

Crustal velocity field in and around Costa Rica and its tectonic implication

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Costa Rica has been continually affected for implication destructive earthquakes. Unfortunately, historic earthquakes have caused thousands of fatalities, injures, evacuation of people and also losses in infrastructure facilities, mainly on roads, railroads, ports, dams and houses. Some of the most destructive events are as follow: Inland earthquakes, which are M6.2 Cartago (1910), M7.7 Limon (1992) and M6.2 Cinchona (2009), and Megathrust earthquakes, which are $M > 7.5$ in Nicoya Peninsula (1853, 1900, 1950 and 2012), and $M > 7.0$ in Osa Peninsula (1853, 1904, 1941 and 1983) whose recurrence period of megathrust earthquakes is approximately 40 years. In addition, most of the land area of Costa Rica is located on the Panama Plate (PM) and a small segment of the country is on the Caribbean Plate (CA); the boundary between these two plates (PM-CA) is not clear, but historic earthquake is available.

A progressive network of GPS/GNSS stations has been established since more than 15 years ago, allowing research projects about crustal deformation in Costa Rica, but most of them conducted in Nicoya Peninsula. In this work, we are using GPS/GNSS observation data from a permanent network in Costa Rica (45 sites). In addition, due to the complexity of the tectonic configuration, GPS/GNSS data from stations located in Nicaragua (21 sites), Panama (19 sites) and Colombia (20 sites) are also analyzed. This data was first selected with a minimal spanning of 2.5 years and processing using Bernese 5.2 GNSS software.

In order to obtain high precision time-series, representative for crustal deformation, we eliminated non-tectonic effects as steps due to unknown phase center offsets after antenna changes and earthquakes occurred in this region. Seasonal components (annual and semi-annual) and no linear post-seismic fitting was also considered in our analysis.

We try to produce a new detailed map of the kinematics in Costa Rica and inside of the complex tectonic vicinity. This velocity field will contribute for the elaboration of a block motion model in order to determine the slip deficit distribution and earthquake potential along the tectonic boundaries around Costa Rica. These results provide a needed complement with previous studies conducted on the Northwest segment (Nicoya Peninsula), for a better understanding of the complex tectonic and earthquake potential in Costa Rica.

Keywords: Costa Rica, GNSS, Crustal Deformation