A Revised Earthquake Catalogue for the Eastern Caribbean Region: 1513-1992

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Abstract

We present a revised earthquake catalogue for the eastern Caribbean region 8 °N to 22.5 °N, 58 °W to 70 °W covering the period 1530 to 1993. Sizes of all events for which sufficient information exists have been expressed in terms of seismic moment either measured directly or derived from earthquake magnitude by theoretical and empirical formulae. From 1530 to 1900 the sources of information consist entirely of written accounts of felt earthquakes. The completeness of this part of the catalogue varies throughout the region but it is probably complete down to magnitude (M_ω) 6.5 to 7 since 1800 and perhaps as far back as 1600 for some parts of the region. From 1900 onwards an increasing number of instrumentally-determined epicentres and magnitudes are available but reports of felt earthquakes continued to exceed instrumental observations at least until 1950. During this period the lower magnitude for completeness is in the range of 5.5 to 6. After 1950 the establishment of more modern seismograph stations within the region gradually improved the location threshold but the major improvement did not occur until 1964 when the almost simultaneous completion of the WWSSN and the establishment of the ISC further reduced the threshold to about 4.0. Within limited regions such as the central Lesser Antilles and the Trinidad-Tobago region where local seismograph systems are particualrly efficient the location threshold is now down to the microearthquake level.

Introduction

An earthquake catalogue with uniform magnitude determinations and estimates of the time period and magnitude ranges for which it is complete is an essential requirement for probabilistic estimates of seismic hazard levels. Until now, such a catalogue has not existed for the eastern Caribbean region so that previous estimates of the levels of ground acceleration and velocity with given probabilities of exceedance in given time periods have been subject to very large uncertainties. In this paper we present an earthquake catalogue for the region 8 °N to 22.5 °N, 58 °W to 70 °W covering the period 1530 to 1993. The catalogue has been prepared in computer-readable form in two sections. The first section contains a one-line entry for each earthquake which includes origin time, hypocentral coordinates, magnitude estimates (if available), maximum intensity (if known) and source identification for the material included. This part of the catalogue is in the Kintbury format of the International Seismological Centre (ISC). Each earthquake is identified by a unique 15-digit identifier which consists of the origin time of the earthquake expressed to the nearest one-tenth of a second. This identifier allows cross reference to the second section of the catalogue which includes extra information such as intensity maps, focal mechanisms and bibliography on any other information relevant to particular earthquakes. Entries into the secondary catalogue are made only for earthquakes which are of particular interest either because they were felt strongly, had unusual focal mechanisms or were in unusual locations.

Data sources

There are two distinct sets of data sources for the catalogue. The first set consists of reports of earthquakes felt in the region since the first European settlements in the early sixteenth century. Until about 1907, these reports constitute the only information available about eastern Caribbean earthquakes. The reports have been collated and analyzed by a number of authors notably Robson (1964) and Grases (1971). For the earthquake histories of Martinique and Guadeloupe we have relied mainly on Feuillard (1982) and Bernard and Lambert (1988). Our main historical source for the Dominican Republic is Iñiguez Pérez et al. (1975) and for Venezuela we have relied on Fiedler (1961) and Centeno-Grau (1969). During the preparation of this catalogue we have re-examined most of the historical sources cited by these authors and carried out further investigations of historical archives in the West Indies and the United Kingdom. We have re-estimated intensities on the Modified Mercalli scale for all earthquakes initially reported felt at intensity VI or greater and for a small number of earthquakes not mentioned by these authors. More detailed descriptions of all of these earthquakes are given by Shepherd and Lynch (1992). Hypocentral coordinates for historical earthquakes have been estimated only for earthquakes reported felt in a number of separated locations. In continental regions, single reports of felt earthquakes may provide valuable information about local seismic sources but in a region almost entirely covered by the sea single felt reports concentrate apparent seismic sources in the islands themselves. The main exception in this region concerns volcanic earthquake swarms which are frequent in some of the islands of the Lesser Antilles. These are significant for earthquake hazard assessment but must be treated in a different way (Shepherd, 1989).

The second data set consists of instrumental determinations of earthquake hypocentres. The first seismograph in this region was established in Trinidad in 1898 but reliable determination of earthquake epicentres from locally-recorded data did not begin until more than sixty years later. As a starting point for the instrumental catalogue we have used the instrumental catalogue of the International Seismological Centre (ISC). For the period up to January 1, 1964, the ISC catalogue consists of a collection of hypocentral determinations from a number of different sources. For this region the most important sources are the catalogues of the International Seismological Summary (ISS), the Bureau Centrale Internationale de Sismologie (BCIS), Gutenberg and Richter (1954, GUTE) and Sykes and Ewing (1964, SAE). More recently, Russo et al. (1992, ROR) have recomputed hypocentral coordinates and magnitudes for the bigger earthquakes of the southeastern Caribbean and Pacheco and Sykes (1992, P&S) have recomputed magnitudes globally for all earthquakes of surface-wave magnitude greater than about 7. Data from all of these sources have been incorporated into the catalogue.

The ISC began to operate in its present form in 1964 which was also the year that the World-Wide Standardized Seismograph Network (WWSSN) came into full operation. Since 1964 the ISC has computed hypocentral coordiantes for all earthquakes for which it has access to sufficient data. Since most of the seismograph stations in operation in the eastern Caribbean region report their data to the ISC, the ISC catalogue is the most comprehensive catalogue for this region for the period 1964 onwards. However, the data computed by the ISC must be used with care. ISC hypocentral cordinates are recomputed from regional arrival times with additional arrival times from outside the region. The travel-times used in the computations are global average travel time tables which might not be entirely appropriate for the Caribbean region. For inclusion in the catalogue we have preferred hypocentral computations using regional travel time tables where these are available. The most comprehensive regional solutions for the eastern Caribbean region are the quarterly bulletins of the Seismic Research Unit of the University of the West Indies (TRN) which incorporate arrival times from other regional networks, including those of the Institut de Physique du Globe (IPG), the Fundacion Venezolana de Investigaciones Sismologicas (FUNVISIS) and, for limited periods, the Caribbean networks of the Lamont-Doherty Geological Observatory. Shepherd and Aspinall (1983, SAA) further refined TRN solutions for the period 1964 to 1979 using the method of joint hypocentral determination and Shepherd et al. (1986) extended these computations to 1985. They have been further extended to 1993 as part of this study.

In a number of cases there are alternative solutions for the same event. In these cases we have selected our preferred solution and the preferred solutions are indicated by an asterisk in column 1 of the record. A blank in column 1 indicates that the record is an alternative solution, and alternative solutions are not included in the statistics which follow. We have not included all alternative solutions to which we had access. Some alternative solutions are preliminary solutions based on limited data which are later superceded. The most frequent examples of this are the solutions of the United States National Earthquake Information Center and its predecessor organisations. NEIC solutions are absorbed by the ISC after a period of about two years and are included here only when there are no alternative solutions. We have also excluded solutions provided by large and small aperture seismic arrays in various parts of the world and solutions from regional networks when the earthquake epicentre clearly lies well outside the region covered by the network. We have made a careful search of the catalague for duplicate and spurious events using software developed by Tanner et al. (1993) for this purpose. We believe that the catalogue is certainly free of duplicate events for earthquakes of magnitude greater than about 4.5. After elimination of duplicate and spurious events exactly 12,010 events remain in the catalogue for the period up to June 26, 1993. The sources of these events are shown in Table 1.

Table 1: Sources of hypocentres in eastern Caribbean catalogue

Source	Number	Remarks
ISC	6816	Instrumental solutions 1964-91
TRN	1826	Instrumental solutions 1953-91
SISRA	1380	Macroseismic solutions exclusively to 1900. Increasing proportion of instrumental solutions from many South American networks (including TRN)
NEIS	803	Mainly 1991-93 for which ISC has not yet published final results.
SBAC	547	Recomputed from TRN solutions 1979-91
SAE	147	Early instrumental 1945-1963
ISS	126	Early instrumental 1913-1963
NEIC	100	As NEIS
SYKES	65	As SAE
SAA	53	As SBAC 1964-1979
GUTE	43	Early instrumental 1900-1952
SAL	30	Macroseismic, 1530-1899
ROR	29	Early Instrumental 1920-1963
CGS	13	As NEIS
USCGS	11	As NEIS
BCIS	7	Early Instrumental 1945-1963
MACRO	6	Macroseismic, early twentieth century
CAR	5	Instrumental
PDE	3	As NEIS

Earthquake magnitudes

One of the main reasons for the compilation of this catalogue was to prepare for the construction of new seismic hazard maps for the region. In the construction of such maps one of the most crucial quantities is earthquake magnitude, or some equivalent measure of earthquake size. Of the 12,010 earthquakes in our data set there are no magnitude estimates at all for 9,276 events. For the remaining 2,734 earthquakes we can identify 37 different methods which have been used to estimate earthquake magnitude.

In order to compare rates of activity in different parts of the region and to predict the levels of ground motion which will result from earthquakes we need to be able to describe the sizes of as many earthquakes as possible in terms of a uniform magnitude scale.

The Moment magnitude

It is now generally recognized that the most reliable quantity for the estimation of the size of earthquakes is the seismic moment M_o (Kanamori, 1977). M_o is preferred over other measures of earthquake size both because it provides a more direct comparison between the sizes of different earthquakes and because it can be more directly related to the parameters of strong ground motion such as peak ground acceleration (PGA) and peak ground velocity (PGV) than can the older measures of earthquake size. There are only 63 events in the catalogue for which direct measurements of seismic moment are available so that it is necessary to estimate seismic moment from the more traditional magnitude measurements. For earthquakes with surface-wave magnitudes (M_s) between about 6 and 7.5, a magnitude-moment relationship

$$\log_{10} M_o = 1.5\ M_s + 16.1 \qquad (1)$$

can be defined empirically (Kanamori, 1977). Conversely, if the seismic moment is known we can define a quantity known as the moment magnitude of the earthquake, M_ω, by inverting equation (1) to

$$M_\omega = (2/3) \log_{10} M_o - 10.7 \qquad (2)$$

M_ω is our preferred magnitude scale for use in this catalogue. Equation (1) becomes a poor predictor of seismic moment if M_s is greater than about 7.5 or less than about 6.0. Okal (1989) has suggested that for the lower magnitude range a better relationship than (1) is

$$\log_{10} M_o = M_s + 19.46 \qquad (3)$$

Combining equations (2) and (3) we have

$$M_\omega = (2/3)\ M_s\ - 2.24 \qquad M \leq 6.0 \qquad (4)$$

In order to test the applicability of these relationships to our data set we have examined those earthquakes for which we have simultaneous measurements of both M_s and M_o. Unfortunately there are insufficient data in the eastern Caribbean data set to make the comparison statistically meaningful so we have used a larger data set (Shepherd and Tanner, in prep.) covering the entire Caribbean/Latin American region which includes 619 simultaneous measurements of the two quantities. Figure 1 shows a scatter diagram of Seismic Moment (plotted logarithmically) against M_s for these events, with the straight lines representing the Kanamori and Okal relationships superimposed. Okal's relationship is reasonably good in the range $10^{24} < M_o < 10^{24}$ dyne-cm and Kanamori's relationship is reasonable up to about $M_o = 10^{28}$ dyne-cm.

We can use these equations to estimate moment magnitudes for earthquakes which have a reliable determination of M_s. We have estimated moment magnitudes for a further 308 events by this method.

By far the most common magnitude scale used in the catalogue is the body-wave magnitude m_b. In principle it ought to be possible to establish similar theoretical and empirical relationships by which M_ω can be estimated from m_b. In fact any such relationships are less precise than the relationships with M_s. In Figure 2 we have plotted m_b against $\log_{10} M_o$ for 1,189 earthquakes in the Caribbean/Latin American region. Although there is a linear trend, there is much more scatter of individual values about the best fitting line and the effect of saturation of the body-wave magnitude scale can be seen fairly clearly. For values of M_o less than about 10^{26} dyne-cm the best-fit relationship is

$$m_b = 0.35 \log_{10}M_o - 3.17 \qquad (5)$$

For greater values of M_o all m_b values are 6.2 ± 0.25. Combining equation (5) with equation (2) we have

$$M_\omega = 1.9m_b - 3.17 \qquad (6)$$

Using equation (6) we can estimate moment magnitudes for a further 1,983 earthquakes making a total of 2,354 or slightly less than 20% of the total number observed. 381 earthquakes remain for which there is a magnitude estimate but we have been unable to establish any realtionship either directly with M_ω or indirectly through other magnitude scales.

An apparent weakness of this method of uniform magnitude estimation is that the least reliable method (derivation of M_ω from m_b) is used for the largest number of earthquakes. In fact this is much less of a weakness than it seems. Table 2 shows the numbers of earthquakes in different magnitude ranges with the methods of estimating magnitudes and the total moment release for each range.

The total moment release for all earthquakes in the catalogue is equivalent to that in a single earthquake of magnitude approximately 8.6. The ten largest earthquakes in the catalogue account for about 75% of the moment release and over 99.7% of the moment release occurred in the 202 earthquakes of magnitude 5.5 or greater. The proportion of reliable magnitude determinations increases dramatically as the magnitude increases, and in the range of magnitudes at which earthquakes begin to cause damage (greater than about 5) we have reliable magnitude determinations for more than 70% of events.

Table 2: Orignal magnitude sources for estimates of M_ω

Magnitude	Direct	From M_s	From m_b	ΣM_o ($\times 10^{28}$ dyne - cm)
All	63	308	1,533	7.1433
>4.5	63	296	286	7.1417
>5.5	29	125	45	7.1203
>6.0	10	89	16	7.0681
>6.5	3	30	5	6.7858
>7.0	-	22	-	6.5433
>7.5	-	10	-	5.5119

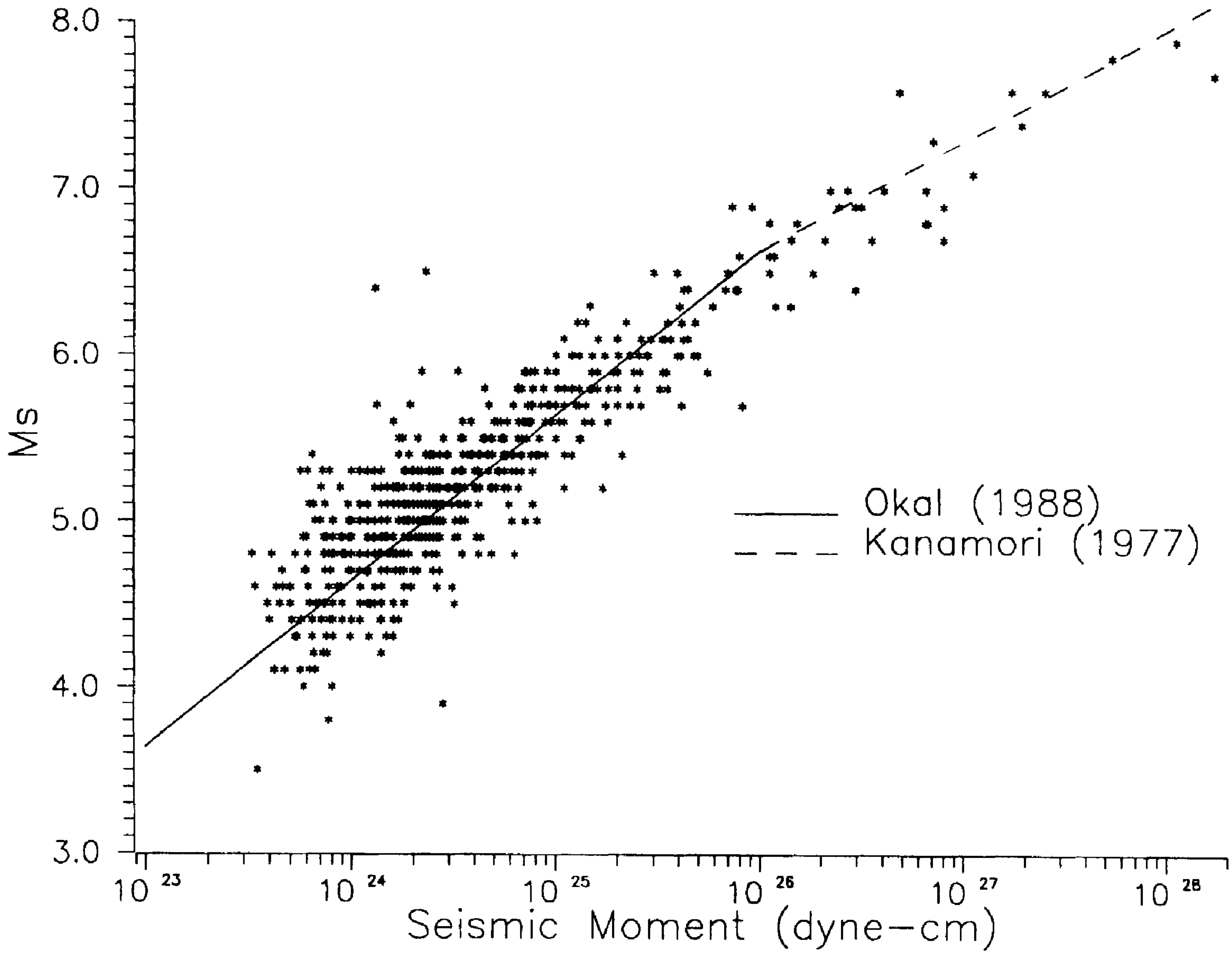

Figure 1: Seismic moment (dyne-cm) plotted against M_S for 619 Latin-American / Caribbean earthquakes.

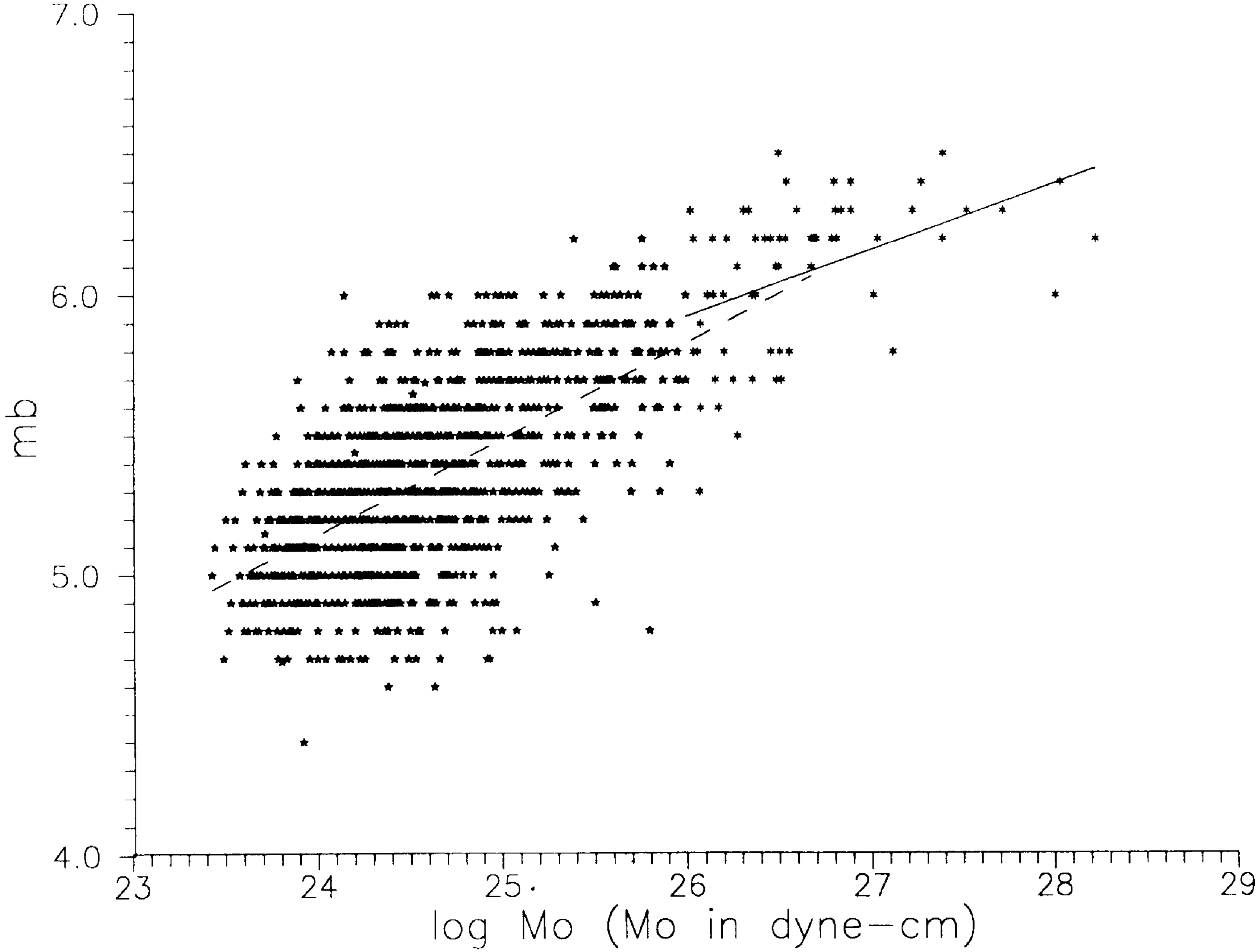

Figure 2: Seismic moment (dyne-cm) against m_b for 1,189 Latin-American/Caribbean earthquakes

Catalogue completeness

The pre-instrumental catalogue relies on reports of felt earthquakes which in turn depend on the presence of people able to feel earthquakes and with the means of communication to report them. The earliest reports of felt earthquakes therefore depend on the earliest dates at which the islands became permanently settled. Because we have restricted catalogue entries to earthquakes which were felt widely or caused damage, the lower magnitude limit for this period is about 6.5-7. The catalogue is probably complete for earthquakes above this limit from the following dates:

Dominican Republic (eastern part), Puerto Rico, Venezuela	1600
French Antilles, Leeward Islands, Barbados	1650
Windward Islands	1750
Trinidad	1766
Tobago	1800

Epicentral coordinates during this period are correct to about the nearest degree. Focal depths can generally be described as shallow (less than 30 km) or intermediate (greater than 30 km). The deepest known earthquakes in this region do not exceed 200 km in depth.

From about 1900 onwards we can rely increasingly on instrumental data. For the period 1899 to 1913, the British Association for the Advancement of Science (BAAS) published annual reports of instrumentally-recorded earthquakes, including reports from seismograph stations in Trinidad and Puerto Rico but these early seismographs did not materially improve the detection rate in the region. Robson (1964) reports over 100 earthquakes felt in the region from 1899 to 1913 but there are instrumental epicentres for only 7 of these. The BAAS Seismological Committee became the International Seismological Summary (ISS) which began to publish regular global bulletins in 1913 but the number of earthquakes felt throughout the region continued to exceed the number of instrumental determinations until the early 1950's when the first eastern Caribbean networks (rather than individual stations) began to report local hypocentre determinations. For this period we have continued to estimate hypocentres from macroseismic information for earthquakes felt widely but not located instrumentally. The lower magnitude limit for complete detection is between 6 and 6.5.

From the time that local networks began to report in the early 1950's, it is reasonable to look at the data themselves to test for completeness. Figure 3 shows the annual numbers of earthquakes in the catalogue from 1900 to 1993. Before 1940, annual numbers are sporadic with no earthquakes reported at all in many years. A significant peak in 1918-20 corresponds to the major Puerto Rico earthquake of 1918 and its aftershocks. From 1940 onwards the annual numbers of earthquakes in the catalogue increase at a roughly exponential rate in parallel with a similar exponential increase in the Latin America/Caribbean region as a whole. The signficant peak in 1946 corresponds to the major earthquakes in the eastern Dominican Republic in that year.

The establishment of regional networks in the 1950's had no significant effect on the overall location rate and the impact of the establishment of the ISC and the almost simultaneous completion of the WWSSN network in 1964 is less dramatic than might have been expected. Total annual numbers have continued to rise at an exponential rate right up to the present. However, from 1964 onwards the numbers of earthquakes in the catalogue with magnitudes M_ω greater than about 4 settled to a reasonably constant value with annual variations which can be explained by chance. We conclude that the catalogue is complete for magnitudes 4 and greater from 1964 to the present. Before 1964 the level of completeness is no lower than 5.5.

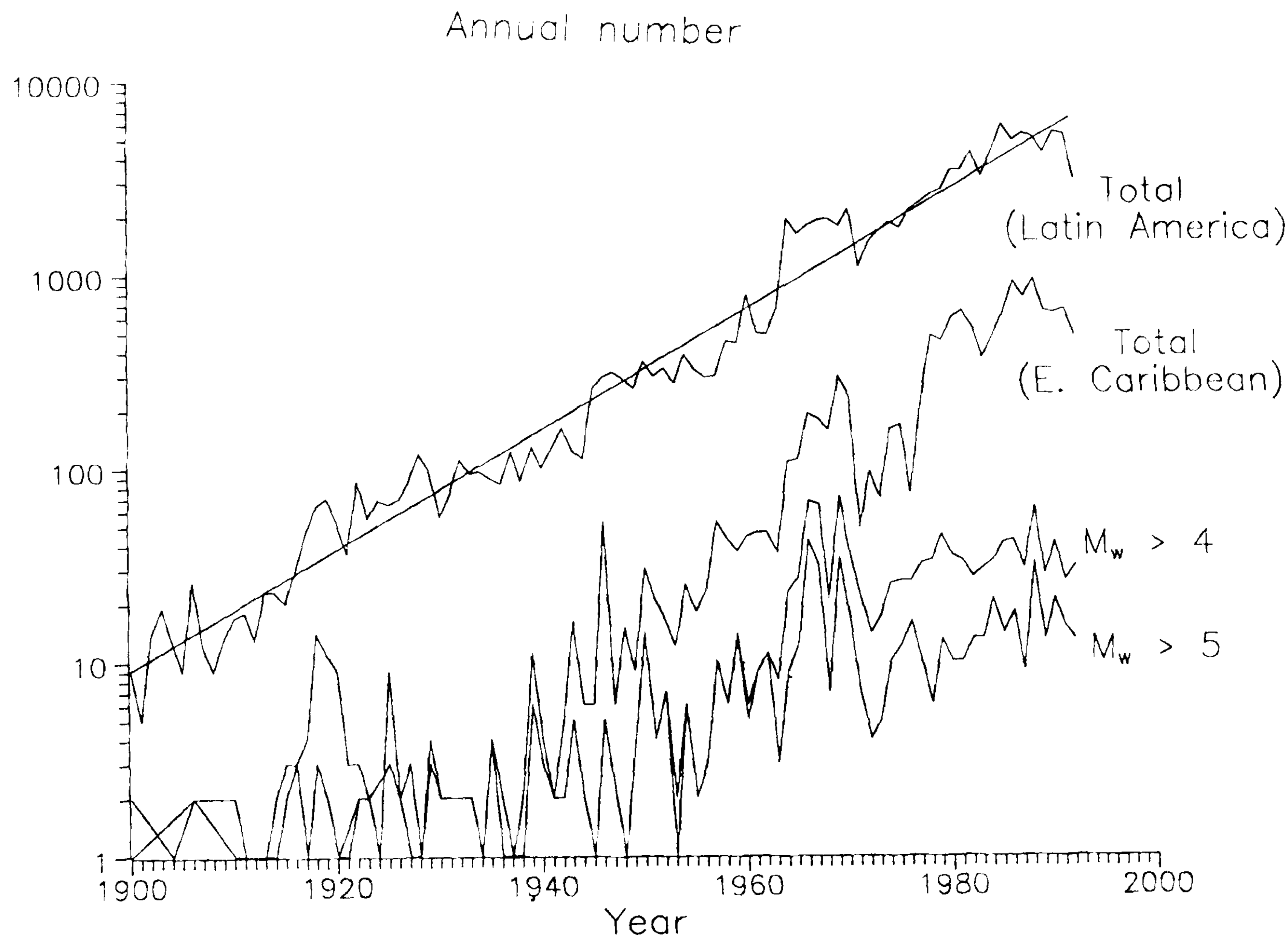

Figure 3: Annual numbers of earthquakes in the catalogue 1900-1993.

Most of the earthquakes which have occurred since 1963 and to which no magnitudes are assigned are not in fact of unknown magnitude. They are simply so small that standard methods of magnitude estimation cannot be applied. The same is not true of the earthquakes which occurred before 1964. The ISS did not report earthquake magnitudes and the BCIS rarely did so. Most of the magnitude determinations in this catalogue therefore result from individual studies of particularly interesting earthquakes which quite naturally tend to be the bigger ones. Seismograms exist for many earthquakes before 1964 for which there are no magnitude estimates althouth analysis of some of these seismograms for the larger events has already been done (e.g. Russo et al., 1992; Russo and Bareford, this volume; Doser and VanDusen, this volume).

References

Bernard, P. and Lambert, J. (1988). Subduction and seismic hazard in the northern Lesser Antilles: revision of the historical seismicity. Bull. Seism. Soc. Am., 78:1965-1983.

Centeno-Grau, M. (1969). Estudios Simologicos. Biblioteca de la Academia de Ciencias Físicas, Mathemáticas y Naturales, Volumen VII. Caracas.

Dziewonski, A.M., Chou, T.A. and Woodhouse, J.H. (1982). Determination of earthquake source parameters from waveform data for studies of global and regional seismicity. J. Geophys. Res., 86: 2825-2852.

Feuillard, M. (1982). La sismicité historique de la Guadeloupe et la Martinique. Ph.D. thesis, Observatoire Volcanologique de la Guadeloupe. (unpublished).

Fiedler, G. (1961). Areas afectados por terremotos en Venezuela. Memoria del III Congreso Geologico de Venezuela vol IV Boletin de Geologia, publicacion especial 3. Ministeria de Minas e Hidrocarburos, Caracas.

Grases, J. (1971). La sismicidad historica del Caribe. Informe que presente el Ing. Jose Grases G. a la Junta Directiva del Comité Conjunto del Concreto Armado. FUNVISIS, Caracas.

Gutenberg, G. and Richter, C.F. (1954). Seismicity of the Earth and related phenomena. Princeton University Press, Princeton.

Iñiguez Pérez, H.M., Acosta Segura, R. and Vizcaíno, I.A. (1975). Relacion de sismos ocurridos en La Isla de Santo Domingo (1551-1975). (unpublished).

Kanamori, H. (1977). The energy release in great earthquakes. J. Geophys. Res., 82: 2981-2987.

Okal, E.A. (1989). A theoretical discussion of time domain magnitudes: the Prague formula for M_s and the mantle magnitude M_m. J. Geophys. Res., 94: 4194-4204.

Pacheco, J.F. and Sykes, L.R. (1992). Seismic moment catalog of large shallow earthquakes 1900 to 1989. Bull. Seism. Soc. Am., 82: 1306-1349.

Robson, G.R. (1964). An earthquake catalogue for the eastern Caribbean 1530-1960. Bull. Seism. Soc. Am., 54: 785-832.

Russo, R.M., Okal, E.A. and Rowley, K.C. (1992). Historical seismicity of the southeastern Caribbean and tectonic implications. Pure App. Geophys., 139: 87-119.

Shepherd, J.B. (1989). Eruptions, eruption precursors and related phenomena in the Lesser Antilles. In: Latter, J.H. (ed.). Volcanic hazards. Springer-Verlag, Berlin, pp. 292-311.

Shepherd, J.B. and Aspinall, W.P. (1983). Seismicity and earthquake hazard in Trinidad and Tobago, West Indies. Earthq. Eng. Struct. Dyn., 11: 229-250.

Shepherd, J.B., Beckles, D.M., Aspinall, W.P. and Clarke, S. (1986). Recent seismicity of the Trinidad/Tobago Paria Peninsula region. Transactions Fourth Latin American Geological Conference, Port of Spain, pp. 926-928.

Tanner, J.G., Nagy, D. and Shepherd, J.B. (1993). MANAGE: computer programs for the treatment of earthquake catalogues. Geophysics Commission, PAIGH. (unpublished).

A Revised Magnitude Scale for the Puerto Rico Seismic Network

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Abstract

The Puerto Rico Seismic Network consists of an array of 18 stations installed in Puerto Rico and the Virgin islands. Most field stations consist of a Teledyne Geotech S-13 vertical component short period seismometer, with a natural frequency of 1 Hz and a Teledyne Geotech preamplifying system (model 46-22). The signals from the stations are recorded on paper on helicorders and digitally with both the Soufrière and IASPEI systems. The program used to calculate the locations and magnitudes of the earthquakes is HYPOINVERSE.

Two magnitudes are determined, local and coda/duration magnitude. The local magnitude is based on maximum peak-to-peak amplitude, while the duration magnitude is based on the duration of the event.

In the seismic bulletins of 1990, 1991 and 1992 published by the Puerto Rico Seismic Network it was observed that the magnitudes, both local and coda, calculated for each of the local events was greater than those reported for the same events by the National Earthquake Information Center's Preliminary Determination of Epicenters Bulletin. The difference in magnitudes increased as the magnitude increased, with a difference of up to a factor of 1 - 2. Therefore, a study is presented to correct the magnitudes as a function of epicentral distance and depth to approximate them to those published by the Preliminary Determination of Epicenters.

Seismic Risk in Southwest Tobago

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Abstract

Tectonically, Trinidad and Tobago lie close to the junction of the Caribbean and South American plates. At such hinge junctions it is normal to have increased seismicity. The strike-slip El Pilar fault runs EW through northern Venezuela and terminates to the east along the southern base of the Northern Range in Trinidad. There has been much debate as to whether or not the eastern extension of the El Pilar in Trinidad is active. Nevertheless, even if this fault system is relatively inactive in Trinidad, major earthquakes from the northern Venezuela region will still pose a seismic risk in Trinidad. In addition to the EW trending El Pilar system there is also an active NE - SW trending fault beginning at the triple junction off Venezuela, passing through southern Trinidad. Seismic risk in Trinidad has, therefore, been an acceptable concept and consequently the building codes and the insurance industry have responded to this type of hazard. It should be noted, though, that the actual level of seismic risk in Trinidad is still controversial. By contrast, Tobago, being more northeasterly and distant from the triple junction in NE Venezuela, has generally been considered low in seismic risk. There is always the low probability of a large background regional seismic event occurring in the vicinity of Tobago. However, prior to 1982, no known active fault system was believed to exist close to or within Tobago. During 1982 a swarm of many hundred earthquakes occurred in SW Tobago directly beneath the main population centres in the island. The largest event had magnitude 5.2. If this earthquake was even one-half magnitude greater the result would have been catastrophic for SW Tobago. The potential of a seismic hazard in Tobago is therefore very real.

In the presentation I will review the events of 1982 highlighting what we now know, and what we need to know about the southern Tobago fault system. The fault system runs from the Bucco Reef to Scarborough. It is, therefore, imperative for the safety of the citizens of Tobago that appropriate personnel discuss and formulate a plan to further investigate and possibly reduce the seismic risk that may be caused by the active southern Tobago fault system.

Diagnosis of the Time of Increased Probability of Earthquakes of Magnitude ≥ 5.5 in the Lesser Antilles arc

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Abstract

The earthquake catalogue issued by the "Département des Observatoires" of the "Institut de Physique du Globe de Paris" provides the possibility of intermediate-term prediction of earthquakes of magnitude $M \geq 5.5$ in the central Lesser Antilles arc. The CN algorithm, applied to this catalogue, identifies two Times Increased Probability (TIP) of such events : the first precedes the only strong earthquake (3.16. 1985, ML =6.2), which occurred during the period considered; the second is a current alarm. During both TIPs, the seismic activity increases above a depth of 40 km and decreased below it.

The application of the method with a data set which includes only shallow events ($h \leq$ 40 km, hence excluding the deeper earthquakes of the Benioff plane) gives encouraging results. This is promising for the future monitoring of TIPs in order to test the methodology by advance prediction.