Team

02.

Insurer Solvency Risk From Sequential Hazards

Does Canada's current insurance capital framework underestimate losses from connected storm-flood events?

Improved modeling of sequential hazards supports more accurate pricing, reserving, reinsurance, and capital planning, while protecting policyholders during extreme events.



This project examines whether Canadian P&C insurers underestimate catastrophe losses by treating sequential storm-flood events as independent risks. In reality, storms can trigger or intensify flooding, causing losses to amplify rather than simply add together. As climate-related catastrophes become more frequent and severe, this modeling gap may weaken capital adequacy under OSFI's MCT framework and leave insurers less prepared for real-world solvency stress.

Methodology

Step 1: Analyzed EM-DAT and CatIQ catastrophe loss data across events, regions, and business lines.

Step 2: Modeled extreme insurance losses using heavy-tailed statistical distributions.

Step 3: Ran 1,000 Monte Carlo simulations and compared simulated and observed losses.

Step 4: Stress-tested OSFI's Minimum Capital Test under sequential catastrophe exposure.

A collaborative project with:

UNIVERSITY OF TORONTO

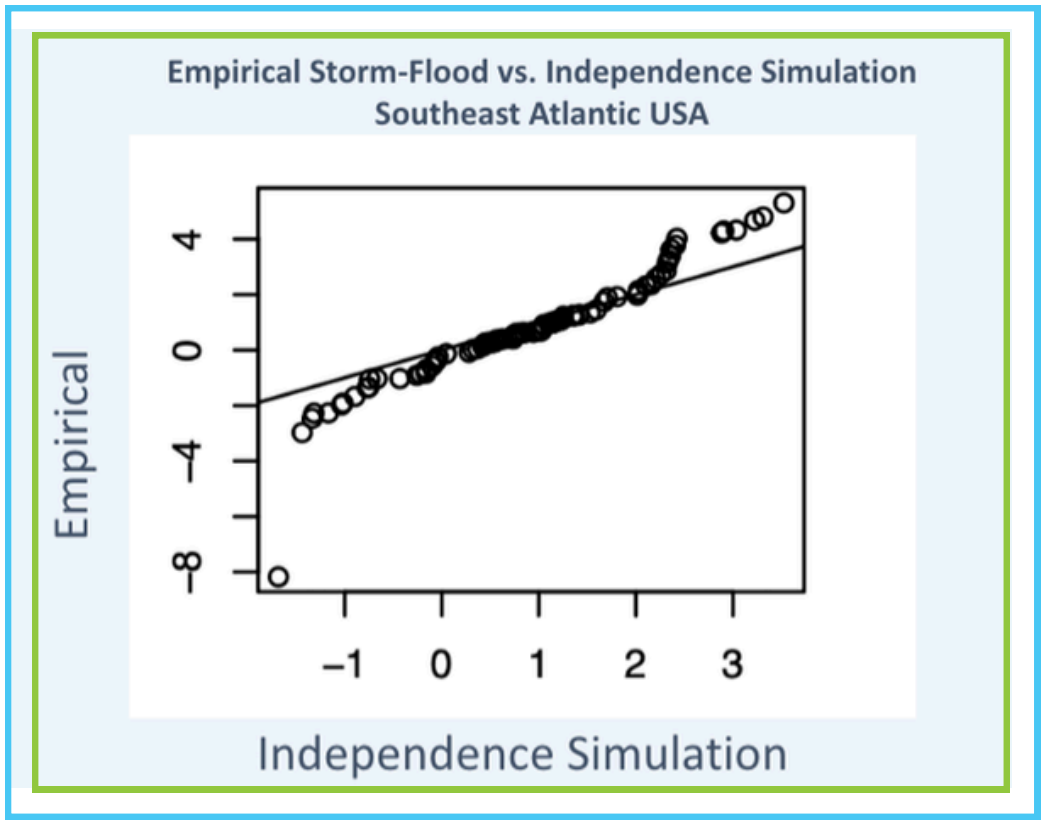
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Key Findings

- Through a stylized MCT scenario, our analysis identified a **$166 million capital gap** under combined storm and flood events. For a real insurer using its own data and financial statements, the gap would likely be considerably larger.
- Risk analysis showed storms and floods were **not fully independent** during extreme disasters, especially in parts of Southeast and Central East Asia.
- Limited Canadian flood-only data restricted the analysis, but CatIQ results still suggested **pressure on OSFI's Minimum Capital Test** under sequential catastrophes.



The 45-degree line indicates perfect agreement between the independence-assumed model and observed data. Tail deviations show that extreme events are not independent, where solvency risk is highest.

Recommendations

- OSFI should consider adding a **natural catastrophe module** to the Minimum Capital Test and require insurers with heavy catastrophe exposure to **test sequential hazards** using dependence-based models.
- This would make required capital more responsive to real loss behaviour and reduce the risk of capital being understated before major events.



Next Steps?

CatIQ's small sample size, especially for flood-only events, limited tail estimation and sequencing analysis. Future research should use richer geographic data and formal dependence models.

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Risk and Insurance Studies Centre

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