,
Fingerprints of pending earthquake from electromagnetic anomalies,
III International Workshop on Magnetic, Electric and Electromagnetic Methods in Seismology and volcanology (MEEMSV-2002), September, 2002, Moscow.
49. Contoyiannis, Y. E, Diakonos, F. K., Kapiris, P.G., and **Eftaxias, K.**,
Intermittent Dynamics of Critical Pre-Seismic Electromagnetic Fluctuations,
Meeting / Conference: EGS - AGU – EGU Joint Assembly, Nice, France, April 2003.
50. **Eftaxias, K.**, Frangos, P., Polygiannakis, J., Kapiris, P., and Peratzakis, A.,
Model of Pre-Seismic Electromagnetic Emissions in Terms of Fractal-Electrodynamics,
Meeting / Conference: EGS - AGU - EGU Joint Assembly, Nice, France, April 2003.
51. Kapiris, P., Peratzakis, A., Kopanas, J., Antonopoulos, G., Polygiannakis, J., Hadjicontis, V., Nomikos, K., and **Eftaxias, K.**,
Did the 07/09/1999 M5.9 Athens Earthquake come with a precursory seismicity and Electromagnetic Activity?
Meeting / Conference: EGS - AGU - EGU Joint Assembly, Nice, France, April 2003.
52. Polygiannakis, J., Kapiris, P., Peratzakis, and A., **Eftaxias, K.**,
A Physical Model of Radio-Electromagnetic Precursors due to Fractal Properties of Fracture and Fragmentation of Materials and the Electrification during Micro-Fracturing,

Meeting / Conference: EGS - AGU - EGU Joint Assembly, Nice, France, April 2003.

53. **Eftaxias, K.**, Kaporis, P., Polygiannakis, J., Peratzakis, A., Kopanas, J., and Antonopoulos, G.,

The Critical Point Hypothesis of the Earthquake Generation in View of Radio-Electromagnetic Precursors, Meeting / Conference: EGS - AGU - EGU Joint Assembly, Nice, France, April 2003.

54. Kaporis, P., **Eftaxias, K.**, and Chelidze, T.,

The Electromagnetic Signature of Pre-Fracture Criticality in Heterogeneous Media,

Meeting / Conference: EGS - AGU - EGU Joint Assembly, Nice, France, April 2003.

55. Balasis, G., and **Eftaxias, K.**,

Inversion and modelling of the Ioannina electromagnetic response data,

Meeting / Conference: EGS - AGU - EGU Joint Assembly, Nice, France, April 2003.

56. Hadjicontis, V., Ninos, D., Hadjicontis, E., Mavromatou, C., and **Eftaxias, K.**,

Laboratory Investigation of Seismo-Electromagnetic Phenomena,

Meeting / Conference: EGS - AGU - EGU Joint Assembly, Nice, France, April 2003.

57. **Eftaxias, K.**, P. Kaporis and A. Peratzakis,

Electromagnetic confirmation of the critical earthquake hypothesis, IUGG, Sapporo, Japan, 2003.

58. **Eftaxias, K.**, P. Frangos, J. Polygiannakis, A. Peratzakis, P. Kaporis and K. Nomikos,

Model of pre-seismic electromagnetic emissions in terms of the critical earthquake concept and fractal-electrodynamics, IUGG, Sapporo, Japan, 2003.

59. **Kaporis, P.**, K. Eftaxias, K. Nomikos, A. Peratzakis, J. Kopanas, G. Antonopoulos, N. Bogris, V. Hadjicontis,

Critical earthquake hypothesis: did the 7/9/1999 M5.9 Athens earthquake come with a short-term simultaneous precursory seismic and electromagnetic hint?

IUGG, Sapporo, Japan, 2003.

60. Balasis G. and **Eftaxias K.**,
Inversion and modeling of the Ioannina electromagnetic response data.
IUGG XXIII General Assembly, Sapporo, Japan, 2003.
61. Balasis G., Kapiris P. and **Eftaxias K.**,
Multidisciplinary precursory peculiarities indicative for the nucleation of the
Athens earthquake.
17th International Workshop on Electromagnetic Induction in the Earth,
Hyderabad, India, 2004.
62. Kapiris P., Balasis G., Polygiannakis J. and **Eftaxias K.**, Isomorphic
signatures indicate the transition from the normal state to the seismic shock or
epileptic seizure in terms of complexity.
17th International Workshop on Electromagnetic Induction in the Earth,
Hyderabad, India, 2004.
63. Li X., Polygiannakis J., Kapiris P., Balasis G., Peratzakis A., Xin Yao and
Eftaxias K., Evolving towards a biological or geophysical catastrophic event:
emergence of isomorphic precursory alterations in scaling parameters in
terms of intermittent criticality.
Joint CHAMP- GRACE Science Meeting, Potsdam, Germany, 2004.
64. Li, X., Polygiannakis, J., Kapiris, P., Balasis, G., Peratzakis, A., Yao, X., and
K. Eftaxias,
Evolving towards a biological or geophysical catastrophic event: emergence
of isomorphic precursory alterations in scaling parameters in terms of
intermittent criticality,
4th International Conference "Fractal and Dynamics systems in Geosciences"
TU Munchen /Kloster Seon, May 2004, 55-57 (Book of Abstracts).
65. **Kapiris, P.**, Eftaxias, K., and Chelidze, T.,
A potential window through which the evolution of earthquake generation
can be step by step monitoring,
Meeting / Conference: EGU General Assembly, Nice, France, April 2004.
66. Peratzakis, A., Kapiris, P., Balasis, G., and **Eftaxias, K.**,
Similarities of multiple fracturing on a laboratory sample, on the Earth and on
a neutron star in terms of precursory electromagnetic emission,
Meeting / Conference: EGU General Assembly, Nice, France, April 2004.
67. Gershenzon, N., Bambakidis, G., and **Eftaxias, K.**,
Comparison of the strengths of various mechano-electromagnetic transducers,
Meeting / Conference: EGU General Assembly, Nice, France, April 2004.

68. Kapiris, P., K. Nomikos, J. Kopanas, G. Antonopoulos, P. Skountzos, A. Zissos and **K. Eftaxias**, Lessons from the Athens earthquake, IV International Workshop MEEMSV-2004, France.

69. **Eftaxias, K.**, J. Polygiannakis, P. Kapiris, J. Kopanas, G. Antonopoulos, and A. Peratzakis, Isomorphic signature indicating the transition from the normal state to the seismic shock or epileptic seizure in terms of complexity, IV International Workshop MEEMSV-2004, France.

70. Contoyiannis, Y., P. Kapiris and **K.A. Eftaxias**, Is the evolution towards global failure unavoidable after the appearance of distinguishing features in the pre-seismic EM time series? IV International Workshop MEEMSV-2004, France.

71. Balasis, G., P. Kapiris and **K. Eftaxias**, Multidisciplinary precursory peculiarities indicating the nucleation of the Athens earthquake, XXIX General Assembly of the European Seismological Commission, Germany, 12-17 Sept. 2004.

72. Nikolopoulos, S., K. Karamanos, P. Kapiris and **K. Eftaxias**, Complexity reduction as a sign of transition from the normal state to the seismic shock or healthy human cardiac system to coronary disease, IV International Workshop MEEMSV-2004, France.

73. **Eftaxias, K.**, P. Kapiris, K. Karamanos, Balasis, G., and A. Peratzakis, Extracting preseismic VLF-VHF electromagnetic signatures: A possible way in which the critical regime is reached as the earthquake approaches. German Geophysical Society, Berlin, Germany, 2004.

74. Balasis G., Kapiris P. and **Eftaxias K.**, Multidisciplinary precursory peculiarities indicative for the nucleation of the Athens earthquake. 17th International Workshop on Electromagnetic Induction in the Earth, Hyderabad, India, 2004.

75. Balasis G., Bedrosian P. and **Eftaxias K.**, Magnetotelluric investigation of the Ioannina plateau

AGU Fall Meeting, San Francisco, USA, 2004.

76. Kapiris, P., Balasis, G., Kopanas, J., Antonopoulos, G., **Eftaxias, K.**,
A unified approach of geological and biological catastrophic events
General Assembly of the European Geosciences Union", Vienna, Austria,
April 2005.

77. Alexiou, N., Samiotakis, A., Balasis, G., Kapiris, P., **Eftaxias, K.**,
What can we learn with wavelets about pre-seismic electromagnetic
sequences?
General Assembly of the European Geosciences Union, Vienna, Austria, April
2005.

78. **Eftaxias, K.**, Chelidze, T., Surkov, V.,
Thresholds for Transport and Fracture: Implications for Earthquakes
precursors,
General Assembly of the European Geosciences Union, Vienna, Austria, April
2005.

79. Karamanos, K., Titchener, M., Aloupis, K., Dakopoulos, D., Kapiris, P.,
Peratzakis, A., **Eftaxias, K.**, Study of Pre-seismic Electromagnetic Signals in
terms of T-Complexity,
General Assembly of the European Geosciences Union, Vienna, Austria, April
2005.

80. K. Karamanos and **K. Eftaxias**,
Approaching Geophysical and biological Catastrophes,
Seventh International Conference on Computing Anticipatory Systems, HEC-
ULG, Liege, Belgium, August 8-13, 2005.

81. Kapiris, P., **Eftaxias, K.**,
Analysis of kHz-MHz pre-seismic EM Anomalies by means of Complexity –
Diffusion Entropy,
General Assembly of the European Geosciences Union, Vienna, Austria, April
2006.

82. Tsekouras, A., Kapiris, P., **Eftaxias, K.**,
Non-extensive entropic analysis in pre-catastrophic signals: the pre-seismic
Signals Case,
General Assembly of the European Geosciences Union, Vienna, Austria, April
2006.

83. **Eftaxias, K.**, Kapiris, P., Peratzakis, A., Balasis, G., Kopanas, J., Antonopoulos, G.,

Is the Evolution Towards Global Failure Irreversible after the Appearance of Distinguishing Features in the Pre-seismic EM signals,

General Assembly of the European Geosciences Union, Vienna, Austria, April 2006.

84. Balasis, G., Kapiris, P., **Eftaxias, K.**,

Similarities in Precursory Features in Strong Seismic Shocks and Magnetic Storms,

General Assembly of the European Geosciences Union, Vienna, Austria, April 2006.

85. Balasis , G., J. Velimsky , Z. Martinec , G. D. Egbert , I. A. Daglis , and **K. Eftaxias**,

Global electromagnetic induction: combined inversion of satellite and observatory magnetic data using non-zonal source models,

General Assembly of the European Geosciences Union, Vienna, Austria, April 2007.

86. Koulouras, G., K. Kontakos, G. Avgoustis, J. Stonham, Y. Ruzhin, G. Stavrakakis, **K.Eftaxias**, and C. Nomicos,

Electromagnetic emissions in the 142 to 415 MHz band,

Geophysical Research Abstracts, Vol. 9, 04778, 2007, SRef-ID: 1607-

7962/gra/EGU2007-A-04778, General Assembly of the European Geosciences Union, Vienna, Austria, April 2007.

87. Contoyiannis, Y., and **K. Eftaxias**,

Is the evolution towards global failure irreversible after the appearance of distinguishing features in the preseismic EM time series?

Geophysical Research Abstracts, Vol. 9, 04824, 2007, SRef-ID: 1607-

7962/gra/EGU2007-A-04824, General Assembly of the European Geosciences Union, Vienna, Austria, April 2007.

88. Balasis, G., and **K. Eftaxias**,

Is there a unified theory for the ways in which elements of a system organize themselves to produce a behaviour that is typical of large classes systems?

Geophysical Research Abstracts, Vol. 9, 04825, 2007, SRef-ID: 1607-

7962/gra/EGU2007-A-04825, General Assembly of the European Geosciences Union, Vienna, Austria, April 2007.

89. **Eftaxias, K.**, Y. Contoyiannis, K. Karamanos, M. Kalimeri, G. Balasis, J. Kopanas, G. Antonopoulos, and K. D. Nomicos, Evidence of a self-affine asperity fault model in pre-seismic electromagnetic activity, Geophysical Research Abstracts, Vol. 9, 04829, 2007, SRef-ID: 1607-7962/gra/EGU2007-A-04829, General Assembly of the European Geosciences Union, Vienna, Austria, April 2007.
90. Karamanos, K., C. Nomikos, and **K. Eftaxias**, Search for signatures that imply the transition to earthquake nucleation by means of complexity, Geophysical Research Abstracts, Vol. 9, 04830, 2007, SRef-ID: 1607-7962/gra/EGU2007-A-04830 General Assembly of the European Geosciences Union, Vienna, Austria, April 2007.
91. Karamanos, K., K. Papadimitriou, M. Kalimeri, L. Athanasopoulou, and **K. Eftaxias**, Entropic Study of a Proper "word length" for Catastrophic Events, Geophysical Research Abstracts, Vol. 9, 04836, 2007, SRef-ID: 1607-7962/gra/EGU2007-A-04836 General Assembly of the European Geosciences Union, Vienna, Austria, April 2007.
92. **Eftaxias, K.**, Contoyiannis, Y.; Balasis, G.; Kalimeri, M.; Kopanas, J.; Antonopoulos, G., Peratzakis, A., Nomicos, C., Evidence of fractional-Brownian-motion-type asperity model for earthquake generation in candidate pre-seismic electromagnetic emissions, Geophysical Research Abstracts, Vol. 10, EGU2008-A-01564, 2008, SRef-ID: 1607-962/gra/EGU2008-A-01564, EGU General Assembly 2008.
93. Papadimitriou, C.; Kalimeri, M., Antonopoulos, G., Kopanas, J., Peratzakis, A., **Eftaxias, K.**, Nonextensivity and universality in the earthquake preparation process in terms of Tsallis statistics, Geophysical Research Abstracts, Vol. 10, EGU2008-A-01566, 2008, SRef-ID: 1607-7962/gra/EGU2008-A-01566, EGU General Assembly 2008.
94. Nikolopoulos, S., Karamanos, K., **Eftaxias, K.**, Detrended fluctuation analysis of pre-seismic electromagnetic emissions, Geophysical Research Abstracts, Vol. 10, EGU2008-A-01567, 2008, SRef-ID: 1607-7962/gra/EGU2008-A-01567, EGU General Assembly 2008.
95. Koulouras, G., Balasis, G., Kiourktsidis, I., Ninnos, E., Kontakos, K., Stoneham, J., Ruzhin, Y., **Eftaxias, K.**, and Nomicos, C.,

Solar activity and Electromagnetic emissions in VHF band acquired from ground base monitors during “Martin Luther King Storm” happened on January 15th and 17th 2005,

General Assembly of the European Geosciences Union, Vienna, Austria, April 2008.

96. C. Papadimitriou, M. Kalimeri, J. Kopanas, G. Antonopoulos, A. Peratzakis, and **K. Eftaxias**,

The activation of a single fault as a reduced self-affine image of the whole regional seismicity and a magnified self-affine image of the laboratory seismicity in terms of kHz electromagnetic precursors,

Geophysical Research Abstracts, Vol. 11, EGU2009-2427, 2009, EGU General Assembly 2009.

97. Y. Contoyiannis, J. Kopanas, G. Antonopoulos, L. Contoyianni, and **K. Eftaxias**,

Description of pre-seismic MHz electromagnetic in analogy with a thermal second order phase transition: the reproducibility of results

Geophysical Research Abstracts, Vol. 11, EGU2009-2435, 2009, EGU General Assembly 2009.

98. S. Nikolopoulos, K. Karamanos, **K. Eftaxias**,

A multidisciplinary analysis of MHz-kHz pre-seismic emissions associated with recent significant earthquakes in Greece,

Geophysical Research Abstracts, Vol. 11, EGU2009-2431, 2009, EGU General Assembly 2009.

99. K. Karamanos, L. Athanasopoulou, and **K. Eftaxias**,

A unified approach to catastrophic events: from the normal state to geological or biological shock,

9th International Conference CASYS'09 on Computing Anticipatory Systems, Organised by ASBL [CHAOS](#) : Centre for Hyperincursion and Anticipation in Ordered Systems Liège, Belgium, August 3-8, 2009.

100. **K. Eftaxias**, G. Balasis, C. Papadimitriou, and M. Manda,

Universality in solar flares, magnetic storms, earthquakes, and pre-seismic electromagnetic emissions by means of nonextensivity,

AGU, Fall Meeting 2009, ID#NG43A-1197.

101. **K. Eftaxias**, G. Balasis , Y. Contoyiannis , M. Kalimeri, C. Papadimitriou , L. Athanasopoulou , J. Kopanas , and G. Antonopoulos,

Are there credible earthquake electromagnetic precursors?

Geophysical Research Abstracts Vol. 12, EGU2010-12282-1, 2010, EGU General Assembly, Vienna Austria, 2010.

102. Y. Contoyiannis, L. Contoyianni, J. Kopanas, G. Antonopoulos, and **K. Eftaxias**,

Critical features in electromagnetic anomalies detected prior to the L'Aquila earthquake,

Geophysical Research Abstracts Vol. 12, EGU2010-12405-2, 2010, EGU General Assembly, Vienna Austria, 2010.

103. G. Balasis, C. Papadimitriou, and **K. Eftaxias**,

Study of pre-seismic kHz EM emissions by means of complex systems,

Geophysical Research Abstracts Vol. 12, EGU2010-12508, 2010, EGU General Assembly, Vienna Austria, 2010.

104. Balasis, G., I. A. Daglis, A. Anastasiadis, and **K. Eftaxias**,

Investigating magnetospheric dynamics using various complexity measures,

In Modern Challenges in Nonlinear Plasma Physics, Edited by D. Vassiliadis, S. F. Fung, X. Shao, I. A. Daglis, and J. D. Huba, AIP Conference Proceedings 1320, 65–71, doi:10.1063/1.3544339, American Institute of Physics, Melville, NY, 2010

105. M. Kefalas, J. Kopanas, G. Antonopoulos, G. Koulouras, D. Cavouras, **K. Eftaxias**, G. Minadakis, and C. Nomicos,

The Telemetric System of Zante station for measuring the Electromagnetic Variations,

Geophysical Research Abstracts, Vol. 13, EGU2011-4480, 2011, EGU General Assembly 2011.

106. **K. Eftaxias**, G. Minadakis, G. Kopanas, and G. Antonopoulos,

Approach of puzzling features in the study of pre-seismic electromagnetic emissions

Geophysical Research Abstracts, Vol. 13, EGU2011-6432-1, 2011, EGU General Assembly 2011.

107. G. Minadakis, C. Nomicos, J. Stonham, and **K. Eftaxias**,

Is the statistical analysis of regional seismicity a macroscopic reflection of the physical processes in the earthquake source?

Geophysical Research Abstracts, Vol. 13, EGU2011-4090, 2011, EGU General Assembly 2011.

108. **K. Eftaxias** and G. Balasis,

Time series analysis of diverse extreme phenomena: universal features,

109. Balasis , G., R. Donner , J. Donges , A. Radebach , **K. Eftaxias** and J. Kurths,

Transdisciplinary assessment of dynamical complexity in magnetosphere and climate: Towards a unified treatment of the nonlinear dynamics across extreme events,

Data analysis and modeling in Earth sciences - DAMES 2012, 8-10 October 2012 Potsdam, Germany

110. Balasis, G., P. V. Donner, J. F. Donges, A. Radebach, **K. Eftaxias**, and J. Kurths,

Towards a unified study of extreme events using universality concepts and transdisciplinary analysis methods,

Research Abstracts, Vol. 15, 2013-8259, EGU General Assembly 2013.

111. **Eftaxias, K.**, S. M. Potirakis, A. Peratzakis, and C. Nomicos,

Preseismic electromagnetic emissions: demystifying the features of the last stages of fracture process,

Research Abstracts, Vol. 15, 2013-11559, EGU General Assembly 2013.

112. Kalimeris, A., S. M. Potirakis, **K. Eftaxias**, G. Antonopoulos, J. Kopanas, and C. Nomicos,

Investigating the fracture non-linear dynamics through multi-spectral time series analysis of fracture-induced electromagnetic emissions,

Research Abstracts, Vol. 15, 2013-11823, EGU General Assembly 2013.

113. Potirakis, S. M., D. Mouzakis, D. Dimogianopoulos, S. A. Mitilineos, N.-A. Tatlas, M. Rangoussi, **K. Eftaxias**,

Laboratory investigation of failure processes in heterogeneous media,

5th International Conference on NDT, MINDT 2013, Athens Greece, Eugenides Foundation, 2013.

114. S. M. Potirakis, Y. Contoyiannis, J. Kopanas, A. Kalimeris, G. Antonopoulos, A. Peratzakis, **K. Eftaxias**, and C. Nomicos,

Fracture induced electromagnetic emissions: extending laboratory findings by observations at the geophysical scale,

European Geosciences Union General Assembly 2014, Geophysical Research Abstracts Vol. 16, EGU2014-4400, 2014.

115. S. M. Potirakis, Y. Contoyiannis, J. Kopanas, A. Kalimeris, G. Antonopoulos, A. Peratzakis, **K. Eftaxias**, and C. Nomicos,

Statistical similarities of pre-earthquake electromagnetic emissions to biological and economic extreme events
European Geosciences Union General Assembly 2014, Geophysical Research Abstracts Vol. 16, EGU2014-4417, 2014.

116. S. M. Potirakis, **K. Eftaxias**,

Current challenges in the research of the fracture-induced pre-seismic electromagnetic emissions in the MHz and kHz bands,
Proceedings of the 10-th international conference Problems of Geocosmos, St. Petersburg, Petrodvorets, Russia, 2014.

117. S. M. Potirakis, Y. Contoyiannis, J. Kopanas, G. Antonopoulos, C. Nomicos, and **K. Eftaxias**,

Recent fracture induced electromagnetic field measurements revealing an Earth system in second order phase transition before the occurrence of significant earthquakes,
Proceedings of the European Geosciences Union General Assembly 2015, Geophysical Research Abstracts Vol. 17, EGU2015-15257, 2015.

118. S. M. Potirakis, J. Kopanas, G. Antonopoulos, C. Nomicos, and **K. Eftaxias**,

On the critical or geometrical nature of the observed scaling laws associated with the fracture and faulting processes, Proceedings of the European Geosciences Union, General Assembly 2015, Geophysical Research Abstracts Vol. 17, EGU2015-15258, 2015.

119. G. Balasis, S. M. Potirakis, C. Papadimitriou, P. I. Zitis, and **K. Eftaxias**,

Magnetic storms and solar flares: can be analysed within similar mathematical framework with other extreme events?"

Proceedings of the European Geosciences Union General Assembly, Geophysical Research Abstracts Vol. 17, EGU2015-15187, 2015.

120. V. Donner, S. M. Potirakis, G. Balasis, **K. Eftaxias**, J. Kurths,

Temporal correlation patterns in pre-seismic electromagnetic emissions reveal distinct complexity profiles prior to major earthquakes,

Proceedings of the European Geosciences Union General Assembly, Geophysical Research Abstracts Vol. 17, EGU2015-8399, 2015.

121. S.M. Potirakis, G. Balasis, C. Nomicos, **K. Eftaxias**,

Earthquakes: can be analysed within similar mathematical framework with other extreme events?

Proceedings of the 26th General Assembly of the International Union of Geodesy and Geophysics, Prague, Czech Republic, 2015.

122. S.M. Potirakis, J. Kopanas, G. Antonopoulos, G. Balasis, C. Nomicos, **K. Eftaxias**,

A four-stage model of earthquake dynamics by means of precursory high frequency fracture induced electromagnetic emissions,

Proceedings of the 26th General Assembly of the International Union of Geodesy and Geophysics Prague, Czech Republic, 2015.

123. S. M. Potirakis, G. Balasis, **K. Eftaxias**,

“Do the scaling laws associated with fracture and faulting emerge from geometrical heterogeneities or from critical behavior of earthquake dynamics?”,

In Proceedings of the 26th General Assembly of the International Union of Geodesy and Geophysics was held from June 22 to July 2, 2015 in Prague, the Czech Republic.

3

RESEARCH OVERVIEW

1. Studies of Semiconductors.
2. Studies of Thermodynamics of Point Defect
3. Investigation of Natural and Synthetic Crystals by Electron Paramagnetic Resonance
4. Reology of the Earth in terms of thermodynamics of point defects
6. Electromagnetic Induction in the Earth - Focus on the sensitivity of a local area to ULF Seismic Electric Signals
7. Study of ULF Seismic Electric Signals
8. Didactic of Physics

The main research fields now are:

9. Modelling of earthquake preparation process by means of fracture-induced MHz-kHz pre-seismic electromagnetic emissions.

Four-stage model of earthquake generation in terms of fracture-induced electromagnetic emissions

We believe that a “preseismic-EME-” shift in thinking towards basic science can lead to their strict definitions; the thorough understanding of fractured-induced EM precursors in terms of physics is a path to achieve deeper knowledge of the last stages of the EQ preparation process and thus a path to more credible short-term EQ prediction. Based on these ideas, we have

focused, in an appropriately critical spirit, on asking the following crucial questions:

1. How can we recognize a MHz or kHz EM observation as a pre-seismic one?
2. How can we link an individual MHz and kHz EM precursor with a distinctive stage of the EQ preparation? Scientists ought to attempt to link the available various precursory EM observations, which appear one after the other, to the consecutive processes occurring in Earth's crust.
3. How can we identify precursory symptoms in EM observations which signify that the occurrence of the prepared EQ is unavoidable?
4. Are the MHz-kHz EM precursors consistent with others precursors?
5. Are the systematically observed preseismic EME characteristics which are commonly considered as “puzzling features” really “puzzling” ones or are they crucial precursory features of the EQ preparation process? Characteristically: (i) EM silence in all frequency bands appears before the main seismic shock occurrence. (ii) Although strain changes are largest at the time of EQ there are not co-seismic EME. (iii) EM silence is also observed during the aftershock period. (iv) Are the fractured-induced EME, if they really exist, detectable?

A “preseismic EME” shift in thinking towards basic science, which is based on a multidisciplinary analysis, has led to the proposal of a four-stage model for earthquake generation (FSMEG). We think that this model provides answers to the all crucial questions noted in the previous section. The proposed model is summarized as following:

First stage: The initially observed MHz EM anomaly is due to the fracture of the highly heterogeneous system that surrounds the formation of strong brittle and high-strength entities (asperities) distributed along the rough surfaces of the main fault sustaining the system. The MHz EM emission can be described by means of a second-order phase transition in equilibrium.

Such a MHz EM precursor should satisfy the following criteria: (i) The underlying control mechanism regulating the fracto-emission should be a negative feedback one that “kicks” the cracking rate away from extremes, providing adaptability to the system that is the ability to respond to various

external stresses. (ii) It should behave as a **second-order phase transition in equilibrium** including the associated crucial features of “critical epoch” and “symmetry breaking” that should appear one after the other. (iii) The analysis of such a candidate precursor should lead to the conclusion that a truncated Lévy walk type mechanism can organize the heterogeneous system to criticality because of a feedback “dialogue” between the stresses and heterogeneity. (iv) The candidate MHz EME and the associated foreshock seismic activity should constitute two sides of the same coin, namely, the corresponding foreshock seismic activity should behave as a critical phenomenon, as well. (v) The candidate MHz EME should be in consistency with geodetic measurements. (vi) Many precursory anomalies are observed before an EQ, for example, short-lived seismo-ionospheric EM precursors, EM anomalies rooted in preseismic LAI-coupling, precursory anomalies of hydrothermal parameters in the coversphere and atmosphere, TIR anomalies. The generation such a large number of them requires the existence of physical and chemical transformations in a spatially extensive area. The MHz EME precursor includes the “critical window”, i.e., the epoch during which the short-range correlations between the cracking events have been evolved to long-range ones. Thus, the precursors should be observed during the same time with the MHz EM anomaly well before the EQ occurrence, approximately during the last week prior to the main event, and it is found that this really happens. (vii) The MHz EM anomaly, in the frame of critical phenomena, should cease by its nature before the EQ occurrence, namely, when the “non-critical window” emerges after the “critical window” indicating the appearance of “symmetry breaking”, i.e., the transition from the phase of non-directional, almost symmetrical, cracking distribution in a spatially extensive area to a directional localized cracking zone, which has been obstructed along the backbone of strong asperities distributed across the surfaces of the main fault, and the transition from the phase of long-range correlations to that of short-range correlations between the cracking event.

We emphasize that in our approach, the appearance of the MHz EM precursor, by its nature, does not mean that the prepared EQ is unavoidable.

The second stage refers to the final stage of fracture of highly heterogeneous system surrounding the main fault (reflected in the tail of the observed MHz EM radiation) or to the initial stage of fracture of the fault (reflected in the observed initial mild kHz EM radiation). The appearance of such MHz or kHz EM precursor should show that the underlying fracto-EM mechanism undergoes a **tri-critical phase transition**. The appearance of an EM anomaly having tri-critical behavior after the appearance of a MHz EME precursor, which behaves as a second order transition, in a sort time interval, strongly supports the seismogenic origin of the observed two precursors by means of

critical phenomena. The fact that the MHz EM radiation is followed by the strong avalanche-like kHz EM anomaly, which has not any symptom of a second-order phase transition, but, on the contrary, behaves like a **first-order phase transition**, further enhances the existence of the second stage of our model and the seismogenic origin of the associated MHz-kHz EM precursors.

We emphasize that in our approach, the appearance of a such as tri-critical MHz or kHz EM precursor, by its nature, does not mean that the prepared EQ is unavoidable.

The third stage refers to the fracture of family of asperities distributed along the fault sustaining the system, i.e., the stick-slip-like plastic flow stage of EQ preparation (reflected in the finally observed strong avalanche-like kHz EME precursor), implying that the occurrence of the imminent EQ is unavoidable as soon as kHz EME have been observed. This suggestion is supported by laboratory experiments, which suggest that the fractured-induced kHz EME is emerged in the tail of the fracture process, studies by means of percolation theory, which connect this precursor with the formation of the Flat Infinite Cluster disintegrating the system, and finally in terms of synergetic principles of physical mesomechanics, which connect the kHz fracto-electromagnetic activity with the large-scale (macrolevel) fragmentation. Such a kHz EME precursor should satisfy the following criteria: (i) It should include the following crucial features of a catastrophic phenomenon: high organization, high information content, low complexity, strong persistency, existence of clear preferred direction of activities, absence of any footprint of a second order phase transition. (ii) The kHz EME precursor should include universal patterns rooted in the well documented aspect of self-affine nature of faulting and fracture, more precisely, the included sequence of fracture-induced “EM-EQs”, which reflects the fracture of asperities, should be in consistency with the requirement that fracture of a single fault should be a reduced self-affine image of regional seismicity and a magnified image of laboratory seismicity, its profile should follow the persistent fractional Brownian motion (fBm) model, and finally, its roughness should be consistent with the universal indicator of surface fracture. (iii) The morphology of the observed kHz EME precursor should be in consistency with characteristics of the stick-slip-like plastic flow stage of EQ preparation, namely, this should include a sequence of strong avalanche-like EME events, and this sequence should be characterized by a sharp onset and cease. (iv) The characteristics of the kHz EME precursor, in terms of the associated energy, organization and information content, should be in consistency with simultaneous seismological or geodetic data which refer to the fault modeling of the impending EQ.

We emphasize that in the frame of our approach, the appearance of such as kHz EM precursor means that the EQ under preparation is unavoidable, the fracture of asperities distributed across the fault sustaining the system has already been done.

The fourth stage refers to the transition to the last stage of the EQ preparation process, namely, the dynamical slip which results to the fast, even super-shear, reflected in the observed quiescence in all EM frequency bands, which follows the abrupt cease of the emerged strong avalanche-like kHz EME.

Accumulated evidence, in terms of laboratory experiments of EME, numerical studies, elastic moduli, heat-flow paradox, and granular packing's notions, enhance the view that the emergence of the systematically observed EM silence is not a puzzling feature but, on the contrary, the final precursory signal indicating the transition to the stage of the dynamical fast slip.

It is difficult to prove associations between any two events separated in time (such as MHz - kHz EME precursors and EQ). However, we consider that in the case of an emerged sequence of MHz and kHz EM anomalies in a sort time interval, namely, a few days, each of them satisfying all the above mentioned strict criteria in terms of the proposed four stage model of EQ dynamics, it is more difficult to prove their association groundless.

List of selected publications

Eftaxias, K., P. Kapiris, J. Polygiannakis, N. Bogris, J. Kopanas, G. Antonopoulos, A. Peratzakis and V. Hadjicontis,
Signatures of pending earthquake from electromagnetic anomalies.
Geophys. Res. Let., 28, 3321-3324, 2001.

Panin, V., Ye. Deryugin, V. Hadjicontis, C. Mavromatou, and K. Eftaxias,
Scale levels of strain localization and fracture mechanism of LiF single crystals under compression,
Physical Mesomechanics, 4, 21-32, 2001.

Eftaxias, K., P. Kapiris, E. Dologlou, J. Kopanas, N. Bogris, G. Antonopoulos, A. Peratzakis and V. Hadjicontis,
EM anomalies before the Kozani earthquake: A study of their behavior through laboratory experiments,
Geophys. Res. Let., 29, 10. 1029, 2002.

Eftaxias, K., P. Frangos, P. Kapiris, J. Polygiannakis, J. Kopanas, A. Peratzakis, P. Skountzos, and D. Jaggard,

Review-Model of Pre-Seismic Electromagnetic Emissions in Terms of Fractal-Electrodynamics.

Fractals, 12, 243 - 273, 2004.

Contoyiannis, Y., F. Diakonos, P. Kapiris, A. Peratzakis, K. Eftaxias,
Intermittent Dynamics of Critical Pre-seismic Electromagnetic Fluctuations,
Physics and Chemistry of the Earth, 29, 397 - 408, 2004.

Kapiris, P., G. Balasis, J. Kopanas, G. Antonopoulos, A. Peratzakis and K.
Eftaxias,

Scaling Similarities of Multiple Fracturing of Solid Materials,
Nonlinear Processes in Geophysics, 11, 137 - 151, 2004.

Kapiris, P., K. Eftaxias and T. Chelidze,

Electromagnetic Signature of Prefracture Criticality in Heterogeneous Media.
Physical Review Letters, 92(6), 065702, 2004.

Contoyiannis, Y., P. Kapiris and K. Eftaxias,

A Monitoring of a Pre-Seismic Phase from its Electromagnetic Precursors,
Physical Review E, 71, 061123-1 - 061123-14, 2005.

Karamanos, K., Dakopoulos, D., Aloupis, K., Peratzakis, A., Athanasopoulou,
L., Nikolopoulos, S., Kapiris, P., Eftaxias, K.,

Pre-seismic electromagnetic signals in terms of complexity,
Physical Review E., 74, 016104-1/21, 2006.

Eftaxias, K., Panin, V.E. and Deryugin Ye Ye,

Evolution-EM signals before earthquakes in terms of meso-mechanics and
complexity,

Tectonophysics, 431, 273-300, 2007.

Papadimitriou, K., M. Kalimeri, and K. Eftaxias,

Nonextensivity and universality in the earthquake preparation process,
Physical Review E, 77, 36101, 2008.

Contoyiannis, Y., and K. Eftaxias,

Tsallis and Levy statistics in the preparation of an earthquake,
Nonlinear Processes in Geophysics, 15, 379-388, 2008.

Eftaxias, K.,

Footprints of nonextensive Tsallis statistics, selfaffinity and universality in the
preparation of the L'Aquila earthquake hidden in a pre-seismic EM emission,
Physica A, 389, 133-140, 2009.

Contoyiannis, Y., C. Nomicos, J. Kopanas, G. Antonopoulos, L. Contoyianni, and K. Eftaxias,
Critical features in electromagnetic anomalies detected prior to the L'Aquila earthquake,
Physica A, 389, 499-508, 2010.

Eftaxias, K., and S. Potirakis,
Current challenges for pre-earthquake electromagnetic emissions: shedding light from micro-scale plastic flow, granular packings, phase transitions and self-affinity notion of fracture process,
Nonlin. Processes Geophysics, 20, 771–792, 2013.

Balasis, G., R. V. Donner, S. M. Potirakis, J. Runge, C. Papadimitriou, I. A. Daglis, K. Eftaxias, and J. Kurths,
Statistical Mechanics and Information-Theoretic Perspectives on Complexity in the Earth System,
Entropy, 15, 4844-4888, 2013 (Review Article).

Potirakis, S. M., A. Karadimitrakis, and K. Eftaxias
Natural time analysis of critical phenomena: The case of pre-fracture electromagnetic emissions,
Chaos, 23, 023117/1-14, 2013.

Potirakis, S. M., P. Zitis, and K. Eftaxias
Dynamical analogy between economical crisis and earthquake dynamics within the nonextensive statistical mechanics framework,
Physica A, 392, 2940-2954, 2013.

Contoyiannis, Y., S. M. Potirakis, K. Eftaxias, and L. Contoyianni,
Tricritical crossover in earthquake preparation by analyzing preseismic electromagnetic emissions,
Journal of Geodynamics, 84, 40-54, 2015.

Reik, D., S. M. Potirakis, G. Balasis, K. Eftaxias, and J. Kurths
Temporal correlation patterns in pre-seismic electromagnetic emission reveal distinct complexity profiles prior to major earthquakes,
Physics and Chemistry of the Earth, in press, 2015.

Potirakis, S.M., Contoyiannis, Y, Nikolaos S. Melis, John Kopanas, George Antonopoulos, Balasis, Charalampos Kontoes , Constantinos Nomicos, KonstantinosEftaxias

Recent seismic activity at Cephalonia (Greece): a study through candidate electromagnetic precursors in terms of non-linear dynamics
Nonlin. Processes Geophys., 23, 223–240, 2016

10. A unified approach of extreme biological, geophysical and economic phenomena by means of complexity and universality - the Earth's crust experiences an epileptic-seizure-type crisis before the earthquake occurrence.

Authors have suggested that dynamics of EQs and Epileptic Seizures (ESs) can be analyzed within similar mathematical frameworks. In the frame of this suggestion Osorio et al. [2010] in a pioneering work have recently shown that that a dynamical analogy supported by scale-free statistics exists between ESs and EQs, analyzing populations of different ESs and EQs, respectively. A question effortlessly arising is whether a dynamical analogy also exists between ESs and EQs at the level of a single fault / seizure activation, namely, whether a dynamical analogy may exist for the ways in which firing neurons / fracture events produce a single ES / EQ. We have shown that such a dynamical analogy really exists: the seizures can be considered as quakes of the brain [Osorio et al., 2010] but also vice-versa the EQs can be considered as ESs of the Earth's crust. This crisis happens during the third-stage of the proposed EQ generation model, namely, during the stick-slip-like plastic flow stage of EQ preparation, as it is reflected in the associated kHz EME.

The above-mentioned findings are consistent with the basic notion of the relatively new field of complexity that a dynamic analogy among the extreme events of various complex systems exists, which may be considered as a footprint of universality among them. The field of study of complex systems considers that the dynamics of complex systems are founded on universal principles that may use to describe disparate problems. Several authors have suggested that earthquake dynamics and the dynamics of economic (financial) systems can be analyzed within similar mathematical frameworks. We apply concepts of the nonextensive statistical physics, on time-series data of observable manifestations of the underlying complex processes ending up to these different extreme events to support the suggestion that a dynamical analogy exists between a financial crisis (in the form of share or index price collapse) and a single earthquake. The obtained results imply the existence of a dynamic analogy between earthquakes and economic crises, which moreover follow the dynamics of magnetic storms and solar flares.

List of selected publications

Nikolopoulos, S., P. Kaperis, K. Karamanos and **K. Eftaxias**.
A unified approach of catastrophic events,
Natural Hazards and Earth System Sciences, 4, 615-637, 2004.

Li, X., J. Polygiannakis, P. Kapiris, A Peratzakis, K. Eftaxias and X. Yao,
Fractal spectral analysis of pre-epileptic seizures in terms of criticality.
Journal of Neural Engineering 2, 1-6, 2005.

Kapiris, P., J. Polygiannakis, X. Li, X. Yao and K. Eftaxias,
Similarities in precursory features in seismic shocks and epileptic seizures,
Europhysics Letters 69, 657-663, 2005.

Eftaxias, K., P.Kapiris, G. Balasis, A. Peratzakis, K. Karamanos, J. Kopanas, G.
Antonopoulos, and K. Nomicos,
A Unified Approach to Catastrophic Events: From the Normal State to
Geological or Biological Shock in Terms of Spectral Fractal and Nonlinear
Analysis,
Natural Hazards and Earth System Sciences, 6, 205-228, 2006.

Balasis, G., I. Daglis, C. Papadimitriou, M. Kalimeri, A. Anastasiadis, and K.
Eftaxias,
Dynamical complexity in Dst time series using non-extensive Tsallis entropy,
Geophysical Research Letters, L14102, doi:10.1029/2008GL034743, 2008.

Balasis, G., I. Daglis, C. Papadimitriou, M. Kalimeri, A. Anastasiadis, and K.
Eftaxias,
Investigating dynamical complexity in the magnetosphere using various
entropy measures,
Journal of Geophysical Research, DOI:10.129, 2009.

Balasis, G., C. Papadimitriou, I. A. Daglis, A. Anastasiadis, L.
Athanasopoulou, and K. Eftaxias,
Signatures of discrete scale invariance in Dst time series
Geophysical Research Letters, 38, L13103, doi:10.1029/2011GL048019, 2011

Eftaxias, K., G. Minadakis, S. Potirakis, and G. Balasis,
Dynamical analogy between epileptic seizures and seismogenic
electromagnetic emissions by means of nonextensive statistical mechanics,
Physica A, 392, 497–509, 2013

Balasis, G., R. V. Donner, S. M. Potirakis, J. Runge, C. Papadimitriou, I. A.
Daglis, K. Eftaxias, and J. Kurths,
Statistical Mechanics and Information-Theoretic Perspectives on Complexity
in the Earth System,
Entropy, 15, 4844-4888, 2013 (Review Article).

Potirakis, S. M., P. Zitis, and K. Eftaxias

Dynamical analogy between economic crisis and earthquake dynamics within the nonextensive statistical mechanics framework,
Physica A, 392, 2940-2954, 2013.

Contoyiannis, Y. F., S. M. Potirakis, and K. Eftaxias,
The Earth as a living planet: human-type diseases in the earthquake preparation process,
Nat. Hazards Earth Syst. Sci., 13, 125–139, 2013.

11. Study of ULF seismo-ionospheric- electromagnetic perturbations in terms of criticality.

Precursory ultra-low-frequency (ULF) magnetic variations are analyzed using the methods of critical fluctuations and Natural time. The application of these two methods indeed verifies the existence of criticality in the ULF magnetic fields a few days to one week before the occurrence of the main shock.

List of selected publications

Hayakawa, M., A. Schekotov, S. M. Potirakis, and K. Eftaxias
Criticality features in ULF magnetic fields prior to the 2011 Tohoku earthquake
Proc. Jpn. Acad., Series B, 91, 25-30, 2015.

Hayakawa, M., Alexander Schekotov, Stelios M. Potirakis, Konstantinos Eftaxias, Qi Li, Tomokazu Asano,
An Integrated Study of ULF Magnetic Field Variations in Association with the 2008 Sichuan Earthquake, on the Basis of Statistical and Critical Analyses,
Open Journal of Earthquake Research 04(03), 85-93, 2015.

Contoyiannis, Y., S., M. Potirakis, K. Eftaxias, M. Hayakawa, A. Schekotov,
Intermittent criticality revealed in ULF magnetic fields prior to the 11 March 2011 Tohoku earthquake (Mw=9),
Physica A, 452, 19-28, 2016.

Potirakis, S, K. Eftaxias, A. Schekotov, H., Yamaguchi, M. Hayakawa,
Criticality features in ULF magnetic fields prior to the 2013 Kobe earthquake
Annals of Geophysics, 59, 3, S0317, 1-15, 2016.