CEC Flood Costing Project
Preliminary Findings from Canada

2nd CEC Virtual Expert Workshop

Hirmand Saffari, BA, MRM Candidate
Pacific Water Research Centre
School of Resource and Environmental Management
Simon Fraser University

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Overall Approach for Application of the CEC Method

- Our attempts to apply the CEC Method began in January 2020, with the bulk of the work occurring over summer 2020

- The data collection process in Canada was predicated on a high level of engagement from both the public and private sector
  - Government agencies at the national level (NRCan, Public Safety Canada) and the insurance industry (IBC, CatIQ) played a key role in facilitating the data collection process

- Both developing and applying the CEC Method in Canada is an ongoing and constantly evolving process, so our approaches need to be flexible

Data Sources for Canada

Data sources	Stage
Public Safety Canada's 'Canadian Disaster Database' (CDD)	1. Rough Estimate of Flood Costs
Catastrophe Indices and Quantification Inc. (CatIQ)	2. Data Collection on Insured Losses
The 2016 Census Program, Statistics Canada	3. Data Disaggregation

Data Collection Process and Analysis

- Stage 1: Rough Estimate of Flood Costs
  - "Back-of-the-envelope' estimation of flood costs over the 2013-2017 period based on open-access data was conducted prior to piloting the methodology
  - Canadian Disaster Database (CDD) served as an effective starting point
  - Estimated total cost (insured losses + DFAA payments) of 9 major flood events from 2013 to 2016 is CAD$5,021,266,000 (not adjusted for inflation)
  - CDD was useful in identifying the costliest Canadian flood events on record and providing a sense of their scale

Map of Canadian Disasters Database Flood Events

Data Collection Process and Analysis (cont.)

- Stage 2: Data Collection on Insured Losses
  - In order to capture insured losses in the project database, a dataset from CatIQ was retrieved
  - Includes estimated catastrophic insured losses (not adjusted for inflation) by province and line of business (personal, commercial, auto), broken down into physical and non-physical damage for 8 significant flood events from 2013 – 2017 across 9 provinces
  - Estimated insured losses are CAD$3,404,738,000 (excluding ALAE, not adjusted for inflation)
  - Does not indicate which sector claimed the loss with insurance, and data are not represented at the municipal level.

CEC Project Database Canada

	A	B	C	D
1	loc_id (CEC database)	loc_id (please keep this now)	ev_id	ho_house
2	CA00001	0	EVF_00001	$ 1,102,099.65
3	CA00002	2	EVF_00001	$ 2,359,516.71
4	CA00003	3	EVF_00001	$ 4,846,822.61
5	CA00004	4	EVF_00001	$ 1,112,437.01
6	CA00005	5	EVF_00001	$ 273,368.92
7	CA00006	6	EVF_00001	$ 1,590,811.20
8	CA00007	7	EVF_00001	$ 42,799,469.12
9	CA00008	8	EVF_00001	$ 5,979,534.55
10	CA00009	9	EVF_00001	$ 595,940.24
11	CA00010	100	EVF_00002	$ 8,726,838.35
12	CA00011	111	EVF_00002	$ 17,252,157.28
13	CA00012	114	EVF_00002	$ 7,010,004.37
14	CA00013	11	EVF_00003	$ 307,192.15
15	CA00014	12	EVF_00003	$ 10,263.82
16	CA00015	13	EVF_00003	$ 21,273.06
17	CA00016	14	EVF_00003	$ 8,070.03
18	CA00017	15	EVF_00003	$ 9,265.30
19	CA00018	16	EVF_00003	$ 4,267.96
20	CA00019	17	EVF_00003	$ 9,623.28
21	CA00020	18	EVF_00003	$ 10,416.80
22	CA00021	20	EVF_00003	$ 8,032.33
23	CA00022	21	EVF_00003	$ 4,169.58
24	CA00023	23	EVF_00003	$ 32,751.22
25	CA00024	24	EVF_00003	$ 23,747.68
26	CA00025	25	EVF_00003	$ 4,327.77
27	CA00026	26	EVF_00003	$ 5,710.26
28	CA00027	27	EVF_00003	$ 4,471.22

Data Collection Process and Analysis (cont.)

- Stage 3: Data Disaggregation
  - Needed to estimate flood damages at the municipal level on a population-based weighting method
  - Population data are supplied by Statistics Canada at pre-defined units (2016 Census Data)
  - In ArcGIS, we overlayed the flood footprints provided by CatIQ with the census subdivisions, extracted which municipalities fall within the footprint, and allocated the total provincial costs for that event according to municipal population
  - We assume that the epicentre of flood damages and losses are in densely populated areas, though this may not always be the case

2013 Southern Alberta Flood Population Statistics

NAME_1	NAME_2	Population	Total population by pro	% of Population
Alberta	Division No. 15	38594	2124229	1.82%
Alberta	Division No. 1	82627	2124229	3.89%
Alberta	Division No. 2	169729	2124229	7.99%
Alberta	Division No. 3	38956	2124229	1.83%
Alberta	Division No. 4	9573	2124229	0.45%
Alberta	Division No. 5	55708	2124229	2.62%
Alberta	Division No. 6	1498778	2124229	70.56%
Alberta	Division No. 8	209395	2124229	9.86%
Alberta	Division No. 9	20869	2124229	0.98%
		2124229		100.00%

Overview of Events Included in the CEC Database

- 2013 Southern Alberta Flood
  - Total damage estimates exceeded $5 billion (2018 dollars)
  - Total insured damage ~ $1.7 billion
  - Costliest natural disaster in Canadian history, until the occurrence of the 2016 Fort McMurray wildfire.
  - 32 local states of emergency
  - 5 deaths
  - 100,000 evacuated
  - 4000 businesses affected
  - 3000 buildings were flooded, including that Saddledome and the Calgary Zoo.
  - Estimated to have reduced GDP in Southern Alberta by $550 million (2013 dollars).

Downtown Calgary during the floods

Flooding of the Saddledome

Overview of Events Included in the CEC Database

- 2017 Ontario and Quebec Spring Flooding
  - Spring snowfall and heavy rain caused floods in southern Quebec and parts of Ontario
  - 5,371 residences were flooded
  - 4,066 people were forced from their homes
  - 261 municipalities were affected
  - March 2017 North American blizzard added another 70 centimeters of snow along the Saint Lawrence River Valley
  - Exacerbated by heavy rain in April and early May 2017
  - Montreal received 156 mm of rain in April, twice the monthly average and nearly beating the record of 159 mm from 2005
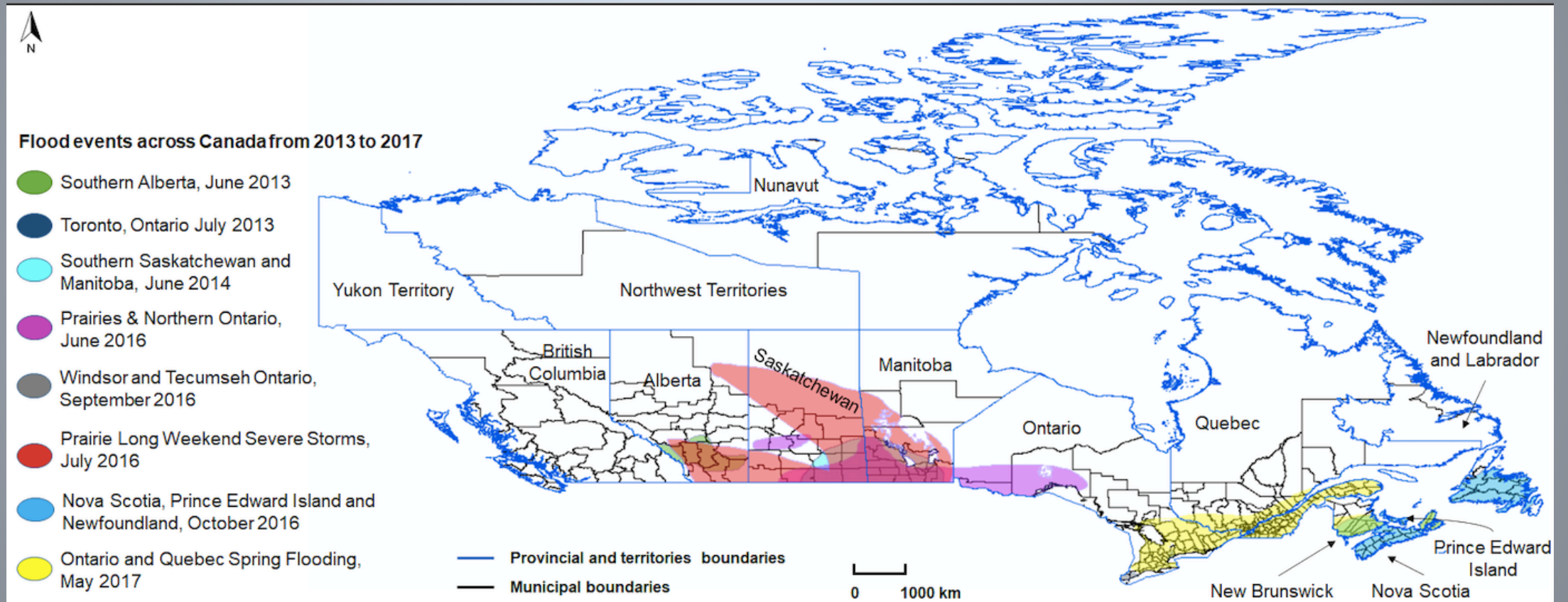

Emergency responders in a Montreal neighbourhood

Montreal resident sandbagging to protect his home

Summary Overview of the Data from Canada

Flood events across Canada from 2013 to 2017

- Southern Alberta, June 2013
- Toronto, Ontario July 2013
- Southern Saskatchewan and Manitoba, June 2014
- Prairies & Northern Ontario, June 2016
- Windsor and Tecumseh Ontario, September 2016
- Prairie Long Weekend Severe Storms, July 2016
- Nova Scotia, Prince Edward Island and Newfoundland, October 2016
- Ontario and Quebec Spring Flooding, May 2017

Provincial and territories boundaries
Municipal boundaries

0   1000 km

The Most Significant Data Challenges for Canada

- Tackling the systemic flood cost data vacuum

- Data granularity
  - Much of the existing flood cost data is aggregated by province and categories are generalized
  - Addressed this challenge through analytic techniques (population weighting adjustment) and the use of software (ArcGIS) to disaggregate the data

- Quantifying uninsured losses has been difficult due to issues around data accessibility and availability

- Flood cost data for remote areas and Indigenous communities is scarce

Improving The Data Situation in Canada

- Canadian Centre for Climate Information and Analytics (C3IA) as an authoritative source of climate information and decision analysis
- In collaboration with IBC, the Canadian Water Network generated objectives and framing for a made-in-Canada solution for improved data and information, knowledge sharing and curation that is useful for municipalities to improve flood risk evaluation in Canadian communities
- CWN's final report recommended that it should employ a phased approach to deliver the following functions:
  - Curation of relevant data and information
  - Curation of different kinds of data and information products from different sectors
  - Provision of advanced expertise on data analytics that could advance flood risk assessment and hazard mapping
- The curation of data generated by other sectors would enable municipalities to compare similarities and differences with how flood risk is identified and assessed by other sectors, resulting in a more complete picture
- There is a clear opportunity for a nationally relevant approach to elevate the success of Canadian municipalities with their task of protecting people, the environment and local economies from flooding