“Did You Feel It?”

Citizen Science & Social Media for Earthquake Science & Response

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USGS

Woodrow Wilson Center,
Washington, D.C.
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Woodrow Wilson International Center for Scholars
Knowledge *in the* Public Service

Road Map:

From “Did You Feel It?” (DYFI?) examples that illustrate some of the uses & benefits of these data for:

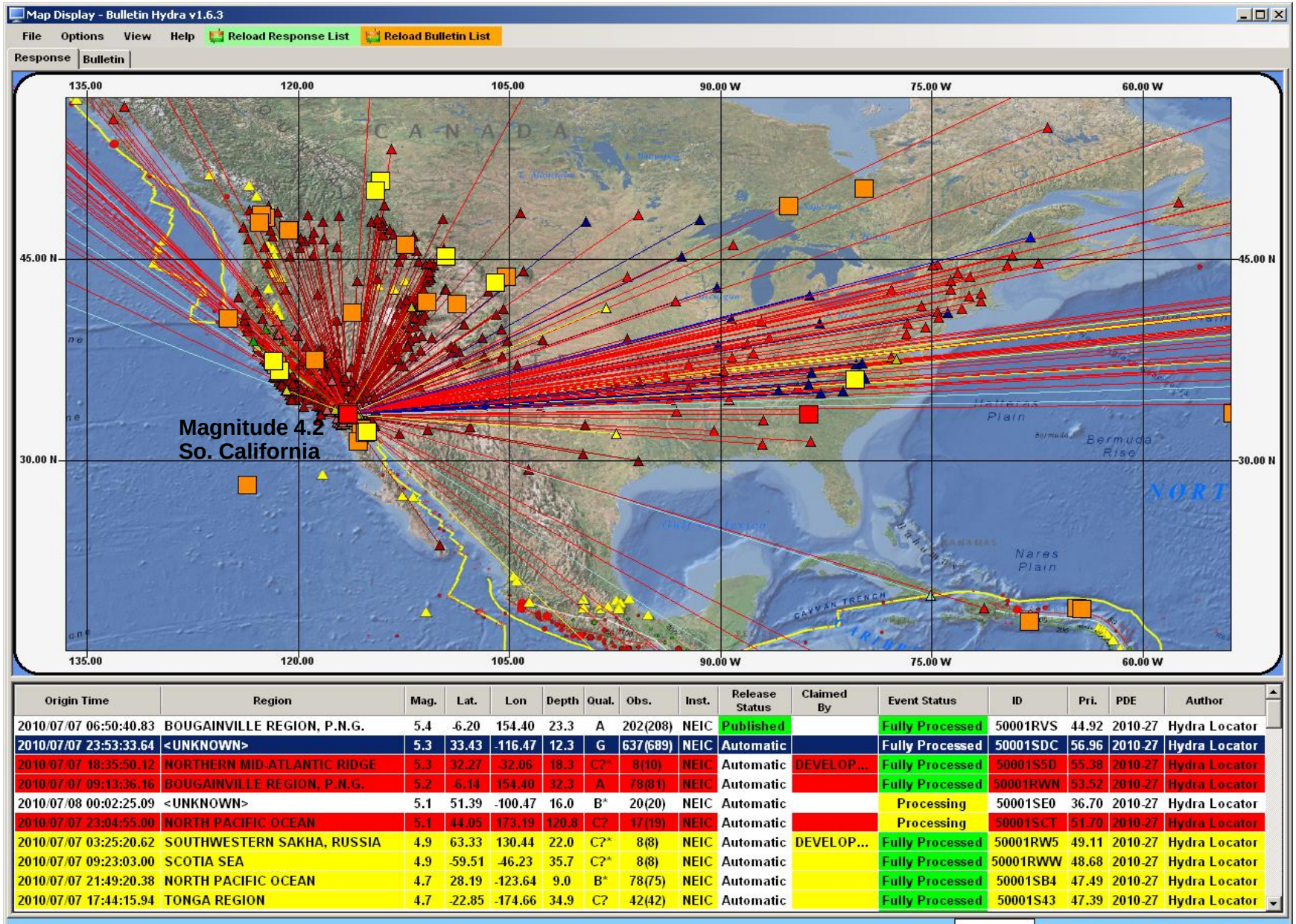
- Earthquake monitoring & science,
- Citizen science & public involvement,
- Communicating earthquake risk,
- Relations to uses & aspects of other emerging social media avenues.
- Discussion…

National Earthquake Information Center

- Federally-mandated to provide information about US and foreign earthquakes,
- 24X7 operations,
- Backup US regional seismic networks,
- Curate global earthquake catalog for hazards research,
- Customers include:
  - Relief organizations (e.g., USAID/OFDA, FEMA, Red Cross)
  - Government agencies (e.g., Whitehouse, State Dept, other nations)
  - Researchers
  - General public, and the media

USGS

USGS Real-time earthquake monitoring

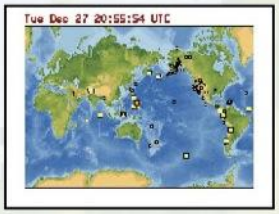


Origin Time	Region	Mag.	Lat.	Lon	Depth	Qual.	Obs.	Inst.	Release Status	Claimed By	Event Status	ID	Pri.	PDE	Author
2010/07/07 06:50:40.83	BOUGAINVILLE REGION, P.N.G.	5.4	-6.20	154.40	23.3	A	202(208)	NEIC	Published		Fully Processed	50001RVS	44.92	2010-27	Hydra Locator
2010/07/07 23:53:33.64	<UNKNOWN>	5.3	33.43	-116.47	12.3	G	637(689)	NEIC	Automatic		Fully Processed	50001SDC	56.96	2010-27	Hydra Locator
2010/07/07 18:35:50.12	NORTHERN MID-ATLANTIC RIDGE	5.3	32.27	-32.06	18.3	C?*	8(10)	NEIC	Automatic	DEVELOP...	Fully Processed	50001S5D	55.38	2010-27	Hydra Locator
2010/07/07 09:13:36.16	BOUGAINVILLE REGION, P.N.G.	5.2	-6.14	154.40	32.3	A	78(81)	NEIC	Automatic		Fully Processed	50001RWN	53.52	2010-27	Hydra Locator
2010/07/08 00:02:25.09	<UNKNOWN>	5.1	51.39	-100.47	16.0	B*	20(20)	NEIC	Automatic		Processing	50001SE0	36.70	2010-27	Hydra Locator
2010/07/07 23:04:55.00	NORTH PACIFIC OCEAN	5.1	44.05	173.19	120.8	C?	17(19)	NEIC	Automatic		Processing	50001SCT	51.70	2010-27	Hydra Locator
2010/07/07 03:25:20.62	SOUTHWESTERN SAKHA, RUSSIA	4.9	63.33	130.44	22.0	C?*	8(8)	NEIC	Automatic	DEVELOP...	Fully Processed	50001RW5	49.11	2010-27	Hydra Locator
2010/07/07 09:23:03.00	SCOTIA SEA	4.9	-59.51	-46.23	35.7	C?*	8(8)	NEIC	Automatic		Fully Processed	50001RWW	48.68	2010-27	Hydra Locator
2010/07/07 21:49:20.38	NORTH PACIFIC OCEAN	4.7	28.19	-123.64	9.0	B*	78(75)	NEIC	Automatic		Fully Processed	50001SB4	47.49	2010-27	Hydra Locator
2010/07/07 17:44:15.94	TONGA REGION	4.7	-22.85	-174.66	34.9	C?	42(42)	NEIC	Automatic		Fully Processed	50001S43	47.39	2010-27	Hydra Locator

USGS
science for a changing world

ANSS Earthquake Information Products & Tools

(Advanced National Seismic System)



Latest Earthquakes

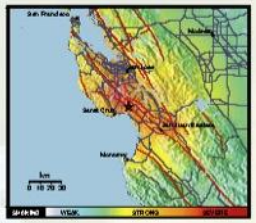
Maps and information for U.S. and worldwide earthquakes within minutes after they occur.

http://earthquake.usgs.gov/eqcenter/

Earthquake Notification

Customizable earthquake information automatically sent to your wireless device or email account.

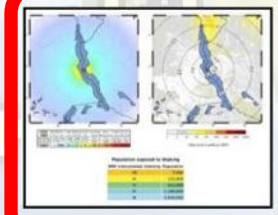
http://earthquake.usgs.gov/ens/



ShakeMaps

Distribution of shaking from an earthquake anywhere in the world within minutes.

http://earthquake.usgs.gov/shakemap/



PAGER

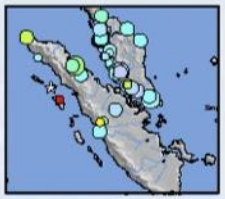
Estimates of population exposure to significant earthquake shaking anywhere in the world within minutes.

http://earthquake.usgs.gov/pager/

Realtime Feeds & Data

Real-time earthquake data in a variety of formats including RSS, CAP, CSV, and KML.

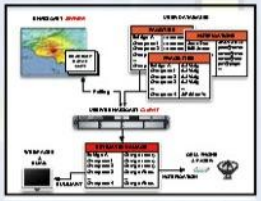
http://earthquake.usgs.gov/eqcenter/feeds_data.php



Did You Feel It?

Citizen science webpage where shaking intensity maps are created by the people who felt the earthquake.

http://earthquake.usgs.gov/dyfi/



ShakeCast

Automated ShakeMap delivery, damage assessment, and notificatio for critical lifeline operators.

http://earthquake.usgs.gov/resources/software/shakecast/

CISN Display

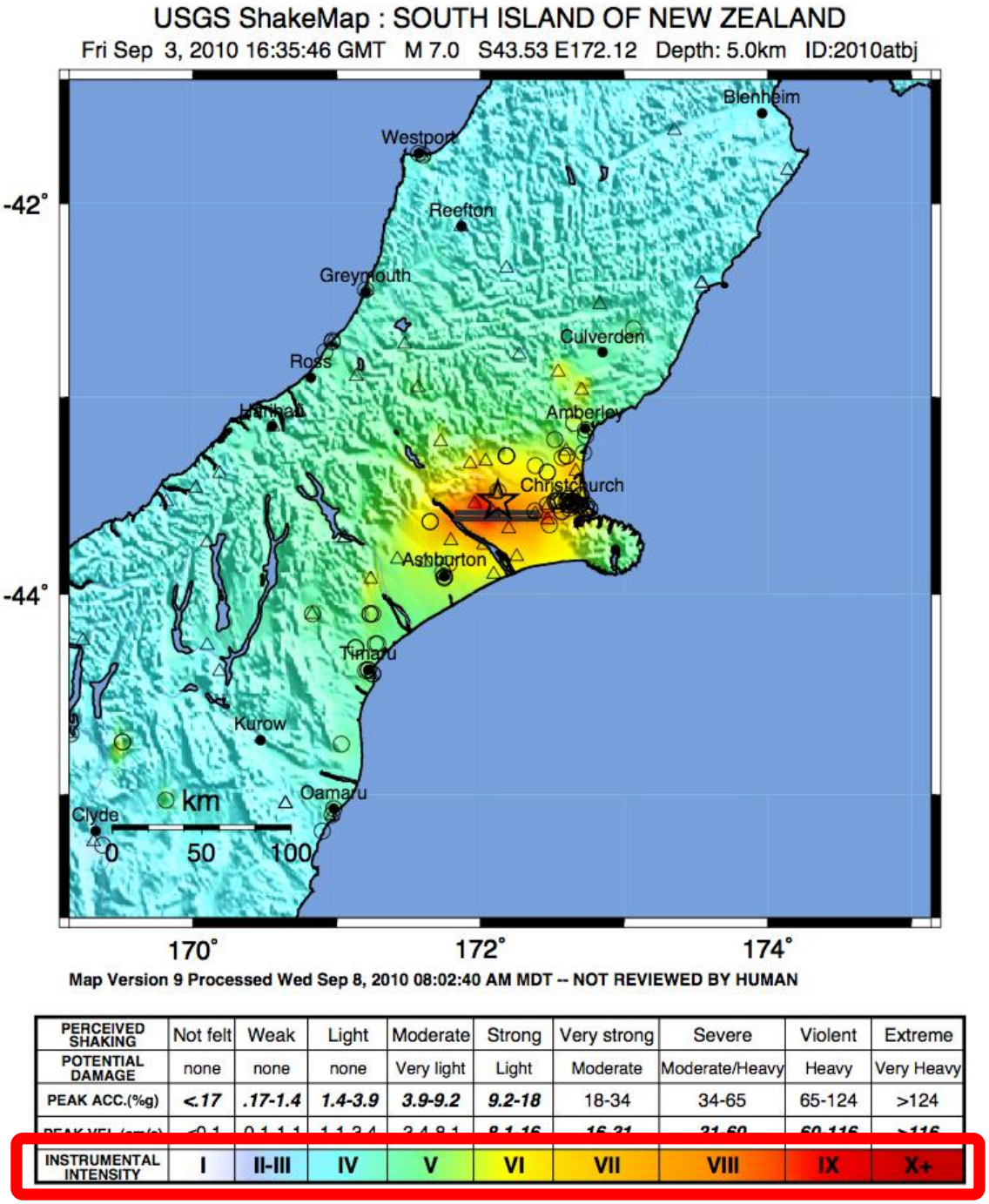
Downloadable software to visualize and receive notifications for seismicity anywhere in the world on your computer

http://www.cisn.org/software/cisndisplay.html

ShakeMap

"Observed & estimated ground shaking intensity in the strongly-shaken region of an earthquake."

- Adjusted in the minutes or hours after an earthquake to account for earthquake fault dimensions - i.e., large earthquakes are not point sources, but rather occur over large areas (up 1000's of km^2)
- ShakeMap output formatted for FEMA's HAZUS

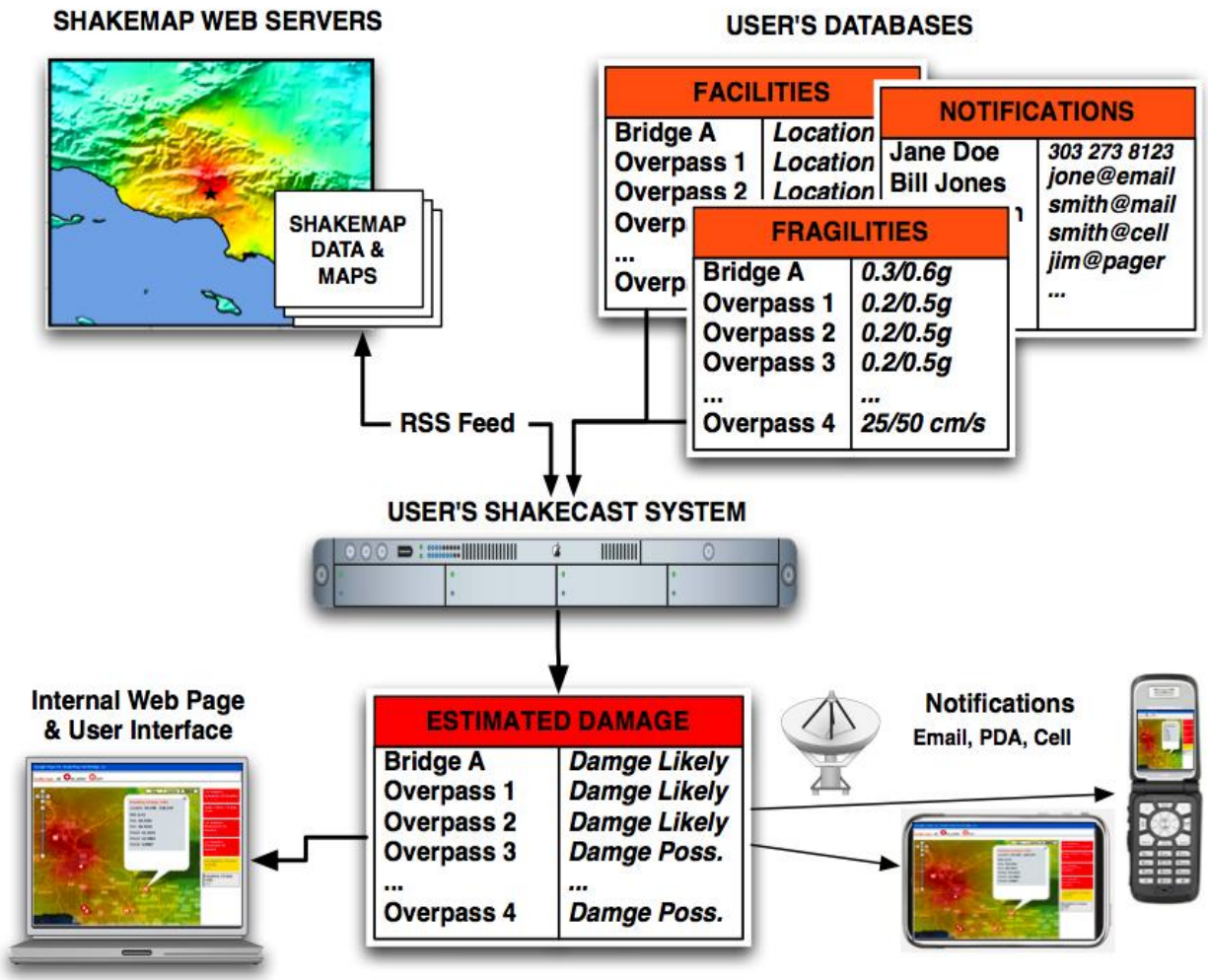


ShakeCast

*"Uses estimates of shaking intensity at **specific sites or critical facilities** in the strongly-shaken region to determine likelihood of damage."*

Requires:

- *ShakeMap as the hazard input,*
- *Knowledge of facility location and vulnerability to shaking.*



USGS
science for a changing world

Earthquake Shaking — Red Alert

GSN ANSS USAID FROM THE AMERICAN PEOPLE

M 8.8, OFFSHORE MAULE, CHILE

Origin Time: Sat 2010-02-27 06:34:14 UTC (02:34:14 local)

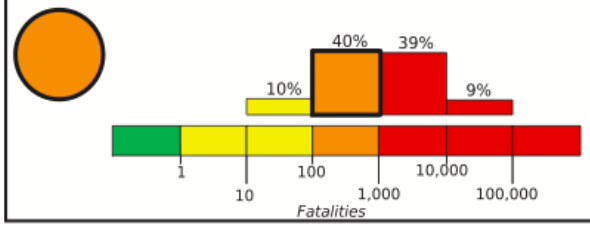
Location: 35.85°S 72.72°W Depth: 35 km

FOR TSUNAMI INFORMATION, SEE: tsunami.noaa.gov

PAGER Version 3

Created: 3 hours, 10 minutes after earthquake

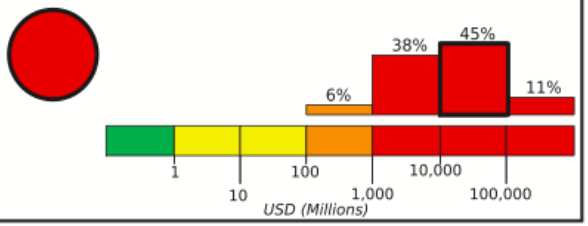
Estimated Fatalities



Red alert level for economic losses. Extensive damage is probable and the disaster is likely widespread. Estimated economic losses are 3-20% GDP of Chile. Past events with this alert level have required a national or international level response.

Orange alert level for shaking-related fatalities. Significant casualties are likely.

Estimated Economic Losses



Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)		- -*	- -*	487k*	2,147k*	3,657k	6,405k	3,083k	0	0
ESTIMATED MODIFIED MERCALLI INTENSITY		I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING		Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	Resistant Structures	none	none	none	V. Light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy
	Vulnerable Structures	none	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	V. Heavy

*Estimated exposure only includes population within the map area.

Global Earthquakes for Response

VIII	Arauco	25k
VIII	Lota	50k
VIII	Concepcion	215k
VIII	Constitucion	38k
VII	Bulnes	13k
VII	Cabrero	18k
VI	Temuco	238k
VI	Valparaiso	282k
VI	Santiago	4,837k
IV	Mendoza	877k
III	Neuquen	242k

bold cities appear on map (k = x1000)

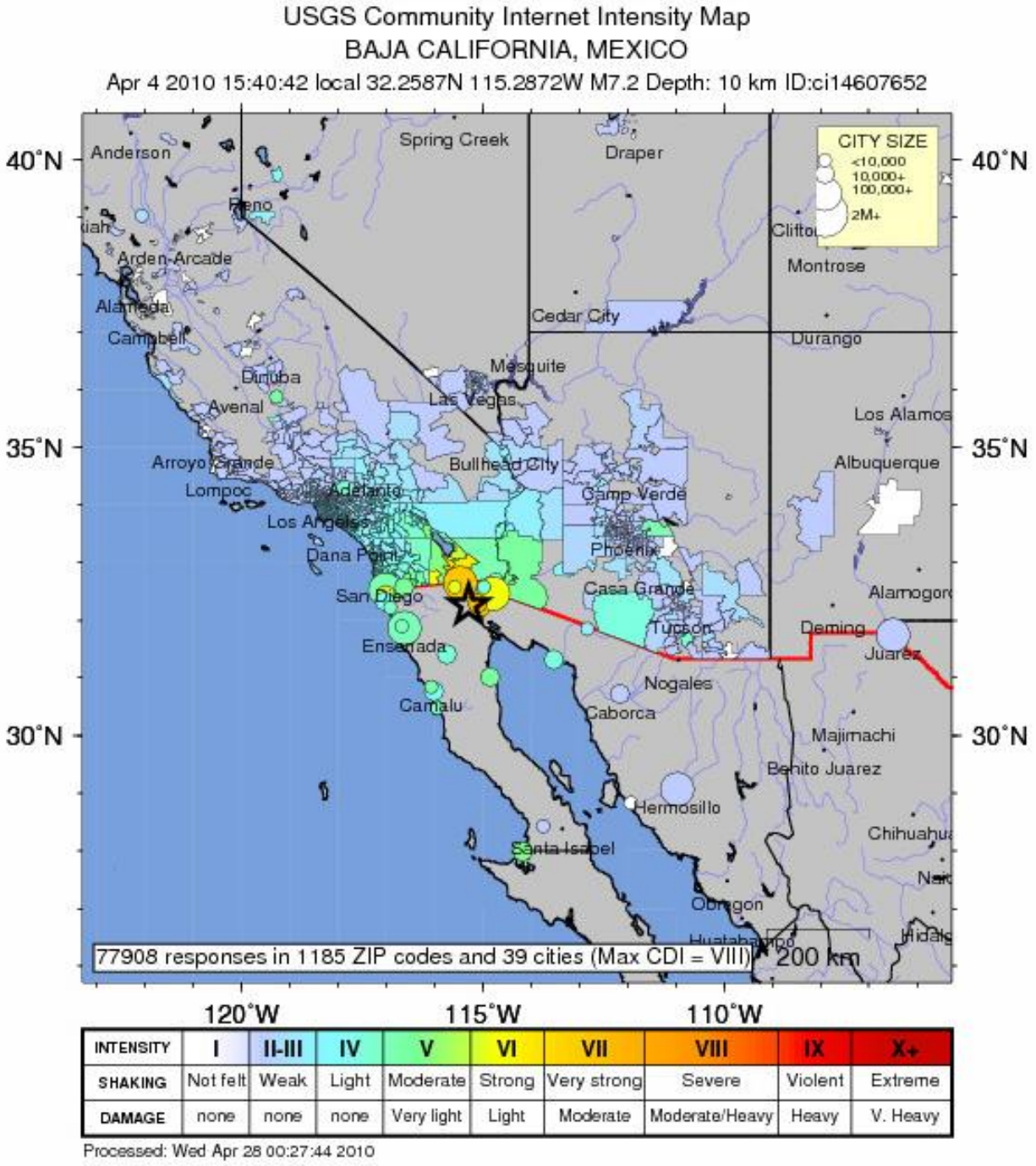
PAGER content is automatically generated, and does not consider secondary hazards in loss calculations. Limitations of input data, shaking estimates, and loss models may add uncertainty.
http://earthquake.usgs.gov/pager

Event ID: us2010tfan

“Did You Feel It”

“Rapid & automatic intensity maps based on felt reports submitted online”

- Users answer simple online questionnaire.
- Color-code ZIP-code to community’s average intensity.
- Replaces traditional postal questionnaire.



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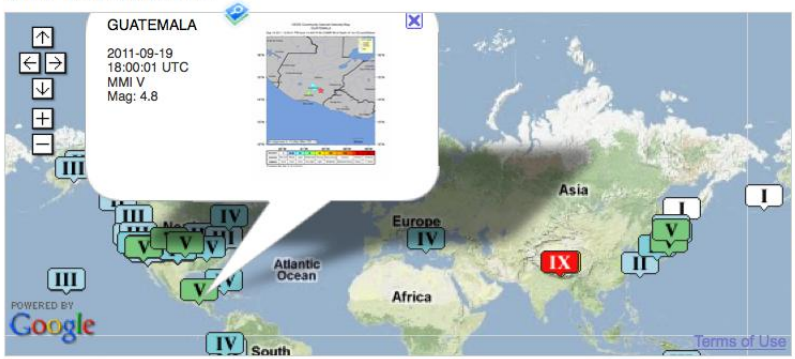
Did You Feel It?



Report Unknown Event **View Archives**

Found 7 matching results Events - Last 24 Hours

MMI	Mag	Location	Event Time	Event ID	Response
V	4.8	GUATEMALA 14.40°N -90.22°W 61Km Deep	2011-09-19 18:00:01 UTC 2011-09-19 12:00:01 LOCAL	USC0005WWR	84
III	2.0	ARIZONA 36.02°N -114.57°W 3Km Deep	2011-09-19 15:16:50 UTC 2011-09-19 08:16:50 LOCAL	NN00348378	2
II	2.2	NORTHERN CALIFORNIA 38.83°N -122.80°W 2Km Deep	2011-09-19 10:54:46 UTC 2011-09-19 03:54:46 LOCAL	NC71649651	2
I	4.8	NORTHWEST OF THE KURIL ISLANDS 47.92°N 147.34°E 417Km Deep	2011-09-19 09:07:23 UTC 2011-09-19 20:07:23 LOCAL	USC0005WRS	0
I	5.8	FOX ISLANDS, ALEUTIAN ISLANDS, ALASKA 52.04°N -171.86°W 34Km Deep	2011-09-19 08:14:15 UTC 2011-09-18 23:14:15 LOCAL	USC0005WRC	0
IV	4.0	SOUTH ISLAND OF NEW ZEALAND 43.62°S 172.80°E 12Km Deep	2011-09-19 01:51:30 UTC 2011-09-19 13:51:30 LOCAL	USC0005WQ0	3
III	2.5	BAJA CALIFORNIA, MEXICO 32.06°N -115.16°W 12Km Deep	2011-09-19 00:19:06 UTC 2011-09-18 17:19:06 LOCAL	CI11008541	2

Found 48 matching results Felt Events - Last 7 Days

MMI	Mag	Location	Event Time	Event ID	Response
IV	4.0	ONTARIO-QUEBEC BORDER REGION, CANADA 45.60°N -75.23°W 1Km Deep	2011-09-18 19:19:13 UTC 2011-09-18 15:19:13 LOCAL	LD60026001	587
VI	4.6	SIKKIM, INDIA 27.38°N 88.27°E 20Km Deep	2011-09-18 13:54:18 UTC 2011-09-18 19:24:18 LOCAL	USC0005WHE	74
V	4.8	SIKKIM, INDIA 27.45°N 88.39°E 20Km Deep	2011-09-18 13:11:57 UTC 2011-09-18 18:41:57 LOCAL	USC0005WGX	42
IX	6.9	SIKKIM, INDIA 27.72°N 88.06°E 19Km Deep	2011-09-18 12:40:48 UTC 2011-09-18 18:10:48 LOCAL	USC0005WG6	1245
III	5.0	HOKKAIDO, JAPAN REGION 41.95°N 142.46°E 68Km Deep	2011-09-18 10:39:48 UTC 2011-09-18 19:39:48 LOCAL	USC0005WFV	5

Did You Feel It?
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Did You Feel It? — Unknown Event

OMB No. 1028-0048
Expires 03/31/2012

PASADENA (Change Location)

Your situation when the earthquake occurred

Did you feel it : ○ Yes ○ No
If you were sleeping, did it wake you?

Physical Situation : Please select...
Select the option that best describes your physical situation during the earthquake.

Were you asleep : Please select...

Did others feel it : Please select...
Your best guess at what others nearby may have felt.

Your experience of the earthquake

Shaking Strength : Please select...
How would you best describe the shaking?

Shaking Duration :
About how many seconds did the shaking last?

Your Reaction : Please select...
How whould you best describe your reaction?

Your Response : Please select...
How did you respond during the shaking?

Stand or Walk : Please select...
Was it difficult to stand and/or walk?

Earthquake Effects

Free-hanging objects : Please select...
Did you notice any swinging/swaying of doors or other free-hanging objects?

Sounds : Please select...
Did you hear creaking or other noises?

Shelved Objects : Please select...
Did objects rattle, topple over, or fall of shelves?

Hanging Pictures : Please select...
Did pictures on walls move or get knocked askew?

Please select...
Please select...
No
Rattled slightly 1
Rattled loudly 2
A few toppled or fell off 3
Many fell off 4
Nearly everything fell off 5

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)

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The Free Encyclopedia

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Italiano
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Norsk (bokmål)

Crowdsourcing

From Wikipedia, the free encyclopedia

Crowdsourcing is the act of outsourcing tasks, traditionally performed by an employee or contractor, to a large group of people or community (a crowd), through an open call.

For example, the public may be invited to develop a new technology, carry out a design task (also known as **community-based design**[1] and distributed participatory design), refine or carry out the steps of an algorithm (see human-based computation), or help capture, systematize or analyze large amounts of data (see also citizen science).

The term has become popular with businesses, authors, and journalists as shorthand for the trend of leveraging the mass collaboration enabled by Web 2.0 technologies to achieve business goals. However, both the term and its underlying business models have attracted controversy and criticisms.

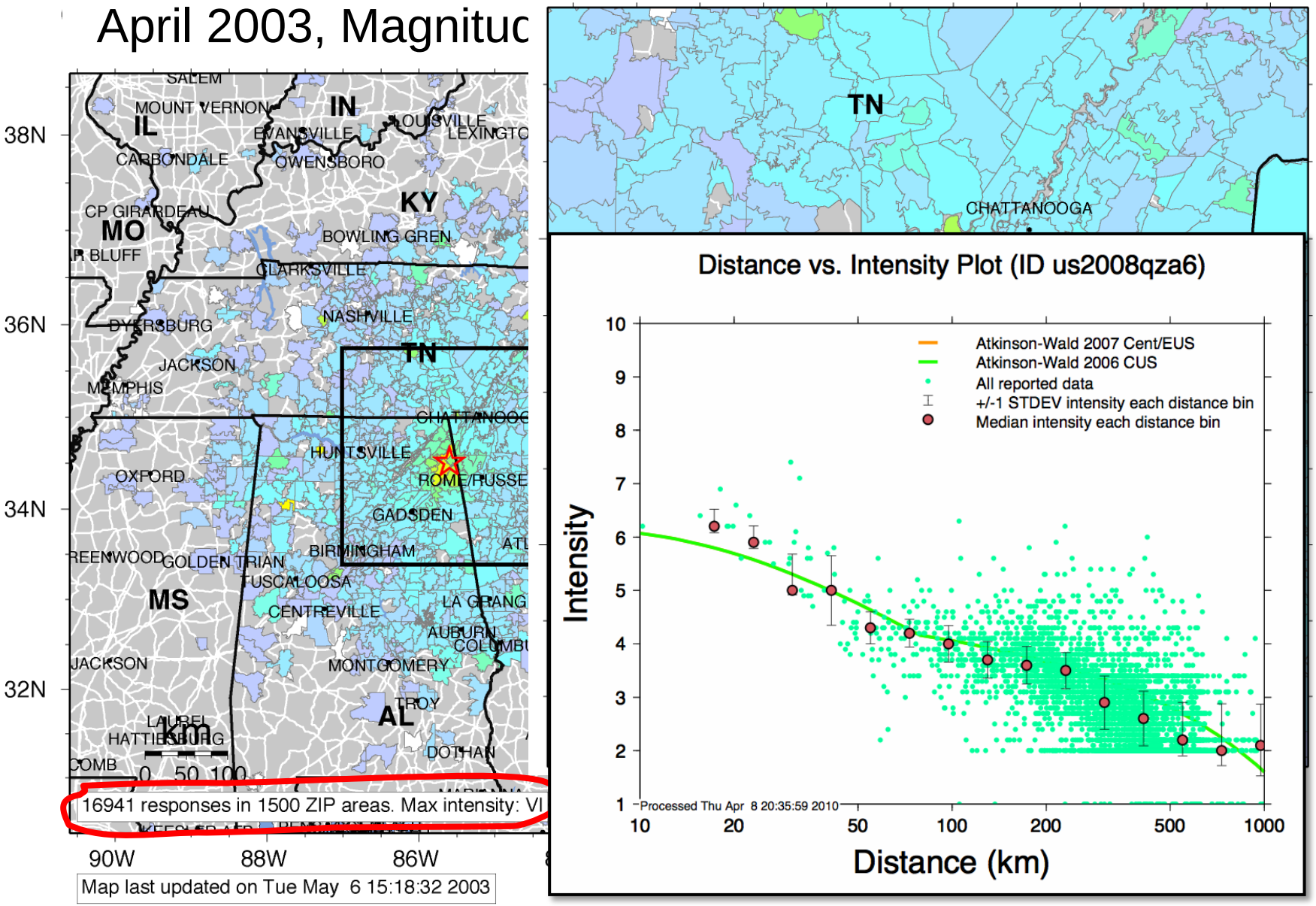
Contents [hide]

History [edit]

The term "crowdsourcing" is a neologistic portmanteau of "crowd" and "outsourcing," first coined by Jeff Howe in a June 2006 *Wired* magazine article "The Rise of Crowdsourcing".[2][3] Howe explains that because technological advances have allowed for cheap consumer electronics, the gap between professionals and amateurs has been diminished. Companies are then able to take advantage of the talent of the public, and Howe states that "It's not outsourcing; it's crowdsourcing."

Projects which make use of group intelligence, such as the LazyWeb or Luis von Ahn's ESP Game, predate that word coinage by several years. Recently, the Internet has been used to publicize and manage crowdsourcing projects

April 2003, Magnituc



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

“DID YOU FEEL IT?”
Statistics

- Operating in CA since 1999; US since 2001, & globally 2005
- To date >**2 million** individual responses from all 50 U.S. States & Territories.
- Outside the U.S., over **190,000** responses in 9,500 cities for 140 countries.
- **40 U.S. earthquakes with >10,000** reports submitted; 300 events with > 1,000 entries.
- Max=**142,000** reports submitted Aug 23 2011, M5.8 Virginia event (45,000/hr; **~750 per min; ~13/sec**).

D. Wald, USGS

DID YOU FEEL IT?
Capabilities

- Immediate feedback, “heads up” on events within 1 min, around the globe.
- Intensity maps are immediately available; update constantly.
- USGS can now automatically collect intensity data for all ***felt*** earthquakes in U.S.
- Magnitude <2.0 events reported in Central & Eastern US (**well below routine** reporting level for most seismic networks).
- Can capture felt reports for non-earthquake related shaking: Sonic booms (shuttle; military aircraft) & bolides; explosions & quarry blasts.
- Allows immediate, quality & cost effective way of collecting a large quantity of macroseismic intensity data, replacing postal questionnaires. [USGS can *still* assign values from field/engineering surveys]
- We can automatically geocode entries to latitude/longitude for higher spatial resolution, as needed.

D. Wald, USGS

DID YOU FEEL IT?
Reasons for Success

From our experience with DYFI, essential components of an internet-based citizen-science portal include:

- Easy-to-use forms, & instantaneous feedback so that users may see their contribution (validating their experience),
- Ability to see one's contribution (but not full responses),
- Open space for first-person accounts (catharsis; risk perception),
- User-friendly tools: common searches, statistics, sorting of responses, time-entry histories, comparing data with empirical intensity estimates,
- Easily-downloadable data exchange format for researchers.

- **MOTHER NATURE GETS PEOPLES' ATTENTION!**

D. Wald, USGS

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M5.8 – Virginia

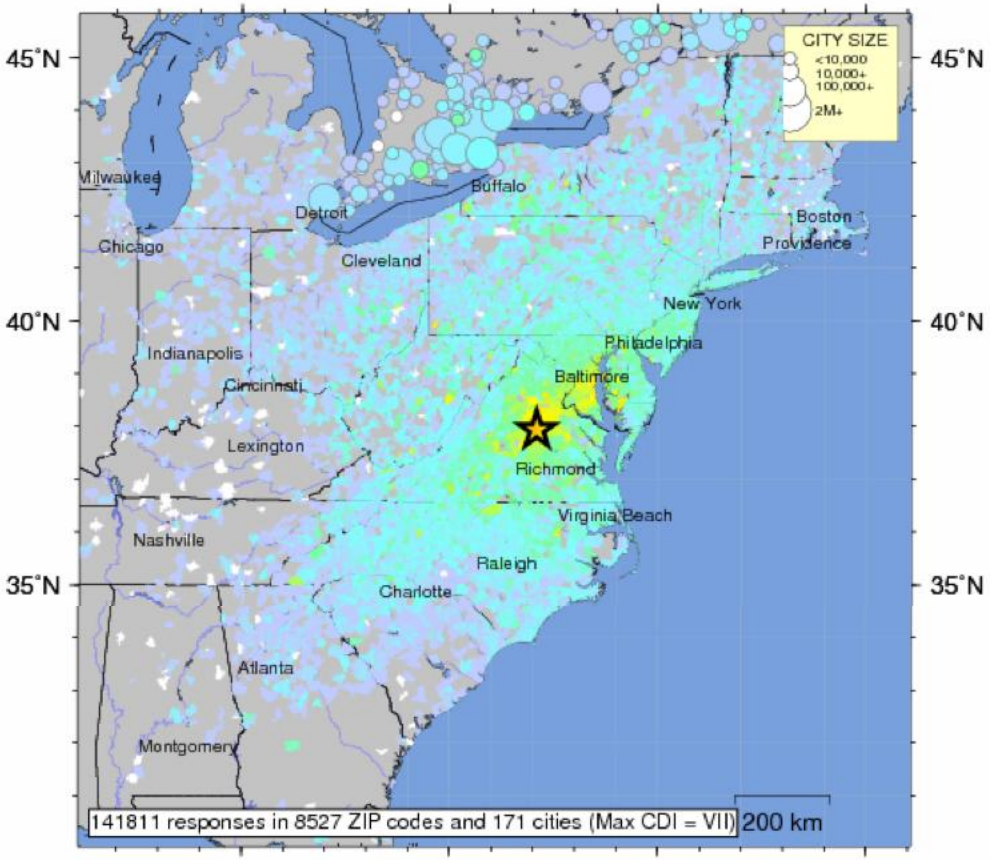
Tuesday, August 23, 2011 at 17:51:04 UTC
Tuesday, August 23, 2011 at 13:51:04 Local

Maps | Graphs | Responses | Downloads | Did You Feel It? — Tell Us !

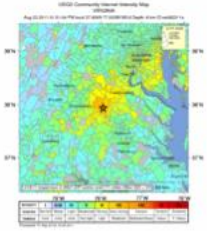
37.94°N 77.93°W
Depth: 6km

USGS Community Internet Intensity Map
VIRGINIA

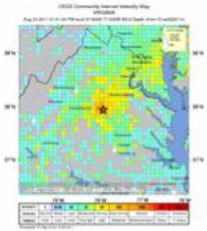
Aug 23 2011 01:51:04 PM local 37.936N 77.933W M5.8 Depth: 6 km ID:se082311a



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	V. Heavy

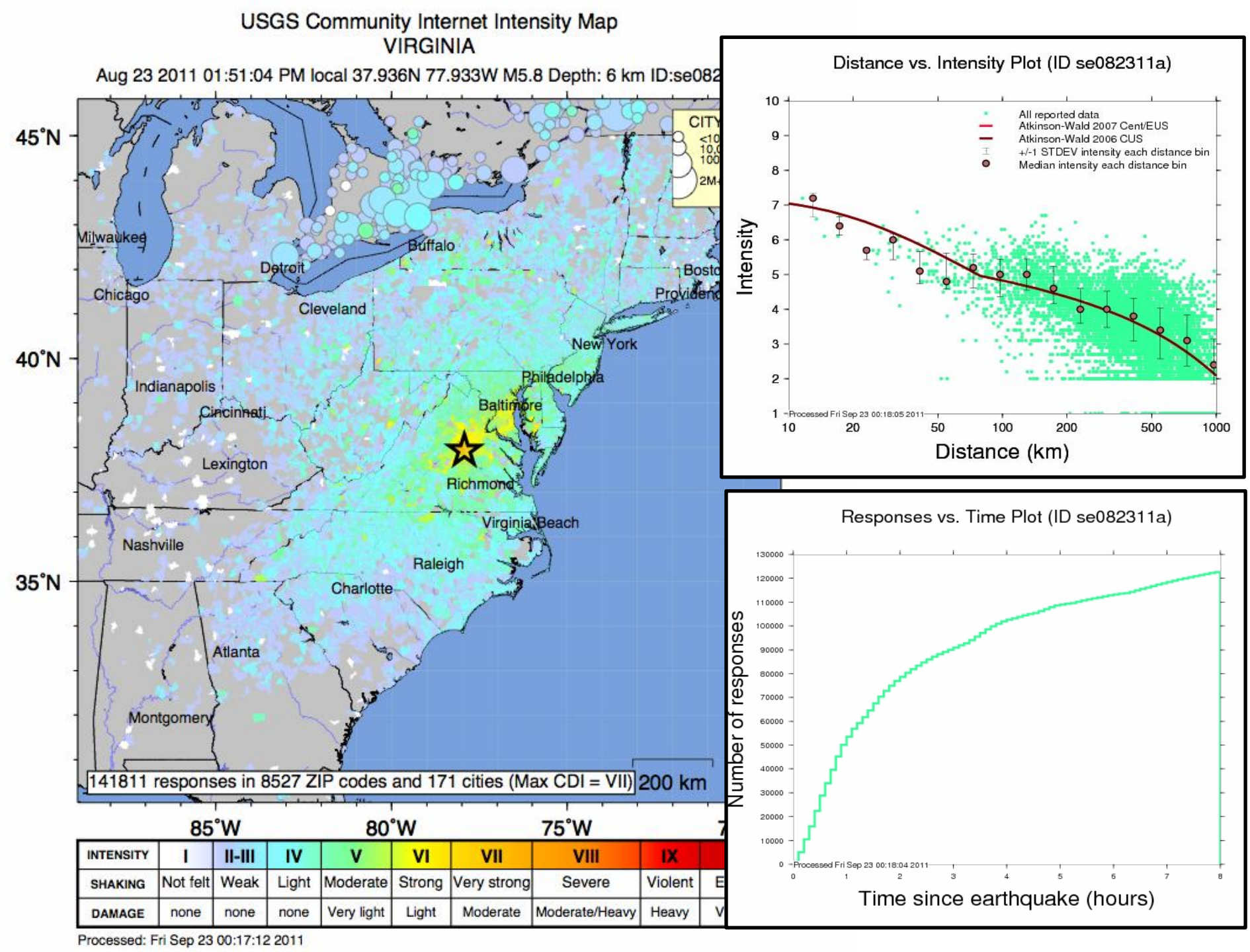


City map



Geocoded Map

Zoomout Map

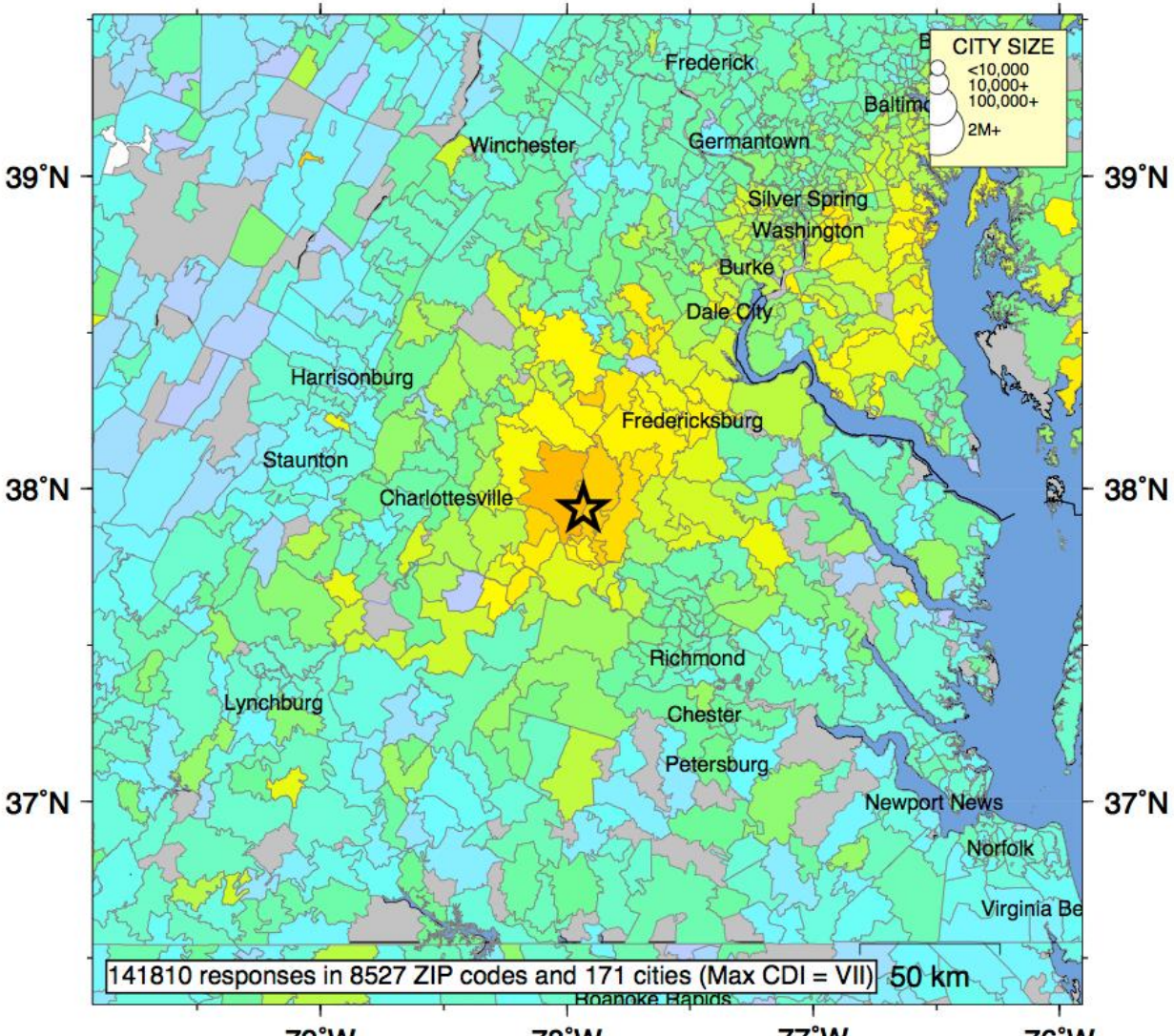

USGS Community Internet Intensity Map
VIRGINIA
Aug 23 2011 01:51:04 PM local 37.936N 77.933W M5.8 Depth: 6 km ID:se082
45°N
40°N
35°N
85°W
80°W
75°W
Milwaukee
Chicago
Detroit
Cleveland
Buffalo
Boston
Providence
New York
Philadelphia
Baltimore
Indianapolis
Cincinnati
Lexington
Richmond
Virginia Beach
Nashville
Raleigh
Charlotte
Atlanta
Montgomery
141811 responses in 8527 ZIP codes and 171 cities (Max CDI = VII)
200 km
INTENSITY | I | II-III | IV | V | VI | VII | VIII | IX
SHAKING | Not felt | Weak | Light | Moderate | Strong | Very strong | Severe | Violent
DAMAGE | none | none | none | Very light | Light | Moderate | Moderate/Heavy | Heavy
Processed: Fri Sep 23 00:17:12 2011
Distance vs. Intensity Plot (ID se082311a)
All reported data
Atkinson-Wald 2007 Cent/EUS
Atkinson-Wald 2006 CUS
+/-1 STDEV intensity each distance bin
Median intensity each distance bin
Intensity
Distance (km)
Processed Fri Sep 23 00:18:05 2011
Responses vs. Time Plot (ID se082311a)
Number of responses
Time since earthquake (hours)
Processed Fri Sep 23 00:18:04 2011

Did You Feel It?

DYFI MOVIE

USGS Community Internet Intensity Map
VIRGINIA

Aug 23 2011 01:51:04 PM local 37.936N 77.933W M5.8 Depth: 6 km ID:se082311a

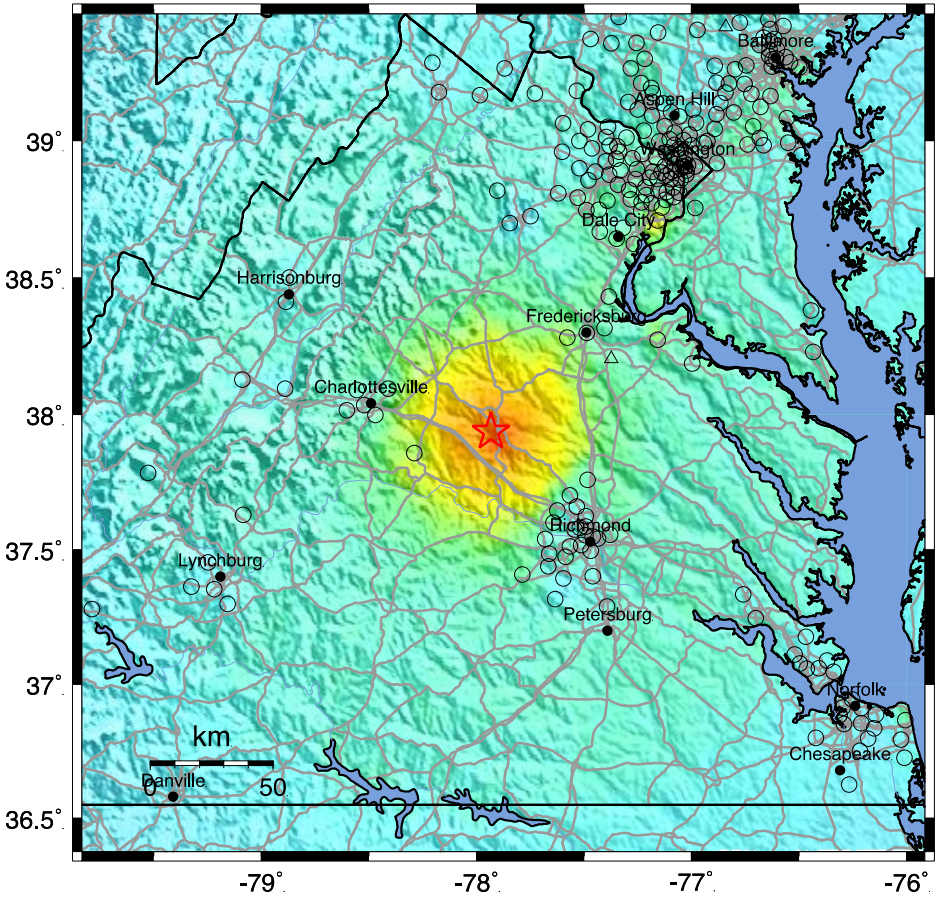


INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy

Processed: Thu Sep 22 16:24:23 2011

USGS ShakeMap : VIRGINIA

Tue Aug 23, 2011 17:51:04 GMT M 5.8 N37.94 W77.93 Depth: 6.0km ID:082311a

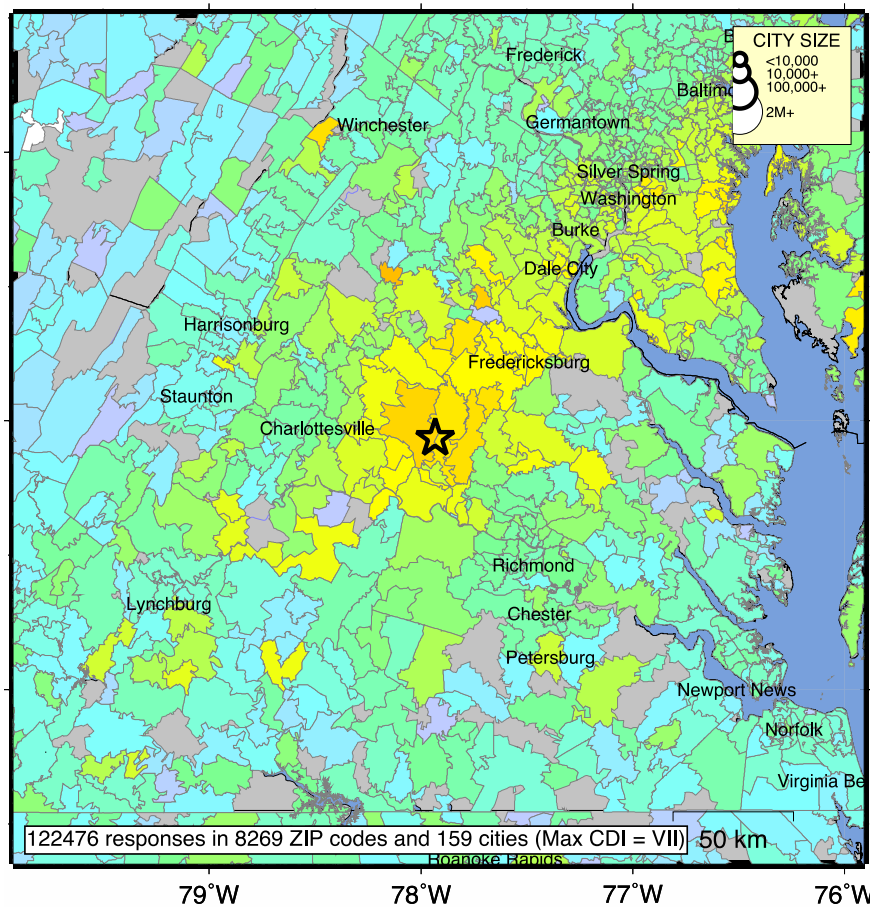


Map Version 4 Processed Tue Aug 23, 2011 01:50:45 PM MDT -- NOT REVIEWED BY HUMAN

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	*8.1-16*	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

USGS Community Internet Intensity Map
VIRGINIA

Aug 23 2011 01:51:04 PM local 37.936N 77.933W M5.8 Depth: 6 km ID:se082311a

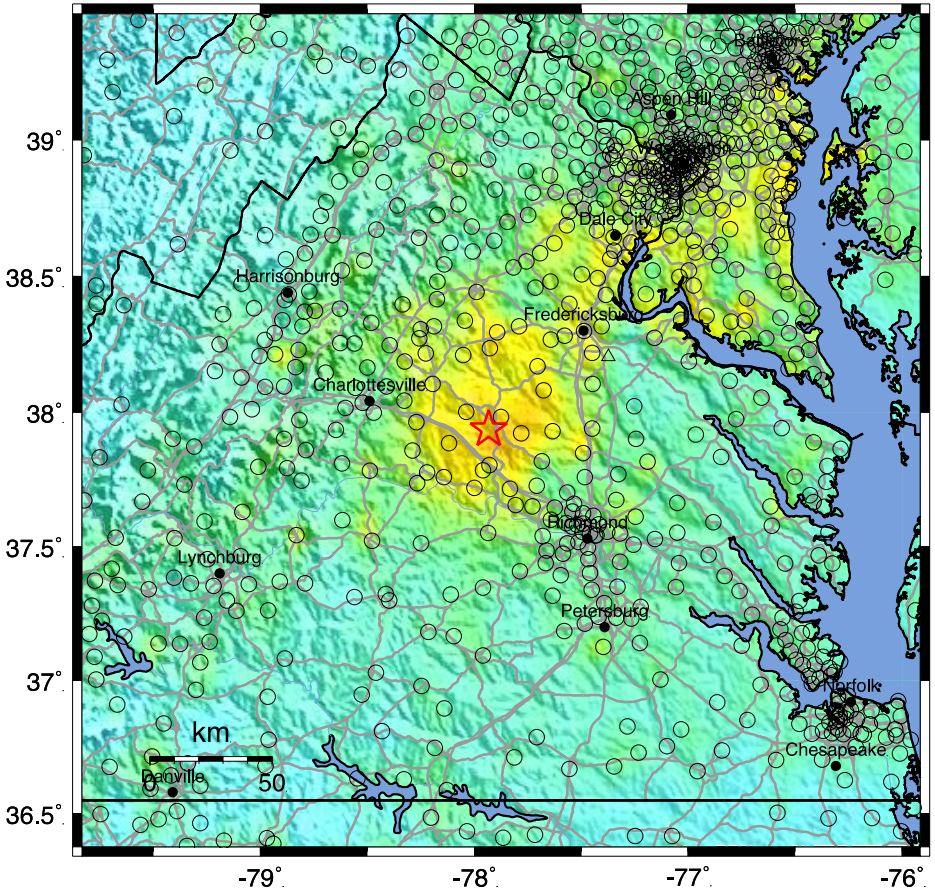


INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy

Processed: Wed Aug 24 11:12:25 2011

USGS ShakeMap : VIRGINIA

Tue Aug 23, 2011 17:51:04 GMT M 5.8 N37.94 W77.93 Depth: 6.0km ID:082311a

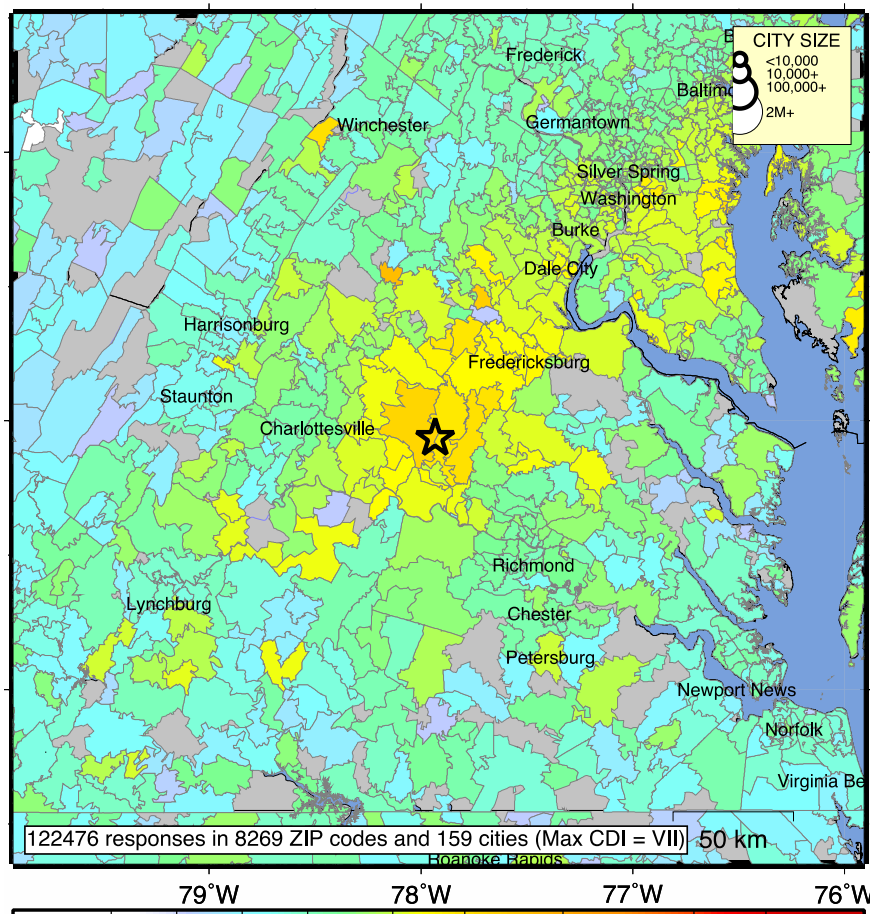


Map Version 6 Processed Wed Aug 24, 2011 08:50:09 AM MDT -- NOT REVIEWED BY HUMAN

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	*8.1-16*	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

USGS Community Internet Intensity Map
VIRGINIA

Aug 23 2011 01:51:04 PM local 37.936N 77.933W M5.8 Depth: 6 km ID:se082311a



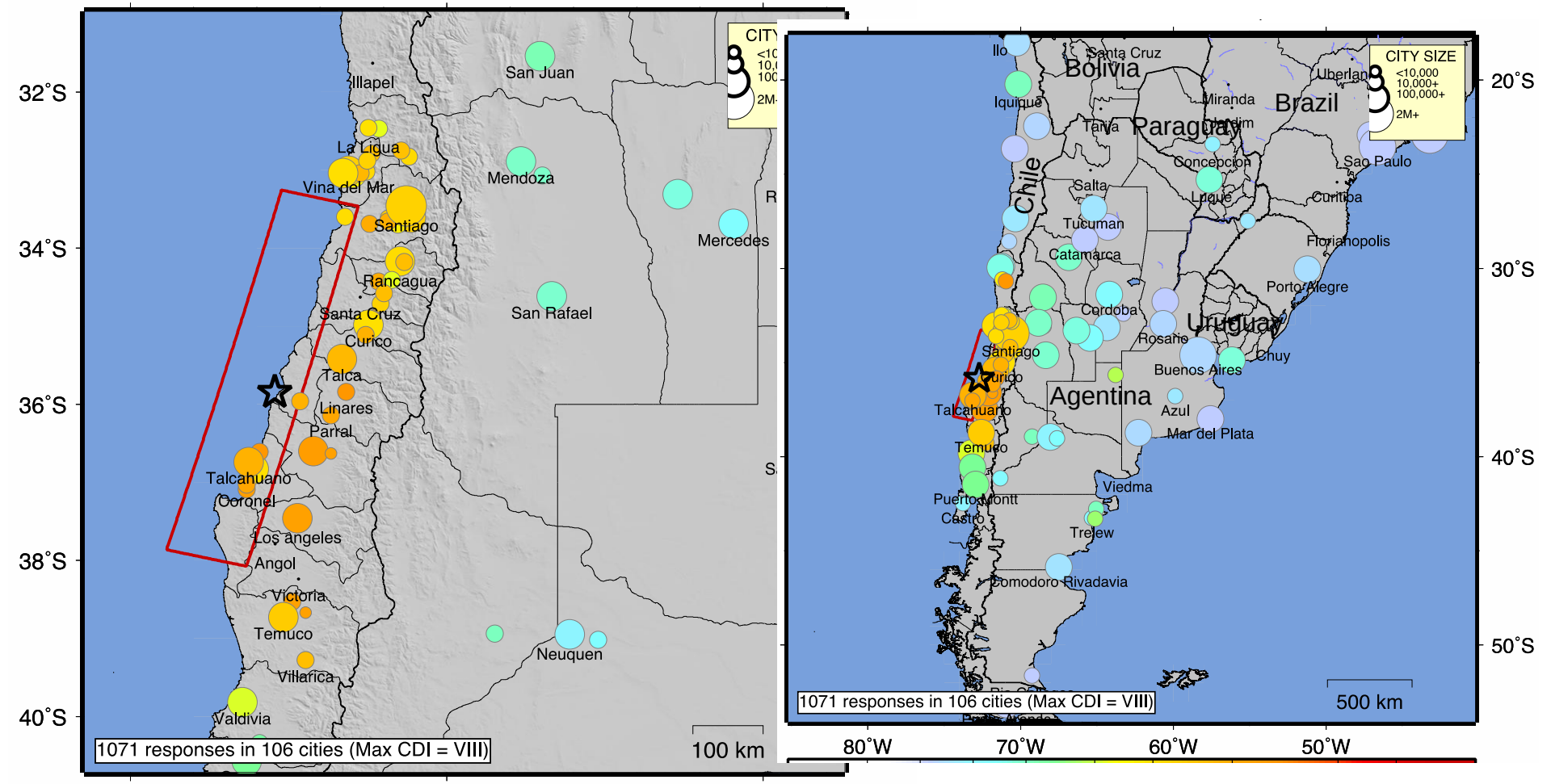
INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy

Processed: Wed Aug 24 11:12:25 2011

“Did You Feel It?” Reported Modified Mercalli Intensities

USGS

USGS Community Internet Intensity Map
OFFSHORE MAULE, CHILE
Feb 27 2010 03:34:14 local 35.8464S 72.7189W M8.8 Depth: 35 km ID:us2010tfan



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	V. Heavy

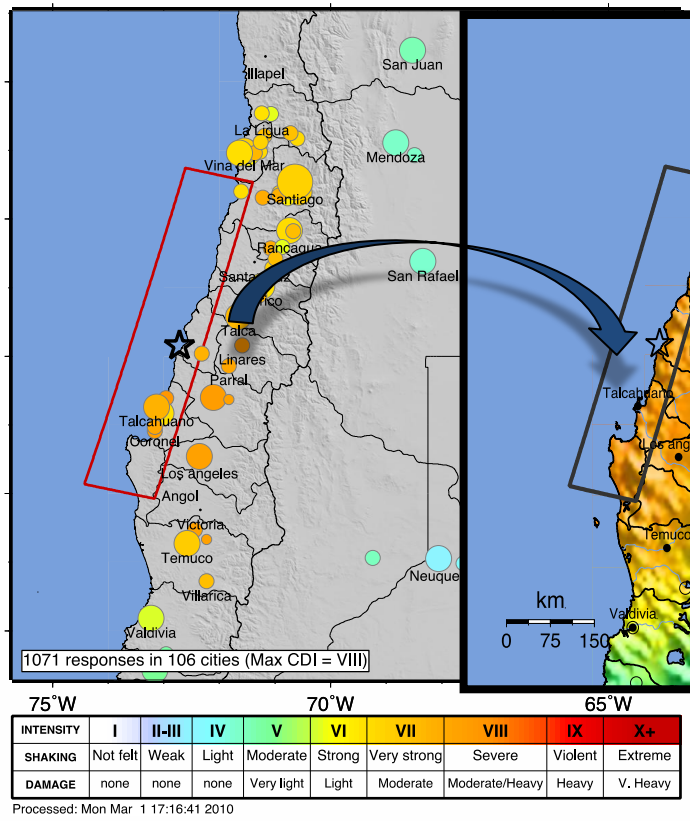
Processed: Mon Mar 1 17:16:41 2010

Red rectangle depicts faulting area

Chile, Feb., 2010
Magnitude 8.8

PAGER

"Did You Feel It?"



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	V. Heavy

Processed: Mon Mar 1 17:16:41 2010

Global ShakeMap