

Site effects assessment along the eastern Enriquillo Plantain Garden Fault Zone in Haiti

Sophia Marie Johanne Ulysse (1), Hans-Balder Havenith (2), and Dominique Boisson (3)

(1) University of Liege, Department of Geology, Georisk and Environment, Liege, Belgium (sophiaulyssse@gmail.com), (2) University of Liege, Department of Geology, Georisk and Environment, Liege, Belgium (hb.havenith@ulg.ac.be), (3) State University of Haiti, Faculty of Sciences, Research Unit in Geosciences, Port-au-Prince, Haiti (dmboisson@yahoo.com)

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*Site effects assessment along the eastern Enriquillo Plantain Garden Fault Zone in Haiti Sophia ULYSSE
University of Liege, Departement of Geology, Georisk and Environment, Belgium
email: smj.ulysse@student.ulg.ac.be

Hans-Balder HAVENITH

University of Liege, Departement of Geology, Georisk and Environment, Belgium
email: hb.havenith@ulg.ac.be

Dominique BOISSON

State University of Haiti, Faculty of Sciences, Research Unit in Geosciences
email:dmboisson@yahoo.com

Abstract

The Republic of Haiti, the western part of the Hispaniola Island, is crossed by two major active faults: the Septentrional Fault in the north and the Enriquillo Plantain Garden Fault (EPGF) in the south. Due to this tectonic context Haiti is affected by an important seismic hazard, also marked by the occurrence of several disastrous earthquakes during the last four centuries. The last event, on January 12, 2010, killed more than 230,000 people, left nearly 300,000 wounded, and 1.2 million homeless; it caused material damage evaluated between 8 and 14 billion dollars. Several large international projects are carried out on Port-au-Prince and at Léogâne which is the epicentral area. Our work which is done in the frame of a Belgian-Haitian collaboration project rather focused on the region east of Port-au-Prince and some local site in the southeastern part of the city. The first area in Fonds-Parisien, in the east, is located near the eastern part of EPGF. The north of the area is bordered by a sedimentary basin hosting the Azuei Lake and to the south it is bordered by the foothills of the "Massif de la Selle". The second area in Petion-Ville, in the southeastern of Port-au-Prince is crossed by the EPGF. It is limited to the north by the Cul-de-Sac plain, a sedimentary basin and to the south, by the foothills of the "Massif de la Selle". We carried out local geophysical investigations to assess site effects 1) in areas relatively far from the epicenter, not intensively hit by the 2010 event, to see if they may fit for future construction projects, 2) on a hill in the southeastern part of Port-au-Prince that was affected by extreme destruction and by secondary effects. We performed Multichannel Analysis of Surface Waves (MASW) profiles and Horizontal to Vertical Spectral Ratio (HVSR) measurements as well as some earthquake recordings in each zone. For the Fonds-Parisien zone, the HVSR data allowed us to outline areas that are more or less affected by site amplification. Site effects are mostly observed in the sectors near the northern sedimentary basin, along the shores of Azuei Lake. These results are well corroborated by the MASW profiles which evidence very low velocity layers in the sedimentary basin and high velocity layers on the foothills. The HVSR measurements performed in the second area show the Gros-Morne hill could be affected by a moderate site effects with a little more sharp frequency peaks in the southern and western foothills. Coupled with some geotechnical and geological data, these geophysical surveys allowed to better constrain soils amplification effects in these areas and will be useful in the future local seismic hazard and risk assessments.