Hazus Starter Kit Part 2: Hazard Scenarios

December 19, 2012

Natural Resources Canada
Ressources naturelles Canada
Canada

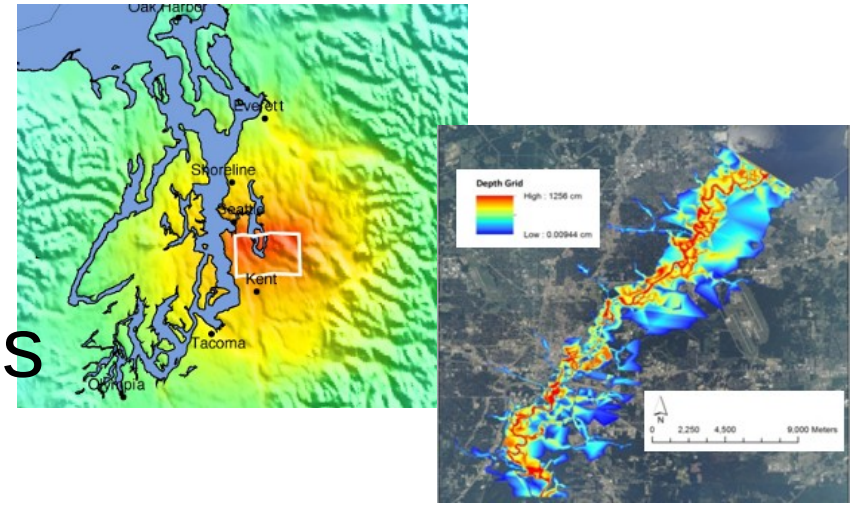
Starter Kit Concept

- Provide resources to help set up and start the use of Hazus Canada.
- Provide overviews and demonstrations of the necessary steps to set up Hazus and start using Hazus.
- Do these things through the CanHUG meetings and accessible websites.

Kit Components

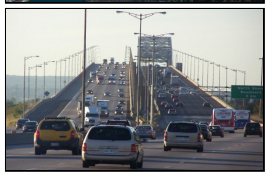
- Inputs (ingredients)
- Installation (equipment)
- Setup (turn on oven, mix, put in pans)
- Operation (bake)
- Outputs (cake, decorate, store, serve)

Hazus Inputs



- Hazard scenarios
- Assets, Part 1 - Building stock
- Assets, Part 2 - Infrastructure and other
- Demographics



Hazard scenarios

What are they?

How are they used?

What are their influence on Hazus loss estimates?

?Hazard scenarios?

A hazard scenario describes characteristics of a type of destructive force

It is a necessary input to Hazus or any loss-estimation tool

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It is not the risk scenario (that includes the hazard scenario and the asset inventory)

It is not the consequence scenario (disaster scenario)

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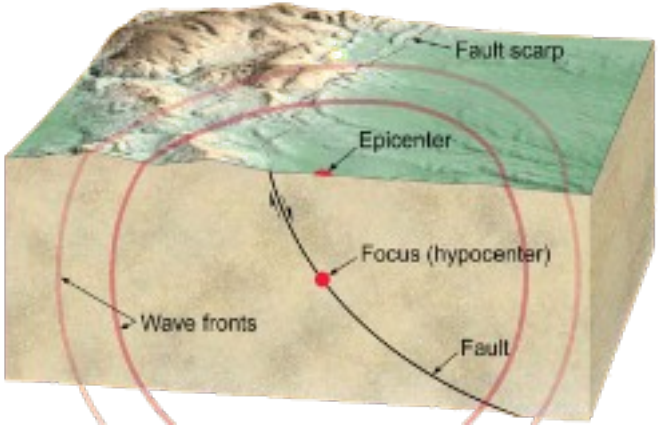
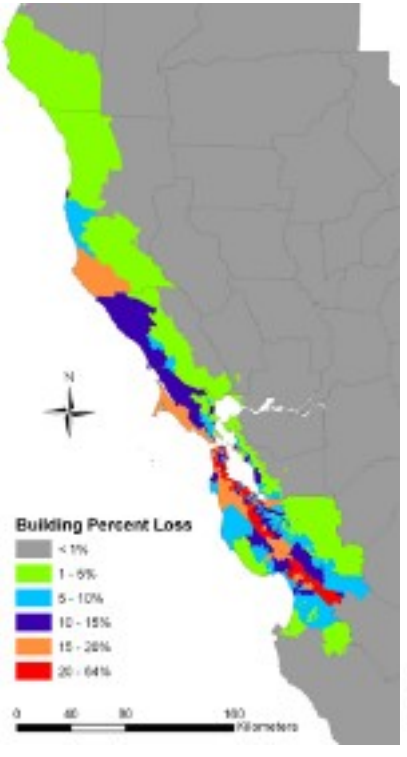
scenario = event simulation = model (?)





Hazard Scenarios

Earthquake scenarios

“Potential earth science hazards (PESH) include ground motion, ground failure (i.e., liquefaction, landslide and surface fault rupture) and tsunami/seiche” *(Chapter 4, Hazus earthquake technical manual - hzmh2_1_eq_tm.pdf)*

Flood scenarios

“... a single flood event, or ... range of flood events allowing for annualized estimates of damages.” *(Prologue, Hazus flood users manual - hzmh2_1_fl_um.pdf)*

Hurricane scenarios

“The geographic scope of ... Hurricane Model is limited to the Atlantic and Gulf coasts of the United States and Hawaii. ... includes a default terrain roughness based on digitized Land Use and Land Cover (LULC) data, but topographic speedups are only modeled in Hawaii.” *(Chapter 1, Hazus hurricane technical manual - hzmh2_1_hr_tm.pdf)*

Earthquake scenarios 1

An earthquake scenario has physical characteristics of a potential earthquake and ground response, and the probability of that earthquake occurring

Earthquake scenarios 3

Probability

Annual potential of such earthquake physical characteristics occurring

Earthquake scenarios 4

Types of earthquake scenarios

Probabilistic

Potential based on cumulative history of measured past earthquakes (data in Hazus Canada)

Deterministic (Potential earthquake determined from geological knowledge)

Historic epicentre event (in Hazus Canada)

Effects of a known past earthquake event

Source event (not in Hazus Canada)

Needs fault information not available for Canada

Arbitrary event (in Hazus Canada)

Just make it up and Hazus does the rest

User supplied

User supplies shake maps with parameters of shaking across area of concern (supply digitized peak ground acceleration (PGA) and spectral acceleration (SA) contour maps). These are used instead of the shake maps that Hazus would calculate from earthquake magnitude, location and ground conditions.

Earthquake scenarios 6

Constraints

Probabilistic

Use for one structure only.

A simple and effective method for single structure risk and loss estimates for a building or infrastructure.

Deterministic (relies on Hazus' calculation of ground shaking)

Historic epicentre event (in Hazus Canada)

Can be used for aggregate analysis for reasonable estimate of potential losses. The historical record is short and recent past events do not commonly reflect possible near-future events.

Source event (not in Hazus Canada)

Hazus calculates earthquake event parameters from data about active faults in the area of interest. Combined with soils and other ground information such scenarios can provide reasonable estimates of potential losses from an earthquake. Best developed and interpreted with the help of a seismologist.

Earthquake scenarios 7

Constraints

Arbitrary Event

Can be used for aggregate analysis for reasonable estimate of potential losses from the hypothetical event. Results should be clearly understood to be of no value to planning, unless the arbitrary event was based on sound geological and seismological principles as a potential earthquake.

Earthquake scenarios 8

Constraints

User supplied (Shake Maps)

Recommended to be developed by a seismologist and geologist.

Requires substantive information about the potential rupture of a fault and the dispersal of energy through bedrock and unconsolidated sedimentary basins.

Development of such earthquake scenarios is useful for the analysis of likely events and those potentially of most concern to a community.

Combined with detailed information about the buildings, infrastructure and people, these can give reasonable estimates of potential earthquake losses for aggregated assets, single buildings of general character and unique buildings or infrastructure.

A an outcome of its case studies, some shake maps will be available from NRCan for the Metro Vancouver and locally in the St. Lawrence lowlands. University research groups may have others available.

Earthquake Scenarios 9

Tsunami and seiche (fresh water wave) can be included in the methodology in the form of user-supplied inundation maps as discussed in Chapter 9 of the technical manual.

The inundation map would show areas that could be affected by tsunami flooding, though they would have no information about tsunami flow affects.

A tsunami module for Hazus is under development.

Earthquake Scenarios 10

Summary:

A) Hazus Canada provides two packaged earthquake scenario options:

1. National probabilistic

2. Historical event

B) Hazus Canada permits the use of user supplied earthquake scenarios, which to be credible need to have been developed by a seismologist.

C) Each of these scenarios require choices for magnitude and would produce more realistic results if they include soil response and ground disturbance parameters.

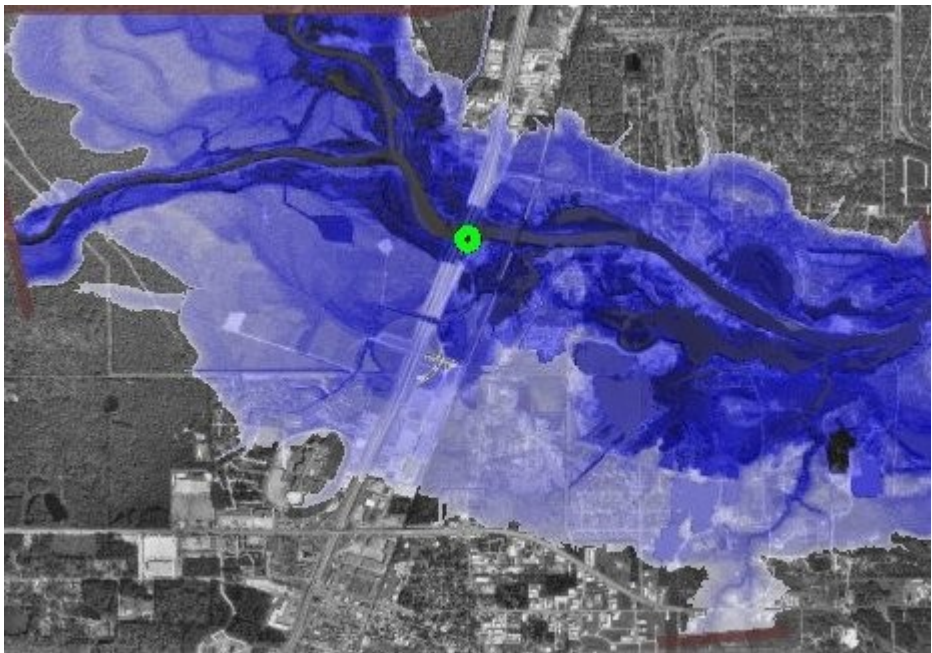
Flood scenarios 1

Flood scenarios describe the height of flood water in a region as constrained by the topography. Hazus considers both river and coastal flooding. The impact of flood water velocity can be determined in a limited case. In the near future this will not be available in Canada.

The flood-height probability is based on a geological and meteorological interpretation. The higher the flood level, the rarer the event: Depth - Frequency curve.

The Canadian version of Hazus does not have a functional flood module. It is under development.

Hazus USA could be used in the mean time.



NOAA

Flood scenarios 2

Ground damage from flooding can be incorporated into the flood scenario. These include river bank and coastal erosion.

Hazus calculates flood depth grids based on Hazus terrain, river and coastal data or from user supplied such data. The Canadian version will be based on user supplied data.

Lake Ha! Ha! dam burst flood, NRCan

Flood scenarios 3

Riverine hazard characteristics:

- frequency,
- discharge, and
- terrain elevation

are used to model the spatial variation in flood elevation and flood depth.

Coastal hazard characteristics:

- frequency,
- still water elevations,
- wave conditions, and
- terrain information

used to model spatial variation in flood-induced erosion, flood elevation, and flood depth..

Flood scenarios 4

A Hazus Flood Information Tool converts user-supplied inputs into the extent, depth and elevation of flooding for rivers and coasts

River flood inputs are:

- ground elevations as a digital elevation model,
- flood elevations, and
- floodplain boundary

Coastal flood inputs are:

- ground elevations as a digital elevation model,
- 100 year flood polygons,
- output data area,
- 100 year still water elevation,
- wave setup at the shoreline

Lake Ha! Ha! dam burst flood, NRCan

Flood scenarios 5

Constraints and Summary

Accuracy of flood depth is the critical flood hazard characteristic for loss estimation.

Hurricane scenarios 1

A Hazus hurricane scenario consists of wind pressure, hurricane areal extent and duration, terrain roughness, topography, wind borne debris missiles, tree blow down, and rainfall.

Single event scenarios can have coastal storm surge and wave estimates fed into the Hazus Flood Model. Not for probabilistic.

It does not take into account rain water inundation.

Hazus presently has a Hurricane module capability for its eastern states and Hawaii only. That is because the topography for those areas is included in Hazus.

Hazus Canada does not have a hurricane module and the schedule for its development has not been set.

Hurricane scenarios 2

Types of hurricane scenarios

Probabilistic

Potential based on cumulative history of measured past hurricanes

Historic hurricane

Effects of a known past hurricane event

User supplied

User supplied wind, rain, elevation, terrain, tree cover and bathymetric maps

Hurricane scenarios

Constraints and Summary

Tree coverage and surface roughness significantly effect damage and loss estimates. Hazus USA has default tree coverage and terrain data or supply your own. Consult with an expert when supplying your own data.

It does not calculate damage from flooding on land.

It will calculate coastal flooding damage from storm surge.

Amount of time of the hurricane over an area greatly affects the loss estimate. It is useful to vary the duration, path, wind speed, and track to evaluate the range of potential losses.

Further information

http://www.fema.gov/hazus technical and user manuals

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Technical Support

https://support.hazus.us

For login credentials e-mail helpdesk@support.hazus.us

Help Desk is available 24/7

1-877-336-2627 during office hours