Understanding and completing a catalogue of earthquakes: The case of Trinidad

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Translated from the French and with a foreword by Julien Fréchet.

Foreword

From 1983 on, Jean Vogt published several notes on the historical seismicity of the Caribbean and adjacent countries of South America. He visited many archives and libraries in the region as well as in Europe and the United States, and collected a large number of new original sources. This paper analyzes several felt or damaging earthquakes in Trinidad and Tobago. Vogt presents new original archive findings that modify significantly the picture of the Trinidad seismicity as found in the catalogue of Robson (1964). An introduction and many details about this and the context of West Indies historical seismicity can be found in Vogt 2004 (A glimpse at …), which announces the present text.

Jean Vogt prepared a draft of this paper in the months preceding his death in 2005. The manuscript was left in a near-final state. The file containing the manuscript included several versions of the paper somewhat mixed together, with handwritten notes and corrections. It contained also copies of the original sources cited in the text. We edited the draft, trying to complete several references and notes. [Our corrections are written within square brackets. The paragraph titles are ours.]

1. Introduction

Any seismicity map shows that Trinidad is located at a seismotectonic crossroads.[1] It so happens that one of the seismicity catalogues of the Lesser Antilles developed was some time ago in Trinidad, probably considered as an observatory *par excellence*.[2] However Trinidad, and Tobago incidentally, are characterized by a usually modest seismicity with notable events in large intervals, regardless of the epicentres, near or far. Significantly, a comparison is made during the earthquake of 1825 with the mainland and the Lesser Antilles: "We shall feel considerable anxiety until we hear from St. Vincent and the neighbouring islands and mainland opposite where these disasters are much more frequent and destructive than in Trinidad."[3]

It seemed worthwhile to take a closer look at this catalogue, until 1890, without precluding subsequent work. Actually, the catalogue is of limited interest about the Lesser Antilles which will be mentioned only incidentally. We will focus our attention on Trinidad, all the more since for a wide time-period it is based extensively on local sources (press). This does not preclude at the same time borrowings from Mallet, on which the author elaborates, and from Perrey whose contribution however is only partially exploited, while Poey's catalogue is not used.[4] Also, the information is often simplified to the extreme, while sources provide valuable information, for example about aftershocks. Appraisal of intensities is sometimes conventional, as pointed out by the author.

While no specific personal research has been undertaken, however random readings provide new elements, clarifications and questions, sharing in a revision programme carried on for several years in the West Indies.[5]

2. Test Period: 1819-1890

We start with brief statistics on Robson's data, for an arbitrary time-period, spanning from 1819, first year mentioning an earthquake in the XIX century, to 1890. Strikingly, Trinidad appears by itself forty times. The grouping Trinidad / Lesser Antilles appears only six times, while that of Trinidad, Lesser Antilles and French Guiana is recorded a dozen times. As to Venezuela, it is mentioned only twice. Obviously, that's where the shoe pinches. Without limiting ourselves to this

chronological bracket, Cumana appears as the major Venezuelan reference point, beyond doubt by ‘urban fixation’. Such a picture leaves us with the impression of a Trinidadian seismicity somewhat in isolation.

In fact, just browsing Robson’s catalogue overall makes us realize that many regional events identified without explicitly mentioning Trinidad were probably felt there. In this regard we can speak of implicit events. That would be the case of two notable events of 1839. Indeed, the first one, damaging in Martinique on 11 January 1839, is reported by Robson in Barbados (with an intensity value of VII) and French Guiana. Such a remark applies to the shock on 2 August 1839 with the same landmarks.

For an even more reduced chronological slice, from 1819 to 1857, let us take a glance at Poey’s catalogue, albeit brief, but which has the advantage of providing us with an extended list of references. If the name of Trinidad appears occasionally in conjunction with other places, mentions of Trinidad alone, or sometimes of Tobago, are found in 1835, 1840, 1847, 1848, 1851, 1854, 1855.

But, returning to a broad chronological framework, Poey feeds in some sort of compensation the list of ‘implicit’ tremors. Such is the case of the events on 24 April 1767, as reported in the Lesser Antilles and French Guiana, and on 22 December 1816, with the same spatial references. Our own research provides similar occurrences, such as on 11 and 30 January 1728.[6]

3. Chronological revision: XVIII century

Let us now follow the chronology, considering only a few notable events or those having special interest, in a somewhat arbitrary manner, in the light of our own readings.

We discard most former events compiled by Robson at some distance, based mostly on Mallet. Here is one exception: based on a modern historian, a sharp shock is reported, with damage, in 1765 in St. Joseph: “In St. Joseph, a strong earthquake damaged houses and a church.” Sources and context escape us. If Robson reports the destruction of Cumana on 21 October 1766, as usually after Mallet, he does not however breathe a word about Trinidad, a surprising silence all the more since Fiedler assumes a nearby epicentre, in the vicinity of Carupano. The same earthquake is recorded in French Guiana.[7] Furthermore an outline of

isoseismals suggests a pleistoseist area extending up to Trinidad.[8] In this context we just identified an obviously second-hand doom-mongering echo, referring to the island. It describes "*une secousse … si violente que la surface de cette île en avait été totalement changée, les plus grandes montagnes s'étant affaissées et se trouvant de niveau avec la plaine*" ("a shock … so violent that the surface of this island had been totally changed, the highest mountains subsiding and flattened to the level of the plain").[9] Although the source of this information escapes us, it does raise concern because of the context.

Robson remains silent until 1790, when he records three shocks in Tobago alone, once again after Mallet. We share with Poey a jolt occurred on 26 February 1785, felt in both Trinidad and Lesser Antilles.

Actually a key event eludes Robson, probably in 1794, the year for which the only report is the destruction of Cumana, now according to the Venezuelan catalogue of Fiedler. Yet, it seems to be this event to which relates the remarkable description by a witness, Moreau de Jonnès, which has become a benchmark text on the seismicity of the Lesser Antilles, of the violent shaking in Port-of-Spain. Thus we read: "… *Soudain les cloches de la grosse tour de l'abbaye se mirent en branle et tintèrent comme pour un glas funèbre ou le tocsin. Une lampe … suspendue à une chaîne à la voûte … s'agita d'elle-même et oscilla comme une pendule … La terre trembla avec une si grande violence que nous faillîmes être renversés*" ("… Suddenly the bells of the big abbey tower were set in motion and rang like for a funeral knell or the tocsin. A lamp … hanging with a chain from the vault … started moving and oscillating like a pendulum … The ground shook with such violence that we were almost thrown to the ground"). The rubble and the sturdiness of the choir grids prevented the nuns from escaping. Then a new jolt occurred: "*un nouveau choc remua jusque dans leurs fondements les murs de la vieille église*" ("a new shock shook the walls of the old church down to their foundations"), causing the collapse of the transept arch, the fracture of the vault, and the collapse of the dome, with forty casualties. Our witness sheltered "*sous les arches du bas-côté de l'église qui résistait encore aux secousses multipliées de la terre*" ("under the arches of the side aisle of the church which was still resisting to the repeated shaking of the ground"). He added that "*à chaque nouvelle secousse, on entendait le fracas de l'écroulement des maisons …*" ("during each new jolt, one could hear the roar of collapsing houses …"). The streets were "*obstruées par des amas de ruines*" ("blocked by mounds of rubble"). The text mentions a succession of shocks, however two of them deserve highlighting. Indeed, a movement of the sea in the harbour happens twice: "*deux fois la mer s'était retirée à perte de vue,*

laissant les navires à sec, puis elle était revenue en furie et avait rempli et coulé ceux de ces navires qui s'étaient couchés faute d'être soutenus" ("twice the sea withdrew as far as the eye can see, leaving vessels dry, and then returned raging, sinking those vessels that had keeled over for lack of support").[10] Clearly further global discussion is needed for this major event, a discussion that is beyond our present topic.

Broad intervals of significant seismic activity are probably one of the reasons for their psychological effects. That was the case in 1795 in Port-of-Spain which was not mentioned by Robson. Let us just mention three quotes. Firstly, "*à chaque nouvelle secousse on entendait le fracas de l'écroulement des maisons, avec des cris d'angoisse, d'agonie et des invocations à Dieu pour qu'il arrêtât cet affreux fléau*" ("with each new tremor we heard the roar of collapsing houses, with cries of anguish, of agony and invocations to God to stop this terrible curse"). Secondly, "*d'autres, ne trouvant plus d'issue pour sortir de leur demeure et voyant les murs près de se renverser sur elles, se précipitaient du haut d'un balcon et venaient se briser sur les dalles de la place*" ("others, not finding their way out of their homes and seeing the walls tipping over them, hurled themselves from the balconies and crashed down onto the paving stones of the place"). Finally "*des terreurs paniques se répandirent dans cette multitude*" ("panic terrors spread in the multitude"). In particular, "*on prétendit que les esclaves de la geôle, libérés par la chute des murailles de leur prison, parcouraient la ville, égorgeant les habitants qui se sauvaient en emportant leur or et leurs bijoux …*" ("some claimed that imprisoned slaves, freed by the fall of the walls of their gaol, roamed the city, slaughtering those who were escaping taking with them their gold and jewellery …"). A frequent fear elsewhere, justified or not … The 1888 earthquake raises moralising comments and initiatives: "*… Notre premier acte fut de remercier Dieu de nous avoir préservés des plus grands malheurs. Il y eut le dimanche suivant des prières d'action de grâces dans toutes les églises, à la demande du gouverneur … Nous ignorons ce que Dieu nous prépare, mais nous savons qu'il reste le Père, même quand il châtie …*" ("Our first act was to thank God for having preserved us from the greatest tragedy. On the following Sunday, thanksgiving prayers were delivered in all churches, at the request of the Governor … We do not know what God is preparing for us, but we know that he remains the Father even when he chastises …"). Let us consider separately a mild event, in 1843, undated. Not lingering on the reflexes of a witness during a succession of shocks, we just note that "*que ce fut la fréquence de ces tremblements de terre qui me décida à revenir en Europe*" ("it was the frequency of these earthquakes that persuaded me to return to Europe").

4. Chronological revision: XIX century

Let us turn to a smaller event that does not appear in Robson, on 13 or 14 August 1811: "… a violent shock … accompanied by a subterranean noise … from three to five seconds …" But for the moment we mention just for the record an event reported in Port-of-Spain in 1815, with unspecified date: "… the church and part of town were thrown down by an (earthquake)." The allusion to some material damage does not preclude a confusion of dates, with the benefit of hindsight.[11]

Let us cut corners. On 20 September 1825, Trinidad is hit again by a notable earthquake, with an assigned intensity value of VIII by Robson. If the effects in the Lesser Antilles and in French Guiana are known, the Venezuelan context has eluded him, however. Robson's description summarizes a lot of observations which either attract attention. This includes cracks affecting numerous buildings including the temple and the residence of the governor. Many falling chimneys are mentioned. However, the new Catholic church remained unharmed. For once rural information is given, in Tacarigna, at the Strealham Lodge Estate sugar mill. In addition to workforce houses, 'negro houses', the chimney of the boiler collapsed. Is this one of the massive chimneys with their delicate intensity value assignment? Aftershocks are reported.[12]

Robson moves quickly to the shock on 3 December 1831 around 7.30 pm, notable in Grenada, assigning it an intensity value of VII, mentioning cracks in the walls of high buildings in Port-of-Spain. A probably second-hand echo gives a fairly accurate description: "… *nous avons essuyé un très fort tremblement de terre. Le souvenir nous en fait encore frémir. Il y a eu d'abord deux secousses bien distinctes ; la première a duré près de trois secondes ; une oscillation très sensible la suivit durant un intervalle de quatre à six secondes. Alors on entendit un bruit sourd semblable au roulement d'un tonnerre lointain, et une seconde secousse, beaucoup plus terrible que la première, se fit sentir dans la direction du sud-ouest. La terre parut se soulever comme les flots de la mer ; et les édifices les plus solides, ainsi que les appentis les plus frêles, cédaient également à la force de cette impulsion, et chancelaient sur leurs bases … Des glaces ont été brisées, quelques murailles lézardées et fendues. Les eaux du golfe étaient dans une agitation remarquable, et à bord des navires on crut avoir reçu un violent choc de quelque corps énorme … A dix heures de la nuit et à deux heures du matin, la terre trembla de nouveau ; mais ces secousses … n'étaient rien en comparaison des premières…*" ("… we suffered a very strong earthquake. The memory still makes us shudder. First there were two distinct tremors; the first lasted about three seconds; a very

sensitive oscillation followed lasting an interval of four to six seconds. Then we heard a thud like the rolling of a distant thunder, and a second earthquake occurred, much more dreadful than the first, oriented towards the southwest. The ground seemed to rise like waves on the sea, and the strongest buildings, as well as the most frail sheds, yielded equally to the force of this momentum, and teetered on their bases … Mirrors broke, some walls cracked and split open. Waters of the gulf were in a remarkable restlessness, and aboard ships many thought they had engaged in a violent encounter with some huge body … At 10 pm and 2 am, the earth trembled again; but these shocks … were nothing compared with the first ones …").[13]

Robson mentions in Trinidad the major earthquake of 1843 in the West Indies, assigning an intensity value of III, all the more surprising since he reports an intensity value of IV in French Guiana. Before and after the notable event on 19 January 1844, with an intensity value of VII in Grenada, V in Trinidad, according to Robson, three other tremors are reported, including two in Trinidad and another one also felt in Saint Lucia. For that time interval, however, a witness comes to our rescue. After a five-year stay he summarised in 1844: "*La terre trembla treize fois*" ("The earth shook thirteen times"), and he clarified: "*Durant les derniers six mois, depuis Janvier jusqu'en Juin, 1844, nous éprouvâmes sept secousses*" ("During the last six months, from January to June, 1844, we felt seven tremors").[14] These were probably minor shocks; it seems however, once again, that Robson's catalogue is incomplete. According to the same witness, an event that occurred in 1843, undated, unidentified, is of particular interest since he reported a short sequence, at night: "… *l'île éprouva trois chocs en sept ou huit minutes*" ("… the island experienced three shocks in seven or eight minutes"), with emphasis, apparently, on the second, with this: "… *arrivé au milieu de chambre, la deuxième oscillation survint et fut si forte que j'en fus renversé*" ("… arriving in the centre of the room, the second oscillation took place, so violent that I was thrown to the ground"). Confusion with the earthquake recorded in 1844, however, is not excluded.

While Robson lists some shaking in 1851 in the Lesser Antilles, the event on 25 November 1851 in Trinidad eludes him however, its signification stressed by the press: "… one of the most alarming (earthquake) felt lately in this island …," with abrupt awakening.[15]

On 10 July 1863, churches and houses were slightly damaged, reaching an intensity value of VI, according to Robson. However, a modern historian wrote:

"… Much damage was done to property, particularly to the roman Catholic and Anglican cathedrals."[16]

We believe it is because he did not thoroughly browse the work of Perrey that events of interest escape Robson. It might be the case of the quake on 22 November 1865, widely felt in Venezuela, particularly in Carupano, the first in a sequence that would continue until 2 December 1865, and of that on 26 May 1866, also widely felt in Venezuela.

Let us complete yet another small oversight of Robson, namely a slight jolt on 7 July 1868, around 5 am "… a smart shock … a few seconds only … accompanied by a rumbling noise … quite distinct from the rattling produced by the earthquake in the materials of a house, furniture, etc. …" Once again, an aftershock broke out, at 5.25 am.[17]

Beyond the mere listing of Robson, sometimes difficult to interpret, one element or another gleaned here and there, quite rightly focuses on some event, with some hindsight. In this way, we can grasp intervals of seismic activity of some interest, again whatever its origin. Such is the case with the jolt on 13/14 August 1811 which eludes Robson's list [*The Times*, 16 November 1811]. We read "It was most severe than any felt in that island for many years preceding," which refer back to 1794. About the damaging earthquake on 20 September 1825, it was emphasized that nothing like this had happened in living memory [*The Barbadian*, 14 October 1825, after the *Port of Spain Gazette*]. Similarly, on a different scale, the earthquake on 10 January 1845 in Tobago, which escapes Robson, is highlighted, with this comment: "*das stärkste (Erdbeben) welches wir hier erlebt haben …*" ("the strongest earthquake we experienced here…"), probably in the last ten years [Bericht von Montgomery auf Tabago von den Jahren 1845 und 1846. In "*Nachrichten aus der Brüdergemeinde*, 1848"].

To conclude this overview, the great issue is the major event on 9 January 1888, destructive in Grenada, Trinidad, and nearby Venezuela. In Port-of-Spain, assigned a degree VII, some details are given: damaged and evacuated barracks, cracks in stone houses, falling plaster elsewhere. Here are once more rural echoes, for example cracks in the church of Diego Martin. We encounter again chimneys in plantations: while numerous exhibited cracks, they remained standing, however. Robson reports about Guiria in Venezuela (Gulf of Paria), according to *Nature*: houses crashed down, crevices, information used by *Cosmos*, adding the mention of panic in Irapa. Once again aftershocks occur: "*Depuis, nous avons eu des secousses*

réitérées, jusqu'à deux dans un jour …" ("Since then, we have had repeated jolts, up to twice a day …").[18]

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[1] About the seismotectonic context, see e.g. for Eastern Venezuela, A. Cisternas and R. Gaulon, 1984, 'Síntesis sismotectonica del nordeste de Venezuela', *Revista de Geofísica.* [Vol. 40, No. 1, pp. 3-10].
For the specific density of instrumental data just West of Trinidad, see e.g., for the time period 1900-73, J. Grases, 1977, 'Introducción al estudio sobre los sismos destructores del Caribe', *Interciencia*, [Vol. 2, No. 4, pp. 222-230], without precluding a host of other work.
[2] G.R. Robson, 1964, 'An earthquake catalogue for the Eastern Caribbean, 1530-1960', *Bull. Seismol. Soc. Am.* [Vol. 54, No. 2, pp. 785-832].
[3] *The Times*, 22 November 1825.
[4] A.M. Poey, 1858, 'Catalogue chronologique des tremblements de terre ressentis dans les Indes occidentales de 1530 à 1857', *Annuaire de la Société Météorologique de France*. [Vol. 5, pp. 75-127].
[5] Ultimately J. Vogt, 2004, 'A glimpse at the historical seismology of the West Indies', *Annals of Geophysics*. [Vol. 47, No. 2-3, pp. 465-476].
[6] J. Vogt, 'L'activité sismique antillaise en 1727 et 1728', submitted to *Généalogie et Histoire de la Caraïbe*. [Published since as: J. Vogt, 2005, 'Quelques précisions sur l'activité sismique antillaise de 1727-1728', *Généalogie et Histoire de la Caraïbe*, No. 183, pp. 4594-4597]
[7] Supplement to *Nouvelles Extraordinaires*, 17 March 1767.
[8] V. Millán, 1978, 'Un sismo que afecto la cuenca Amazonica', *Interciencia*. [Vol. 3, No. 4, p. 264]
[9] *Nouvelles Extraordinaires*, 6 March 1767.
[10] M.A. Moreau de Jonnès, 1858, 'Aventures de guerre au temps de la République et du Consulat', Vol. 1, Paris, with simplified new edition issued in 1893.
[11] *The Times*, 26 November 1811.
[12] W.H.B. Webster, 1834, 'Narrative of a voyage to the southern Atlantic Ocean in the years 1828, 29, 30', Vol. 1, London.
See *The Times*, 22 November 1825, after the *Trinidad Gazette* [21 September 1825].
[13] Nouvelles Annales des Voyages, Vol. 2, 1832 [p. 140].
[14] H.E. Marquand, 1853, 'Souvenirs des Indes occidentales [et impressions intimes]', London. [p. 236]
[15] *Antigua Herald*, 6 December 1851, after *Free Press*.
[16] G. Carmichael, 1961, 'The history of the West Indian islands of Trinidad and Tobago [, 1498-1900]', London.
[17] Note on the earthquake of the 7th July,1868, Proceedings of the Scientific Association [of Trinidad].
[18] L'Année Dominicaine, May 1888.