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Slip rate variability over the Holocene period in the middle Aterno fault system (Italy), retrieved from in situ ^{36}Cl cosmogenic nuclide dating of exhumed fault-plane.

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Numerous numerical modeling studies have described and quantified non-stochastic spatio-temporal variations of earthquake occurrences within fault-networks, such as temporal clustered earthquakes or fault synchronization. However, very few long-enough paleoseismological and geological records are available to test those models against well-constrained dataset and thus account for such variability in the fault behavior. The prerequisites for improving our understanding of fault-rupture processes and thus our capacity to better assess seismic hazard are to acquire paleoseismological records that enable to derive both long-term slip-rate and short-term variability, on a large population of faults and/or within a fault system. These conditions met in Central Apennines, an extensional province where substantial paleoseismological dataset accurately described the Holocene seismic history of a dense network of normal faults. In this study we use ^{36}Cl in situ cosmogenic nuclide to retrieve the seismic history of 3 faults belonging to the Middle Aterno fault system, from north to south: the Bazzano fault, the Roccapreturo fault and the Sulmona fault, a portion of which ruptured during the 2009 L'Aquila earthquake in Italy. We use a new modeling approach to determine the age and slip of past seismic events from the ^{36}Cl concentration profiles. This model is based on an inverse approach and uses an optimization algorithm enabling all the parameter space (number of events, age and slip of events, pre-exposure) to be explored without a priori constraints (see Tesson et al. in session TS4.2/NH4.16/SM3.8). Using this new approach, we precisely determine the slip events occurrences over the Holocene period of those three faults. The results indicate that the three studied faults have ruptured between 4.5 and 5.5 ka, while the southernmost part of the system has also ruptured between at 1.5-3 ka (Sulmona fault and southern segment of Roccapreturo). Those results are in agreement with the ages of seismic events retrieved from trenching paleoseismological studies performed on fault segments also belonging to the Middle Aterno fault system. Those results thus suggest that the 50 km long fault-system (from the Paganica fault to the Sulmona fault) entirely ruptured in a sequence of events between 4.5 and 5.5 ka. During these periods of intense seismic activity, the associated slip-rate increases up to 3 mm/yr on those faults. Those results shed new light about the seismogenic potential of this fault-system and bring crucial data for the seismic hazard assessment of this area.