



Intensity reports for the Val-des-Bois, Québec, Earthquake of June 23, 2010

Stephen Halchuk
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Geological Survey of Canada
7 Observatory Crescent
Ottawa ON K1A 0Y3

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Note: This Canadian Hazard Information Service Internal Report is a preliminary version of a report that will be issued as a GSC Open File once revisions are completed and the report has undergone internal review; the preliminary report is issued to provide researchers quick access to the GSC's data in advance of the release of the Open File.



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ABSTRACT

This report presents preliminary information for the earthquake intensity shaking reports submitted by the public to the Earthquakes Canada website following the moment magnitude (M_w) of 5.0 June 23rd 2010 Val-des-Bois earthquake.

RÉSUMÉ

Ce rapport présente l'information préliminaire des données des intensités (des secousses) soumise au site web du Séismes Canada par la publique après le séisme de magnitude moment (M_w) 5.0 du 23 juin 2010 de Val-des-Bois.

INTRODUCTION

The Val-des-Bois earthquake which occurred on June 23, 2010 was the one of the largest recent earthquakes in eastern Canada. The epicenter of the earthquake occurred at a latitude of 45.88°N, and longitude of 75.48°W. The moment magnitude (M_w) of the earthquake was 5.0 and the depth of the source was 22 km.

As with all earthquakes that are felt by residents in Canada, the public is encouraged to fill out the “Did You Feel It?” earthquake intensity report form on the Earthquakes Canada website. Contributors are invited to provide information about their location, shaking experience and any observed damage for a particular event (sample form is shown in Appendix A, the default report form can be found at:

<http://earthquakescanada.nrcan.gc.ca/dyfi-lavr/unknown-inconnu-eng.php>). The checked boxes in the submitted form are automatically processed to obtain an individual Internet Intensity value, in a manner very similar to that used by the United States Geological Survey (USGS) (Wald et al., 1999). We are using an adaptation of USGS community internet intensity calculation software version 2, obtained in December, 2006. Details of the process are given on the USGS’s “Did You Feel It? The Science Behind the Maps” page at: <http://earthquake.usgs.gov/earthquakes/dyfi/background.php>.

The location information provided by users to the Earthquakes Canada website (which can include street address, nearest cross street, city, province, country and postal code) is submitted to a geo-location program provided by GeoCoder.ca. The program attempts to provide latitude and longitude coordinates based on the submitted location information. Those reports which could not be automatically geo-referenced were reviewed. Corrections, where possible, were made to the submitted location data. For approximately 50-60% of the reports the location information was re-submitted manually to obtain the coordinates in this report.

Geo-located intensity data are valuable to the scientific and engineering communities. It is intended that this data will be compared to the site classification work done by Hunter et al., (2009) for the city of Ottawa. Other uses for the data include: reviewing and revising predicted distance versus intensity relations, and examining the azimuthal variations in felt intensity to identify directivity effects.

AVAILABLE INTENSITY RECORDS OBTAINED FOR THE VAL-DES-BOIS EARTHQUAKE OF JUNE 23, 2010

Extent of the felt records

The shaking from the Val-des-Bois earthquake was widely experienced throughout the Quebec City – Windsor corridor and beyond (Figure 1). With more than 18 million people, this is Canada’s most densely populated region. It contains more than half the country’s population and three of the four largest metropolitan areas in Canada. This

document contains all of the submitted reports which were successfully geo-referenced for the time period of June 23, 2010 to July 18, 2010 inclusive (in Universal Coordinated Time). There are a total of 5249 reports. More than 2700 of these were received from the Ottawa-Gatineau region (Figure 2), with a few hundred each from the Montreal (Figure 3) and Toronto-Hamilton (Figure 4) regions. The data extends from hypocentral distances of 20 km to more than 700 km (Figure 5).

Description and discussion of data

The collated reports are contained in the accompanying Excel spreadsheet. The various categories released for each geo-referenced report are described in Table 1, and a sample page from the spreadsheet is displayed in Table 2. The report form is available on the website in both official languages. The descriptions provided by the users are recorded here in their original language. We trust that people have been honest in their reporting of their experiences, but recognize that there can be a lot of variability in perceived shaking between individuals. Some form of averaging of the individual reports will help to provide a clearer overall picture of the intensity across the felt area.

The geo-reference values have been reported to the nearest 1/1000th of a degree. More precise values are produced by the geo-referencing software, allowing one to pinpoint the reporter's home, provided that they have entered their location information in a manner that the program can process. The location data have been rounded to protect the privacy of those submitting the information while still being at a precision that will be useful for scientific study. Other information is also available, including the details of an individual's shaking experience. It is hoped that this information can eventually be publically released in a later version of this report.

Not all locations should be considered accurate to the nearest 1/1000th of a degree. In metropolitan areas, street addresses and postal codes can be parsed to provide a reasonably accurate location (generally within a few hundred metres or better). In smaller towns and rural areas, location information is not as easily converted to a location. Those rural addresses which rely solely on postal codes or nearest city will potentially have much larger uncertainty in their determined location (submitters whose location reference was based on postal code only will be geo-referenced to a central location – often the rural post office or the geographic centre of the region covered by the postal code). In this data set, some geo-referenced locations in rural areas may be incorrect by 5 to 10 km. It is not possible at this time to assign accuracy to individual locations.

Some effort has been made to remove duplicate submissions to the felt report form. In the attempt to release this information in as timely a fashion as possible, it is recognized that some duplicate submissions still exist within the dataset.

In addition to the intensity reports collected at the Earthquakes Canada website, more than 56,000 reports were collected by the USGS for the Val-des-Bois earthquake. Unlike the dataset in this preliminary report, the USGS provides average values for zip code regions within the United States, and for nearest city in Canada. The summary table of

intensities collected by the USGS is available on their website at:
<http://earthquake.usgs.gov/earthquakes/dyfi/events/us/2010xwa7/us/index.html>

It is impossible to geo-reference the data submitted for Canadian locations to the USGS site to the accuracy obtained for the data in this report. However, for more distant communities the USGS data may represent the only values for that location. The USGS data may be used to check and supplement the data in this report.

SUMMARY

This report presents the earthquake intensity shaking reports submitted by the public to the Earthquakes Canada website following the moment magnitude (M_w) of 5.0 June 23rd 2010 Val-des-Bois earthquake. The more than 5200 records contained in this report were obtained from hypocentral distances ranging from about 20 km to about 700 km. The data includes all reports that were successfully geo-located from the time period of 2010-06-23 to 2010-07-18 (UT) inclusive.

REFERENCES

Hunter, J A; Crow, H; Brooks, G R; Pyne, M; Lamontagne, M; Pugin, A; Pullan, S E; Cartwright, T; Douma, M; Burns, R A; Good, R L; Motazedian, D; Kaheshi-Banab, K; Caron, R; Kolaj, M; Muir, D; Jones, A; Dixon, L; Plastow, G; Dion, K; Duxbury, A; Landriault, A; Ter-Emmanuil, V; Folahan, I., (2009). City of Ottawa seismic site classification map from combined geological/geophysical data, Geological Survey of Canada, Open File 6191; 1 sheet

Wald, D. J., Quitoriano, V., Dengler, L. A., and Dewey J. W. (1999). Utilization of the Internet for Rapid Community Intensity Maps *Seismological Research Letters*, 70, No. 6, 680-697.

Table 1. Description of data fields in digital Appendix

- **gmt_now:** The date and time the report was submitted in Universal Coordinated Time (format YYYYMMDD.HHMMSS).
- **event:** The date and time of the earthquake report that the report has been assigned to (format YYYYMMDD.HHMM). Several of the earliest submitted reports used the default “unknown” event report form. These were later assigned to the Val-des-Bois earthquake based on the user-provided information on time.
- **city:** Location name provided by the user.
- **zip:** Canadian postal code provided by the user.
- **latitude and longitude:** Geo-referenced coordinates of user’s location based on the information provided. Coordinates are provided to the nearest 1/1000th of a degree. This precision is equivalent to approximately 111 metres in latitude, 72 to 83 metres in longitude for the range of data in this report (between 42 and 50 degrees latitude).
- **epi dist:** Epicentral distance in kilometres, based on the mainshock location of 45.879 latitude, -75.479 longitude.
- **hypo dist:** Hypocentral distance in kilometres, based on the mainshock location of 45.879 latitude, -75.479 longitude, 22 km depth.
- **user_cdi:** The assigned Modified Mercalli Intensity value based on the user input, expressed to the nearest 1/10th of a unit.
- **user_cdi_rom:** The assigned Modified Mercalli Intensity value, expressed as a Roman numeral.
- **building:** The type of building as chosen by the user. The form allows the user to choose from the following options – No building, Single Family home or Duplex, Apartment Building, Office Building/School, Mobile Home with Permanent Foundation, Trailer or Recreational Vehicle with No Foundation, Other
- **building_details:** Information on the type of building and location within the building provided by the user.
- **Building_eff:** Information on the type of building provided by the user.

Table 2. Sample page from the digital appendix containing submitted intensity reports, sorted on hypocentral distance.

Digital Appendix: Val des Bois 20100623 M 5.0 "Did You Feel It?" responses, 20100623-20100718

Canadian Hazards Information Service Internal Report 2010-3.1, Halchuk, S., 2010.

				latitude	longitude	depth							
				Mainshock location	45.879	-75.479	22.0						
gmt_now	event	city	zip	latitude	longitude	epi dist	hypo dist	user_cdi	user_cdi_rom	building	building_details	building_eff	
20100625.011123	20100623.1741	Val-des-Bois		45.880	-75.576	7.5	23.3	6.6	VI	Single	Wooden cottage beside a lake, resting on clay foundations en bloc, murs des 2 étages en bois, recouverts de crépis		
20100623.193630	20100623.1741	Val-des-Bois	J0X 3C0	45.913	-75.596	9.9	24.1	7.0	VII	Single			
20100624.014032	20100623.1741	Bowman	J0x 3c0	45.913	-75.596	9.9	24.1	5.6	V		Brique		
20100701.172957	20100623.1741	Val des Bois	J0X 3C0	45.887	-75.607	9.9	24.1	5.4	V	Single	wood logs/inside and outside	wood logs	
20100702.201455	20100623.1741	Notre-Dame-de-la-Salette	J0X2L0	45.775	-75.544	12.6	25.4	2.0	II	Single	House on bedrock at top of mountain		
20100709.172321	20100623.1741	Near ND de LaSalette	J0X 2L0	45.788	-75.582	12.9	25.5	5.0	V				
20100716.114012	20100623.1741	Notre-Dame-Du-Laus	J0X 2M0	45.985	-75.558	13.3	25.7	3.8	III		Mobile, No Foundation		
20100628.032437	20100623.1741	Notre-Dame-de-la-Salette		45.768	-75.586	14.9	26.6	7.1	VII				
20100708.113736	20100623.1741	Notre-Dame-de-la-Salette		45.766	-75.583	14.9	26.6	5.4	V	Office			
20100627.122438	20100623.1741	Bowman	J0X3C0	45.917	-75.666	15.1	26.7	5.8	V	Single	home on slab, wood, cement upper floor, 2 storey maison 2 étages construite sur une		
20100715.030524	20100623.1741	Val-desBois	J0X 3C0	45.959	-75.636	15.1	26.7	6.4	VI	Single	'slab'; de ciment, recouverte de pierre à l'extérieur		
20100623.194116	20100623.1741	L'Ange-Gardien	J8L 2W9	45.699	-75.433	20.4	30.0	5.2	V	Single	Two story home, vinyl siding, cement foundation build directly on rock.		
20100624.205742	20100623.1741	Montpellier	J0V 1M0	45.854	-75.213	20.8	30.3	3.1	III	Single	charpente de bois		
20100624.210830	20100623.1741	Montpellier	J0V 1M0	45.854	-75.213	20.8	30.3	5.3	V	Single			
20100625.184533	20100623.1741	L'Ange-Gardien		45.690	-75.534	21.4	30.7	5.4	V	Single			
20100624.133918	20100623.1741	Denholm	J8N 9G7	45.820	-75.743	21.4	30.7	4.1	IV	Single	Maison en bois/briques 2 étages, nous étions au premier.		
20100627.221724	20100623.1741	Denholm	J8N 9P1	45.813	-75.743	21.7	30.9	6.3	VI	Single	First floor, single family home		
20100630.043926	20100623.1741	Montpellier	J0V 1M0	45.855	-75.168	24.2	32.7	3.4	III				
20100624.020137	20100623.1741	Val-des-Monts	J8N 6L8	45.674	-75.586	24.3	32.8	4.1	IV	Single	wood frame / 1st floor		
20100623.231652	20100623.1741	Montpellier	J0V 1M0	45.853	-75.165	24.5	32.9	4.6	IV	Single	bois, sous-sol		
20100623.203144	20100623.1741	Montpellier	J0V 1M0	45.855	-75.161	24.7	33.1	6.8	VI	Single	blocs de béton		
20100627.000927	20100623.1741	Denholm	J8N 9H8	45.849	-75.796	24.8	33.1	6.3	VI	Other	Bois, un étage, pas de solage	Chalet en bois non isolé	

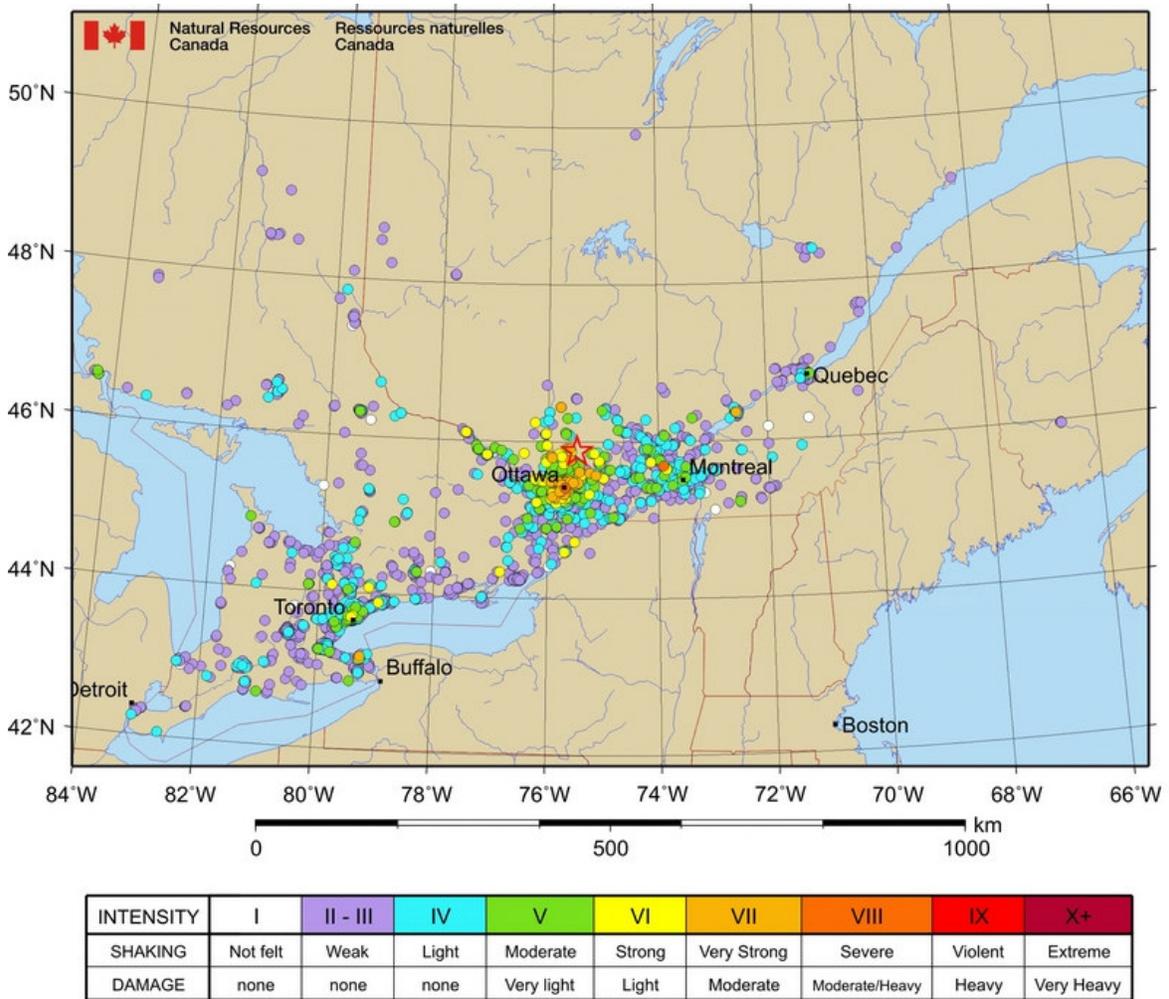


Figure 1. More than 5200 intensity reports submitted to the Earthquakes Canada website for the time period 20100623-20100718 inclusive following the Val-des-Bois earthquake. The red star indicates the earthquake's epicentre.

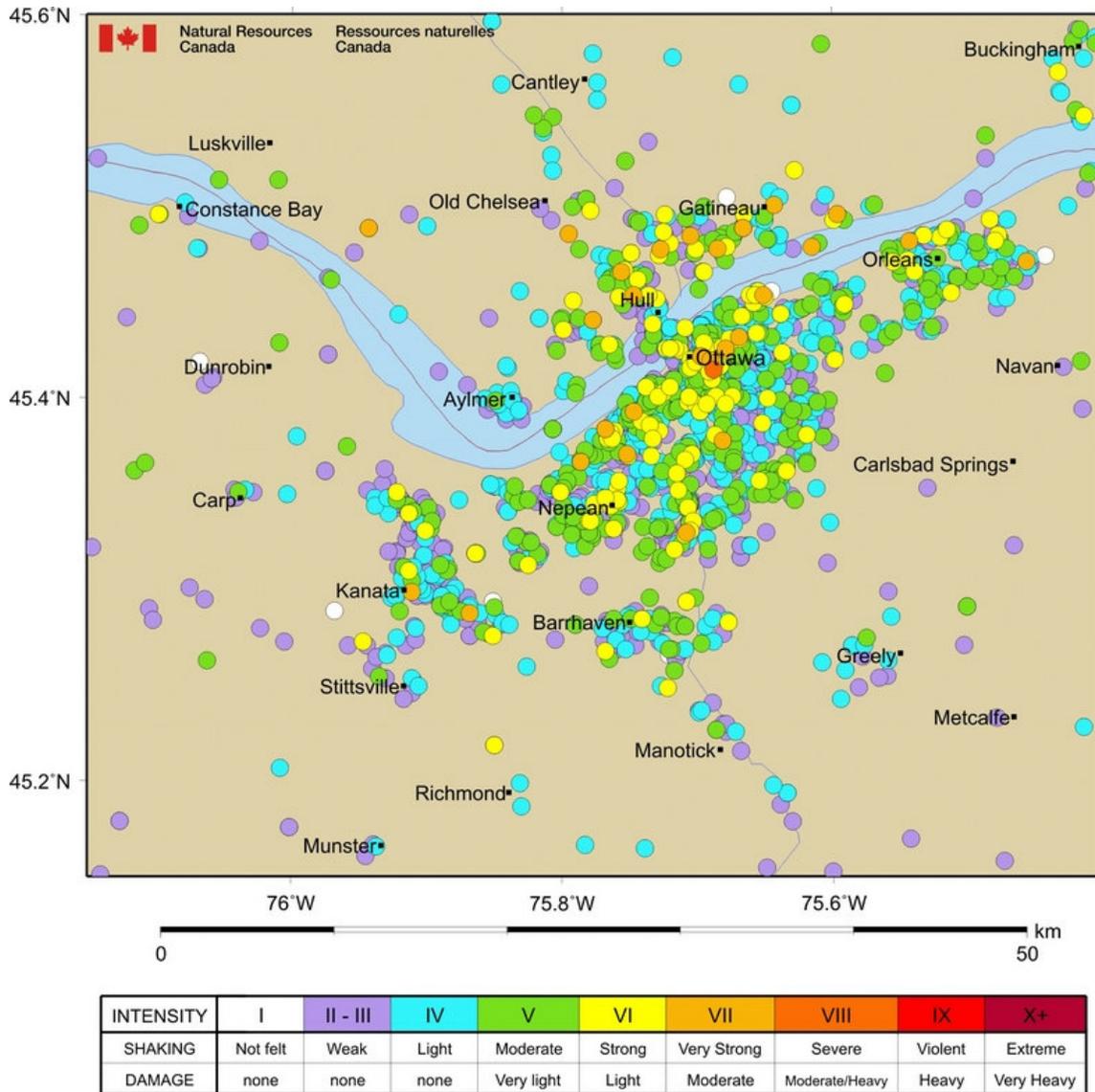
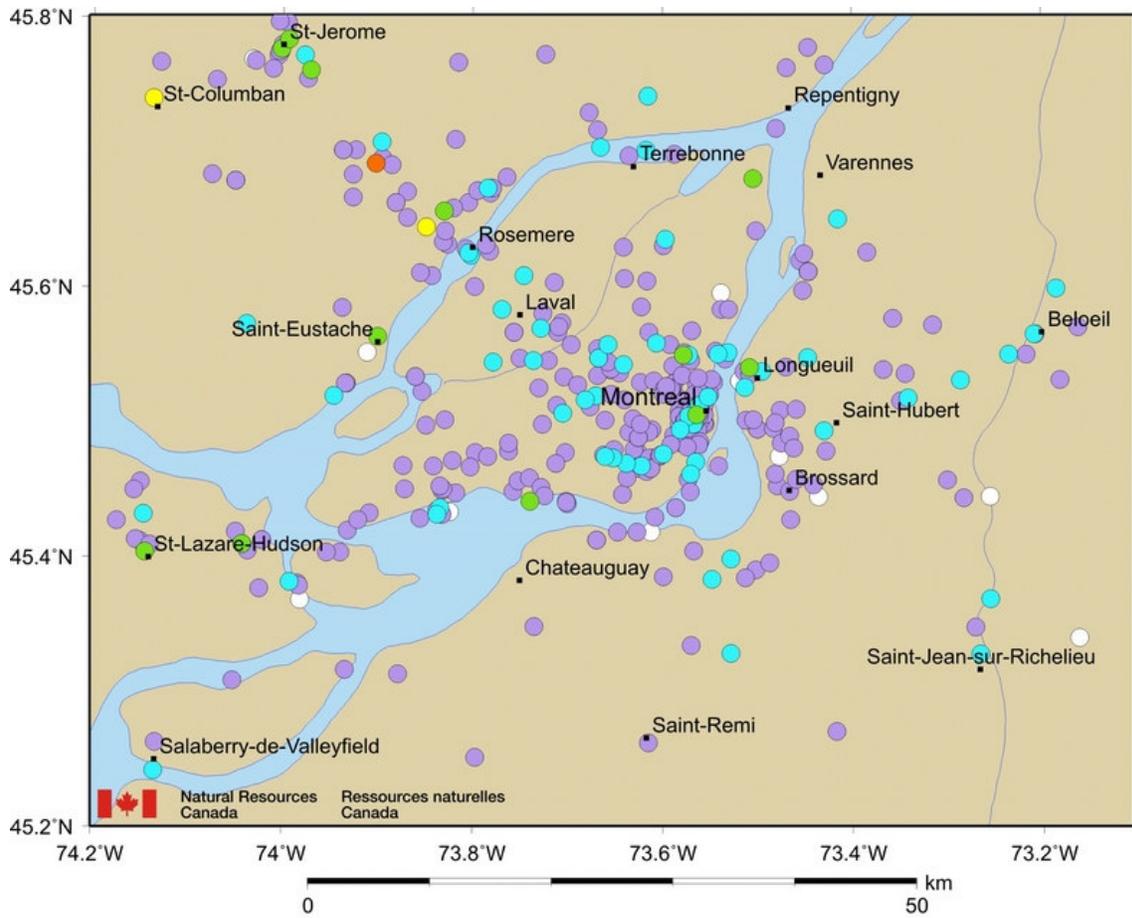


Figure 2. More than 2700 intensity reports in the greater Ottawa-Gatineau region submitted to the Earthquakes Canada website for the time period 20100623-20100718 inclusive following the Val-des-Bois earthquake.



INTENSITY	I	II - III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy

Figure 3. More than 400 intensity reports in the greater Montreal region submitted to the Earthquakes Canada website for the time period 20100623-20100718 inclusive following the Val-des-Bois earthquake.

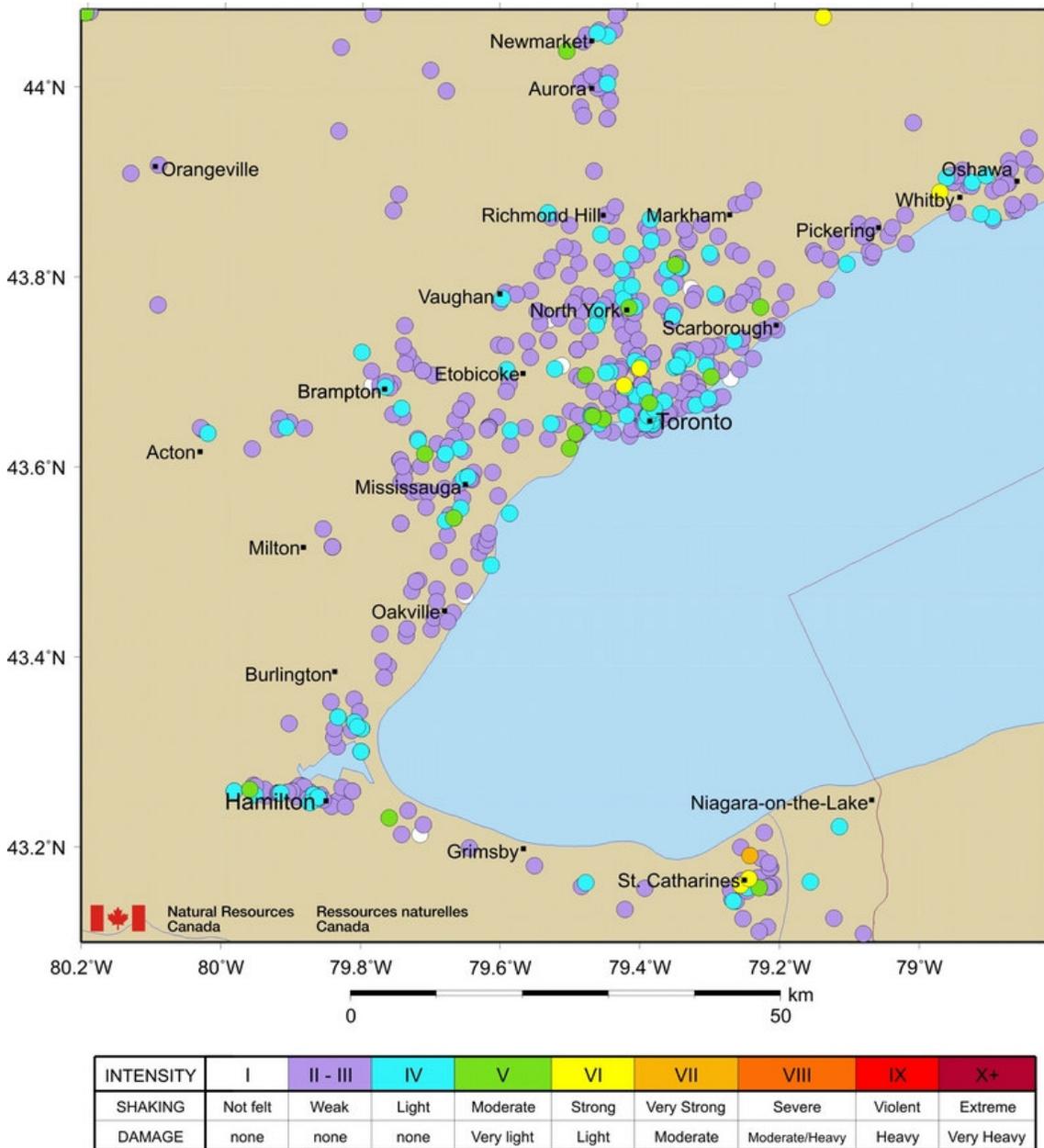


Figure 4. More than 650 intensity reports in the greater Toronto-Hamilton region submitted to the Earthquakes Canada website for the time period 20100623-20100718 inclusive following the Val-des-Bois earthquake.

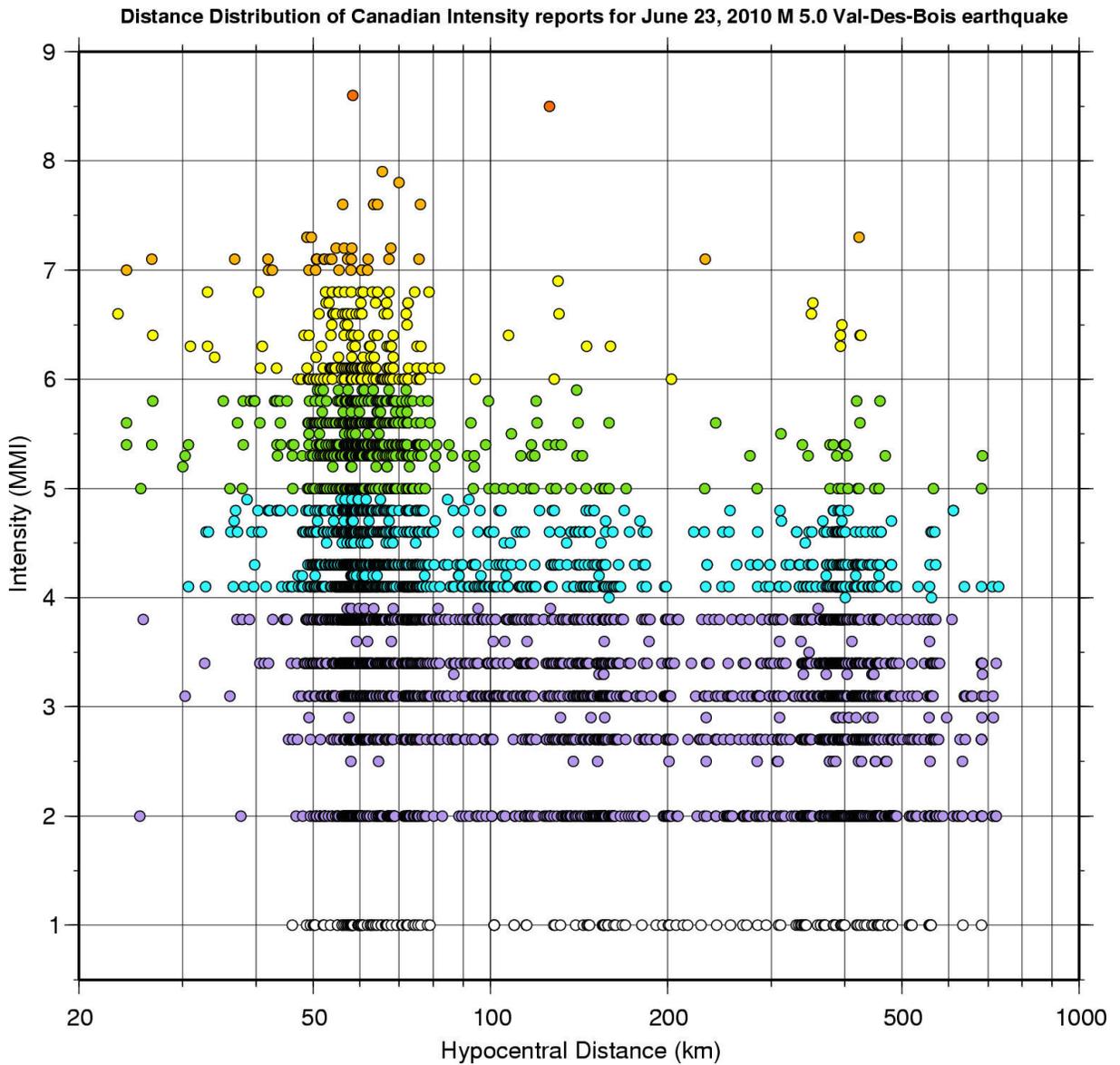


Figure 5. Distance distribution of intensity reports submitted to the Earthquakes Canada website for the time period 20100623-20100718 inclusive following the Val-des-Bois earthquake.

APPENDIX A

Felt Report Form for Community Internet Intensity Maps

DID YOU FEEL IT? REPORT IT HERE!

You can help provide information about the extent of shaking and damage for earthquakes in Canada. The specific details you may provide will help us determine how your area may respond to future earthquakes.

While identifiers such as name, e-mail address, and telephone are optional, please provide as complete address information as possible to help us locate the intensity in your area.

*For other events or historic events, go to the [GSC CIIM archive](#).
If you were in the U.S.A. at the time of the earthquake, please go to the [USGS earthquake site](#) to locate the appropriate form.*

Name:
E-mail: Phone:

Since you are submitting this form for a new or unknown earthquake, **please fill out the following information completely.** This will help us accurately locate this event.

Your location when the earthquake occurred:

Street Address:
Nearest Cross Street:
City:
Province:
Country:
Postal Code: **REQUIRED!**

Postal Code: If you were in the United States, please use the [USGS](#) version of this questionnaire.

Please fill out as completely as you can:

Date of earthquake Month: Day: Year:
Time of earthquake Hour: Minute:

While answering all these questions is optional, we encourage you to fill out as many as possible so we can provide a more accurate intensity estimate.

What was your situation during the earthquake?

If you were inside please select the type of building or structure:

If other, please describe:

Were you asleep during the earthquake?

Did you feel the earthquake? (If you were asleep, did the earthquake wake you up?)

No Yes

Did others nearby feel the earthquake?

Your experience of the earthquake:

How would you best describe the ground shaking?

About how many seconds did the shaking last?

How would you best describe your reaction?

How did you respond? (Select one.)

If other, please describe:

Was it difficult to stand or walk?

Earthquake effects:

Did you notice the swinging/swaying of doors or hanging objects?

Did you notice creaking or other noises?

Did objects rattle, topple over, or fall off shelves?

Did pictures on walls move or get knocked askew?

Did any furniture or appliances slide, tip over, or become displaced?

Was a heavy appliance (refrigerator or range) affected?

Were free-standing walls or fences damaged?

If you were inside, was there any damage to the building? Check all that apply.

- No damage
- Hairline cracks in walls
- A few large cracks in walls
- Many large cracks in walls
- Ceiling tiles or lighting fixtures fell

- Cracks in chimney
- One or several cracked windows
- Many windows cracked or some broken out
- Masonry fell from block or brick wall(s)
- Old chimney, major damage or fell down
- Modern chimney, major damage or fell down
- Outside wall(s) tilted over or collapsed completely
- Separation of porch, balcony, or other addition from building
- Building permanently shifted over foundation

If you know the type of building (wood, brick, etc.) and/or your location (which storey, basement, penthouse, etc.) please indicate here:

Additional Comments:

You may use the next box to clarify answers or to make observations that are not accommodated by other questions. You may also use the following box to give first-person descriptions of how the earthquake affected you. GSC scientists may use some of the information that you enter in qualitative descriptions of shaking or damage in GSC publications. You would be identified as "an observer" and your location would be given in general terms. Parts of some first-person accounts may be reproduced as quotations in GSC publications.