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Systematic survey of high-resolution b-value imaging along Californian fault lines: can we map more asperities beyond Parkfield?

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One of the remarkable properties of the Parkfield section of the San Andreas fault is the fact that the observed strong spatial variations in the relative frequency-magnitude distribution, or b-value, are highly stable with time throughout a seismic cycle. This can be interpreted as a sign that the stressing regimes associated with locked (b < 0.5) and creeping sections (b > 1.2) are largely stationary, not changed by moderate events such as the 2004 M6 'Parkfield' event. In this study, we re-analyze first of all the micro-seismicity data from the Parkfield section of the San Andreas fault, with the aim of establishing a conceptual model and testable hypothesis of the relationship between b-value and future rupture areas. We improve existing techniques for high resolution imaging of the b-value by adding a filter that highlights along a fault projection regions of significantly different and highly linear frequency–magnitude distribution. We then apply this mapping technique to all Californian faults documented in the UCERF model, providing us with a systematic survey of b-values along fault surfaces. Our goals are to 1) Evaluate if imaged regions of significantly higher and lower b-values correspond with the knowledge of past M6+ events and the knowledge on locked and creeping sections, 2) Develop a testable forecast model that uses the b-value imaging along faults as a basis for forecasting earthquake occurrence rates.