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Determination of the basement depth in Portoviejo, Ecuador, using active seismic methods

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The city of Portoviejo in Ecuador, is located in the western region of the South American continent is one of the main active tectonic zones of the world, due to the convergence of the South-American and Nazca plates. The Jama-Pedernales earthquake (Mw = 7.8) of April 16, 2016, caused great damage, attributed to important site effects within the sedimentary basin with soft quaternary deposits. The National Polytechnic School, in cooperation with Venezuelan Foundation for Seismological Research (FUNVISIS) developed in 2017 the seismic microzoning study of the Portoviejo canton. Here, we focus on the determination of the configuration and physical parameters of the sediments and the depth of the basement with active seismic methods, applied along five seismic profiles (~ 1 km) with a separation between geophones of 10 m using explosives as a source and 4 GEODE "Geometrics" seismometers (24 channels each) to record the signals. The geometry and location of the profiles depended on previous estimations of the depth of Quaternary sediments, as well as on logistical issues related to profile length and use of explosives as energy source. The results of the Portoviejo subsoil velocity models obtained from active seismic methods (seismic refraction and multichannel analysis of surface waves) with linear arrays are presented. Seismic basement was defined in all seismic sections by P-wave velocities between 1900 and 2300 m/s and S-wave velocities of 900 to 1300 m/s. The depth of the bedrock is generally greater than 100 m in Portoviejo and decreases to 50 m at the edges of the fluvio-marine channel close to the city center, reaching a maximum of 190 m in the northwest area of the city. The present work presents the Portoviejo subsoil velocity models obtained from the seismic refraction and the multichannel analysis of surface waves (MASW) and compares them with the results obtained with other geophysical methods executed in the project.