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# Climate Change and Heavy Rainfall-Related Water Damage Insurance Claims and Losses in Ontario, Canada

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## ABSTRACT

The objective of this paper was to project possible impacts of climate change on heavy rainfall-related water damage insurance claims and incurred losses for four selected cites (Kitchener-Waterloo, London, Ottawa, and Toronto) located at Ontario, Canada. To achieve this goal, the future climate change scenarios and rainfall simulations, at local scale, were needed. A statistical downscaling method was used to downscale five global climate model (GCM) scenarios to selected weather stations. The downscaled meteorological variables included surface and upper-air hourly temperature, dew point, west-east and south-north winds, air pressure, and total cloud cover. These variables are necessary to project future daily rainfall quantities using within-weather-type rainfall simulation models. A model result verification process has been built into the whole exercise, including rainfall simulation modeling and the development of downscaling transfer functions. The results of the verification, based on historical observations of the outcome variables simulated by the models, showed a very good agreement. To effectively evaluate heavy rainfall-related water damage insurance claims and incurred losses, a rainfall index was developed considering rainfall intensity and duration. The index was evaluated to link with insurance data as to determination of a critical threshold of the rainfall index for triggering high numbers of rainfall-related water damage insurance claims and incurred losses. The relationship between rainfall index and insurance data was used with future rainfall simulations to project changes in future heavy rainfall-related sewer flood risks in terms of water damage insurance claims and incurred losses. The modeled results showed that, averaged over the five GCM scenarios and across the study area, both the monthly total number of rainfall-related water damage claims and incurred losses could increase by about 13%, 20% and 30% for the periods 2016-2035, 2046-2065, and 2081-2100, respectively (from the four-city seasonal average of 12 ± 1.7 thousand claims and $88 ± $21 million during April-September 1992-2002). Within the context of this study, increases in the future number of insurance claims and incurred losses in the study area are driven by only increases in future heavy rainfall events.

## KEYWORDS

Climate Change; Statistical Downscaling; Rainfall-Related Flooding Risks; Water Damage; Insurance Claims; Canada

## Cite this paper

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