VENEZUELAN STRONG MOTION ACCELEROGRAPH NETWORK

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SUMMARY

This paper describes the Venezuelan strong motion accelerograph network, as well as the criteria used for its implementation. It also includes a summary of the maximum accelerations recorded up to now by the network.

INTRODUCTION

Seismic events represent one of the highest potential risks of human and economic losses. The present day development of the country, characterized by a high index of population growth and a constant increase in infrastructural investments, results in an ever greater risk. Fitfy seven percent of the Vezuelan population, as well as a large percentage of its basic industries, are concentrated in the country's higher seismicity regions; that is region 3 and 4 with accelerations equal or greater than 0.22 g. (Fig. 1, Ref, 1). In 1979 FUNVISIS began a six year program towards the installation on a 120 instrument strong motion accelerograph array. The purpose of this network is to provide basic information required for the prediction of the dynamic response of various types of structures, building code improvement, determination of ground amplification effects, as well as for a better perception and research of earthquake's consequences.

VENEZUELA'S SEISMICITY

From the tectonic-geological point of view, Venezuela is one of the most interesting areas in the Caribbean. The large faults with strike-slip movement, associated with a possible border between the Caribbean and South American plates have been known for quite some time (the faults of Bocono, El pilar, San Sebastian, Urica, Caparo, Valera, Oca. etc.). Towards the east of the country, the faults with highest activity, historical as well as instrumental, are those of El Pilar, Los Bajos-El Soldado and Urica. In mid-country the most highly active are the San Sebastian, La Victoria and Tacagua faults. In the west we have the Bocono, Caparo and Oca faults being the most active. Venezuela has been hit by 120 earthquakes which have caused some sort of damage to its localities between 1530 and 1982; a list of the most important of these earthquakes is given in Table 1.

INSTRUMENT DISTRIBUTION

Based on existing data regarding the seismicity and tectonic-geological structure of Venezuela, three areas were selected for instrumentation in the first stage. The state of Sucre, being crossed from east to west by the

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El Pilar fault system, was chosen in the east; in the west the states of Lara, Merida and Tachira, which are crossed northeast-southwest by the Bocono fault system, and in the central region, the Federal District and state of Miranda, where the San Sebastian fault system is located. Once the first stage was completed, strong motion stations were installed in other regions. The distribution of these instruments was also done on the basis of the location of important faults, installing them at different distances, both perpendicular and parallel to the fault, in order to study attenuation patterns in those areas (Ref. 2). The selection of locations for the stations was based on the criteria of obtaining free field records on rock and other soil conditions, as well as records from buildings, dams, bridges, etc.

SUMMARY OF RECORDS OBTAINED

From the year in which the array was started, 1979 on, some moderate earthqukaes have occurred, six of them having been recorded. The most important characteristics of these records, as well as of the earthquakes which produced them, can be found in Table 2. It is important to point out that the October 18, 1981 earthquake, with m_b=5.5, produced maximum horizontal accelerations in the order of 0.04, 0.15 and 0.09g in three instruments located about 110, 114 and 113 km., respectively, from the epicenter, in the Uribante-Caparo area. This difference in the maximum acceleration recorded at stations in such proximity of each other, as well as the 0.15g maximum at 114 km. of the epicenter, can be explained by the following: i) effects due to focal mechanism (directionality); ii) effects due to local conditions and iii) uncertainty in determination of magnitude and epicentral location (Ref. 3). Another case which can be pointed out is that of the May 9, '82 and March 8, '83 earthquakes, in which higher maximum values were recorded at San Juan de Las Galdonas than at Guiria, even though the first station was about three times as far as the latter. This is probably due to the subduction of the South American plate under the Caribbean plate in that region, which would justify a higher attenuation rate towards Guiria than towards the San Juan de las Galdonas station (Ref. 4).

PRESENT AND FUTURE DEVELOPMENT OF THE NETWORK

The National Strong Motion Accelerograph Network has, to this date, 68 instruments, of which 23% are installed in buildings and dams (Fig. 2). This array is made up of SMA-1 accelerographs, built by Kinemetrics. Future plans are to install fifty instruments between years 1984 and 85, not counting those to be installed according to the specifications of the new 1982 Venezuelan Regulations for Earthquake Resistant Buildings, which require at least two accelerographs in buildings of certain importance.

ACKNOWLEDGMENT

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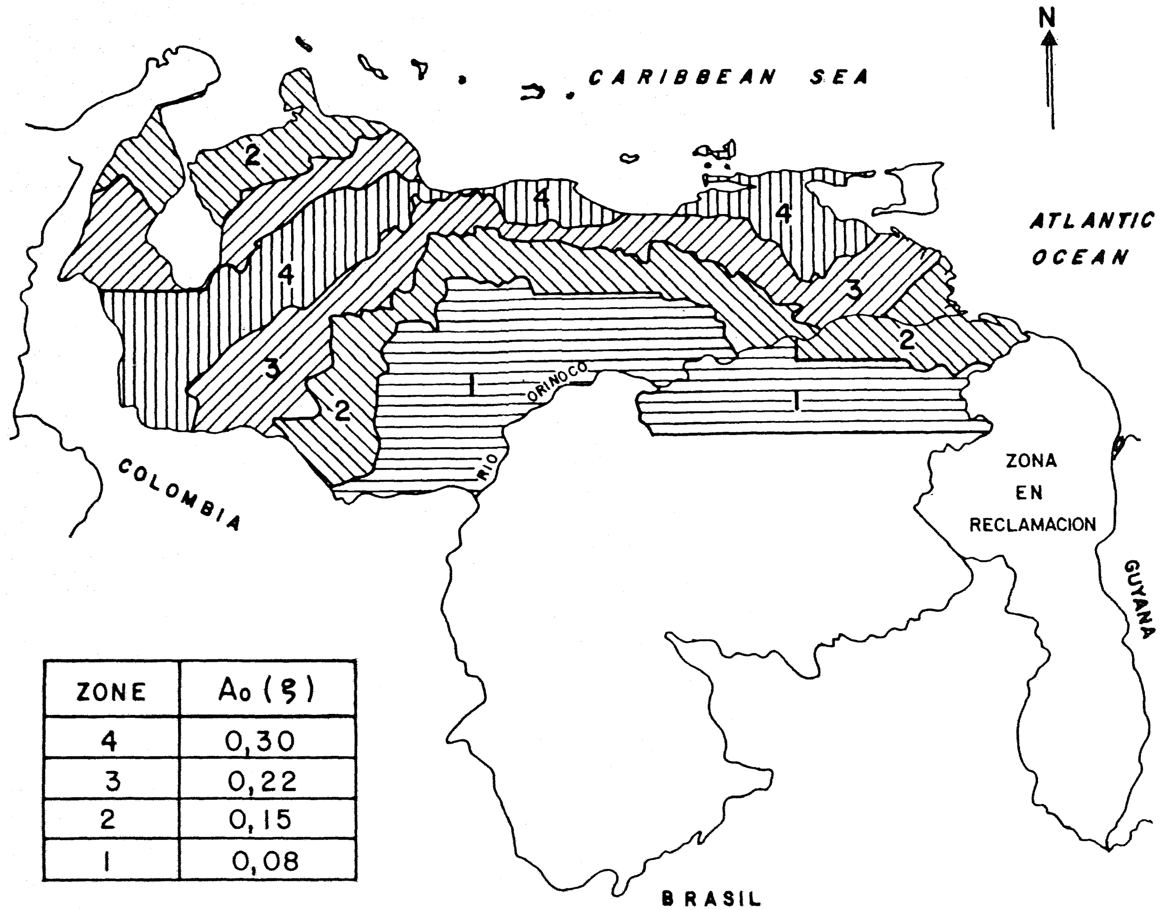
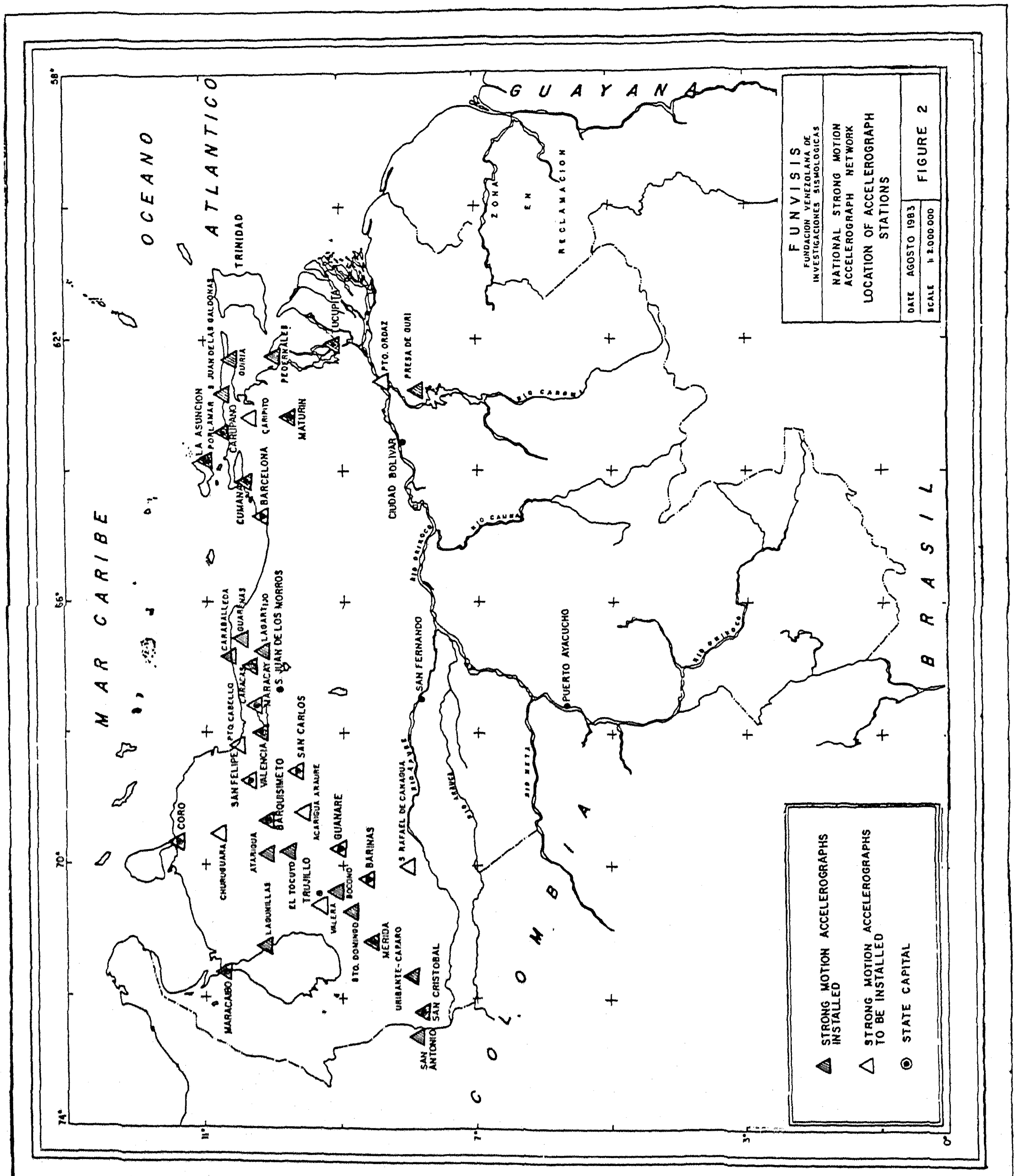


ZONE	Ao (g)
4	0,30
3	0,22
2	0,15
1	0,08

FIGURE 1 SEISMIC ZONING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LOCATION OF ACCELEROGRAPH STATIONS
DATE AGOSTO 1983
FIGURE 2

TABLE 1

MAXIMUM INTENSITIES OBSERVED FOR SOME EARTHQUAKES

YEAR	LOCATION	Io	CASUALTIES
1530	Cumaná	9-9.5	Numerosos
1543	Cubagua	9	-
1610	Mérida - La Grita	9.5	60
1641	Caracas	8	200
1644	Pamplona/Colombia	9-9.5	7
1766	Cumaná	9	-
1796	Cumaná	8	16
1812	Caracas, Mérida y San Felipe	9-9.5	22.000
1853	Cumaná	8	113
1875	Cúcuta/Colombia	9-9.5	2.500
1900	Caracas	8	40
1929	Cumaná	9	50
1933	Lagunillas	8	-
1950	Cúcuta/Colombia	9-9.5	126
1950	El Tocuyo	8-9	15
1957	Carúpano	8-9	Numerosos
1967	Caracas	8	234
1981	San Cristobal	7	100

Io ..... Intensity Mercalli-Siesberg in the epicenter

TABLE 2

STATION LOCATION	TYPE OF SOIL	EARTHQUAKE		MAG. mb	COORD. OF EPICENTER	INTENSITY (MM)		MAX ACELERATION (g)		EPICENTRAL DISTANCE (Km)
		DATA	TIME (GMT)			EPICENTRAL Io	STATION I	HOR.	VER.	
Presa La Honda. Uribante-Caparo.	Residual soil	10-18-1981	04h 31'	5.5	8.15°N 72.75°W	VIII	V	0.15	0.06	114
Presa Las Cuevas. Uribante-Caparo.	Weathered Rock	4-7-1982	06h 16'	4.7	7.86°N 72.20°W	V	IV	0.031	0.010	41
San Juan de Las Galdonas	Aluvial deposit holocene	5-9-1982	01h 26'	4.5	10.74°N 62.37°W	V	V	0.031	0.019	52
San Juan de Las Galdonas	Aluvial deposit holocene	3-8-1983	17h 06'	4.8	10.7°N 62.3°W	VI	VI	0.089	0.025	57
Guiria	Deep Aluvial deposit pleistocene.	4-11-1983	8h 19'	4.8	10.42°N 62.44°W	VI	VI	0.122	0.048	25
Presa La Honda. Uribante Caparo.	Residual Soil	6-15-1983	14h 00'	4.8	8.02°N 72.16°W	VI	V	0.194	0.045	36