A new python code to invert 36Cl cosmogenic nuclide dataset on normal fault bedrock scarps: comparison with previous published codes and results on the accuracy of the retrieved seismic history of two normal fault systems in Central Apennines

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Résumé

Measuring 36Cl cosmogenic nuclides on exposed bedrock fault scarps has now been used in several places in the Mediterranean to retrieve ages of the fault seismic history (Cowie et al., 2017; Iezzi et al., 2021; Mechernich et al., 2023).
In Central Apennines, around the Fucino basin, at least 16 36Cl sampling sites were analyzed in previous studies using several codes to interpret the 36Cl data as seismic history or slip-rates. At least 3 different codes (Beck et al., 2018; Cowie et al., 2017; Schlagenhauf et al., 2011) were used as a basis for solving equations to calculate chlorine 36 concentration resulting from bedrock scarp exhumation history. Some codes included an MCMC routine to retrieve the seismic histories generating theoretical 36Cl concentration the closest to the dataset. The difference between the various codes lies in the fault history prior to exhumation, the parameters the authors decided to inverse (as an example, mean density of the colluvium is inversed in Beck et al. 2018 but not in Tesson and Benedetti 2019) and the *a priori* distribution of those parameters (for instance the time between two earthquakes follows a Brownian distribution for Beck et al. 2018 but a uniform distribution for Tesson and Benedetti 2019). We have compared the various codes and run the same dataset (one site at Campo Felice and one site at Magnola) with those codes and found that retrieved seismic histories are similar, although the estimation of uncertainties differs. We explore those different aspects.

Moreover, all previous cited codes run under Matlab or Fortran. Fortran code has the advantage of fast computing time but is not user-friendly. We have adapted the code of Tesson and Benedetti, 2019 in Python. The inversion algorithm is also going to take in account variation in attenuation length of muons differently from the Fortran code.
Using this new code, we have reanalyzed several 36Cl sites around the Fucino and compare with the previous results.

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Mots-Clés: Active Tectonics, Cosmonuclide, Python