USGS
science for a changing world

Agency Vision and Decision-Maker Needs: A USGS Perspective

Connecting Grassroots to Government for Disaster Management

David Applegate
USGS Associate Director for Natural Hazards
September 13, 2012

USGS hazard roles and responsibilities

- Delegated federal responsibility to provide notifications and warnings for earthquakes, volcanic eruptions, and landslides.
- Seismic networks support NOAA's tsunami warnings.
- Streamgages and storm surge monitors support NOAA's flood and severe weather (including hurricane) warnings.
- Geomagnetic observatories support NOAA and AFWA geomagnetic storm forecasts.
- USGS has key role in tracking zoonotic diseases.
- Geospatial information supports response operations for wildfire and many other disasters.

USGS

Crowdsourced Data and Social Media:
An Infrastructure for Hazard Assessment, Monitoring, and Response

- Did You Feel It?
- Did You See It?
- USGS TED: Tweet Earthquake Dispatch
- Quake Catcher Network
- Netquake Sensor Volunteers
- National Map Corps

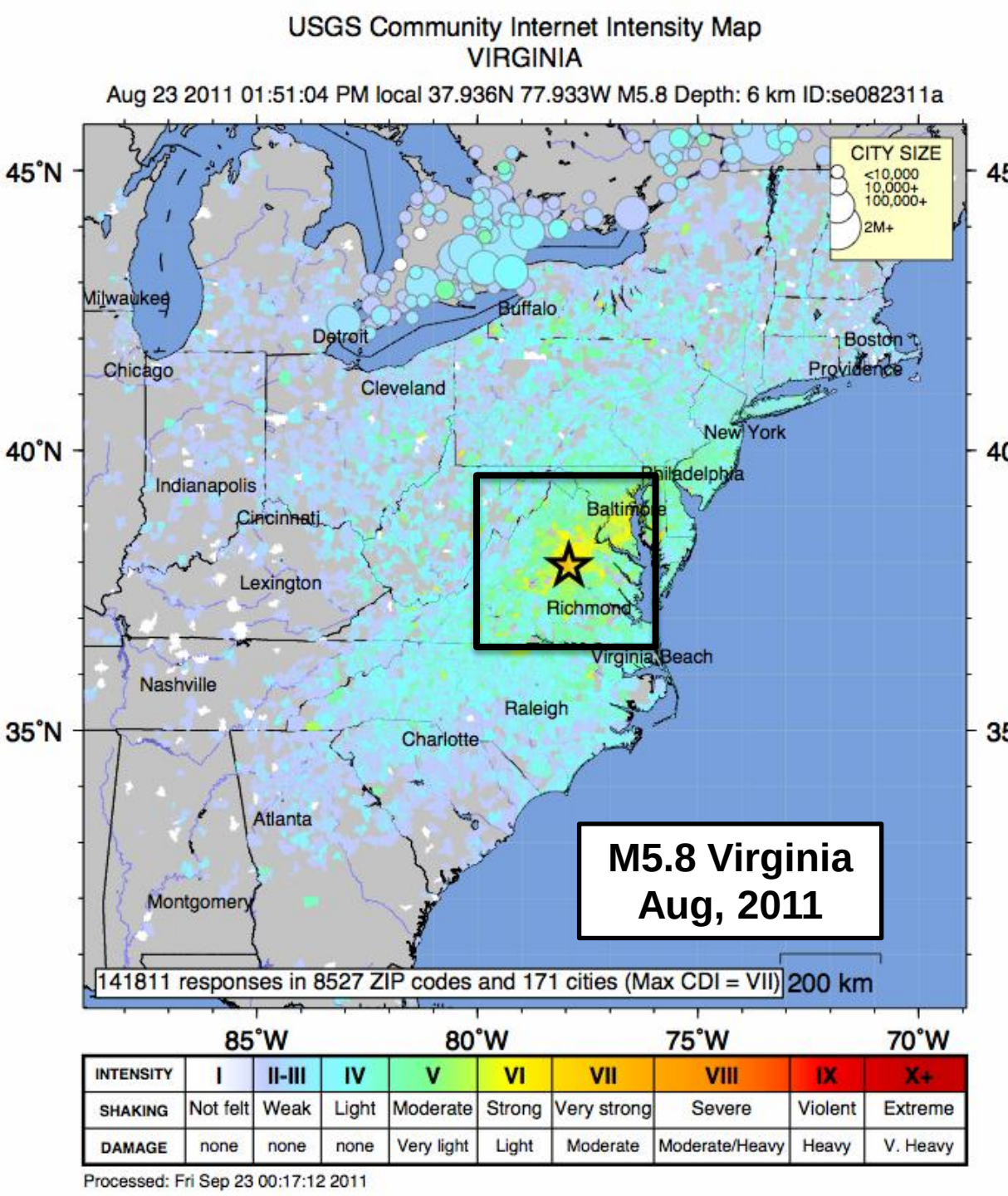
USGS

Did You Feel It?

Rapid & automatic intensity maps based on felt reports submitted online.

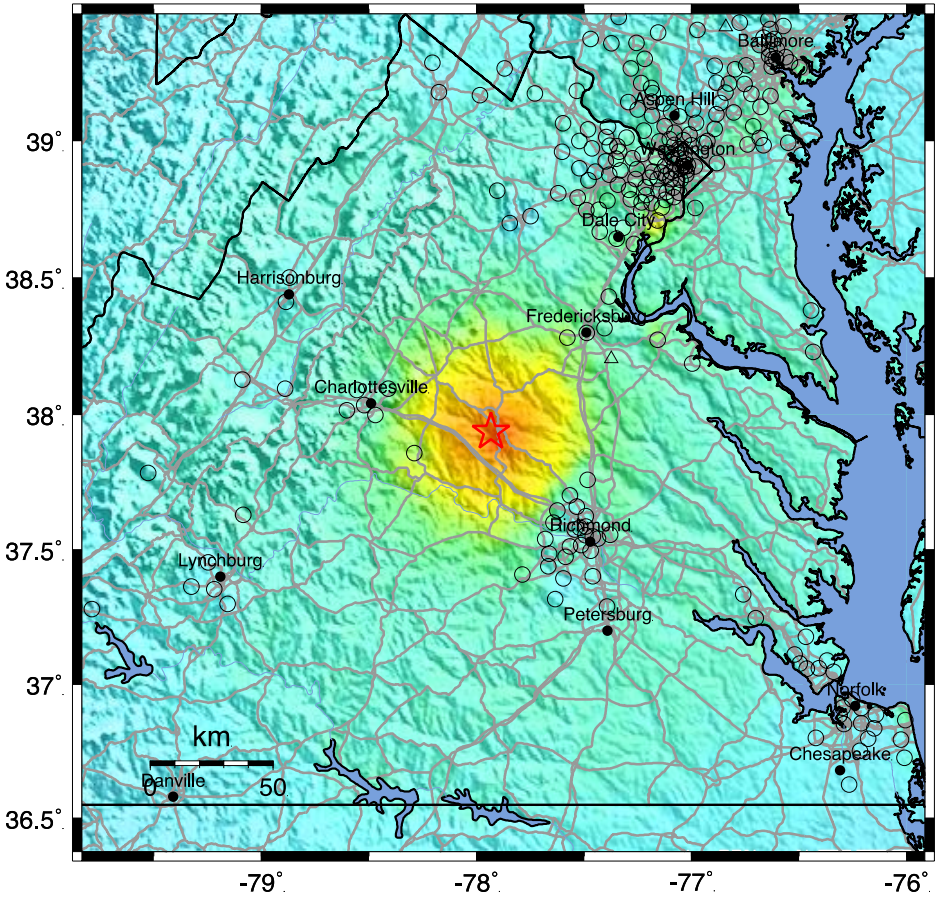
- Users answer simple online questionnaire.
- Color-code ZIP-code to community's average intensity.
- Replaces traditional postal questionnaire.

USGS



USGS ShakeMap : VIRGINIA

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

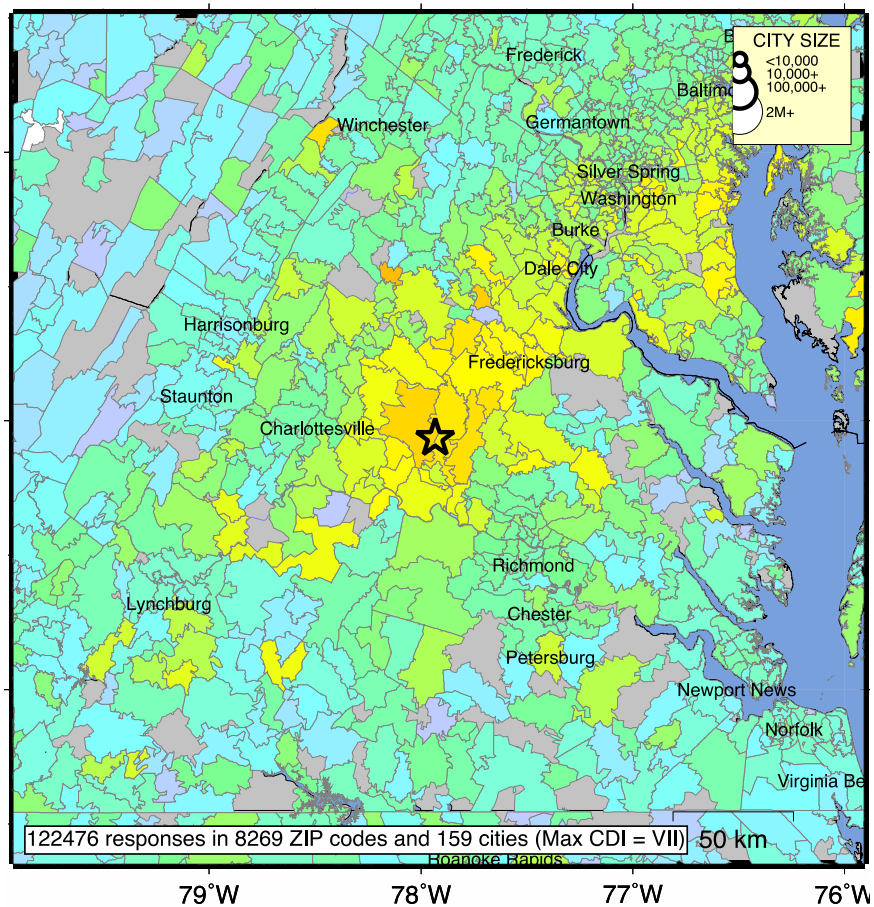


Map Version 4 Processed Tue Aug 23, 2011 01:50:45 PM MDT -- NOT REVIEWED BY HUMAN

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

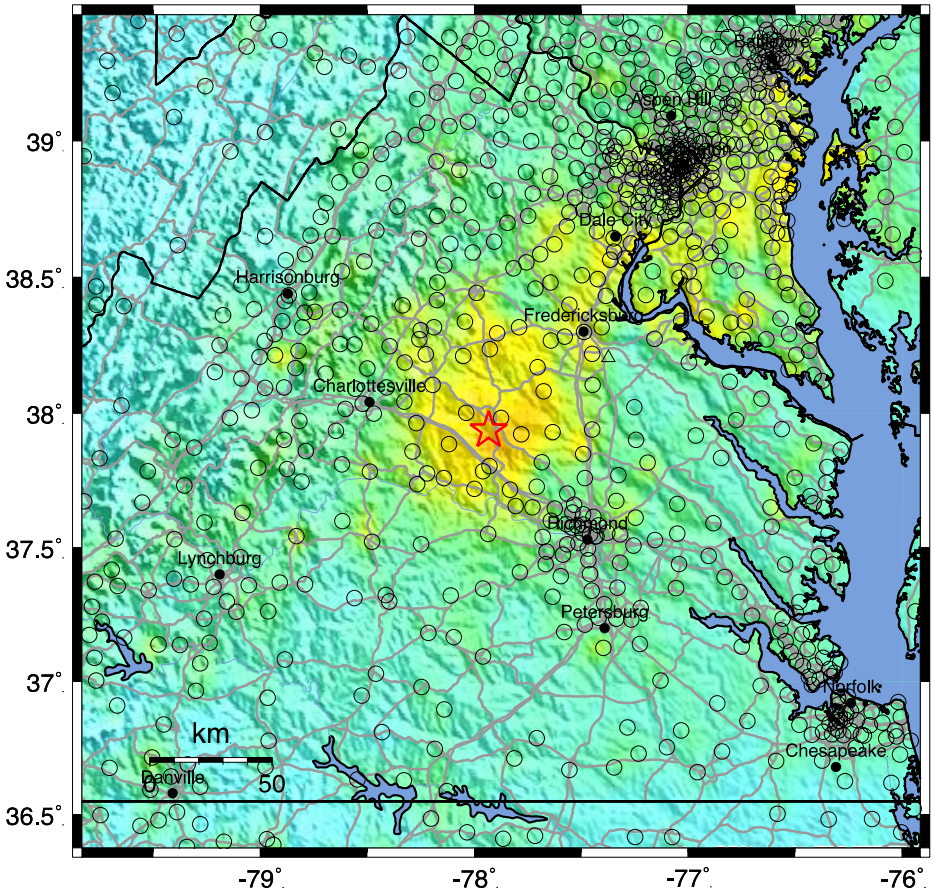
Aug 23 2011 01:51:04 PM local 37.936N 77.933W M5.8 Depth: 6 km ID:se082311a



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

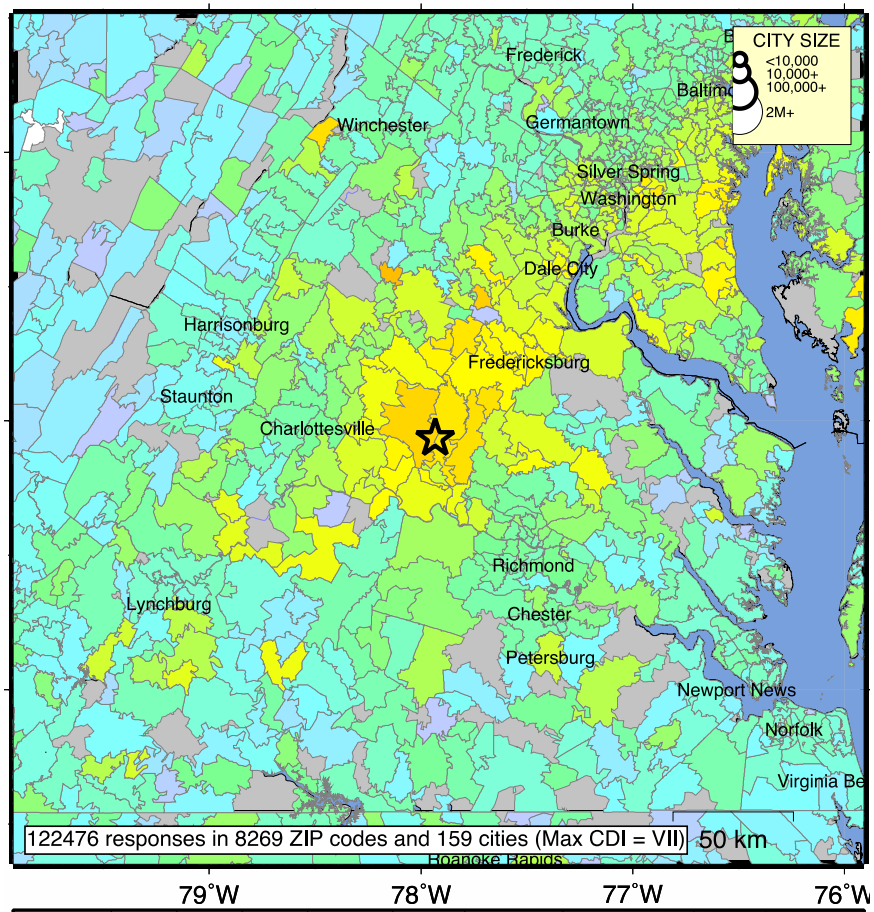
ShakeMap



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+

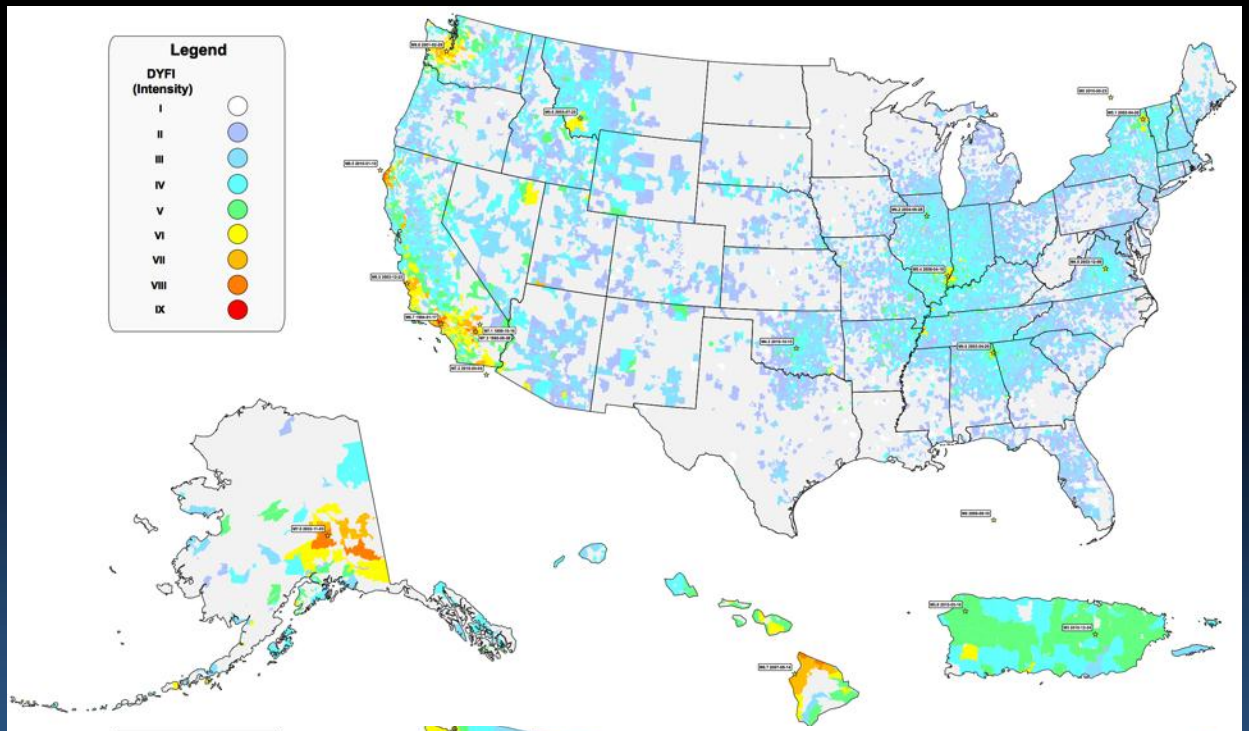
"Did You Feel It?"



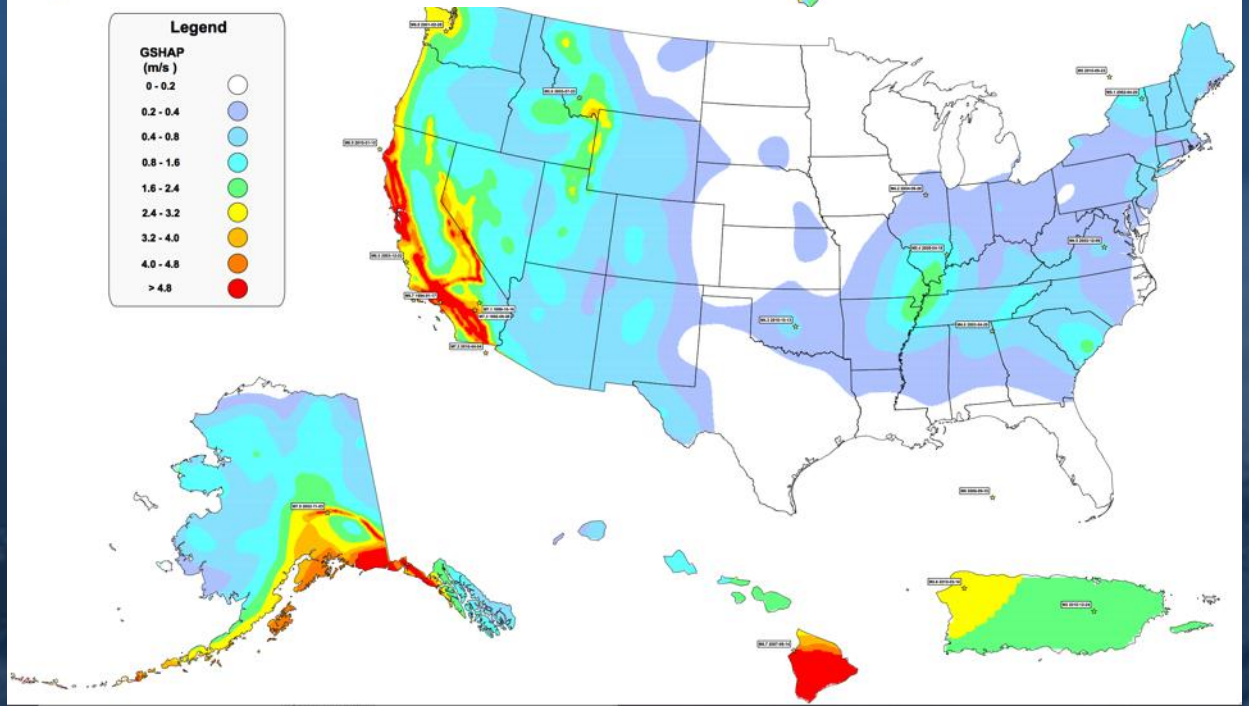
INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy

Processed: Wed Aug 24 11:12:25 2011

10 Years of DYFI Data (~2 *million* responses)



USGS National Seismic Hazard Map (2% in 50 Year Probability of Exceedence)



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Did You See It?
Landslide Reporting

Landslide Summary

Location Required

Address, zip code, or other information to describe the landslide location.

Input Coordinates Instead

When did you first see the landslide? Required

This may be different than when the landslide occurred.

Date Format: 2011-08-31

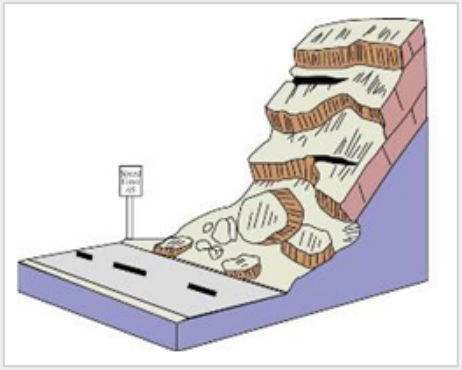
12:00 AM

Landslide Type

Hover your mouse over each option for additional information, or see:

- Fall
- Flow
- Topple
- Rotational
- Translational

A **fall** occurs when a mass of any size detaches from a steep slope or cliff and descends mostly through the air by freefall, bouncing, or rolling.



- Enables crowd-sourced, online landslide reports
- Qualitative information may be used in USGS reports

TED: Tweet Earthquake Dispatch

- Alerts for earthquakes worldwide with M 5.5+.
- Magnitude descriptor, location, origin time, link to USGS webpage.
- Alerts include frequency of tweets in event region that contain the word “earthquake” or its equivalent in several languages.

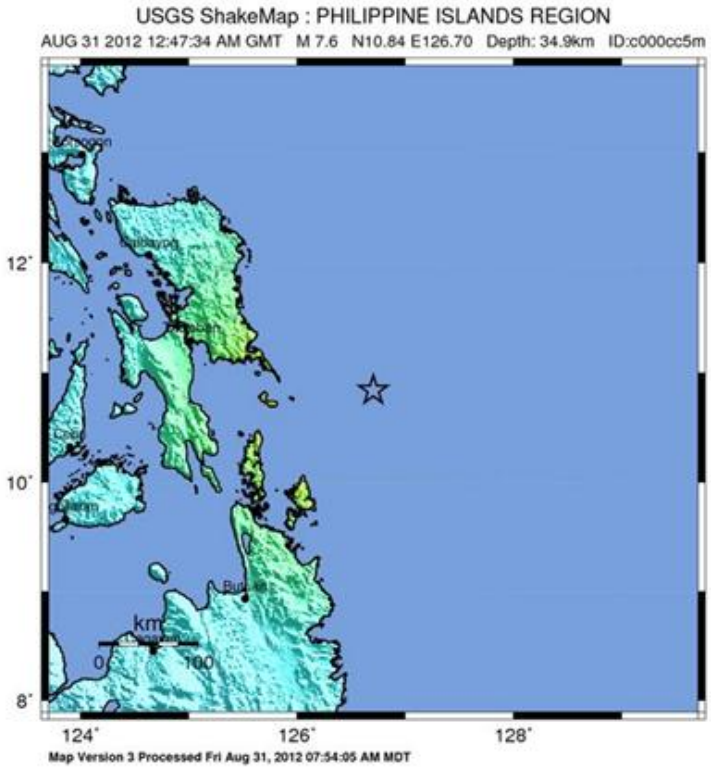
USGS TED Example: Philippines Quake

M7.6 - 88km E of Sulangan, Philippines
2012-08-31 12:47:33 UTC

PAGER - GREEN | ShakeMap - VI | DYFI? - VII

Google Earth KML

ShakeMap Contributed by USGS Ne



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	<0.02	0.1	1.4	4.7	9.6	20	41	86	>178
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Worden et al. (2011)

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Goldman Analysts Call Banking Slowdown Structural, Not Temporary


Shipping Magnate Uses Gut (and Guts) in $11B Bet on Energy Revival

Twitter Alerts U.S. Geological Survey to Philippines Quake

By Douglas MacMillan - Aug 31, 2012 5:17 PM ET

2 COMMENTS QUEUE

Twitter Inc., the microblogging service that lets more than 140 million users send short messages on everything from the mundane to the life-altering, tipped off the U.S. Geological Survey to the 7.6-magnitude earthquake that hit near the coast of the Philippines today.

The Reston, Virginia-based agency detected tweets about the earthquake one minute and seven seconds after the seismic event, which occurred at about 8:47 p.m. local time, Paul Earle, a USGS seismologist, said in a telephone interview.

Enlarge Image

Filipino science researcher Ponech Colleen Aloones checks computer data on a 7.7-magnitude earthquake that struck off the Philippines' eastern coast 8/31/2012. Photograph: Francis Malasig/EPA/Landov

Social media sites such as San Francisco-based Twitter are playing a more prominent role in raising awareness of and coordinating responses to natural disasters, including the 2010 earthquake in Haiti and one last year in Japan that led to the failure of the Fukushima nuclear plant. USGS scientists monitor tweets for mentions of the word "earthquake" and its equivalents in other languages.

"In some cases, it gives us a heads up that it happened before it can be detected by a seismic wave," Earle said.

USGS TED Example: Philippines Quake

M7.6 - 88km E of Sulangan, Philippines
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PAGER - GREEN | ShakeMap - VI | DYFI? - VII

Google Earth KML

ShakeMap

Contributed by USGS NE

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Shipping Magnate Uses Gut (and Guts) in $11B Bet on Energy Revival

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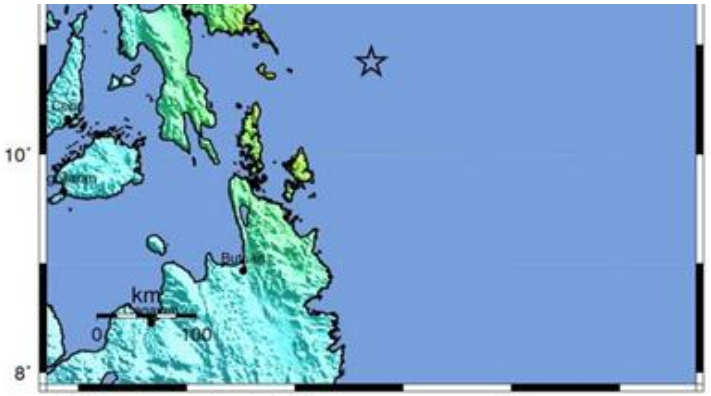
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.02	0.02-0.4	0.4-2.2	2.2-7	7-12	12-20	20-36	36-63	>63
TWITTER ABBREV		*WT?*	*WTH?*	*WTF?*	*NFW*	*SOAB*	*UFB*	*OMG*	*OMFG*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+



Map Version 3 Processed Fri Aug 31, 2012 07:54:05 AM MDT

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	<0.02	0.1	1.4	4.7	9.6	20	41	86	>178
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Worden et al. (2011)

Survey to the 7.6-magnitude earthquake that hit near the coast of the Philippines today.

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"In some cases, it gives us a heads up that it happened before it can be detected by a seismic wave," Earle said.

Other Citizen-aided science: Cheap seismic sensors

QuakeCatcher Network
(Stanford Univ.)

iShake
(U.C. Berkeley)

NetQuakes
(USGS)

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USGS

Distribution of QCN Participants

▲ Participants

● Earthquake Locations

Statistics

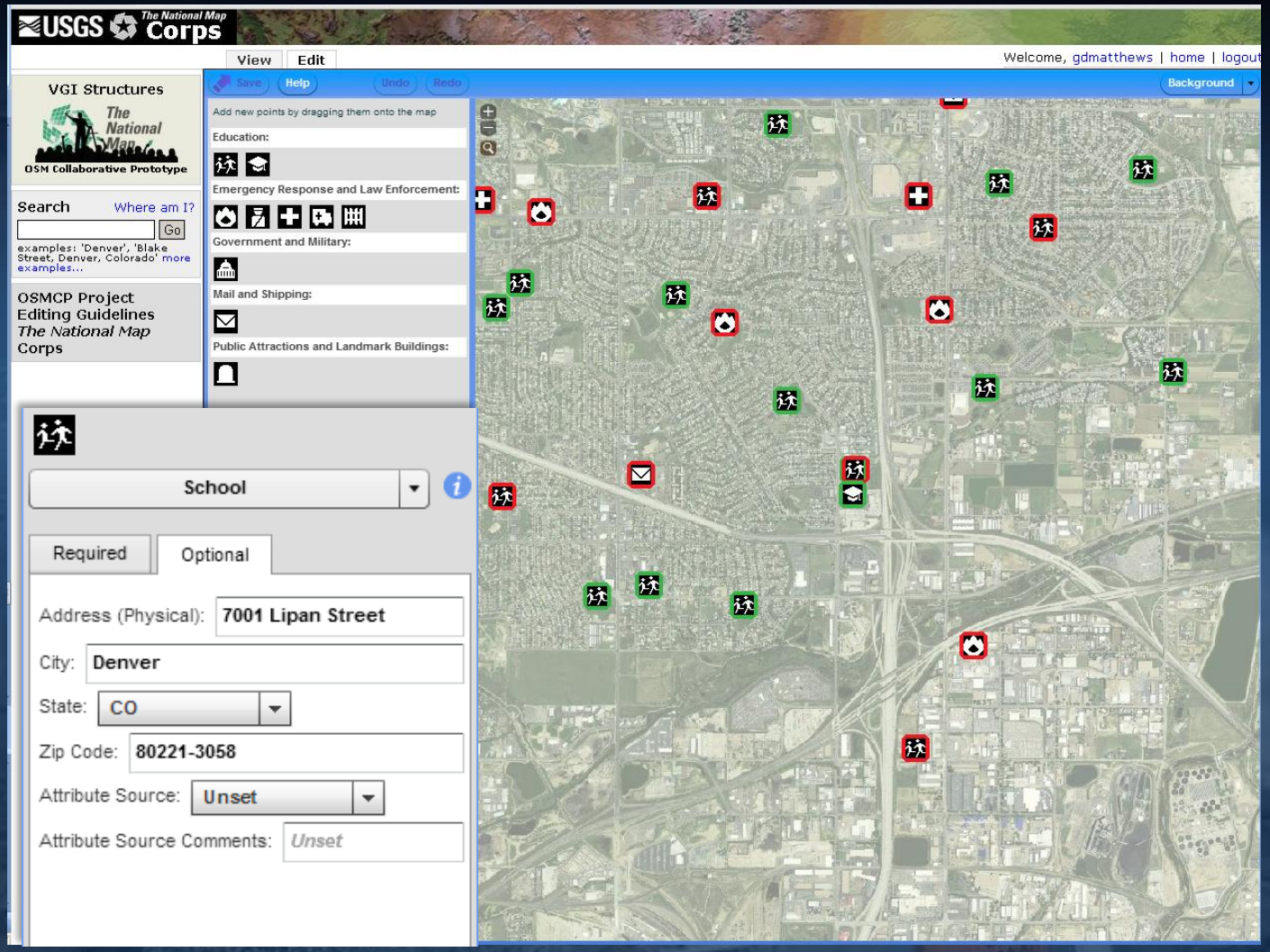
- Over 2000 seismic stations globally in 67 countries
- Recorded earthquakes between M 2.6 (New Zealand) – M 8.8 (Chile)

NetQuakes Volunteers

National Map Corps

Crowdsourcing used to update USGS geographic data

- Volunteers mapping structures
- Pilot program in CO
- Improved map quality



USGS

Any questions?

applegate@usgs.gov
703-648-6600

USGS

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).

USGS

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.

USGS

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!

USGS

D. Wald, USGS

Quake-Catcher Network

Website: http://qcn.stanford.edu

Dense strong-motion (M>3) network:

- Involves the public in seismic data collection by installing sensor in homes, businesses and schools
- Small, low-cost sensors are connected to desktop computers and plug computer

Objectives:

- Community understanding of earthquake risk and seismology
- Rapid earthquake detection and characterization
- Earthquake source imaging
- Wave propagation and seismic hazard