Natural Resources Canada
Ressources naturelles Canada

Canada

Data Preparation for Validation Study of Hazus Canada Flood Model

I3R2 Conference
May 20, 2014
Perdue University

H. McGrath (UNB)
E. Stefanakis (UNB)
M. Nastev (NRCan)
M. McCarthy (PSC)

May 20, 2014

Flood History in NB

- 1887 - 1971 damages
 - > \$1 million
- 1971 – 1976, damages
 - ~\$17 million
- Since 1900s
 - > \$133 million
- 2014 flood, in Sussex, NB
 - estimates: \$12million
- 1960-1970s, settlement along Saint John River floodplain
 - Increased by 30%

Candidate City	# floods (last 10yrs)	Damage amount (thousand \$)
Edmundston	5	\$23,288
Perth-Andover	2	\$54,483
Fredericton	8	\$43,068
Hartland/ Somerville	6	\$29,483
Simonds	3	\$23,288
Saint John	3	\$16,000
Quispamsis	3	\$23,288
Clair/Fort Kent	2	\$23,288
Woodstock	2	\$42,718
Maugerville	4	\$29,483
Jemseg	5	\$28,888

Adaptation of Hazus for Canadian Settings

- Adapting Hazus –MH (developed by FEMA)
 - Earthquake model available
 - Flood model (Summer 2014)
- Scientifically calculate:
 - Extent of areas vulnerable to flood hazard
 - Calculate the potential damage to the exposed infrastructure
 - Calculate repair and replacement costs in the risk areas
 - (FEMA, 2009)
- Hazus is a mitigation tool!

Agreement between
NRCAN, DRDC and
FEMA (2011)

Community Selected

- Fredericton, NB
 - Capital of the province
 - Open data policy
 - Aging Mactaquac Dam
 - Flood history

Fredericton, NB

Population: ~56,000

~22,000 households

Mix of Public and
Private
infrastructure

Historic buildings:
dating back to late
1700s

Hazus Risk Assessment Process

Department / Municipality	Available Datasets
City of Fredericton	Building Footprints
City of Fredericton	Fire Stations
City of Fredericton	Police Offices
City of Fredericton	Parking Facilities
City of Fredericton	Street Centreline
City of Fredericton	Wastewater, potable water
City of Fredericton	LiDAR data (2008)
New Brunswick Department of Environment	Flood depth grids
New Brunswick Department of Education and Early Childhood Development	Public Schools
Public Safety New Brunswick	Local infrastructure
Public Safety New Brunswick	Cell Towers
Public Safety New Brunswick	Disaster financial assistance
Service New Brunswick	Property Assessment
SNB - GeoNB	Digital Property Maps (DPM)
SNB – GeoNB	Flood risk areas & historical floods
SNB - GeoNB	National Railway Network
SNB - GeoNB	Pipelines
SNB - GeoNB	Road Network

Building Datasets

Reclassification

Hazus Category	Hazus Description	NB Code	NB Code Description	Property Description contains
RES1	Single Family Home	120	Residential Improved	House & Lot
RES2	Mobile Home	104	Mobile Home Parks	Mobile Home Lots, Pine Grove LLC
		105	Mobile/ Mini Home w/ Land	Mini Home, Mobile & Lot
RES3A	Duplex 1-2 units	120	Residential Improved	Duplex
RES3C	Apartment 5 -9 units	120	Residential Improved)	Apt. Bld
COM1	Retail trade	202- 207, 210, 214	Service stations, restaurant	
EDU1	Grade School	402	Schools	EDU1
IND2	Light industrial	304 - 310	Food, Fish, Textile, Apparel Processing Plants, Lumber Mills	

Calculation of Replacement costs

$$V_{RES1,k} = (A_{RES1,k}) * [\sum_{i=1}^4 \sum_{j=1}^4 w_{i,k} * w_{j,k} * C_{i,j}] + (A_{RES1,k}) * w_{l,k} * [\sum_{i=1}^4 \sum_{j=1}^4 w_{i,k} w_{j,k} C_{i,j,l}] + (RES1Cnt_k) * [\sum_{i=1}^4 \sum_{j=1}^4 w_{i,k} w_{m,k} C_{i,m}]$$

$V_{RES1,k}$	Total estimated valuation for RES1 for a given census block (k)
$A_{RES1,k}$	Total RES1 floor area for given (k)
i	Means construction class
$w_{i,k}$	Means construction class weighting factor
j	Number of stories of RES1
$w_{j,k}$	Means number of stories weighting factor
C_{ij}	RES1 cost per square foot
l	Basement status (yes [1] or no [2])
$w_{l,k}$	Means basement status weighting factor
$C_{i,j,l}$	Additional cost per square foot for a finished basement
M	Garage combination (1 car, 2 car, etc.)
$w_{m,k}$	Weighting factor for garage type
$C_{i,m}$	Additional replacement cost for a given garage type
$R_{RES1Cnt}$	Count of RES1 structures within a given census block

Essential Facilities

- Hospitals
- Police stations
- Fire Stations
- Schools
- Care Facilities

Flood Scenario

- Flood gauge (Station: 01AK003) indicated the highest water level of 8.359m on May 2, 2008
 - Flood Stage: 6.50m
- May 1: 50 roads closed
 - Including off ramps at the cities two bridges
- 680 evacuees registered with Canadian Red Cross
- 304 customers without power (May 3)
- Total Cost: \$23 million (Canadian Disaster Database)

Validation tests

- Depth damage curves
- Regression equations
- Manning's n values
- Hazus loss estimates vs. real expenditures
 - Shelter requirements
 - Building damage
 - Economic losses

Future Plans

Future Plans

Source: USGS Flood Inundation Mapper, <http://wim.usgs.gov/FIMI/>

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Heather McGrath

Heather.mcgrath@unb.ca