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Millennial strain partitioning revealed by ^{36}Cl cosmogenic data on active bedrock fault scarps from Abruzzo, Italy

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In zones of distributed continental faulting, it is critical to understand how slip is partitioned onto brittle structures over both long-term millennial time scales and shorter-term individual earthquake cycles. Measuring earthquake slip histories on different timescales is challenging due to earthquake repeat-times being longer or similar to historical earthquake records, and a paucity of data on fault activity covering millennial to Quaternary scales in detail. Cosmogenic isotope analyses from bedrock fault scarps have the potential to bridge the gap, as these datasets track the exposure of fault planes due to earthquakes with millennial resolution. In this presentation, we present new ^{36}Cl data combined with historical earthquake records to document orogen-wide changes in the distribution of seismicity on millennial timescales in Abruzzo, central Italy.

Seismic activity due to extensional faulting was concentrated on the northwest side of the mountain range during the historical period, or since approximately the 14^{th} century. Seismicity is more limited on the southwest side of Abruzzo during historical times. This pattern has led some to suggest that faults on the southwest side of Abruzzo are not active, however clear fault scarps cutting Holocene-aged slopes are well preserved across the whole of the orogen. These scarps preserve an excellent record of Late Pleistocene to Holocene earthquake activity, which can be quantified using cosmogenic isotopes that track the exposure of the bedrock fault scarps. ^{36}Cl accumulates in the fault scarps as the plane is progressively exhumed by earthquakes and the concentration of ^{36}Cl measured up the fault plane reflects the rate and patterns of slip. We utilise Bayesian modelling techniques to estimate slip histories based on the cosmogenic data. Each sampling site is carefully characterised using LiDAR and GPR to ensure that fault plane exposure is due to slip during earthquakes and not sediment transport processes.

In this presentation we will focus on new data from faults located across-strike in Abruzzo. Many faults in Abruzzo demonstrate slip rate variability on millennial timescales, with relatively fast slip interspersed between quiescent periods. We show that heightened activity is co-located and spatially migrates across Abruzzo over time. We highlight the importance of understanding this dynamic fault behaviour of migrating seismic activity, and in particular how our research is relevant to the 2016 Amatrice-Vettore seismic sequence in central Italy.