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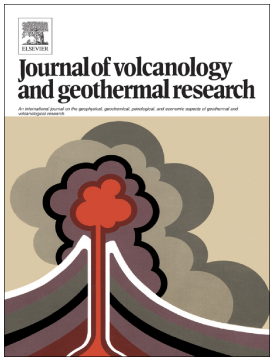

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Shengwang Hao, Hang Yang, Derek Elsworth

PII: S0377-0273(17)30131-2
DOI: doi: 10.1016/j.jvolgeores.2017.07.009
Reference: VOLGEO 6157

To appear in: *Journal of Volcanology and Geothermal Research*

Received date: 26 February 2017
Revised date: 14 July 2017
Accepted date: 15 July 2017

Please cite this article as: Shengwang Hao, Hang Yang, Derek Elsworth , An accelerating precursor to predict "time-to-accelerating-failure" in creep and volcanic eruptions, *Journal of Volcanology and Geothermal Research* (2017), doi: 10.1016/j.jvolgeores.2017.07.009

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ACCEPTED MANUSCRIPT

An accelerating precursor to predict "time-to-accelerating-failure" in creep and volcanic eruptions

Shengwang Hao[1,2,*], Hang Yang, Derek Elsworth[3,*]

[1]School of Civil Engineering and Mechanics, Yanshan University, Qinhuangdao, China

[2]The State Key Laboratory of Nonlinear Mechanics, Institute of Mechanics, Chinese Academy of Science, Beijing, China

[3]Energy and Mineral Engineering, Geosciences, G[3] Center, and EMS Energy Institute, Pennsylvania State University, University Park, Pennsylvania, USA.

*Correspondence to: elsworth@psu.edu; haoshengwang@gmail.com

Abstract

Real-time prediction by monitoring of the evolution of response variables is a central goal in predicting rock failure. A linear relation $\dot{\Omega}\ddot{\Omega}^{-1} = C\left(t_f - t\right)$ has been developed to describe the time to failure, where Ω represents a response quantity, C is a constant and t_f represents the failure time. Observations from laboratory creep failure experiments and precursors to volcanic eruptions are used to test the validity of the approach. Both cumulative and simple moving window techniques are developed to perform predictions and to illustrate the effects of data selection on the results. Laboratory creep failure experiments on granites show that the linear relation works well during the final approach to failure. For blind prediction, the simple moving window technique is preferred because it always uses the most recent data and excludes effects of early data deviating significantly from the predicted trend. When the predicted results show only small fluctuations, failure is imminent.

Keywords: Volcanic eruptions; Time-to-accelerating-failure; Creep; Accelerating precursor.

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