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Relationship between spatial variations in active creep and large magnitude hanging wall earthquakes associated with the Alto Tiberina low angle normal fault, central Italy.

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The Alto Tiberina fault (ATF) in central Italy is a rare instance of a low angle normal fault that appears to be actively creeping at shallow to mid-crustal depths. While conventional Anderson earthquake mechanics dictate that these faults should lock up under extension, recent studies using GPS velocity data and simple fault models suggest that the ATF accommodates slip by aseismic creep below $\sim$4 km depth in the latitude range of 43.2 N to 43.5 N. This creeping section of the ATF is well imaged and there are no instrumentally recorded large magnitude earthquakes in the hanging wall. There is no evidence for active fault creep north and south of the creeping section where large hanging wall earthquakes have occurred. We use geodetically determined images of fault creep and earthquake focal mechanisms data to explore the stress transfer relationships between the creeping section of the ATF and adjacent portions of the fault zone, which appear to be locked. In one interpretation, hanging wall earthquakes occur as a result of strain accumulation caused by variations in creep on the low angle normal fault. An alternative explanation is that creep on the low angle fault has been inhibited in the vicinity of the large magnitude hanging wall earthquakes. These spatial relationships notwithstanding, the resolution of the imaged pattern of creep is relatively low. A borehole strainmeter network would provide unprecedented temporal resolution of aseismic creep transients that would help to evaluate the possible relationships between hanging wall stress accumulation and stress sensitive creep. The combination of modeling and seismic/geodetic monitoring with a new borehole strainmeter array would also help to decipher the fault structure, earthquake mechanisms, and seismic risk in a populated area.