Across-strike variations of fault slip-rates constrained using in-situ cosmogenic 36Cl concentrations.

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It is important to constrain the spatial distribution of strain-rate in deforming continental material because this underpins calculations of continental rheology and seismic hazard. To do so, it is becoming increasingly common to use combinations of GPS and historical and instrumental seismicity data to constrain regional strain-rate fields. However, GPS geodetic sites, whether permanent or campaign stations, tend to be widely-spaced relative to the spacing of active faults with known Holocene offsets. At the same time, the interpretation of seismicity data can be difficult due to lack of historical seismicity in cases where local fault recurrence intervals are longer than the historical record. This causes uncertainty on how regional strain-rates are partitioned in time and space, and hence with uncertainty regarding calculations of continental rheology and seismic hazard. To overcome this issue, we have gained high temporal resolution slip-rate histories for three parallel faults using in situ ³⁶Cl cosmogenic dating of the exposure of three parallel normal fault planes that have been progressively exhumed by earthquakes. We study the region around Athens, central Greece, where there also exists a relatively-dense GPS network and extensive records of instrumental and historical earthquakes. This allows to compare regional, decadal strain-rates measured with GPS geodesy with strain-rates across the faults implied by slip since ~40,000 years BP. We show that faults have all had episodic behaviour during the Holocene, with alternating earthquake clusters and periods of quiescence through time. Despite the fact that all three faults have been active in the Holocene, each fault slips in discrete time intervals lasting a few millennia, so that only one fault accommodates strain at any time. We show that magnitudes of strain-rates during the high slip-rate episodes are comparable with the regional strain-rates measured with GPS (fault strain-rates are 50-100% of the value of GPS regional strain-rate). Thus, if the GPS-derived strain-rate applies over longer time intervals, it appears that single faults dominate the strain-accumulation at any given time, with crustal deformation and seismic hazard localised within a distributed network of faults.