Webinar Prep

• Due to the large attendance, all participants are muted for the duration of the session to prevent background noise.
  • Please use the Q&A functionality within Zoom for questions that are relevant to the whole group.
  • We will address these Q&A at the end of the webinar!

• This webinar will be recorded.
Welcome
Chris Vaughan, FEMA GIO
Get your GIS Shop ready for Earthquakes!

What is the goal of the EM Geo Forum Series?

• Platform for GIS professionals and the EM Community to learn how to access/request geospatial analysis and tools
• Provide an opportunity for the community to learn from one another by highlighting national best practices and lessons learned.

What is the goal of this session?

• Reinforce the concept of readiness via a (Geospatial) Game-Plan
• Share resources available to support your community throughout the timeline of an earthquake
• Learn how FEMA, Regions, States, and Locals use data and models to support decision-makers
• Discuss planning considerations for Response and Recovery

Why your contributions are important?

• Share your great work to help further advance the Emergency Management Community
• Critical Mission Partner through your continued coordination and collaboration to improve the outcomes of survivors

Participation To-Date:

Total Participants 1,471
Today’s Presenters

01 Madeline Jones
New Light Technologies, FEMA Contract Support

02 Jesse Rozelle
Program Manager
NHRAP, FEMA

03 Matt Welshans
Geospatial Information Unit Lead, FEMA

04 Jimmy Rodriguez
GIS Unit, DHS-FEMA Region II

04 John Holub
Geospatial Coordinator, FEMA Region 8
About NAPSG Foundation

Our Vision
A Nation of emergency responders and leaders equipped with the knowledge and skills in applying technology and data to change the outcome for survivors.

• 501(c)(3) Non-profit organization established in 2005
• +20,000 member network: Public Safety leaders, first responders, and GIS practitioners
• Board of Directors comprised of public safety & emergency management industry leaders
How Do We Do It

- Defining and promulgating consistent best practices
- Fostering regional collaboration through implementation
- Building capacity in using innovative technology
- Transferring knowledge and skills
- Education & Training
- Exercises & Simulations
- National Guidelines and Standards
Today’s Attendees

Total Participants

251

*may include duplicates that attended multiple events or exclude those who did not provide location details.

https://napsg.maps.arcgis.com/apps/opsdashboard/index.html#/a81ee901e1574f089d675ccf860544a4
Today’s Attendees

https://napsg.maps.arcgis.com/apps/opsdashboard/index.html#a81ee901e1574f089d675ccf860544a4
Objectives

At the end of this session, participants will:

• Learn about FEMA’s response to the January 2020 Puerto Rico Earthquake.

• Discover important geospatial resources for earthquakes for all phases of emergency management.

• Gain insight into regional readiness and preparation efforts for earthquake events.
An Overview of Earthquake Response Products and Resources

Madeline Jones, New Light Technologies
EM Geo Forum Tues. Oct. 27, 2020 2pm
Overview

- Earthquake Products Timeline
    - [https://gis.fema.gov/Model-and-Data-Inventory/index.html](https://gis.fema.gov/Model-and-Data-Inventory/index.html)
  - The MoDI is an inventory of data and models used by Emergency Mgmt
  - Effort led by FEMA and the **Modeling and Data Working Group (MDWG)**
    - Purpose: identify and characterize the models used to support operational decision making in the context of Emergency Mgmt

- Updated & new resources

- FEMA Earthquake Incident Journal

- Other Resources for Earthquakes
# Earthquake Products Timeline

**Primary Source: MODI Earthquake Annex**

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USGS Earthquake Hazards Program

- USGS is the authoritative agency for monitoring and reporting on earthquakes, assessing impacts and hazards, and conducting targeted research on cause/effect of earthquakes.
- Products that provide situational awareness immediately after significant earthquakes.
- Standard products:
  - ShakeMap + web services
  - Did You Feel It?
  - ShakeCast
- Recent products include:
  - Aftershock forecasts
  - Ground failure estimates
  - Impact estimation (financial loss, fatalities)

www.usgs.gov/natural-hazards/earthquake-hazards
Earthquake Timeline: **FIRST 12 HOURS**

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**USGS Earthquake Notification Service (ENS)**  
[https://earthquake.usgs.gov/ens/](https://earthquake.usgs.gov/ens/)

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The Earthquake Notification Service (ENS) is a free service that can send you automated notification emails when earthquakes happen in your area. You can customize ENS to only deliver messages for certain areas, at specified times, and to multiple addresses. ENS can send text notifications to your cell phone.
# Earthquake Timeline: FIRST 12 HOURS

**USGS ShakeMap**

https://earthquake.usgs.gov/data/shakemap/

ShakeMap provides near-real-time maps of ground motion and shaking intensity following significant earthquakes.

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**Scale based upon Worden et al. (2012)**

- **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 (mg)**
  - <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+
## Earthquake Timeline: **FIRST 12 HOURS**

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### USGS OnePAGER (USGS Model)

- Estimated Population Exposed to Earthquake Shaking
- Estimated Direct Economic Losses from Earthquake
- Estimated Potential Future Earthquakes

### FEMA/USGS TwoPAGER (Hazus)

- Hazard Building Tagging Estimates
- Hazard Building Losses by Category Type

Source: Zuzack, FEMA’s Hazus Earthquake Model

[https://earthquake.usgs.gov/data/pager/](https://earthquake.usgs.gov/data/pager/)
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**EAGLE-I**
The DOE EAGLE-I system is a situational awareness viewer, providing web-based, near real-time energy sector (ESF #12) monitoring capability.

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Energy Lifeline Dashboard: Power & Energy

https://gis-fema.hub.arcgis.com/#dashboards
Earthquake Timeline: FIRST 12 HOURS

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**HHS MedMap/GeoHealth**

[https://geohealth.hhs.gov/arcgis/home/](https://geohealth.hhs.gov/arcgis/home/)

MedMap and GeoHealth will provide situational awareness but do not directly estimate medical resource requirements. Full utilization of either system requires an account from HHS.

**ESF #6 and ESF #7 Calculators**

These FEMA-owned and operated decision support tools guide FEMA’s logistical decision-making for the Mass Care, Emergency Assistance, Temporary Housing and Human Services ESF #6 and the Logistics ESF #7.

**FEMA NMETS**

The National Mass Evacuation Tracking System (NMETS) is software provided by FEMA designed to guide states and local municipalities in mass care support (e.g., food and water); track evacuees, belongings, and pets; and support the reunification of families.

**Red Cross National Shelter System**

[https://nss.communityos.org/cms/](https://nss.communityos.org/cms/)

The National Mass Evacuation Tracking System (NMETS) is software provided by FEMA designed to guide states and local municipalities in mass care support (e.g., food and water); track evacuees, belongings, and pets; and support the reunification of families.
Lifeline Dashboards

FEMA’s lifeline dashboards are based on the community lifelines construct. These dashboards display the status of each lifeline and are designed to work with all types of disasters and data. Not all dashboards are publicly available.

https://gis-fema.hub.arcgis.com/#dashboards
FEMA Lifeline Dashboards

Communications: FCC DIRS (Cell Tower Outages)

Transportation: WAZE Traffic Feed

Safety & Security

Hazardous Materials

https://gis-fema.hub.arcgis.com/#dashboards
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**Hazus Results Viewer**

http://disasters.geoplatform.gov/publicdata/NationalDisasters/

Hazus is a comprehensive consequence model which typically requires trained analysts and up to 12 hours to run. Results will be published during a live event to the Earthquake Incident Journal.
Earthquake Timeline: **12+ HOURS**

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**USAR Wide Area Search Templates & Information**

https://sargis-napsg.hub.arcgis.com/

This is the template that FEMA USAR and several states have adopted.

**CUSEC Safety Assessment**

https://safety-assessment-cusec.opendata.arcgis.com/

Central US Earthquake Consortium (CUSEC), in partnership with FEMA’s National Earthquake Hazards Reduction Program (NEHRP) and the U.S. DHS S&T Directorate has developed a mobile data collection tool for post-disaster safety assessments. Developed with Esri technologies, the CUSEC "Safety Assessment App" operates on mobile devices and was designed to speed data collection by professionals who assess buildings and structures for safe occupancy following a disaster. The app includes data entry forms that are used by field assessment teams and maps that provide assessment results and situational awareness to emergency managers.
POST (Prioritizing Operations Support Tool)

• FEMA POST is a predictive output that displays areas of greatest risk for a given event based on social vulnerability, population, building location and types, and hazard data.

• [https://gis-fema.hub.arcgis.com/](https://gis-fema.hub.arcgis.com/)
Earthquake Timeline: **12+ HOURS**

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**USACE Debris Estimating Model/FEMA Debris Estimating Tool**


The U. S. Army Corps of Engineers (USACE) Debris Estimating Model is a decision support tool used to calculate the commodities necessary to support debris removal (i.e. truckloads required to remove debris and gallons of fuel required). This is a limited access resource, and is viewed via the SimSuite situational awareness viewer. The FEMA Debris Estimation Tool is similar, but is focused on cost estimates for debris removal.

**NOAA Imagery + ENVI Analytics**

**FEMA RGO Debris Detection for Hurricane Michael**
Earthquake Timeline: **12+ HOURS**

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**FCC DIRS**
https://www.fcc.gov/general/disaster-information-reporting-system-dirs-0

The FCC Disaster Information Reporting System (DIRS) provides data on the impacts to the communications system post-event. DIRS is a voluntary program, supported by a web-based system where communications companies report infrastructure status and impacts to customers.

**Communications Lifeline Dashboard**
https://gis-fema.hub.arcgis.com/#dashboards
Earthquake Timeline: 12+ HOURS

FEMA uses the Logistics Supply Chain Management System (LSCMS) and Deployment Tracking System (DTS) to support response logistics. LSCMS tracks meals, blankets, and water in near real time from warehouse to consumption, and it can be used to project when more supplies will be needed.

FEMA Earthquake Logistics Dashboard within the Earthquake Incident Journal Web App Gallery
Earthquake Timeline: **12+ HOURS**

### Ongoing response needs and activities:
- ShakeMap updates (up to 3 days)
- Iterations to impact estimates and consequence models with each new ShakeMap update

### Continue recovery efforts:
- Preliminary Damage Assessments
  - Field-surveyed
  - Imagery-based
  - Modeled

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**FEMA's Earthquake Incident Journal**

[FEMA's Earthquake Incident Journal](https://gis-fema.hub.arcgis.com/pages/earthquakes)

FEMA's Earthquake Incident Journal provides relevant spatial decision-making support for FEMA leadership and a view into federal information available to the general public.

- All earthquakes within last 3 weeks. ShakeMaps enriched with demographics and planning factors.
- **Demographics Dashboard** (Total Population Exposed, Senior Population Exposed, Housing Units Exposed, etc)
- **Logistics Dashboard** (shelters, cots, blankets, water per day, etc)
Earthquake Timeline: **ADDITIONS?**

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**NASA ARIA Damage Proxy Map**
[https://aria.jpl.nasa.gov/](https://aria.jpl.nasa.gov/)
[https://disasters.nasa.gov/](https://disasters.nasa.gov/)

Damage approximation maps that are automatically derived from synthetic aperture radar (SAR) images. Damaged areas are depicted as red and yellow pixels.
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### NASA ARIA Ground Displacement Map (Interferogram)

[https://aria.jpl.nasa.gov/](https://aria.jpl.nasa.gov/)
[https://disasters.nasa.gov/](https://disasters.nasa.gov/)

Ground displacement maps automatically derived from synthetic aperture radar (SAR) images and GPS measurements.
# Earthquake Timeline: ADDITIONS?

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**Earthquake Building Exposure**
This web app would be made available within the FEMA Earthquake Incident Journal.
Other Resources

- FEMA Hub Site – Earthquake Page
  - https://gis-fema.hub.arcgis.com/pages/earthquakes

- USGS Earthquake Hazards Page
  - www.usgs.gov/natural-hazards/earthquake-hazards

- www.ShakeOut.org
  - Additional resources for earthquake preparedness
  - Information on the Great ShakeOut, the world’s largest earthquake drill
Thank you!

Madeline Jones
Madeline.Jones@NLTGIS.com
FEMA Natural Hazards Risk Assessment Program
Hazus Earthquake Modeling

Jesse Rozelle
FEMA NHRAP
Program Manager
Hazus Model Supported Hazards

- Earthquake
- Hurricane Wind & Storm Surge
- Riverine & Coastal Flooding
- Tsunami (near & distant source)
Hazus Model Development Timeline

1992
Hazus Program initiated.

1997
Earthquake Model first released.

1998
Hurricane and Flood Model development initiated.

2004
Hazus-MH released.

2011
Storm surge added to the Hurricane Model.

2017
Tsunami Model released.
• FEMA P-366 Methodology “Hazus Estimated Annualized Earthquake Losses for the United States (April 2017)”
  https://www.fema.gov/media-library/assets/documents/132305
• The Hazus analysis indicates that the AEL to the national building stock is $6.1 billion per year
• Updated study planned for late 2018/early 2019 to include 2018 RS Means replacement costs and updated USGS seismic hazard map data
• Hazus Estimated Annualized Earthquake Losses for US Infrastructure planned for late 2018/early 2019
USGS Earthquake Event Pager

https://earthquake.usgs.gov/
Online Access – Hazus Loss Library, FEMA Earthquake Journal

- Hazus Loss Library currently under development for online access of a large suite of catastrophic earthquake planning scenarios
- FEMA Geospatial Resource Center Earthquake Incident Journal provides access to many response event analysis results.
- https://gis-fema.hub.arcgis.com/pages/earthquakes

FEMA Earthquake Incident Journal Dashboard

Hazus Loss Library Prototype
FEMA’s Hazus Program is now managed by the Natural Hazards Risk Assessment Program under FIMA’s Risk Management Directorate. For any questions or comments regarding Hazus or the NHRAP please feel free to contact FEMA-NHRAP@fema.dhs.gov.
Using GIS in FEMA’s PR Earthquake Response

Matt Welshans, GIS Unit Lead, National IMAT Blue
In this talk...

- Introduce the PR Earthquake Swarm from 2019-2020
- Discuss how FEMA used GIS in its response to the PR Earthquake
- Highlight Best Practices from after-action
What Happened?

• Dec 28, 2019 – Initial M4.7 earthquake along southwest coast of Puerto Rico
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- From January 6-31: Over 1900 aftershocks along faults. 14 M5.0+
  - Major Disaster approved January 16.
Dec 28, 2019 – Initial M4.7 earthquake along southwest coast of Puerto Rico

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Jan 7, 2020 – M6.4 earthquake: damage to several municipalities. Emergency Declaration approved.

From January 6-31: Over 1900 aftershocks along faults. 14 M5.0+
  • Major Disaster approved January 16.

Aftershocks still occurring, generally in the M2.5-M4.5 range.
  • May 2 (M5.4)
  • July 3 (M5.3)
  • August 6 (M4.8)
What Happened?

- 1 fatality attributed to earthquake
- Over 8,000 temporarily displaced
- Financial losses estimated to be over $3 billion
How GIS Was Used by FEMA in Response

- Initial situational awareness
  - CAP Imagery
  - Crowdsourced Imagery
- Sheltering
- Building Inspections
- Infrastructure Restoration
Initial Situational Awareness

PR Earthquake – 1/7/2020 (MMI >5)

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
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<tbody>
<tr>
<td>Est. Population in MMI 5+</td>
<td>1,746,772</td>
</tr>
<tr>
<td>Airports</td>
<td>2</td>
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<tr>
<td>Hospitals</td>
<td>28</td>
</tr>
<tr>
<td>Public Schools</td>
<td>622</td>
</tr>
<tr>
<td>Ports</td>
<td>6</td>
</tr>
<tr>
<td>Fire Stations</td>
<td>41</td>
</tr>
<tr>
<td>Bridges</td>
<td>1,022</td>
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</table>
Initial Situational Awareness

Computer Modeling (Hazus and POST)  Crowdsourced Photos
Civil Air Patrol Mission

• Due to high winds, CAP teams unable to fly for several days
• CAP teams collected ground-level photos in damaged areas
• FEMA Staff also deployed to field to take additional images
• Over 200 images collected from ground level
• Imagery used to determine preliminary damage assessments
Sheltering Mission

• Due to fears of additional damage and lack of power/water, residents fled homes.
• Traditional sheltering where available
• Non-traditional sheltering (tent villages) in neighborhoods
• Puerto Rico National Guard established survivor support base camps

Survivor Base Camp in Ponce
https://twitter.com/wandavazquezg/status/1217083604477587456
Sheltering Mission: Non-Traditional Sheltering

- Field GIS Unit worked with Mass Care and Crowdsourcing to locate non-traditional shelters
- Information was cross-referenced with social media and news articles to try to locate additional non-traditional shelters
- Staff used these maps and information to determine any additional needs.
# Sheltering Mission: Survivor Support Base Camps

## National Guard Criteria
- Not near mountains/landslide threats
- Not near dams or levees
- Not around areas where buildings could collapse

## Additional Criteria
### Impact Area Proximity
- Outside of MMI 6+ area
- Within 1 hour drive time

### Land Type
- Public land (preferably sports complex)
- Greater than 5 acres

### Hazard Reduction
- Outside flood/tsunami zones
- Away from steep slopes (landslide threat)
Sheltering Mission: Survivor Support Base Camps
Building Damage Assessments

• Teams from California and New York supplemented FEMA’s building assessment teams

• Utilized Survey123 to collect information on building stability.

• Data visualized to show areas where assessments are needed and shared with teams in near-real-time to reduce duplication of inspections.
Power Restoration

- Daily maps for decision makers on restoration of power generation plants
- Data matched to existing infrastructure data to address plant damage and additional temporary power needs.
Best Practices

- Coordination – Region, HQ, and Field staff were synced quickly and frequent (multiple times/day) contact with staff beyond a daily sync call. This was a major win.
- Utilize USGS and partners to build scenarios for crisis action planning and use GIS for spatial analysis.
- Work with stakeholders to confirm base infrastructure information that can be used in Hazus and other datasets in case of a no-notice event
- During blue skies, work with stakeholders to integrate and script products that need to be fired up quickly, including power outage and water outage information
FEMA Geospatial Resource Center

**FEMA GIS** supports the emergency management community with world-class geospatial information, services, and technologies to prepare for, protect against, respond to, recover from and mitigate against all hazards.

FEMA Geospatial Resource Center: [https://gis-fema.hub.arcgis.com/](https://gis-fema.hub.arcgis.com/)
Special Thanks

- Martin Waysome and FEMA Response Geospatial Office
- Julia O’Brien and the FEMA Region II GIS Unit
- FEMA Puerto Rico Joint Recovery Office and DR-4473 GIS Units
Questions?

Matt Welshans
Matthew.Welshans@fema.dhs.gov
Call to Action!

• Build your Geospatial Game Plan
  • Add new feeds to maps and apps
  • Become familiar with available Earthquake data
  • Build your game plan for internal and public maps – Train on it!

• Public Information Maps (Evac, Shelter, Roads)

• Share your work!
  • Contribute to FEMA's Resource Center

Earthquake Geospatial Game Plan
Form your team. Identify core information needs. Build a game plan.
NAPSI Foundation | IncIt

Story Map: https://arcg.is/0TKSCI
What’s Next?

### EVENTS

#### IN-PERSON EVENTS

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<th>Date</th>
<th>Location</th>
<th>Event</th>
<th>Registration</th>
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<tbody>
<tr>
<td>April 5-6, 2021</td>
<td>Salt Lake City, Utah</td>
<td>InSPiRE Professional Solutions</td>
<td>Event Page</td>
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#### VIRTUAL EVENTS

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<tr>
<td>October 27, 2020</td>
<td>Virtual</td>
<td>EM Geo Forum: Earthquake Resilience &amp; Resources</td>
<td>Open</td>
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<tr>
<td>November 17, 2020</td>
<td>Virtual</td>
<td>PrepTech Talks: Decoding Risk, Resilience, Social Vulnerability Data &amp; Indices</td>
<td>Coming soon</td>
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<th>Location</th>
<th>Event</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 13, 2020</td>
<td>Virtual</td>
<td>The Modern Frontier: Exploring Emerging Technologies for First Responders in the Indoor Environment</td>
<td>Slide deck &amp; Recording</td>
</tr>
<tr>
<td>July 29, 2020</td>
<td>Virtual</td>
<td>Applying Drones &amp; Imagery for Disaster Management</td>
<td>Slide deck &amp; Recording</td>
</tr>
<tr>
<td>June 20, 2020</td>
<td>Virtual</td>
<td>EM Geo Forum: GeoTech Weekly Technology, Business Conference &amp; Tools &amp; Resilience</td>
<td>Slide deck &amp; Recording</td>
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</tbody>
</table>
Modeling and Data Working Group (MDWG)

Meeting the 3rd Wednesday of the month
from 2:00-3:30 PM ET

Adobe Connect: https://fema.connectsolutions.com/mdwg-monthly-meeting/
Conference Bridge: 800-320-4330, Passcode: 399137#

Email: fema-mdwg@fema.dhs.gov
Thank you!