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Modern methods applied to historical seismograms: Perspective and examples

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The long recurrence times characteristic of major earthquakes (typically one to several centuries) result in severe undersampling of the Earth's seismicity as documented by digital seismic networks (at most 40 years old), or even their immediate predecessor, the WWSSN (53 years old). For this reason, historical records of large earthquakes (typically from 1900 to 1962) can still contain unsuspected, but crucial information which can be extracted using variations of modern techniques routinely applied to digital data. We present a review of these algorithms, notably the PDFM moment tensor inversion and the application of energy- moment discriminants. We will review several examples, including the resolution of the "twin eights" of 17 August 1906, the quantification of the slowness parameters of the 1932 Manzanillo and 1947 Hikurangi tsunami earthquakes, and focal mechanism solutions for two major plate boundary events, on 01 May 1915 in the Kuril Islands and 26 June 1941 in the Andaman Islands, which are both shown to be incompatible with a shallow-angle thrust geometry. Application to large normal faulting intraplate earthquakes (e.g., Sanriku, 02 March 1933) is particularly important given the probably longer recurrence times of such events, which are thus even more undersampled by modern records.