



Geophysical Characterization of Zamora Municipality (Guatire), Miranda State, By Natural Seismic Noise and Gravimetric Methods

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Summary

The present work is part of seismic microzonification studies carried out in various cities in the north-central area of Venezuela, supported by the Venezuelan Foundation of Seismological Researches (FUNVISIS). The main goal of this research was to characterize the Guatire basin by the application of seismic methods (shallow seismic refraction and natural seismic noise) and gravimetric methods.

The Guatire basin consist of following geological units: Quaternary Alluviums, (cemented and uncemented) Guatire Formation of Pleistocenic age and Las Mercedes Schist of Cretacic age (Picard, 1976)

By elaborating 2D models with the seismic refraction information 3 layers were determinated: the shallow layer (thickness up to 14 m) related to unconsolidated sediments and alluviums with average P and S wave velocities of 900 m/s and 400 m/s, respectively. The middle layer (up to 39 m deep) of consolidated sediments with average P and S wave velocities of 1200 m/s and 550 m/s, respectively. The third layer (depth between 40 and 60 m) related to metamorphic meteorized rocks with P wave velocities greater than 2200 m/s. This layer could not be seen in the S wave models. A preliminary Vs30 map is proposed, which shows average velocities between 550 and 650 m/s.

With the data obtained from the natural seismic noise study, a map of fundamental periods of the basin was elaborated. In the central area of the map, towards the east, periods values between 0.9 and 2.2 s were registered, which are related to the greatest sedimentary thickness in the area. For the remaining region the values were between 0.6 and 0.9 s, decreasing gradually towards the south and north (0,1-0,3 s).

Based on the gravimetric data a Bouguer anomaly map with $\rho_b = 2.5 \text{ g/cm}^3$ was elaborated, in which a general east-west tendency of the isoanomalies curves can be observed. The range of variation of the anomalies values is between 15.5 - 28.5 mGals. The values below 19 mGals are predominating in a great part of the study area, including the central and eastern area of the region. These minimum values are associated with the areas with greater sedimentary thickness. A 3D model of the basin was elaborated based on the residual gravity data. The depth of the basin was approximately 370 m in the central and eastern area, and decreased down to 200 meters westwards. The basin is a sinforme with east-west alignment. Larger structures were not found. The results obtained in this study are in agreement with the results of a previous gravimetric study carried out by Graterol (1970).

The integration of the gravimetric data with the seismic noise data was elaborated by period-deep profiles. With these profiles, 4 apparent ranges for the relation period-deep were determinated: periods between 0.2 and 0.4 s were correlated with a sedimentary thickness of 10 to 60 m, periods between 0,6 and 1,0 s can be associated to 100 and 200 m, periods between 1 and 1.5 s correlated to deeps between 200 and 250 m and for periods between 1.5 and 2.2 s a range of sedimentary thickness between 250-350 m was determinated.

The integrated analysis of the Bouguer anomaly map with the map of fundamental periods indicates an inverse apparent relation of the results of both methods. For the area with lowest gravimetric anomalies the highest values of fundamental periods were obtained.

A standard statistical analysis of the gravimetric and seismic noise data was performed. Furthermore, all data and results obtained during this study were completely integrated in GIS in order to ease their presentation and interpretation, and to begin the digital database of the area, that is of special value in any study of hazard prevention.