

Study of minima of the fluctuations of the order parameter of seismicity using GCMT catalogue in global scale.

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It has been recently shown [1,2] that earthquakes of magnitude M greater or equal to 7 are globally correlated. The identification of this correlation became possible when studying the variance κ_1 of natural time which has been proposed as an order parameter for seismicity[3,4]. In the present study, we focus on the behaviour of the fluctuations of κ_1 before major earthquakes using the Global Centroid Moment Tensor catalogue for a magnitude threshold $M_{thres}=5.0$ as in Ref.[5]. Natural time analysis reveals that distinct minima of the fluctuations κ_1 of seismicity appear within almost five and a half months on average before all major earthquakes of magnitude larger than $M8.4$. This phenomenon corroborates the recent finding [6] that similar minima of seismicity order parameter fluctuations had been observed before all major shallow earthquakes in Japan. Finally, we examine the statistical significance of the results by using ROC graphs [7,8] and the proposed prediction method has a p -value to occur by chance well below 0.1%. The hit rate is 100% with a false alarm rate only 6.67%. An attempt to lower the target earthquake magnitude threshold will be also presented.

REFERENCES

- [1] N. V. Sarlis, *Phys. Rev. E* **84**, 022101 (2011).
- [2] N. V. Sarlis and S.-R. G. Christopoulos, *Chaos* **22**, 023123 (2012)
- [3] P. A. Varotsos, N. V. Sarlis, and E. S. Skordas, *Practica of Athens Acad.* **76**, 294 (2001).
- [4] P. A. Varotsos, N. V. Sarlis, and E. S. Skordas, *Phys. Rev. E* **66**, 011902 (2002).
- [5] N.V. Sarlis, S.-R. G. Christopoulos, and E. S. Skordas, *Chaos* **25**, 063110 (2015)
- [6] N. V. Sarlis et al., *Proc. Natl. Acad. Sci. U.S.A.* **110**, 13734 (2013)
- [7] T. Fawcett, *Pattern Recognit. Lett.* **27**, 861 (2006).
- [8] N. V. Sarlis and S.-R. G. Christopoulos, *Comput. Phys. Commun.* **185**, 1172 (2014).