Incorporating Flood Quantiles in Remote Sensing-based Flood Mapping Techniques

Introduction

- In Canada, flood damages exceeded US\$ 7.4 billion over the recent five years (2011-2016), with 9 lives lost and more than 100,000 individuals directly affected.
- Floodplain mapping is essential for various design & developmental activities by the purposes government.
- Detailed hydraulic modelling is not possible at all locations due to lack of fine resolution survey data.
- There is a need to adopt approaches that are not data intensive and can be applied over any location across Canada to obtain a preliminary assessment of flooding extents for different floods.

Objectives

- To determine the magnitude of flood for various return periods (eg. 50-,100-, 250-, 500-year) across Canada;
- To determine corresponding stage at stream gauges for the estimated flood magnitudes using stagedischarge relationships;
- To propose a method for delineating the flooding extent along the stream network using the estimated stage and the DEM; and
- To compare flooding extents obtained using the proposed method with available flood extents maps.

Data

- Streamflow and level data at daily scale from HYDAT database are available through Environment and Climate Change Canada.
- Canada Digital Elevation Model with a resolution of 20m is available at <u>http://maps.canada.ca/czs/index-</u> en.html

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Classified flood hazard map (CFHM)

(Elshorbagy et al., 2017)

• Prepared using two topographic indices derived from DEM: elevation above nearest drainage (EAND) and distance from nearest drainage (DFND)

Classes of EAND, DFND, and the resultant flood hazard of Canada

EAND	Class	DFND (m)	Class	Hazard	Class	Hazard
(m)						level
≤ 2.0	5	≤ 1000	5	21 - 25	5	Severe
2.1 - 4	4	1001 - 2500	4	16 - 20	4	High
4.1 – 6	3	2501 - 5000	3	11 – 15	3	Medium
6.1 – 8	2	5001 - 10000	2	6 – 10	2	Low
> 8.0	1	> 10000	1	1 – 5	1	Very low



Hazard map for Canada showing different classes of Hazard (CFHM)

Results





Comparison of 100-year flood extents obtained by the proposed approach with (a) 100-yr extent from hydraulic model and (b) the CFHM of Canada.

Results (cont.)



(a) The 100-yr flooding extent within the Oldman River Basin, Alberta, Canada, and (b) the CFHM for the same Basin.



Flooding extents for different return periods for a stretch of the Northern Thames River, Ontario, Canada, estimated using the proposed approach.

Conclusions

- The approach can be applied for any stream network having discharge and stage information at multiple locations.
- Can be used to obtain a preliminary assessment of flooding extents for different return periods across Canada.
- CFHM can provide reliable information on areas likely to be flooded in ungauged locations also.
- Goal: to produce a complete flood hazard map for Canada using the proposed approach.

References

Elshorbagy A, Bharath R, Lakhanpal A, Ceola S, Montanari A., Lindenschmidt KE (2017) Topography-and nightlight-based national flood risk assessment in Canada. Hydrol Earth Sys Sci 21(4): 2219-2232.

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