Quantifying the slip over various time scales on an active normal fault in the Apennines (Italy): the Liri fault from paleoearthquakes to long-term slip rate

Magali Riesner*[1], Lucilla Benedetti[1], Stéphane Baize[2], Stefano Pucci[3], Matthieu Ferry[4], Stéphanie Gautier[4], Régis Braucher[1], Jules Fleury[1], Hervé Jomard[2], Stéphane Mazzotti[4], and Fabio Villani[3]

[1]Centre européen de recherche et d'enseignement des géosciences de l'environnement – Institut de Recherche pour le Développement, Aix Marseille Université, Collège de France, Institut National des Sciences de l'Univers, Centre National de la Recherche Scientifique, Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement – France

[2]IRSN – Institut de Radioprotection et de Sûreté Nucléaire – France

[3]Istituto Nazionale di Geofisica e Vulcanologia - Sezione di Roma – Italie

[4]Géosciences Montpellier – Institut National des Sciences de l'Univers, Centre National de la Recherche Scientifique, Université des Antilles, Université de Montpellier – France

Résumé

Studies along long-term fault escarpment have revealed a spatio-temporal slip variability. Understanding this spatial and temporal slip variability on individual faults and over a complex fault system provide a better knowledge of co-seismic rupture extents, essential for estimating past earthquakes magnitude and for seismic hazard assessment.
Up to now, most studies have focused on a timeframe over few seismic cycles, making it difficult to apprehend the rupture barriers persistence and cumulative slip distribution. Here, we aim at quantifying the slip variability over several timescales ranging from a few months to a few million years on the same fault.

Our study focusses on the ~50 km-long Liri fault, SW of the Fucino basin. The fault is located at the contact between Cretaceous limestone and patches of Quaternary deposits locally covering Mio-Pliocene flysch sediments. Detailed mapping of the fault trace on high-resolution Digital Elevation Model (DEM) from UAV-acquired images, Pleiades images and Lidar together with field observations revealed changes in the morphological expression of the fault north and south of an important wind gap located at Capistrello. To the north, the faut trace is ~16 km-long located on the eastern side of ~2km-wide limestone ridge, reaching ~1300m asl elevation. In this section, the fault scarp appears subtle and no Quaternary deposits are observed on the hanging wall. In the 30 km-long section, the cumulative scarp composed of numerous splays is evidenced by a sharp trace, offsetting several quaternary surfaces. A 6-8 km-long relay zone is observed in this section of the fault, separating 10 to 30 km-long segments striking between N110◦ and N160◦. Two alluvial surfaces offset by long-term displacement of the fault were dated at ~35kyr and ~27 kyr , respectively, using 36Cl cosmogenic dating suggesting a minimum slip rate of 0.4 and ~2 mm/yr. Moreover, we

*Intervenant

excavated three small trenches at the base of the fault scarp within the Quaternary deposits affected by the fault revealing 3 rupture-surfacing earthquakes over the last 2500 yr, the last one occurring after 1226 CE.
We will discuss how the displacement varies along the fault both in time and space.

Mots-Clés: Active fault, paléoseismology, geomorphology, slip rate, Apennins