2004 Fall Meeting
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AN: **S24A-08**
TI: Constraints on Dynamic Triggering from very Short term Microearthquake Aftershocks at Parkfield
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AB: The study of microearthquakes helps bridge the gap between laboratory experiments and data from large earthquakes, the two disparate scales that have contributed so far to our understanding of earthquake physics. Although they are frequent, microearthquakes are difficult to analyse. Applying high precision relocation techniques, Rubin and Gillard (2000) observed a pronounced asymmetry in the spatial distribution of the earliest and nearest aftershocks of microearthquakes along the San Andreas fault (they occur more often to the NW of the mainshock). It was suggested that this could be related to the velocity contrast across the fault. Preferred directivity of dynamic rupture pulses running along a bimaterial interface (to the SE in the case of the SAF) is expected on theoretical grounds. Our numerical simulations of crack-like rupture on such interfaces show a pronounced asymmetry of the stress histories beyond the rupture ends, and suggest two possible mechanisms for the observed asymmetry: First, that it results from an asymmmetry in the static stress field following arrest of the mainshock (closer to failure to the NW), or second, that it is due to a short-duration tensile pulse that propagates to the SE, which could reduce the number of aftershocks to the SE by dynamic triggering of any nucleation site close enough to failure to have otherwise produced an aftershock. To distinguish betwen these mechanisms we need observations of dynamic triggering in microseismicity. For small events triggered at a distance of some mainshock radii, triggering time scales are so short that seismograms of both events overlap. To detect the occurrence of compound events and very short term aftershocks in the HRSN Parkfield archived waveforms we have developed an automated search algorithm based on empirical Green's function (EGF) deconvolution. Optimal EGFs are first selected by the coherency of the cross-component convolution with respect to the target event. Then Landweber deconvolution is applied. The resulting source time functions (STF) are often noisy and corrupted by sidelobes due to finite frequency band of the data. They are scanned for subevents, exploiting the consistency of the occurrence of secondary peaks (outliers among the STF maxima) throughout the 30 network channels. Subevents are picked, in many cases to sub-sample precision, by waveform fitting using all the EGFs available. We have detected a total of 30 such multiple or compound eve nts with inter-event delays of less than one second, in a catalog that spans over 10 years of seismicity in Parkfield (2300 cataloged events in our working box). Most of them are not detectable by visual inspection of the seismograms. In most cases, their timing and relative location are consistent with dynamic triggering. Also, the seismicity rate at very early times (less than 0.1 seconds) seems higher than expected from the longer term aftershock seismicity rate observed in the region. This points to dynamic effects in very short term aftershock decay. Finally, more of these immediate aftershocks occur to the NW, as with the earlier NCSN results, although the number of events analysed so far is small. We will discuss these and ongoing observations from the standpoint of dynamic rupture on bimaterial interfaces, supported by numerical simulations.
DE: 7260 Theory and modeling
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DE: 7209 Earthquake dynamics and mechanics
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SC: Seismology [S]
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