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On the statistical analysis of maximal magnitude

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We show how the maximum expected magnitude within a time horizon $[0, T]$ may be estimated from earthquake catalog data within the context of truncated Gutenberg-Richter statistics. We present the results in a frequentist and in a Bayesian setting. Instead of deriving point estimations of this parameter and reporting its performance in terms of expectation value and variance, we focus on the calculation of confidence intervals based on an imposed level of confidence α. We present an estimate of the maximum magnitude within an observational time interval T in the future, given a complete earthquake catalog for a time period T_c in the past and optionally some paleoseismic events. We argue that from a statistical point of view the maximum magnitude in a time window is a reasonable parameter for probabilistic seismic hazard assessment, while the commonly used maximum possible magnitude for all times does almost certainly not allow the calculation of useful (i.e. non-trivial) confidence intervals. In the context of an unbounded GR law we show, that Jeffreys invariant prior distribtution yields normalizable posteriors. The predictive distribution based on this prior is explicitely computed.