

# Author's Accepted Manuscript

Detecting precursory patterns to enhance earthquake prediction in Chile

E. Florido, F. Martínez-Álvarez, A. Morales-Esteban, J. Reyes, J.L. Aznarte-Mellado



PII: S0098-3004(14)00280-5  
DOI: <http://dx.doi.org/10.1016/j.cageo.2014.12.002>  
Reference: CAGEO3472

To appear in: *Computers and Geosciences*

Received date: 23 October 2014

Revised date: 4 December 2014

Accepted date: 10 December 2014

Cite this article as: E. Florido, F. Martínez-Álvarez, A. Morales-Esteban, J. Reyes and J.L. Aznarte-Mellado, Detecting precursory patterns to enhance earthquake prediction in Chile, *Computers and Geosciences*, <http://dx.doi.org/10.1016/j.cageo.2014.12.002>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# Detecting precursory patterns to enhance earthquake prediction in Chile

*E. Florido*

*Department of Artificial Intelligence, Universidad Nacional de Educación a Distancia – UNED, Spain*  
*e-mail: eflorido1@alumno.uned.es*

*F. Martínez-Álvarez<sup>1</sup>*

*Department of Computer Science, Pablo de Olavide University of Seville, Spain*  
*e-mail: fmaralv@upo.es*

*A. Morales-Esteban*

*Department of Building Structures and Geotechnical Engineering, University of Seville, Spain,*  
*e-mail: ame@us.es*

*J. Reyes*

*TGT-NT2 Labs, Chile*

*e-mail: daneel@geofisica.cl*

*J. L. Aznarte-Mellado*

*Department of Artificial Intelligence, Universidad Nacional de Educación a Distancia – UNED, Spain*  
*e-mail: jlaznarte@dia.uned.es*

**Abstract** The prediction of earthquakes is a task of utmost difficulty that has been widely addressed by using many different strategies, with no particular good results thus far. Seismic time series of the four most active Chilean zones, the country with larger seismic activity, are analyzed in this study in order to discover precursory patterns for large earthquakes. First, raw data are transformed by removing aftershocks and foreshocks, since the goal is to only predict main shocks. New attributes, based on the well-known  $b$ -value, are also generated. Later, these data are labeled, and consequently discretized, by the application of a clustering algorithm, following the suggestions found in recent literature. Earthquakes with magnitude larger than 4.4 are identified in the time series. Finally, the sequence of labels acting as precursory patterns for such earthquakes are searched for within the datasets. Results verging on 70% on average are reported, leading to conclude that the methodology proposed is suitable to be applied in other zones with similar seismicity.

**Key words:** Seismic time series; earthquake prediction; pattern discovery; clustering.

## 1 Introduction

Chile stands out as the most seismic country in the world, as evidenced by the fact that in the last 450 years in the Chilean mainland a total of 38 earthquakes of a magnitude larger than 7.5  $M_s$  have taken place; 17 of them resulted in tsunamis [3].

Moreover, the greatest magnitude earthquake occurred in history around the world and known as *Earthquake of Valdivia* (May 22, 1960) took place in Chile and reached a magnitude of 9.5  $M_s$ , producing a 10 meters high tsunami and reaching Hawaii [4].

---

<sup>1</sup>Corresponding author

Download English Version:

<https://daneshyari.com/en/article/6922633>

Download Persian Version:

<https://daneshyari.com/article/6922633>

[Daneshyari.com](https://daneshyari.com)