

A high-resolution local seismic network in the Southeast of Ecuador: Preliminary results

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The “Santiago” seismic network was implemented since October 2016 within the framework of feasibility and final designs of the Santiago Hydroelectric Project (3600MW/h) developed by CELEC EP HIDROPAUTE. The network consists of seven seismological stations located in the province of Morona Santiago at the southeastern Ecuador and, a register center equipped with the Antelope System version 5.4 for monitoring and processing microseismic data in real time. Using the HYPO71 program of hypocentral location (Lee y Lahr, 1972) with a velocity model consisting of two layers over a half-space, P wave velocities of: 6.2, 6.85 and 8.15 km/s and thicknesses of 15 and 30 km; hypocentral solutions were calculated in a preliminary manner during first 10 months of observation. The Vp/Vs ratio used in this calculation was 1.75. Estimates of earthquake origin time (T_0), velocity relations of seismic waves (Vp/Vs), time of the vertical trajectory of P and S waves (T_z), depth of the earthquake (H), average wave velocities for P and S (Vp and Vs, respectively), and path length from the focus up to the surface, were determined according to diagrams of Wadati y Riznichenko (1958). After 10 months of operation, seismic data was processed using Antelope modules, the resulting seismic catalog comprises a total of 15810 events obtained during at least three periods of information recording with empty intervals corresponding to periods in which the seismological network was not operational. Earthquake distribution by depth shows that 68% of the processed earthquakes are located between 0 and 40 km depth, these correspond to surface seismicity arising in the crust; between 40 and 80 km there is a decrease in the occurrence of earthquakes; between 80 and 160 km there is 20% of earthquakes that may correspond to the subducting plate. Earthquake distribution by magnitude ranges from 1 to 3 with a 65% frequency, magnitudes between 3 and 4 comprise 15% of the frequency, and magnitudes distributed between -1 and 6 comprise 99.80% of the frequency of the records. Preliminary results suggest a seismic activity concentrated in belts where an amount of energy is released in the form of small earthquakes. The rupture mechanisms indicate thrust fault planes, although a local concentration of earthquakes close to the register center location suggest a slightly strike-slip component. Cross-sectional subduction models with hypocentral locations suggest a highly stressed upper crust with evident cluster earthquakes separated by a notable seismic gap from a deeper wadati zone located at around 200 - 220 km depth, which is dipping to the east.