Table 7

Comparison of CERESIS and IPGH Gridded Seismic Hazard Values

Return Period : ~500 yr

Value	CERESIS Grid			IPGH Grid		
gal	Number of Grid Values	Average gal	RMS Deviation gal	Number of Grid Values	Average gal	RMS Dispersion gal
>500	25	567	46	21	617	83
250-500	163	337	68	235	335	59
125-250	267	180	35	250	185	35
62.5-125	103	102	11	52	107	12
<62.5	0	0	0	0	0	0

Figs. 20 and 21 show respectively the maps compiled from data provided by CERESIS and IPGH. Fig. 20 has been compiled by CERESIS from results provided by each of the member countries using attenuation laws that varied with the country. Comparison of the two maps suggests the following:

- the pattern on this CERESIS-based map is not as broad as that of IPGH,
- there is more area of "high' seismic hazard on the CERESIS map than on the IPGH map,

On several occasions seismologists from South America have noted the difficulty of gaining a good understanding of attenuation of seismic waves within this vast region. Explanations for such things as the high rate of attenuation beneath the Andes, at least in the Chile-Argentina region, have yet to be found. Despite continuing efforts seismologists from the region often refer to the difficulties of getting good strong motion records and leave the impression that it could be some time before they acquire enough data to carry out a thorough study.

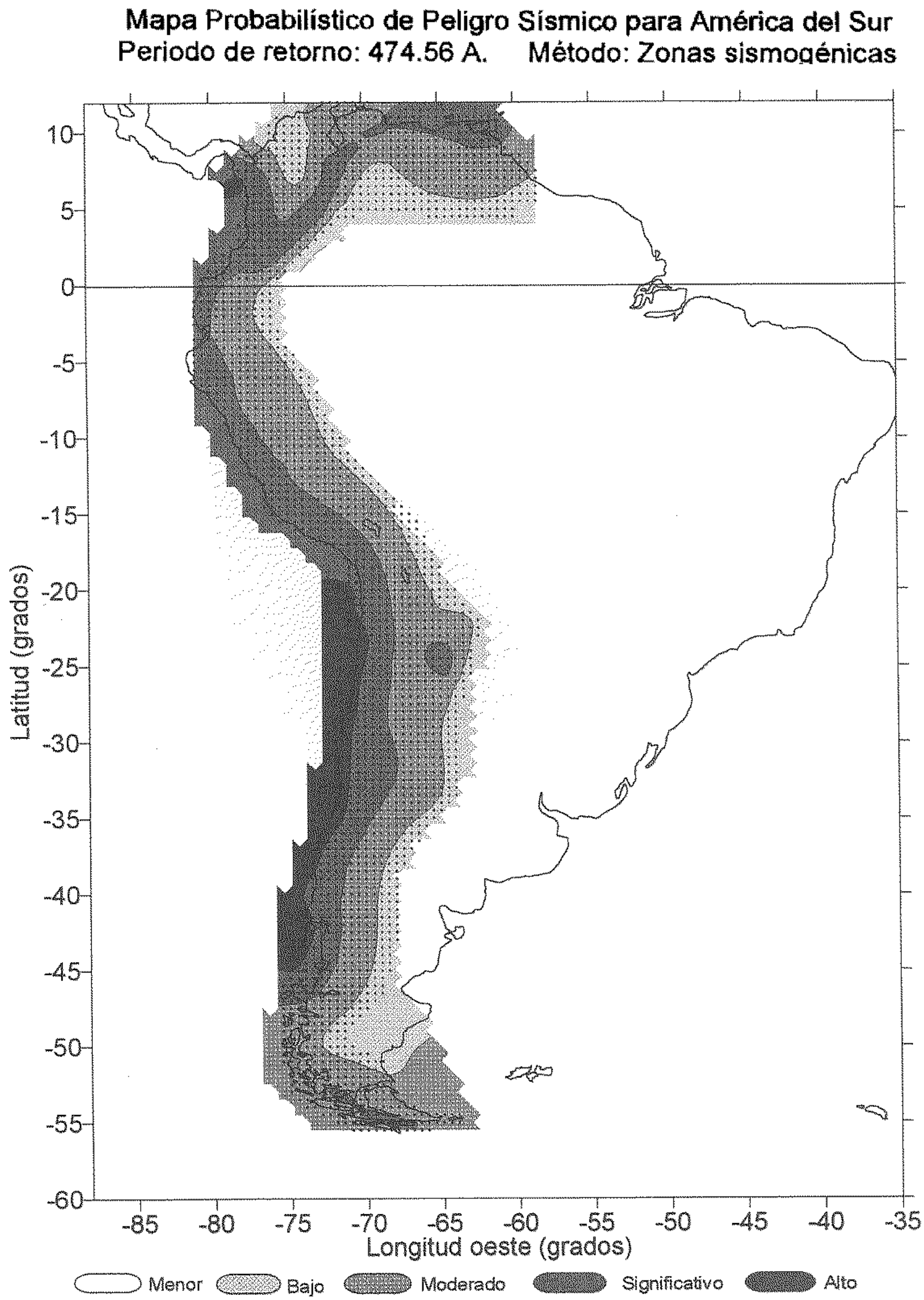

Figure 20. Probabilistic seismic hazard map for South America (solid rock or equivalent) compiled from gridded data supplied by CERESIS. The dots indicate the points for which seismic hazard estimates have been calculated. Although the contouring extends beyond the limits of the computed points in places, it is only valid within their bounds.

Probabilistic Seismic Hazard Map of South America
Return period: 474.56 yr Method: Historic Parametric

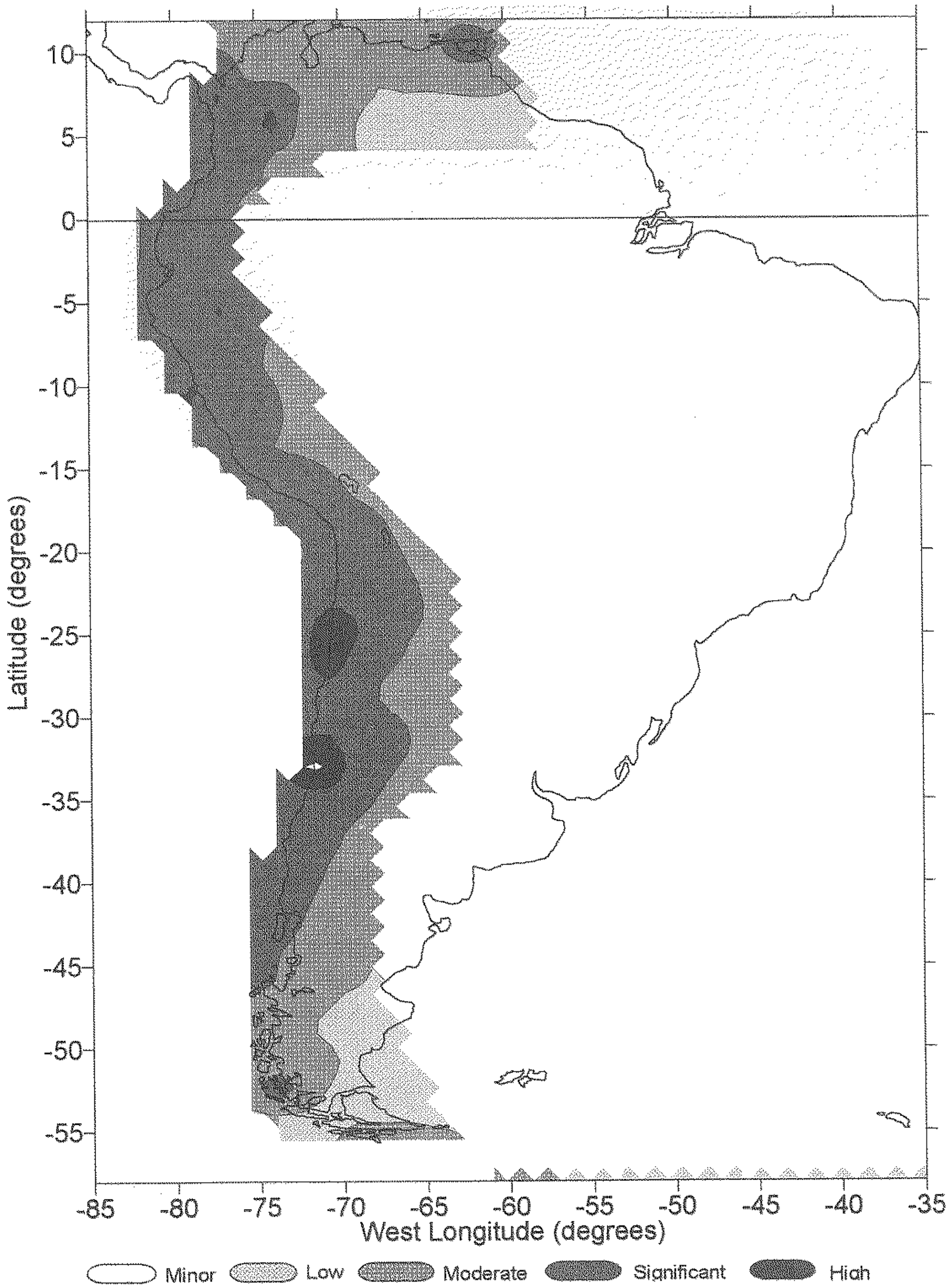

Figure 21. Probabilistic seismic hazard map for South America (solid rock or equivalent) compiled from data computed by IPGH. The contoured map has been compiled from data computed on the same grid as Fig. 20 and cliipped using the same function.

The differences in level of hazard take place mainly at the high end of the seismic hazard spectrum and have been confirmed by looking at some of the gridded values. A number of possible explanations have already been suggested in the discussion of the maps from other regions. One of the most plausible is the CLIM94 attenuation law used for the computations by IPGH gives the lowest peak or maximum values of all the relations suggested by the regional representatives (see Fig. 10 which shows all the relations for a hypothetical earthquake of M = 8 and depth equal to 50 km - calculations for other earthquake magnitudes indicated this difference decreased with smaller magnitudes). Differences may also be explained, wholly or partly, by the use of different methods of computing seismic hazard, one of which is more interpretative (source zone) and therefore influenced by the ideas of the individuals responsible for the defining the distribution of source zones.

We conclude this section with a comparison of the results for the Caribbean. The IPGH values have been computed in the usual way with the JB93 and CLIM94 attenuation relations used respectively for earthquakes located at depths greater than and less than 15 km. The regional values for the Caribbean have been provided by McQueen, 1997 who carried out an evaluation of seismic hazard in the Caribbean using three different probabilistic methods of seismic hazard estimation. The methods she used are the source zone or Cornell-type (two different computer programmes), the extreme value method (Gumbel, 1958; Makropoulos and Burton, 1986) and the historic parametric method as described in this report. In her evaluation of the results she found all methods gave similar results, but concluded that the historic parametric method seemed more stable under varying conditions of computation. We therefore follow her recommendation and use the results she obtained with the historic parametric method as the basis for comparison.

The procedures for the calculation of the grid provided by McQueen, 1997 differed from the practices adopted here in the following respects.

- the JB93 and WC82 attenuation relations have been used respectively for events less than and greater than 15 km,

- the values at each grid point have been determined from 25 iterations using random numbers to scale the estimated uncertainties of all parameters used in the calculations.

The regional probabilisitic seismic hazard map for the Caribbean is given in Fig. 22 and the corresponding map produced by IPGH in Fig. 23. The patterns of seismic hazard in the two maps are generally the same as are the peak levels of seismic hazard. They differ, however, for the lower levels of seismic hazard. The regional map in Fig.22 does not show any values within the range of seismic hazard that is here called "minor" (i.e., <62.5 gal) whereas the IPGH map shows significant areas at this level. This can be seen more clearly in Table 8 which shows the regional results of McQueen, 1997 contain no values in the range of "minor" hazard. The explanation of this difference almost certainly lies in the differences of behaviour of the CLIM94 and WC82 attenuation relations. The WC82 relation does not attenuate as rapidly as does CLIM94 (see Fig. 10) and therefore we can expect the ground effects of the earthquakes in the Caribbean (many of which have an inermediate to deep focal depth) to extend to a much greater distance.

Table 8
Comparison of Seismic Hazard Results for the Caribbean
Return Period: ~475 yr

Range	Regional Grid (McQueen, 1997)			IPGH Grid		
gal	Number of Events	Average Value gal	RMS Dispersion gal	Number of Events	Average Value gal	RMS Dispersion gal
>500	2	522	6	1	524	0
250-500	84	330	62	54	320	54
125-250	216	177	35	171	176	33
62.5-125	162	100	16	132	91	18
<62.5	0	0	0	106	42	13

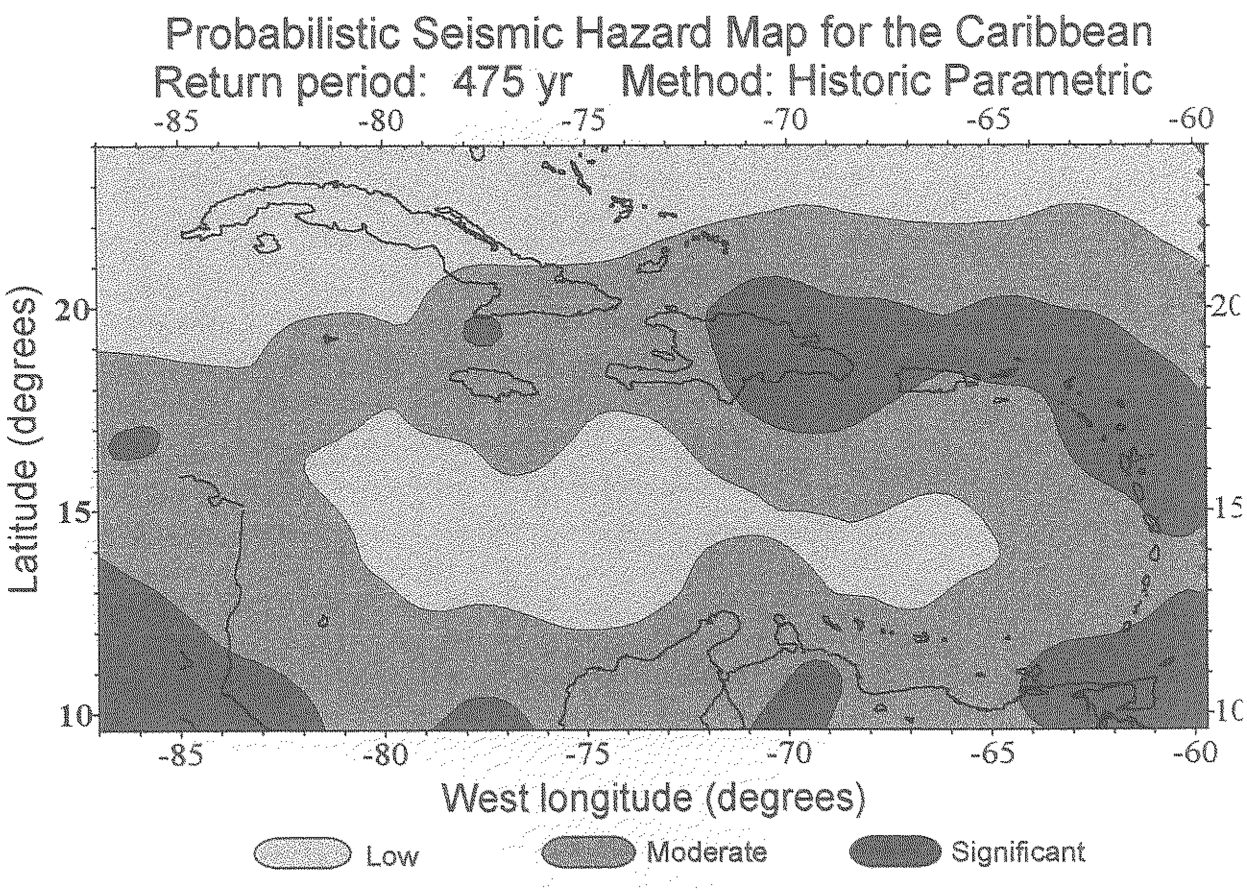

Figure 22. Probabilisitc seismic hazard map of the Caribbean compiled for the gridded values provided by McQueen, 1997. The computations were made at intervals of 0.2° with each value determined from 25 iterations using random numbers to scale estimated uncertainties of all earthquake parameters used in the calculations.

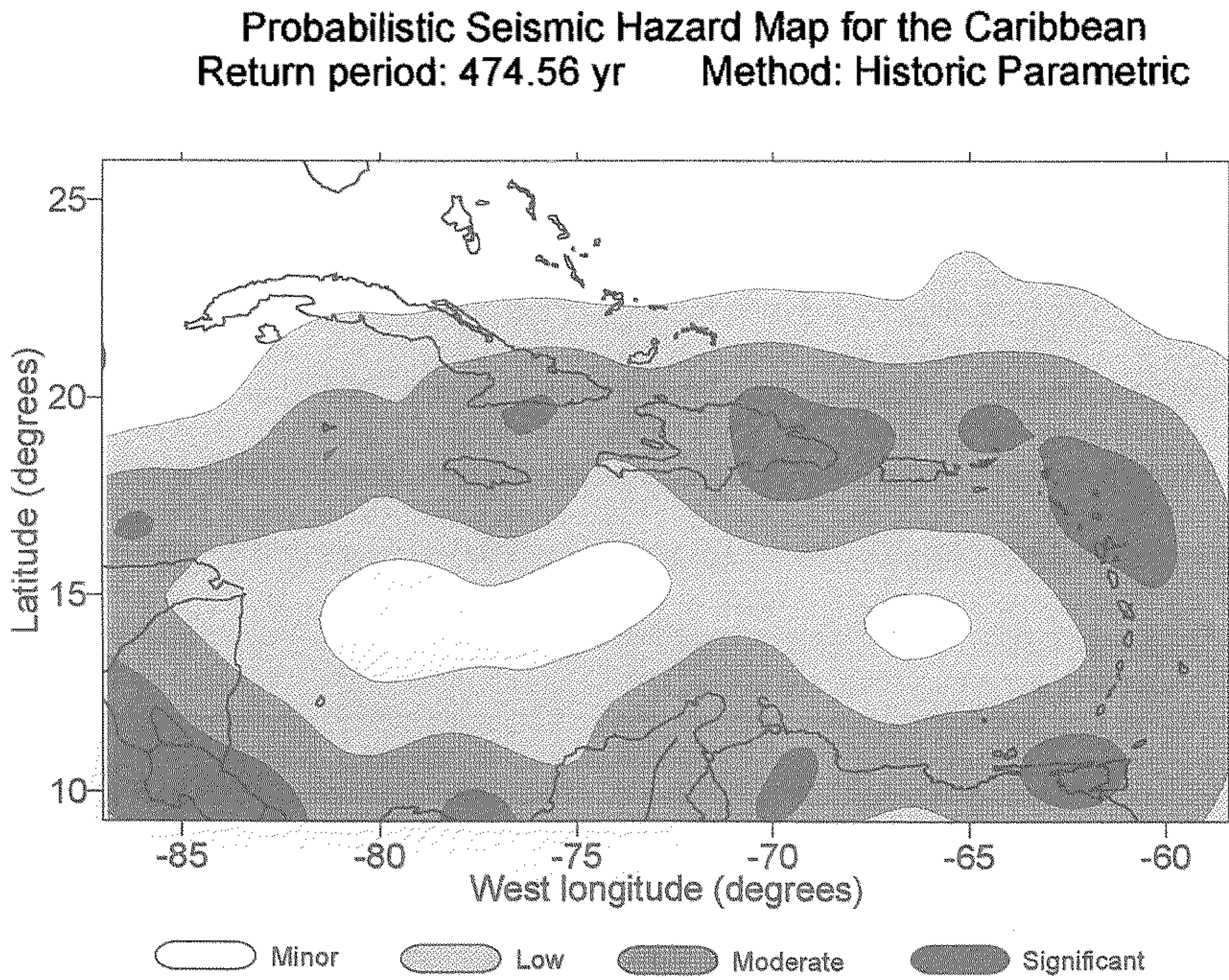

Figure 23. Probabilistic seismic hazard map for the Caribbean compiled from data provided by IPGH for solid rock or equivalent The grid interval is 0.25° - all values detemined after 100 iterations using random numbers to scale estimated uncertainties in earthquake parameters.

The observant reader will also note that a "seam" exists between the regional results for Central America (Fig. 18) and the Caribbean (Fig. 22) McQueen, 1997 resolved these differences

Local representations

Fig. 23 shows a seismic hazard map of the Caribbean compiled to the specifications of the Steering Committee. Attention is drawn to the island of Jamaica in the central west part of the map, south of the eastern end of the Island of Cuba. According to the map in Fig. 23 the entire island is covered by the same level of hazard (called "moderate" in this report). However. Fig.24 shows the presence of a quasi-circular zone of hazard values falling within the level called "significant" in this report. This area of "significant" hazard is about one-half degree square and is located over the eastern end of the island.

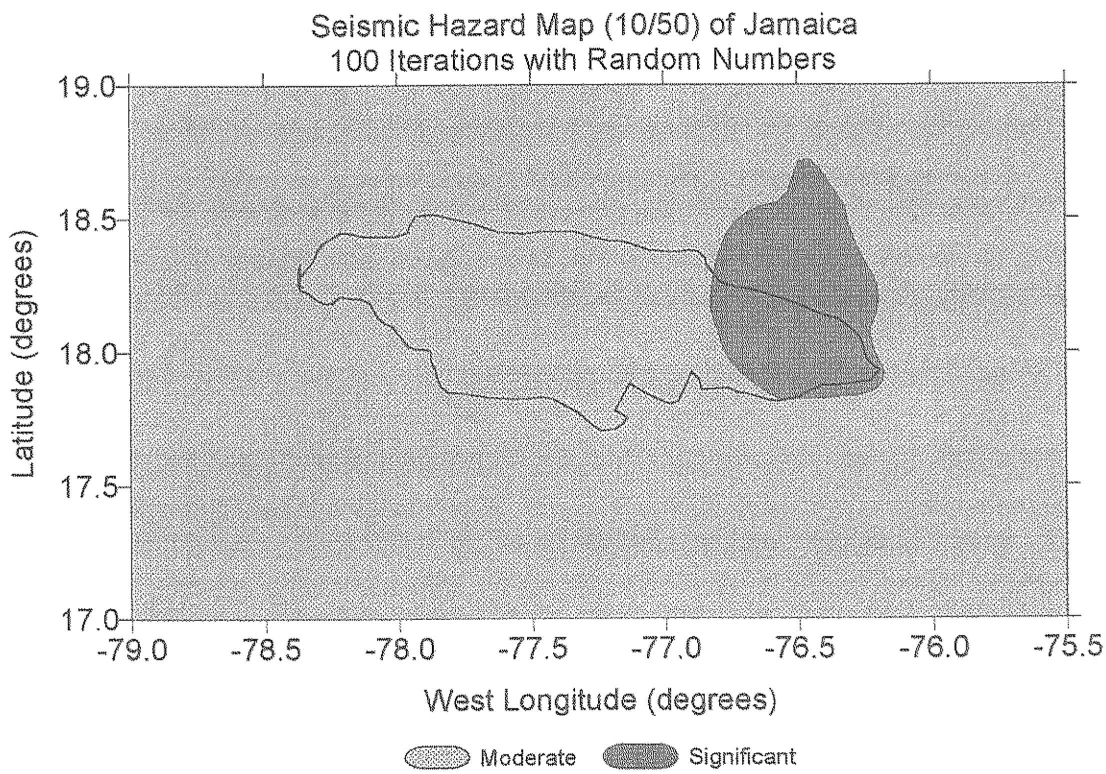

Figure 24. Seismic hazard map (solid rock or equivalent) of the island of Jamaica computed by the historic parametric method at a grid interval of 0.1° from the IPGH catalogue. The values at grid points were detemined after 100 iterations using random numbers to scale estimated uncertainities of parrameters used in the calculations.

In Fig. 23 the hazard values used to compile the map were computed at 0.25° intervals as compared to 0.1° for those for Fig. 24. Depending on where the points in the regional grid fall, there could be only two or three of them located within the area which would make any values in the "significant" range good candidates for elimination by the smoothing used in SURFER during the gridding and contouring processes.

The difference in the two maps demonstrates the necessity of computing a more detailed grid to provide the fullest possible view of seismic hazard when faced with the need to provide advice to authorities responsible for setting building codes or criteria for the construction of large engineered structures.