

### 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

U.S. Department of the Interior U.S. Geological Survey

### **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.





**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

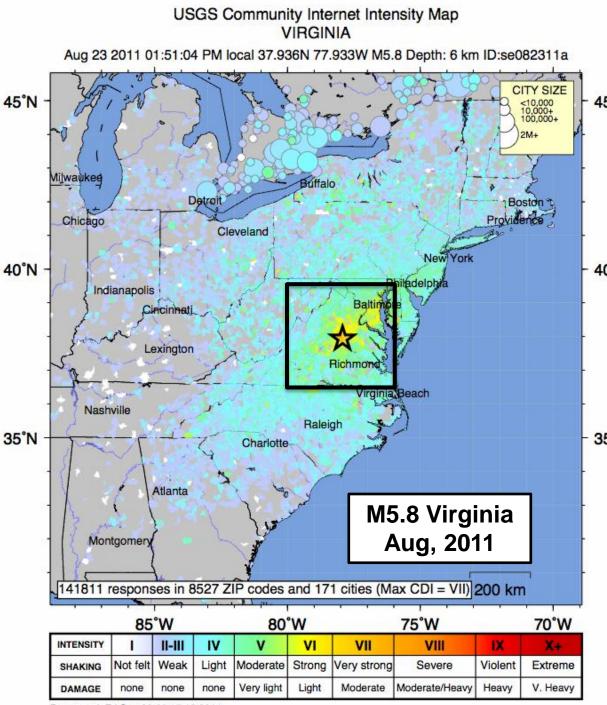


### Did You Feel It?

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.





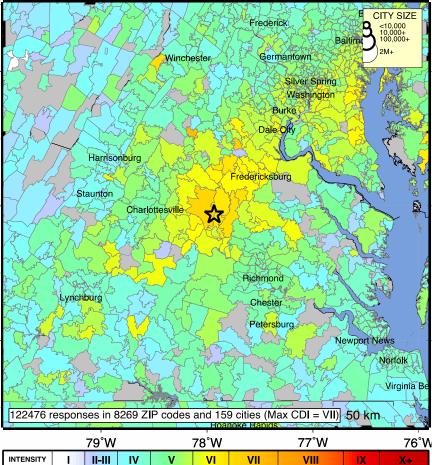
Processed: Fri Sep 23 00:17:12 2011

#### **USGS ShakeMap : VIRGINIA** Tue Aug 23, 2011 17:51:04 GMT M 5.8 N37.94 W77.93 Depth: 6.0km ID:082311a 39 38.5 arrisonbu Chartottesville 38° 37.5°. Lynchburg. Petersburg 37°. km Chesape 50 36.5° -76° -79° -77° -78° 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	L	11-111	IV.	V.	VI.	VIL	VIII	IX.	<b>X+</b> .

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

USGS Community Internet Intensity Map



Processed: Wed Aug 24 11:12:25 2011

none

Not felt Weak

none

SHAKING

DAMAGE

Light

none

Moderate

Very light

Strong Very strong

Moderate

Light

Severe

Moderate/Heavy

Violent

Heavy

Extreme

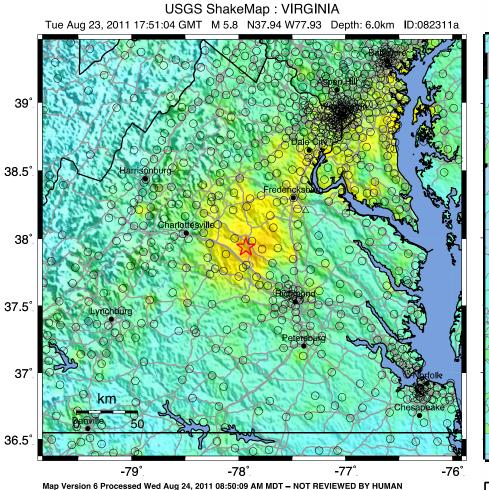
V. Heavy

#### **ShakeMap**

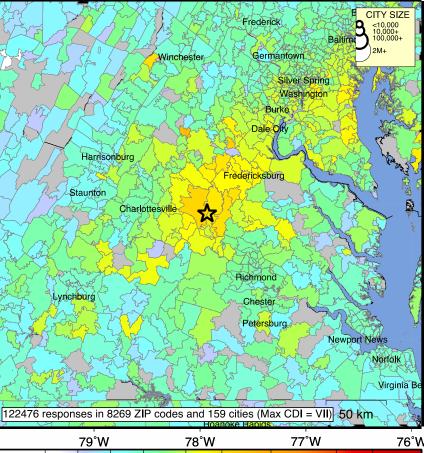
#### "Did You Feel It?"

VIRGINIA

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



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. <u>9</u>	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	I,	11-111,	IV.	V.	VI.	VIL	VIII	IX.	X+.



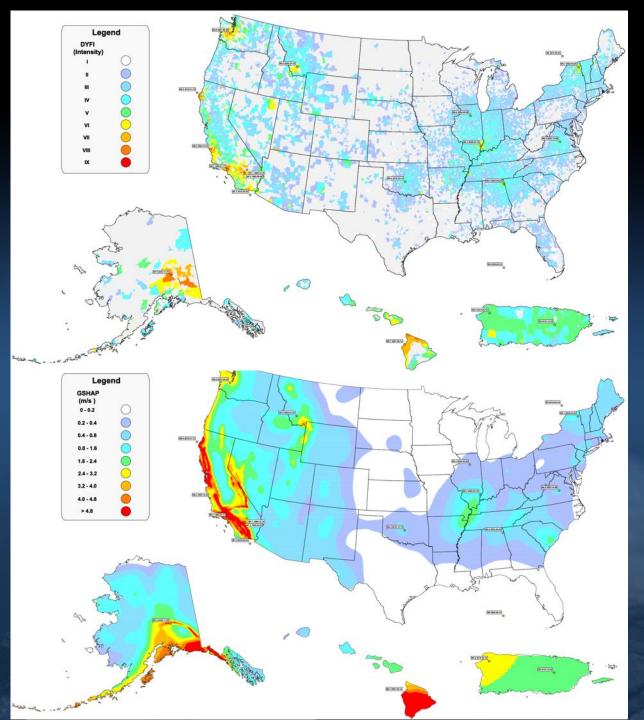
	79 W				78 W			77 W		
INTENSITY	- 1	11-111	IV	V	VI	VII	VIII	IX	Х+	
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme	
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	
Due e e e e e el M		24.44.40	05 0011							

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)





### **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

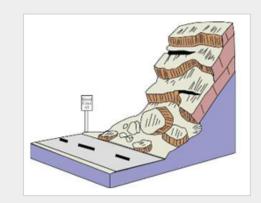
12:00 - AM -

#### Landslide Type

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

⊙ Fall	A fall occurs when a mass of any size detaches from a steep
Flow	slope or cliff and descends mostly through the air by freefall, bouncing, or rolling.
Topple	
Rotational	
Translational	

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



Translational

### **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.

accounts, and to en http://usgs.gov/so	gical Survey earthquake alerts. For other official ngage with us on other channels see	<ul> <li>Follow</li> <li>478 TWEETS</li> <li>3 FOLLOWING</li> <li>29,955 FOLLOWERS</li> </ul>
Follow USGSted	Tweets All / No replies	
Full name	USGSted @USGSted	8 Sep
Email	Powerful earthquake, KURIL ISLANDS, Sep-9 05:39 UT tweets/min, on.doi.gov/OiPXTO	C, 0 #quake
Password	from Северо-Курильский район, Province of Sakhalin	
Sign up	USGSted @USGSted Strong earthquake, COSTA RICA, Sep-8 20:29 UTC, 13 tweets/min, on.doi.gov/Ni3nyd	8 Sep 8 <b>#temblor</b>

### **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	Cut	
Google Earth KML				
ShakeMap				Contributed by USGS Na

USGS ShakeMap : PHILIPPINE ISLANDS REGION AUG 31 2012 12:47:34 AM GMT M 7.6 N10.84 E126.70 Depth: 34.9km ID:c000cc5m 126 128'

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

PERCEIVED	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL	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	1	11-111	IV	V	VI	VII	VIII	18	- Ma

Bloomberg Our Company

Our Company | Professional | Anywhere

QUICK NEVVS OPINION

PER SONAL FINANCE

POLITICS SUSTAIN/



Goldman Analysts Call Banking Slowdown Structural, Not Temporary IE

酒



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

TECH

#### Twitter Alerts U.S. Geological Survey to Philippines Quake

MARKET DATA

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



E 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 7.7magnitude earthquake that struck off the Philippines1 eastern coast 8/31/2012. Photograph: Francis Malastig/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 <u>Japan</u> 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 2012-08-31 12:47:33 UTC

PAGER - GREEN ShakeMap - VI DYFI? - VII

Soogle Earth KML

Contributed by USCC

HOME QUICK NEVV \$

Bloomberg

Slowdown Structural, Not Femporary 💽

Goldman Analysts Call Banking

OPINION



PERSONAL FINANCE

Our Company | Professional | Anywhere

MARKET DATA

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

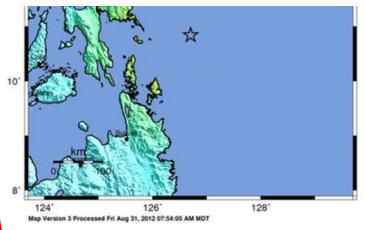
POLITICS

SU STAINA

TECH

ShakeMap

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)	<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	-	IV	V	VI	VII	VIII	IX	Х+



INSTRUMENTAL	1	11-111	IV	V	VI	VII	VIII	18	×.
PEAK VEL.(cm/s)	<0.02	0.1	1.4	4.7	9.6	20	41	86	>178
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heav
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme

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



ech Colleen outer data on a 7.7ake that struck off the Philippines1 eastern coast 8/31/2012. Photograph: Francis Malastig/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 arthquake 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.

### **Other Citizen-aided science: Cheap seismic** sensors

#### QuakeCatcher Network (Stanford Univ.)

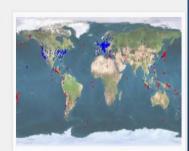
#### iShake (U.C. Berkeley)

#### **NetQuakes** (USGS)



#### The Quake-Catcher Network

he Quake-Catcher Network is a collaborative initiative for developing the world's largest, low-cost strong-motion seismic network by utilizing sensors in and attached to internet-connected computers. With your help, the Quake-Catcher Network can provide better understanding of earthquakes, give early warning to schools, emergency response systems, and others. The







View Data

Northern California

Southern California

Pacific Northwest

Sign Up

FAO





The USGS is trying to achieve a denser and more uniform spacing of seismographs in select urban areas to provide better measurements of ground motion during earthquakes. These measurements improve our ability to make rapid post-earthquake assessments of expected damage and contribute to the continuing development of engineering standards for construction.

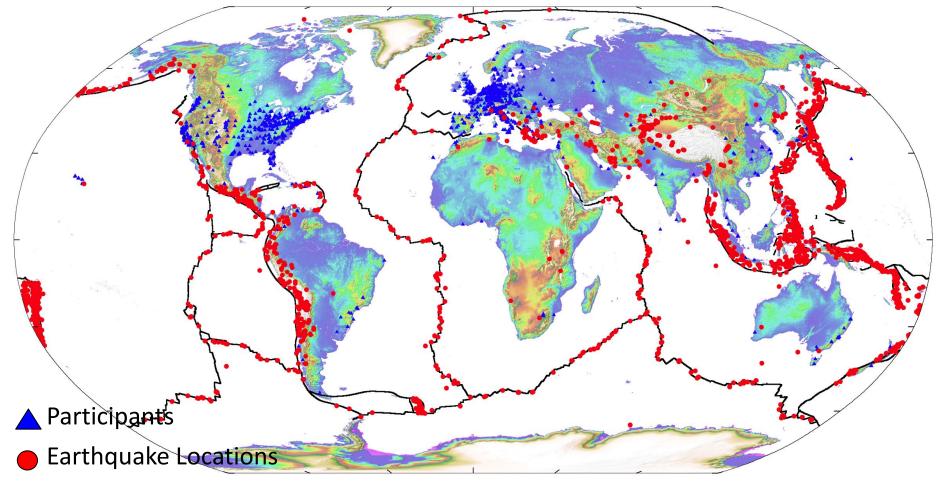
**\$\$\$** 





### **Distribution of QCN Participants**





• Over 2000 seismic stations globally in 67 countries

**Statistics** 

• Recorded earthquakes between M 2.6 (New Zealand) – M 8.8 (Chile)

## **NetQuakes Volunteers**



lat 37.972760° lon -95.070887° elev 910 ft

### National Map Corps Crowdsourcing used to update USGS geographic data

View Edit

0 Z + G III

Education:

汸 😭

Add new points by dragging them onto the map

Emergency Response and Law Enforcement:

SUSGS Corps

VGI Structures

Search

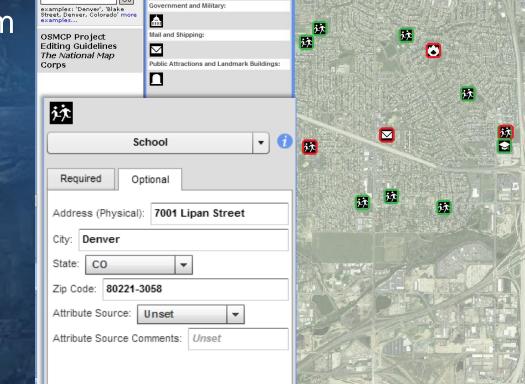
The

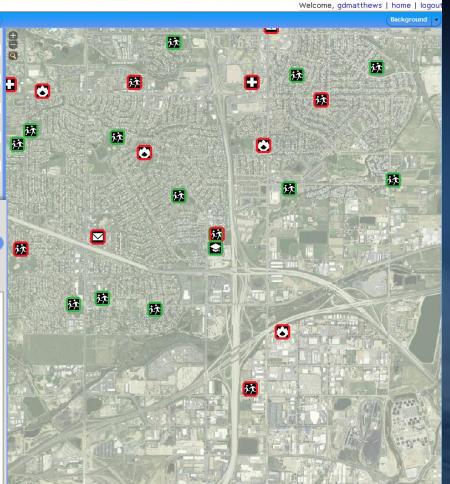
Nationa

Where am 17

Go

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





### Any questions?

### applegate@usgs.gov 703-648-6600



### 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).



### 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!

### **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

