

## **The earthquake history in a fault zone tells us almost nothing about $m_{\max}$**

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In the present study, we summarize and evaluate the endeavors from recent years to estimate the maximum possible earthquake magnitude  $m_{\max}$  from observed data. In particular, we use basic and physically motivated assumptions in order to identify “best cases” and “worst cases” in terms of lowest and highest degree of uncertainty of  $m_{\max}$ . We demonstrate in a general framework that earthquake data and earthquake proxy data recorded in a fault zone, provide almost no information about  $m_{\max}$ , unless reliable and homogeneous data of a long time interval including several earthquakes with magnitude close to  $m_{\max}$  are available. Even if detailed earthquake information from some centuries including historic and paleo-earthquakes are given, only very few, namely the largest events, will contribute at all to the estimation of  $m_{\max}$ , and this results in unacceptably high uncertainties. As a consequence, estimators of  $m_{\max}$  in a fault zone, which are based solely on earthquake-related information from this region, have to be dismissed.