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Paleoseismic and morphometric analysis of the El Triunfo Fault, a main seismic source in El Salvador

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El Salvador is located at the pacific active margin of Central America, here, the subduction of the Cocos Plate under the Caribbean Plate with a rate of ca. 80 mm/yr is the main seismic source. However, the relative eastward drift of the Caribbean plate induces deformations within the Central American Volcanic Arc, and active faults within it have been responsible of several damaging earthquakes in El Salvador.

The El Salvador Fault Zone is the main geological structure in El Salvador and accommodates 14 mm/yr of horizontal displacement between the Caribbean Plate and the forearc sliver. In order to assess what are the faults which are the more likely sources of the next damaging earthquake in El Salvador and after the seismic sequence of January and February, 2001, we have modeled the past recent relevant earthquakes as well as the secular stress increase on the main faults of the El Salvador Fault Zone due to the plate tectonics motion. Coulomb Failure Stress modeling is widely used as a tool to infer the interaction between faults and to investigate seismic sequences. The areas where the Coulomb Failure Stress is increased are more likely to suffer an earthquake in the future. El Triunfo segment (one of the longest faults in the country and a main segment of the El Salvador Fault Zone) is accumulating elastic energy and seems capable of generating a damaging earthquake too in the future.

That make us to focus our effort in the El Triunfo Fault, where four paleoseismological trenches were excavated during two fields campaign. We also have developed a morphometric analysis on high resolution Lidar images in order to constrain the long-term slip rate in different sections of the fault and a detailed surface trace of the fault. This approach allowed to identify that surface fault rupture has occurred at least three times in the last 15 ka, and morphometric results show horizontal slip rates of 4.7 mm/ yr and vertical slip rates of 0.5 mm/yr for the El Triunfo Fault.