Mapping the slip rate, tip propagation, geometry and tectonic geomorphology of the Aremogna Fault, central Apennines, Italy

Peter R Sammonds[1]

[1] *University College London*

Summary

In order to understand the seismic hazard posed by an active faults it is necessary to know (i) the long-term rate of movement of the fault; (ii) the geometry of the fault; and (iii) the time that has elapsed since the last earthquake occurred on the fault. This study aimed to improve the information known about the Aremogna-Cinque Miglia Fault in the central Apennines, Italy. We collected a real-time kinematic GPS survey of the southeastern tip of the Aremogna segment of the Fault (Figure 1a) to map the surface trace of the fault, and map the offset of the fault. This was combined with a magnetic surveys and gravity surveys. We pursued a field campaign in 2014 (reported in GEF Minor Loan Scientific Report 1034 in 2016). This reports our second field campaign in 2015.

Research facilitated by this loan

The aim of this project was to map the faults of the Aremogna Plain using a RTK GPS survey, and measure the slip-rate. In conjunction with the GPS survey, we carried out magnetic and gravity surveys using equipment from the UCL geophysical equipment pool: Caesium magnetometer and Romberg-Lacoste micro-gravity meter. Mapping fault slip-rates and fault geometries can reveal data that can be used in seismic hazard assessments (e.g. Roberts et al, 2010). This year we focussed on mapping the extent of the rupture in order to: 1) accurately map the fault geometry, this is important when resolving stresses following Coulomb stress changes; and 2) map along strike changes in the slip rate and kinematics of the Aremogna Fault which are currently poorly constrained.

Survey Methodology and Data Processing

The GNSS equipment was used in survey mode and data was added to GNSS data collected. The Digital Elevation Model (DEM) was produced using Leica Geo Office. We aimed to supplement data collected in 2014 and map the extent of the likely surface rupture of the 1349 earthquake. The data supplemented a digital terrain model of the fault and we related this to palaeoseismology from trenching in the plain (e.g. D'Addezio, 2001).

Project Outcomes

Data were collected with a vertical resolution of 0.25m and a horizontal spacing of 0.5m. In post-processing, the data was interpolated to produce a 2.5m resolution digital elevation model (DEM; Figure 1b). The data were then analysed alongside field mapping carried out at the same time as the field survey to identify the faults in the region of study. The GNSS equipment used performed adequately for the task required. Levels of accuracy were sufficient for combing with geomagnetic and gravity data collected during the same field expedition. The level of accuracy was sufficient for this task.

Figure 2 clearly shows magnetic anomalies at approximately 15-20m and 85-90m along the survey line, indicating the presence of the fault causing the anomaly. The Bouger gravity anomalies produced are the interpolated using Matlab and plotted in 3D in red against the GNSS DEM topographical data in blue (Figure 3). Figure 3 shows a distinct correlation between the topography of the fault scarp and gravity anomalies, with the greatest relative gravity occurring at the areas of lowest topography, at the edge of the fault scarp, and is possibly due to the presence of denser fault breccia.

Outputs

No publications have yet been produced using the data. Subsequent geophysical surveys using equipment from the UCL geophysical equipment pool is underway to supplement the data in this report. The data have been used in Luke Wedmore's PhD thesis which was successfully examined in 2017.

Data Archiving

When data processing has been completed, the data will be archived within the UCL data archive and the relevant

NERC data centre. All publications that use this data will be open access.

References

D'Addezio, G., Masana, E. and Pantosti, D. (2001). The Holocene paleoseismicity of the Aremogna-Cinque Miglia Fault (Central Italy). J Seismology, 5(2), pp.181-205.

Roberts, G, Raithatha, B., Sileo, G., Pizzi, A., Pucci, S., Faure Walker, J., Wilkinson, M., . . . Walters, R. (2010). Shallow subsurface structure of the 2009 April 6 Mw 6.3 L'Aquila earthquake surface rupture at Paganica, investigated with ground-penetrating radar. Geophys J Int. doi: 10.1111/j.1365-246X.2010.04713.x

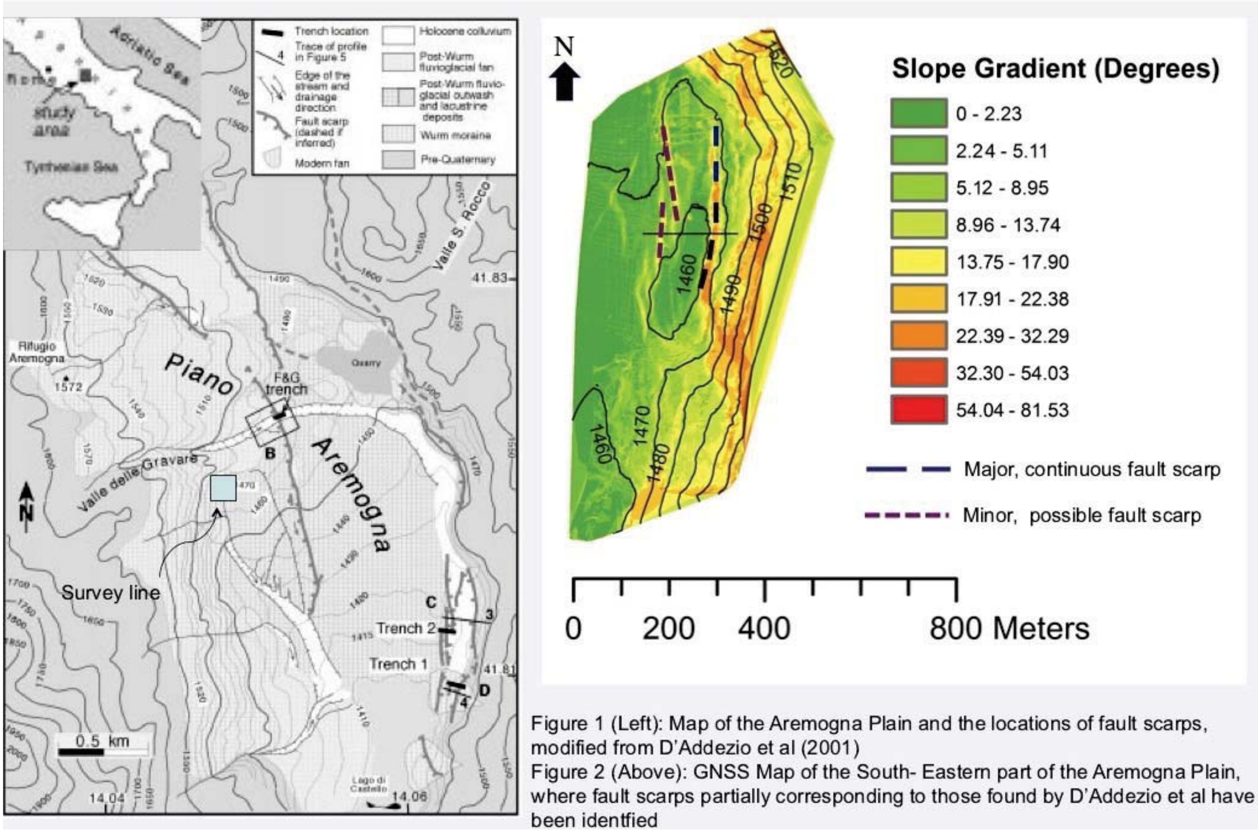

Figure 1

Figure 1a : Map of the Aremogna Plain and the locations of fault scarps, modified from D'Addezio et al (2001)
Figure 1b: GNSS Map of the South- Eastern part of the Aremogna Plain, where fault scarps partially corresponding to those found by D'Addezio et al have been identified

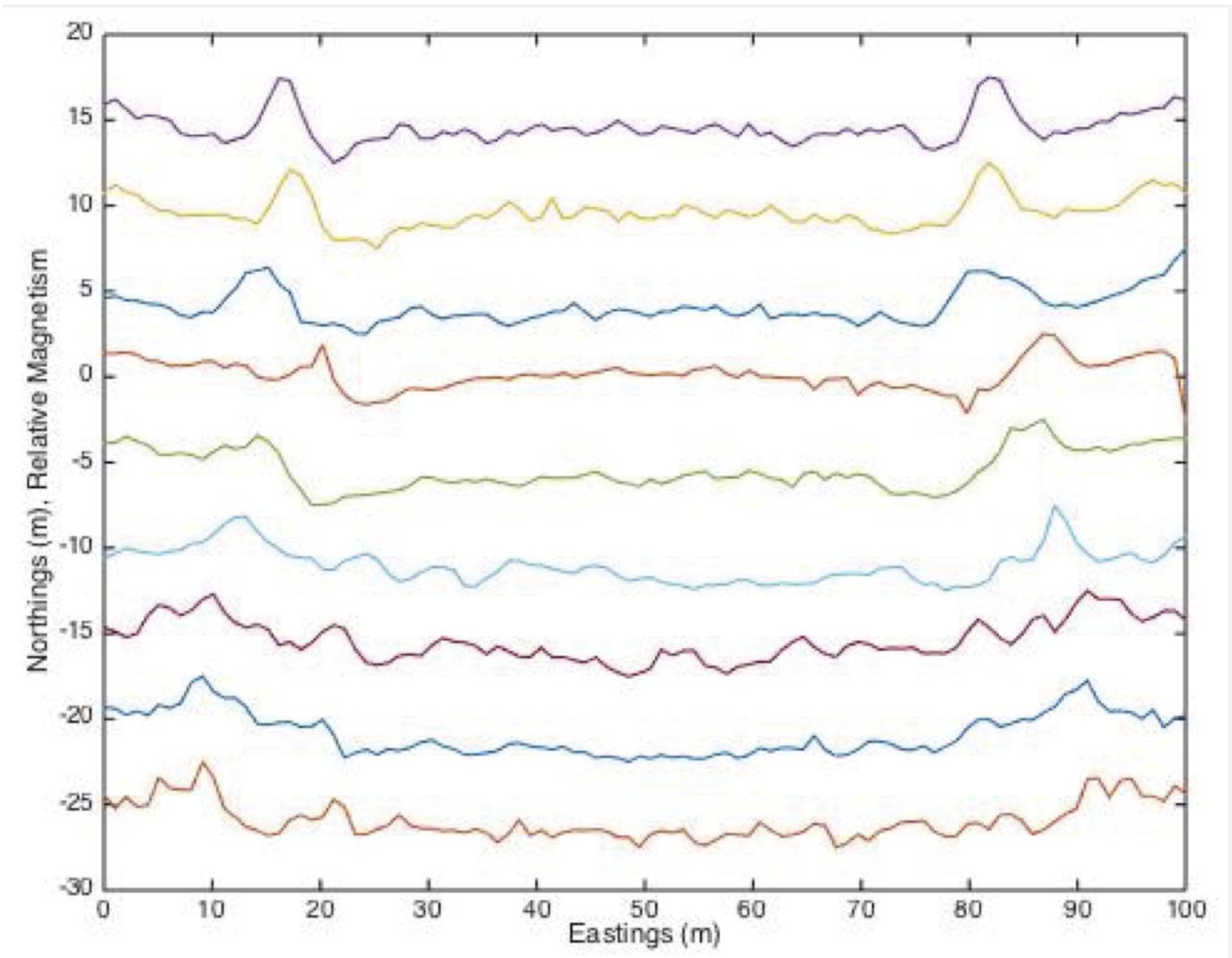

Figure 2

Figure 2 : A 2D surface plot showing the relative positions of magnetics survey lines and the relative magnetism recorded along the lines.

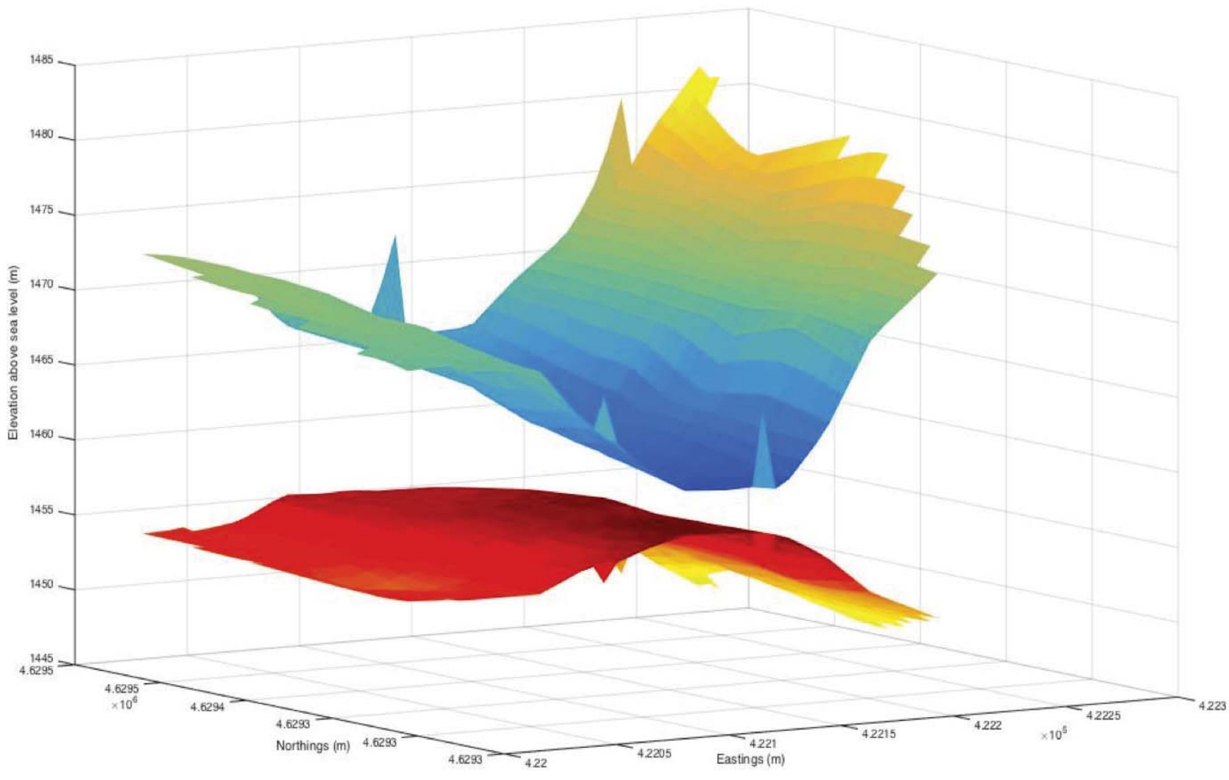

Figure 3