This earthquake ruptured ~20 faults within an ~180-km-long, northeast–southwest (NE–SW)-trending swath in NE South Island, New Zealand. We propose here an application of the Bayesian Statistical Analysis to unravel complex palaeo-earthquakes ruptures. For this purpose, we revisit all the available palaeoseismic data of the Kekerengu-Needles Fault System. This structure represents the northern end of the fault system involved in the 2016 Kaikōura earthquake. We also study its structural prolongation to the north, the Wairarapa Fault. We constructed Oxcal models for each site, to obtain probability density functions (PDF) for each postulated palaeoearthquake. Then, we reconstruct the composite surface rupture histories of each fault system analyzing the degree of overlap between the PDFs of the postulated palaeo-events. After that, we repeat this overlap analysis at a fault-scale, comparing the events proposed for the composite surface ruptures of each fault, in order to identify possible complex palaeo-ruptures. After all this analysis we postulate that two complex ruptures involving both the Kekerengu-Needles Faults System and the Wairarapa could have occurred in the last ca. 2000 years. Our results do not discriminate if these complex ruptures were actually single events or two different palaeoearthquakes occurred close in time. In any case, our analysis further support a possible stress triggering between the Kekerengu-Needles Fault System and the Wairarapa faults, pointing to a potential complex rupture involving both structures.

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FAULT RELAY ZONES WITHIN THE TERUEL GRABEN SYSTEM (EASTERN IBERIAN CHAIN): GEOMETRIES, INTERACTIONS AND SEISMOLOGICAL IMPLICATIONS

Alba Peiro, José Luis Simón y Teresa Román-Berdiel

A new type of fault relay zone that contrasts with the classical models of hard- and soft-linkage is described, based on the structural characterization of the relay zones at the eastern boundary of the Jiloca graben, as well as on a previous study of analogue modelling. These relay zones show abundant faults and fractures at map and outcrop scale that cut Neogene and Quaternary materials. Between the Sierra Palomera, Concud and Teruel faults, these ruptures define an along-strike pattern of recent fractures, more or less parallel to the macrostructures depending on the relative influence of the structural heritage and the biaxial extension regime active in the region. Transverse ruptures are absent within these relay zones. In contrast, the relay zone between the Calamocha and Sierra Palomera faults is characterized by along-strike minor faults at its southern sector, and transverse fractures at its northern sector that do not seem to propagate southwards. Previous studies defend that the main faults are independent structures from the geometric and kinematic point of view, although they undergo dynamic interaction. The described ruptures within the relay zones probably play an important role in such interaction: i) transferring part of the displacement, ii) accommodating stress perturbations, iii) triggering seismic events on another adjacent main fault, hypothetically resulting in alternating slip on both of them, as proposed for the Concud and Teruel faults. The Jiloca fault system is considered to be in a transient stage previous to linkage. The latter will probably occur in the future by propagation of one of the involved faults, giving rise to a final anastomosed fault pattern different from the final linkage geometries classically defined in the literature.

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FAULT AND FOLD SEGMENTATION AND COMPLEXITY: NEW INSIGHTS FROM 3D P-CABLE DATA OFFSHORE SOUTHERN CALIFORNIA

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Often fault and fold segmentation and characterization of their kinematics and evolution in time is based on surficial geology and 2D seismic data. Despite many advances, 3D seismic data is required to understand how faults interact in space and time and the complexity of the fault systems. To achieve this objective, a high-resolution 3D Parallel Cable (P-Cable) seismic dataset was acquired along the Newport-Inglewood Rose Canyon (NIRC) fault. The NIRC is a complex right lateral strike-slip fault system that stretches for 120 km, mostly offshore, and parallel to the southern California coast. The Holocene fault slip-rate ranges from 1.5-2.0 mm/yr to 0.5-1.0 mm/yr, from south to north, according to onshore paleoseismological studies. An earthquake rupturing the entire length of the offshore system could produce a M7.3 earthquake and potentially impact around 20 million Southern California residents. The acquired offshore dataset images

the outer continental shelf and upper slope. The preliminary analysis of this high-resolution seismic volume has allowed mapping of several faults that offset different seismostratigraphic units. The mapping shows two main families of faults, some trending N-S to NNW-SSE and the others NE-SW, being the former the predominant. In addition, it reveals that the faults consist of a number of segments that may join at depth, but also that the NE-SW system acts as a structural boundary in the continuation in the N-S faults and folds. In conclusion, the 3D mapping of the geological structures along the NIRC system highlights the complexity and relationship between faults and folds in a shear zone.

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MARCA-GEHN, A PROTOTYPAL MACROSEISMIC ARCHIVE OF FOUR CENTRAL AMERICA COUNTRIES

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In the frame of the activities of RIESCA Project ("Proyecto de formación aplicada a los Escenarios de Riesgo con la vigilancia y monitoreo de los fenómenos volcánicos, sismicos e hidrogeologicos en América Central", funded by the Agenzia Italiana per la Cooperazione allo Sviluppo, and coordinated by the University of Palermo) we agreed to build up a prototypal archive of macroseismic data points for the Central America countries involved in the project, namely, El Salvador, Guatemala, Honduras and Nicaragua. The objective of this collection is to establish a common, quality controlled seismological dataset, for checking, validating, and eventually updating the earthquake parameters for some damaging and destructive events. They will be integrated into new fault/area source characterization for seismic hazard purposes as well as into site-specific characterization of metropolitan areas. With collaborative efforts, a google form for inputting the data into a repository has been realized and tested in 2017. During 2018, the seismological working group has uploaded about 1500 intensity data-points of 60 earthquakes in a prototypal archive named MARCA-GEHN (Macroseismic Archive of Central América - Guatemala, El Salvador, Honduras, Nicaragua). We will present the general features of the database and some interesting case studies among the earthquakes collected.

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POST-SEISMIC DEFORMATION FOLLOWING THE 2016 NORCIA EARTHQUAKE (ITALY), AS REVEALED BY INSAR TIME SERIES

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The Mw 6.5 Norcia earthquake occurred on October 30, 2016 along the Vettore fault (Central Apennines). It was the largest earthquake that took place during the 2016-2017 Italian seismic sequence that started on August 24, 2016 with the Mw 6.0 Amatrice earthquake and lasted almost six months. . To quantify strain release and detect potential postseismic slow slip during the sequence, we produced time-series using 6-day repeat cycles of Sentinel-1A/1B SAR images. The images span almost two years for the ascending track (from July 2015 to June 2017), and span from October 2016 to February 2017 for the descending track. The produced time-series indicate that a centimetre-scale deformation took place during the 10 weeks following the Norcia earthquake, while no deformation was detected after Amatrice earthquake. Two areas of deformation have been detected: one in the Casteluccio basin (hanging wall of the Mt Vettore fault), and one in the southern extremity of the Norcia surface rupture in a structurally complex area where the activated normal Mt Vettore fault system cuts the Sibillini thrust system. In the Casteluccio basin, the deformation reaches 14.89 ± 1.32 mm in the ascending line of sight (LOS) on January 06, 2017. South of the Norcia surface rupture, the post-seismic deformation affects a smaller area, but reaches 29.98 ± 1.65 mm in ascending LOS. Pattern tracking of this southernmost deforming area indicates a logarithmic temporal decay consistent with postseismic deformation and afterslip along the Mt Vettore-Bove fault system. We estimate that this afterslip released a geodetic moment equivalent to a Mw 5.7 event. Our analysis suggests that the structurally complex area located south of the Norcia rupture is characterized by a conditionally stable friction. This geometrical and frictional barrier likely halted seismic slip propagation during the Amatrice and Norcia ruptures.