US Federal Emergency Management Agency (FEMA)

National Flood Insurance Program and Hazus Loss Estimation

Jesse Rozelle
Program Manager
Natural Hazards Risk Assessment Program/Hazus
Jesse.Rozelle@fema.dhs.gov
FEMA National Flood Insurance Program
- Insurance

• Founded by the National Flood Insurance Act of 1968 after Hurricane Betsy
• NFIP policies available in 22,000 communities across the US
• The NFIP assists and regulates local governments lowering the built environment’s exposure to flood, which saves the Nation more than $1.6 billion/year in avoided flood losses.
• The NFIP paid over $64 billion in claims during the last 50 years, averaging $1.28 billion per year.
• More than 1,485 communities have taken a more assertive approach to keep their residents safe by joining the NFIP’s Community Rating System, which provides discounts for some flood insurance policies. NFIP policies available in 22,000 communities across the US
• FEMA has dedicated nearly $4 billion in flood grants—buying out or elevating nearly 53,000 properties.
• Since NFIP Flood Mitigation Grants were first provided, in 1996, the NFIP has helped mitigate more than 6,300 flood prone properties, investing $1.1 billion. For every one dollar invested in disaster mitigation today, six dollars can be saved.
Since 1970, over 1.1 million riverine and coastal miles have been mapped to identify flood hazards, assess flood risks, and provide accurate flood hazard data, which has created more safe and resilient communities.
What is Hazus?
What is Hazus?

• Software tools and support system designed by FEMA for the purpose of providing communities with the means to identify and reduce risk from natural hazards
• Nationally applicable standardized methodology
• Estimates physical, economic, and social impacts at the state, county, census tract, census block level, or site-specific level
• Used by a variety of communities and organizations
• Available from FEMA free of charge (requires ArcGIS license)
Supported Hazards

- Hurricane Wind (can be combined with Storm Surge/Coastal)
- Flooding (both Riverine and Coastal)
- Earthquake
- Near and Distant Source Tsunami (can be combined with Earthquake)
Hazus History

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.

Tornado
Platform Integration

Open Hazus

Open Source

Structures

Damage
Use Levels

- **Level 1**: Default hazard, inventory, and damage information
- **Level 2**: Combinations of local and default hazard, inventory, and damage data
- **Level 3**: Input detailed engineering data

**Required user effort and data sophistication**

- **Low** to **High"
• Hazus allows users to follow a simplified process to create a local risk assessment
Inventory/Exposure Data

- General building types and occupancies
  - Lifelines
  - Replacement costs
  - Demographics
- Hazard-specific
  - Specific building types
  - Elevation
  - Building configurations
Integrating User-Provided Data

• Non-Hazard Data Integration Tools
  • Comprehensive Data Management System (CDMS) enables integration of locally developed non-hazard data
  • CDMS validates that user data are compliant with Hazus requirements

• Hazard Data Integration
  • ShakeMap and Hurrevac hazard data integration
  • Each model includes tools for integrating user-provided hazard data

• Techniques for integrating user-provided data are covered in other courses.
## Analysis and Output

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<th>Hazus Capabilities</th>
<th>Earthquake</th>
<th>Flood</th>
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<td>Ground Shaking</td>
<td>Ground</td>
<td>Riverine</td>
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<tr>
<td>Ground Failure</td>
<td>Frequency</td>
<td>Depth</td>
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### Inputs
- Historic
  - ✔
- Deterministic
  - ✔
- Probabilistic
  - ✔
- User-supplied
  - ✔

### Other supported inputs
- Real-time & scenario USGS ShakeMaps
- Risk MAP, User-supplied depth grids (ArcGRID, GeoTIFF, IMAGENE), HEC-RAS (FLT)
- Hurrevac, User-supplied wind files (.dat)
- NOAA PMEL SIFT, State models

### Direct Damage
- General Building Stock
  - ✔
- Essential Facilities
  - ✔
- Transportation Systems
  - ✔
- Utility Systems
  - ✔
- User-Defined Facilities
  - ✔

### Induced Damage
- Fire Following
  - ✔
- Debris Generation
  - ✔

### Direct Losses
- Cost of Repair
  - ✔
- Income Loss
  - ✔
- Agricultural
  - ✔
- Casualties
  - ✔
- Shelter and/or Evacuation Needs
  - ✔
- Average Annualized Loss (AAL)
  - ✔
Hazus Capabilities

• Produce maps, tables, and reports
• Analyze social and economic impacts
• Consider what is at risk
• Identify hazard
• Identify physical landscape

Social Impacts

Direct Damages
How Hazus Can Be Used

• Identify vulnerable areas
• Estimate potential impacts of hazards
• Assess level of readiness and preparedness
• Inform resource allocation
• Prioritize mitigation measures
• Inform response and post-disaster recovery efforts
Why Choose Hazus?

• Hazus can help build stronger and safer communities by providing communities with the ability to
  • Identify their areas at risk
  • Assess vulnerabilities
  • Help support their planning and mitigation options
Hardware and Software Requirements

- Computer Speed: 2.2 GHz dual core or higher
- Memory: 2 GB or higher
- Disk space: 10GB for one multi-hazard large urban study region, plus inventory data size (varies by state), or 70 GB to store entire U.S. inventory data
- Graphics Adaptor: 24-bit capable video card with at least 128 MB of video memory, resolution of 1078 x 768 or higher
- Supporting Software: Appropriate version of Esri ArcGIS and Spatial Analyst extension for flood model
FEMA Hazus Website

https://www.fema.gov/hazus

Other Useful Links

• GITHUB
  • https://github.com/NHRAP-Hazus

• Training Videos
  • http://bit.ly/HAZUS

• Disaster Information and Training Material
  • https://disasters.geoplatform.gov/publicdata/NHRAP/Training/
New in Hazus 4.2 Service Pack 3
New To Hazus in 2019-2020

Automated data updates
- Hospitals
- Schools
- Police Stations
- Fire Stations
- EOCs
- Other HIFLD Data Coming Nov 2019

Hazus Loss Library
- Scenario Library With Results
- Reports and Data Download
- All Hazus Hazards Supported

Site-Specific Utilities
- FAST – Flood Assessment Structure Tool
- Building Specific Results in Seconds
- Additional Utilities Forthcoming

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Connecting Hazus to FEMA Programs

FEMA Mapping Information Platform
- DFIRM Study
- Flood Risk Database

Future Risk MAP

OpenHazus

Hazus AAL for Graduated Risk
Communicate Flood Risk
Reduce Risk
Support Planning Efforts
Hazus 4.2 Service Pack 3 Updates

• FEMA IA Damage Categories
• Updated Essential Facilities
• Combined Wind and Surge Losses with Custom Flood Hazard Data
• Better USGS ShakeMap Scenario Library Integration
• Hurricane Seasons 2017/2018 Data

Release Notes: https://www.fema.gov/media-library/assets/documents/105743
HIFLD Data Integration

• Hazus 4.2 Service Pack 3
  - Hospitals
  - Schools
  - Police stations
  - Fire stations
  - EOCs

• 11/29/2019 Release
  - Infrastructure
  - Transportation
  - Communication
Now Available Hazus Github

https://github.com/nhrap-hazus

• FAST (Flood Assessment Structure Tool) and Export and Report tool available 11/29/2019
• Hazus Quarterly call presentations and newsletters
• Hazus Program conference presentations
• Training Material
Hazus Help Using Twitter
@HazusProgram | #Hazus #HazusHelp
Hazus Training Platform

https://disasters.geoplatform.gov/publicdata/NHRAP/Training/

- Full Hazus training course curriculum now publicly available
- Includes student guides, slide presentations, exercises, and exercise data
Hazus Training Videos

• Learn or Refresh Hazus on YouTube!

• Hazus Training Video Series
  1. Getting Started: Download and Install
  2. Managing Inventory Data
  3. Working with Hazard Data
  4. Analysis and Sharing
FAST – Flood Assessment Structure Tool

• Inputs: flood depth grid, structures
• Outputs: economic loss
• Python, runs independent from Hazus
• FAST – not flash!
Hazus Loss Library (in dev)

- Library of Authoritative Hazus Analysis to Support non-technical Hazus Users
- Simple Interface
- All Hazards and Data Available
- Results Distribution Platform

- Public Release: May 2020
How Does Hazus Work

- Economic
- Social
- Physical
- Damage

Displaced Households
Building Damages
Economic Loss
Critical Facility Impacts
Shelter Needs
Hazard Impacts
Debris
Injuries and Fatalities
Flood Hazard Challenges

- Flood hazard data not available continuously across the country
- Flood hazard data provided as lines (BFE) or areas (A zone) – NOT DEPTHS
- Structure data generalized to the census block
- Structure data collected and analyzed for local studies in an EXPENSIVE process
FEMA Flood Strategy is Changing

- RiskMAP is acknowledging the need for non-regulatory flood data to help communicate risk more effectively
- RR 2.0 is transitioning to graduated risk measurement
- FEMA wants to communicate risk to individual property owners
Risk MAP Flood Risk Assessments in OpenHazus

Flood Data

OpenHazus

Nationwide Structures → Risk Analysis Tools → Hazus Loss Library
Nationwide Structures
Local Attributes vs Statistical Assumptions

- Microsoft/Oak Ridge nationwide building footprints offer an exciting opportunity for structure-level risk assessment nationwide, but footprints are missing attribute information crucial for risk analysis.

In Minot, ND, we got within 89% of general occupancy type, 64% of specific occupancy type, and 91% of averaged annualized flood losses.
NHRAP Partnerships

- NHRAP has fostered strong and cooperative relationships with numerous federal agencies, scientific communities, and academia
- Allows NHRAP to provide dynamic data linkages to authoritative hazard risk data sets and validate scientific methodologies
- Impact
  - Increased credibility of hazard risk data
  - More focused program investment in accurate loss estimation methodology and effective delivery of model results
  - Translate hazard data into actionable risk information
Hazus Support for Hurricanes

• NHRAP serving as Hazus wind modeling SME to support Hurricane Dorian response
  • Improves confidence by conducting QA/QC of model results
  • Ensures HQ and Regions are using the same planning factors
• Model results provide readily-available and credible data
  • Provides common operating picture for senior leadership
  • Compares building damages to PDA classes to support States’ declaration requests
  • Allows state and local emergency management to target life safety concerns
  • Supports resource planning to prioritize high impact areas
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 OpenHazus please feel free to contact FEMA-NHRAP@fema.dhs.gov.

Jesse Rozelle  
Program Manager  
Natural Hazards Risk Assessment Program/Hazus  
Jesse.Rozelle@fema.dhs.gov

Casey Zuzak  
Senior Risk Analyst  
Natural Hazards Risk Assessment Program/Hazus  
Casey.Zuzak@fema.dhs.gov