28*th* IUGG Conference on Mathematical Geophysics, June 7-11, 2010, Pisa, Italy
Session 4: Brittle deformation and computational seismology

The 2009 L'Aquila (Central Italy) seismic sequence as a chaotic process and implications for main shock predictability

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Keywords: *seismic sequence; chaotic process; accelerated strain release; nonlinear prediction.*

In this presentation we shall demonstrate that the seismic sequence of foreshocks culminating with the recent Mw =6.3 main shock on April 6, 2009 in L'Aquila (Central Italy) evolved as a chaotic process. To do this, we apply a nonlinear retrospective prediction to L'Aquila seismic sequence and look at the behaviour in time of the error between predicted time and true occurrence of the main shock when gradually increasing parts of the sequence are considered. This is a typical nonlinear approach which is quite powerful to detect chaos in relatively short time series. The method of prediction is based on the Accelerated Strain Release (ASR) analysis that considers magnitudes and occurrence times of foreshocks. We find that i) the prediction error decays exponentially with a time constant of about 10 days and ii) at around 6 days before the main shock, ASR is quite powerful for anticipating the time of occurrence with an uncertainty of about a day. Due to their retrospective characteristics, the latter results could be affected by changes on some a-priori parameters used in the ASR technique. However, since the error behaviour in time should not depend, in principle, on the type of prediction technique, we consider these results to be strong evidence that the studied sequence of foreshocks is a chaotic process with K-entropy of about 0.1/day.