CLIMATE CHANGE AND REINSURANCE

By **Team 6**
Yue Zhen
Hitesh Arulnesan
Ivy Osei

RISC Risk and Insurance Studies Centre
YORK UNIVERSITÉ UNIVERSITY

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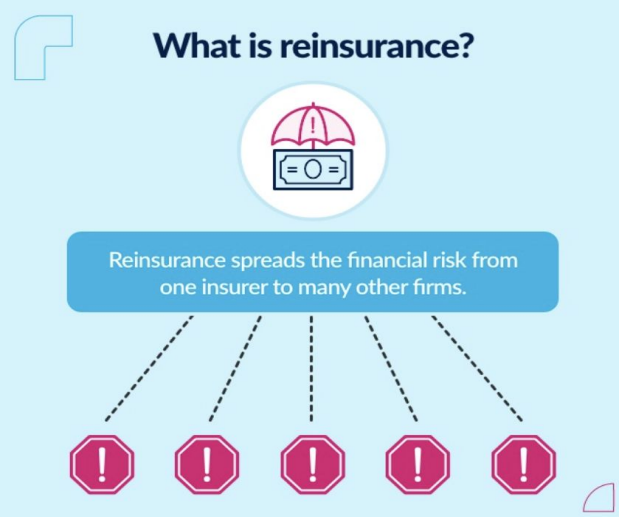
Introduction

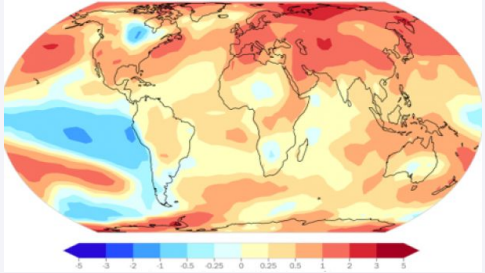
Project Overview

How will climate affect the reinsurance market?



What is Climate Change?

- **Since 1950** human activities have led to virtually all temperature rise
- Sea level rise has accelerated from 1.7 mm/year most of twentieth century to **3.2 mm/year since 1993**
- Glaciers are shrinking: average thickness of 30 studied glaciers has decreased more than 60 feet since 1980
- With rising global surface temperatures the possibility of more droughts and increased intensity of storms will likely occur
- As more water vapor is evaporated into the atmosphere it becomes fuel for more powerful storms to develop
- More heat in the atmosphere and warmer ocean surface temperatures can lead to increased wind speeds in tropical storms.

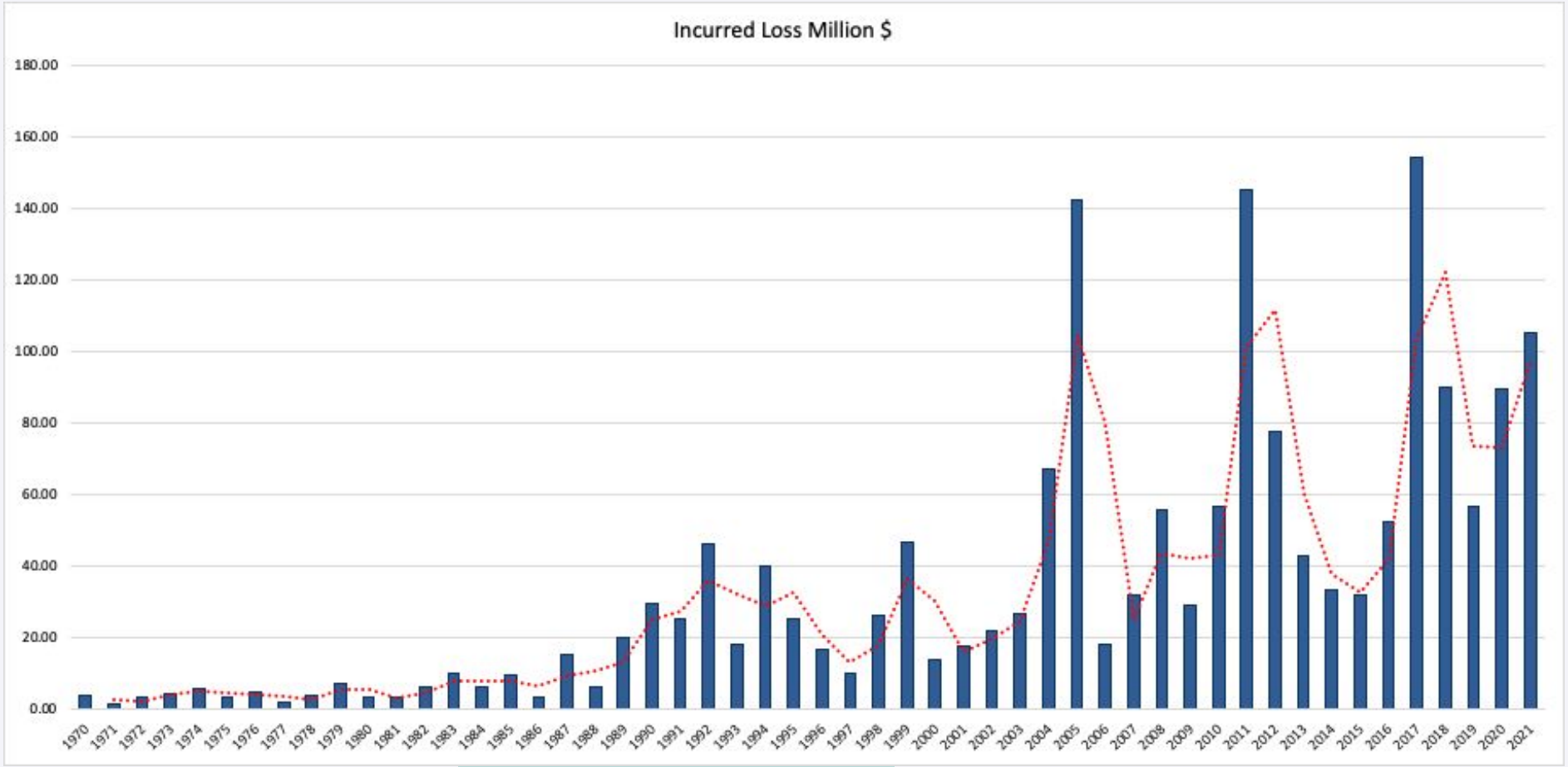


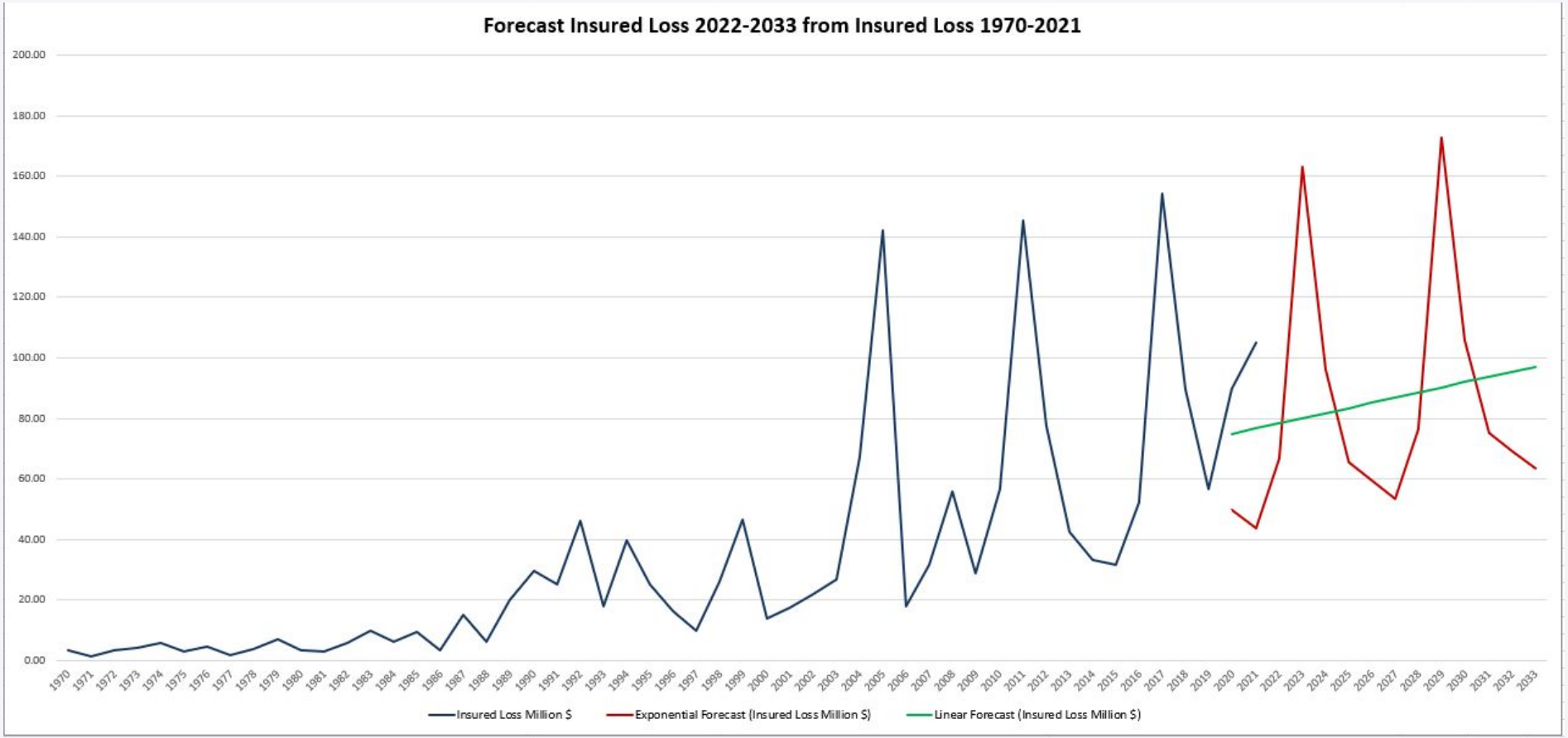
Top 10 Costliest World Natural Disasters By Insured Losses, 1900-2022 (1)

(2022 US$ billions)

Rank	Date	Country/region	Event	Insured loss (2)
1	Aug. 2005	U.S.	Hurricane Katrina	$99
2	Sept. 2022	U.S., Cuba	Hurricane Ian	53
3	Mar. 11, 2011	Japan	2011 Tohoku Earthquake/Tsunami	47
4	Sep. 2017	U.S., Caribbean	Hurricane Irma	40
5	Aug.-Sep. 2021	U.S., Caribbean	Hurricane Ida	39
6	Oct. 2012	U.S.	Hurricane Sandy	39
7	Aug. 2017	U.S.	Hurricane Harvey	36
8	Sep. 2017	U.S., Caribbean	Hurricane Maria	36
9	Aug. 1992	U.S., Bahamas	Hurricane Andrew	34
10	Jan. 17, 1994	U.S.	Northridge Earthquake	31

Insured Losses by Natural Disasters Worldwide 1970-2021

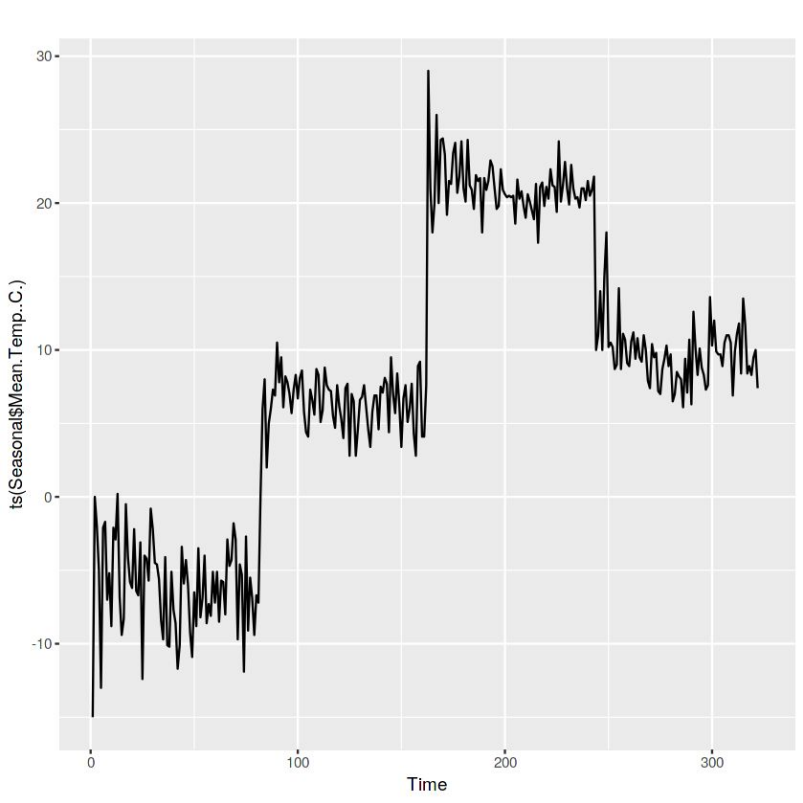



Forecast Insured Loss 2022-2033 from Insured Loss 1970-2021
200.00
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033
Insured Loss Million $
Exponential Forecast (Insured Loss Million $)
Linear Forecast (Insured Loss Million $)

Future Insured Losses Forecast

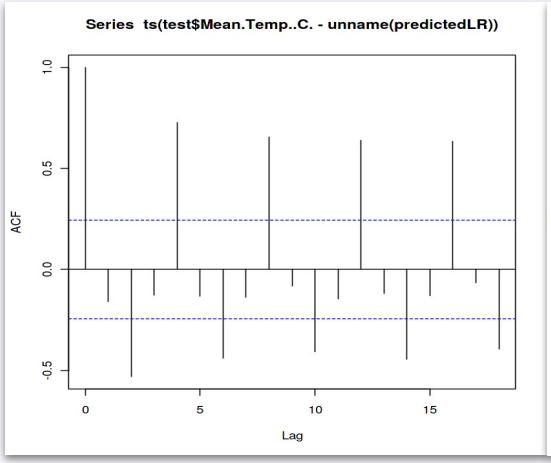
Date	Insured Loss Million $	Expontential Forecast (Insured Loss Million $)	Linear Forecast (Insured Loss Million $)
2009	28.76		
2010	56.59		
2011	145.22		
2012	77.62		
2013	42.46		
2014	33.11		
2015	31.71		
2016	52.34		
2017	154.04		
2018	89.74		
2019	56.69		
2020	89.54	49.56748517	74.86386122
2021	105	43.66080229	76.57414598
2022		66.52326373	78.28443073
2023		163.1520014	79.99471549
2024		96.10080808	81.70500024
2025		65.34813628	83.41528499
2026		59.40091025	85.12556975
2027		53.49422737	86.8358545
2028		76.35668882	88.54613926
2029		172.9854265	90.25642401
2030		105.9342332	91.96670876
2031		75.18156136	93.67699352
2032		69.23433534	95.38727827
2033		63.32765246	97.09756303

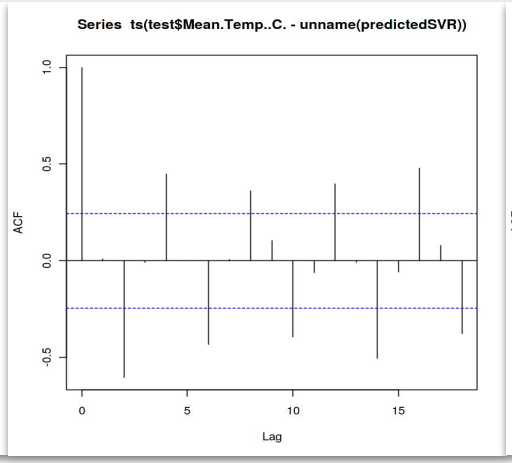
Time Series Analysis of Toronto Temperature

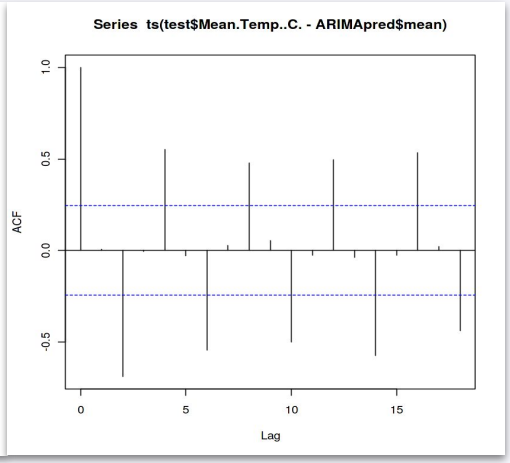


Validating Accuracy of Regression Models

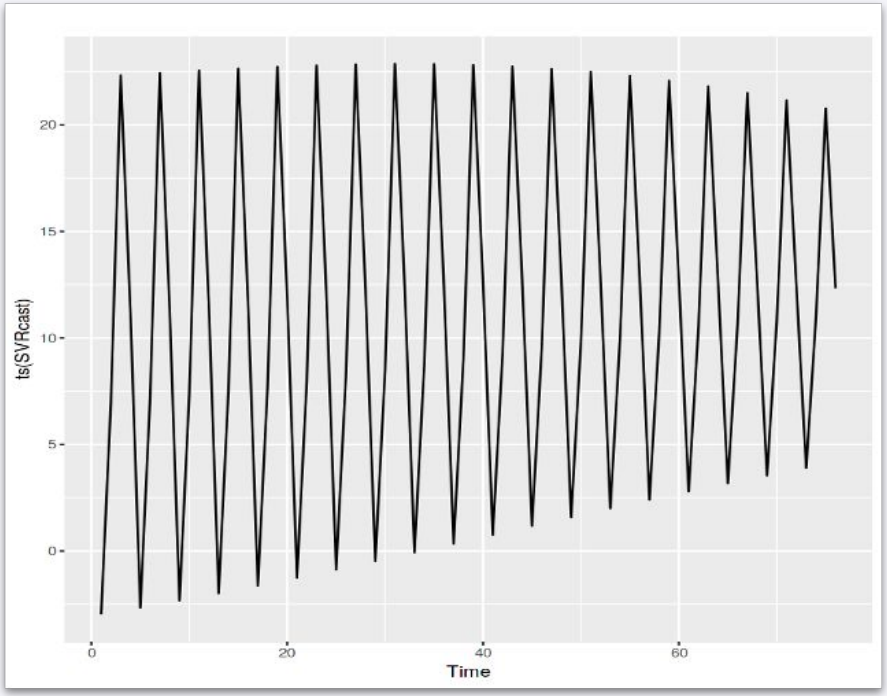
- *ARIMA:* Train RSME = 2.91, Test RSME = 5.65
- *Multivariate Regression:* Train RSME = 7.04, Test RSME = 7.49
- SVR: Train RSME = 1.80, Test RSME = 4.52



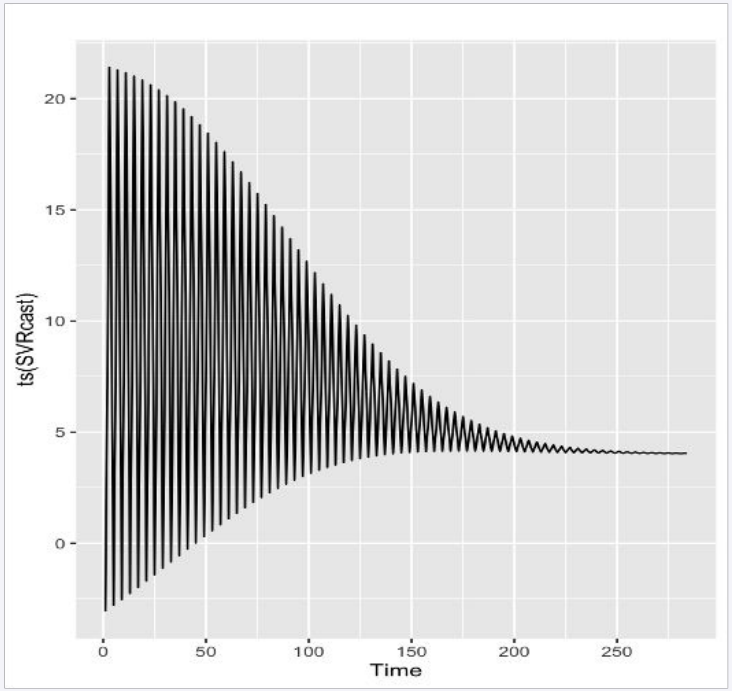




Global Warming & Canada's Climate



Left: SVRCast for 1937 – 2018



Right: Predicted SVRCast for the future

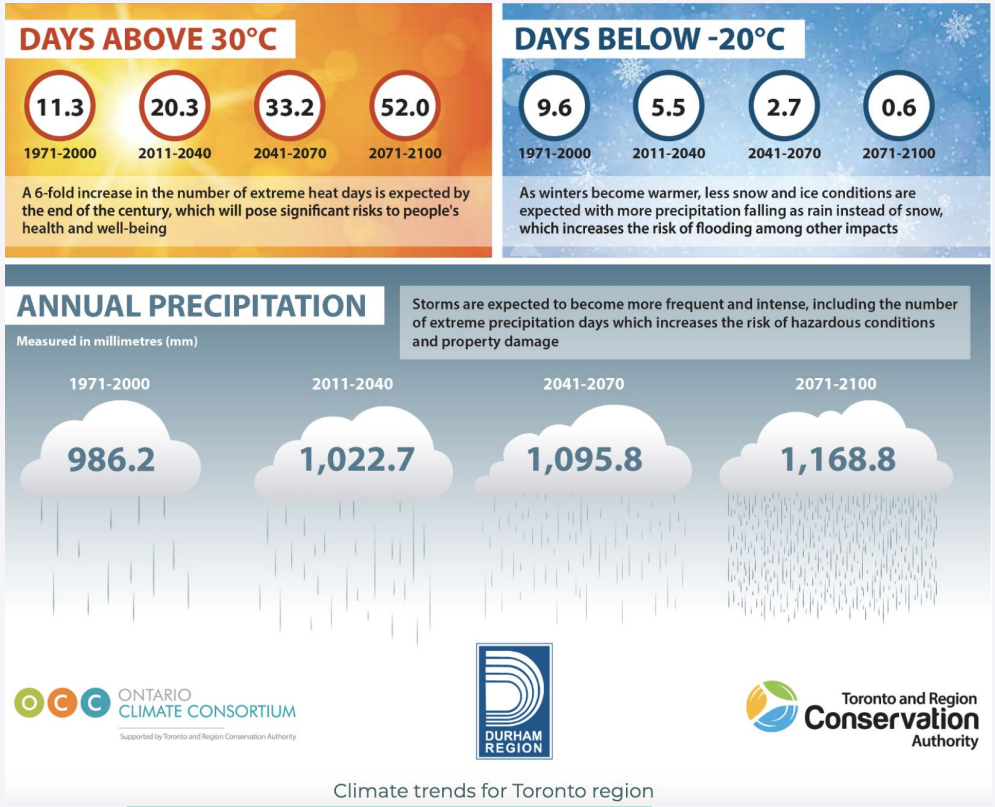
SVR Toronto Temperature Forecast

	Year	Month	SVRcast
266	2003	1	-2.98243210
.....	.....	...	.....
281	2073	1	4.949529
282	2073	4	4.966348
283	2073	7	4.970685
284	2073	10	4.942841

Canada: Future Insured Catastrophic Losses

Year	Total loss ($ billion	Target Date	Estimated Total Loss ($ billion)
2017	1.42	**2048**	**10.0897**
2018	2.4	**2073**	**16.9754**
2019	1.56		
2020	2.46		
2021	2.48		
2022	3.12		

Projected Weather Trends for Toronto



Climate trends for Toronto region

02

Implication of Climate Risk

Reinsurance Firms

Underwriting

- **Market dislocation** (Underinsurance)
- **Premium loss**
- **Higher capital requirements** - Reinsurance consumption
- **ESG awareness** - Terms and policies adjustment

Forecasting

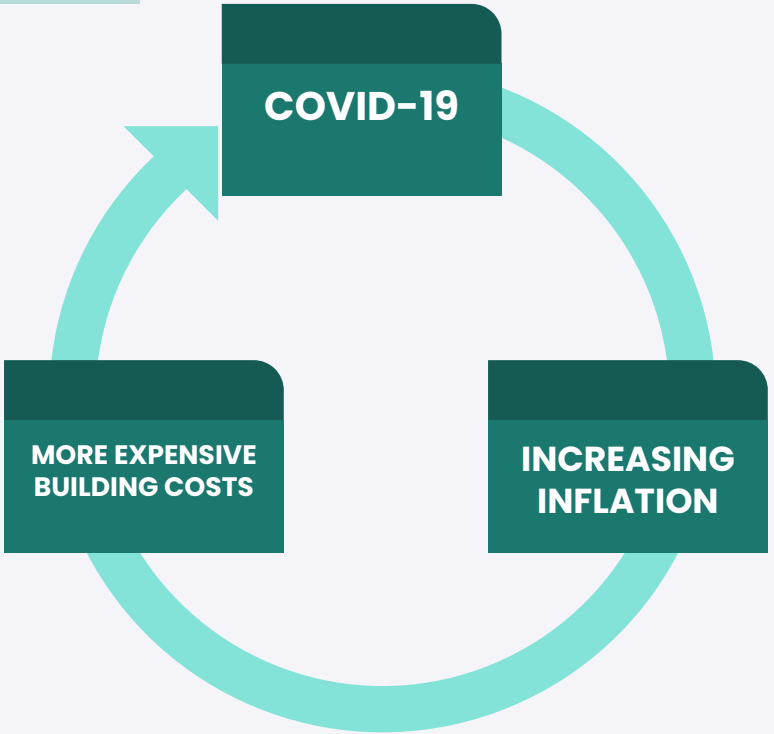
- Risk modelling & Catastrophe management framework - **Reassess**
- **Tightening market** (certain jurisdictions & certain lines of business)
- Regular stress test & Solvency assessment
- **Capital market instruments** - cover catastrophe losses

Individual Consumers

- Elevated premiums - **Higher costs**
- Engaging in **“Bluelining”** - decrease or deny services to customer in most at risk area
- **Failure of insurers** - Devastating financial harm for people who lose their home
- **Climate migration** - People move to places where insurance costs are lower

Inflation

- Weather affects inflation on losses → directly impacts reinsurance coverages long-term
- Question of whether companies can bear cost – increasing inflation, building cost is more expensive due to COVID-19 – affects ecosystem
- Companies analyze these risks and try to figure out how it'll get better, reinsurance companies often go bankrupt
- **Goal:** get solutions to try to help stabilize the market



Interest Rate Risk

- Weather increases ultimate losses, impacts coverages long-term
- Survey for American Property Casualty Insurance Association (APCIA) shows that only **30% of insured homeowners updated their policy** within the last year
- Majority are inadequately insured to cover the cost of rebuilding home should catastrophe occur
- Policyholders should try to update coverage frequently to protect against incurred damages

Housing Market

- In 2020 – 2021, United States' insurance companies paid out **$176 billion** in their natural catastrophe claims, the **highest on record** for a two-year period
- Costlier now than ever before to rebuild a home because of inflation, supply chain issues, increased demand for climate-resistant construction materials and skilled labourers
- Between December 2019 to December 2021, the cost of construction materials **rose by 44%** in the United States

Cause and Effect

- 64% of insured homeowners surveyed unsure if coverage covers cost to rebuild their home or was “based on the real estate market value of their home”
- Inflation impacts **reinsurance industry** – housing market, cost of goods and lumber → reinsurance companies often go bankrupt
- Impact on **consumers**: pay higher premiums for house insurance, makes them inadequately insured for other types, i.e. not proper health and life insurance in the US

03

Case Study of Florida Market

Historical Background

ERIN, OPAL

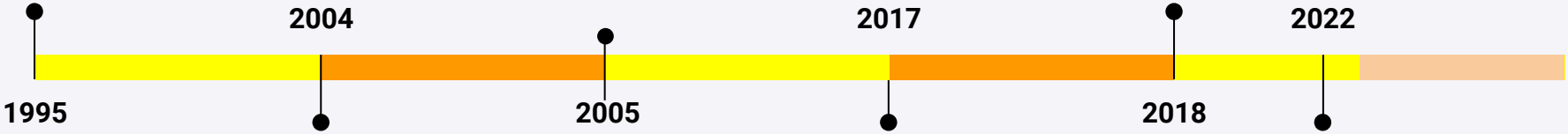
Total losses caused are estimated at $700 million and $2.1 billion respectively

DENNIS, KATRINA, WILMA

Total losses caused are estimated at $6 billion, $81.2 billion and $29 billion in damages respectively

MICHAEL

Causes about $25 billion in damages



CHARLEY, FRANCES, IVAN, JEANNE

Total losses caused are estimated at $15 billion, $9 billion, $18 billion and $8 billion in damages respectively

IRMA

Caused about $50 billion in damages

IAN

Caused about $65 billion in damages

Hurricane Katrina

2005

MOST EXPENSIVE NATURAL CATASTROPHE FOR THE GLOBAL INSURANCE INDUSTRY TO DATE

- Had a remarkable impact on the reinsurance industry
- Private reinsurance rates increased by 10–15% for Florida insurers

$160 BILLION

IN TOTAL ECONOMIC DAMAGES

- The Florida Hurricane Catastrophe Fund (FHCF) paid $5.536 billion in reimbursements
- Swiss RE estimated its own claims to be in the range of 1.2 billion and incurred losses of US $500 million

Hurricane Ian

2022

THIRD MOST EXPENSIVE HURRICANE SEASON TO DATE

By the official end of the storm season in late November, 14 named storms had been counted in the North Atlantic, of which eight reached hurricane strength and two were storms of the most severe categories 3–5

$110 BILLION

IN TOTAL ECONOMIC DAMAGES

- Hurricane Ian alone is expected to generate losses of $100 billion
- Munich Re estimates $60 billion of these losses to be passed on to private re/insurers.

Future Impact

- **Overall reinsurance prices** are expected to increase by more than **10% in 2023,** pointing to losses from disasters such as Hurricane Ian and “increasing frequency and severity of natural catastrophe claims”
- **Tighter restrictions** when reinsurance policies are renewed in 2023, while raising the possibility that Florida property insurers will not be able to buy all of the reinsurance they need
- Florida property insurers rely on a combination of **reinsurance bought in the private market** and from the **state-run Florida Hurricane Catastrophe Fund.** As an example of the importance of reinsurance, the Florida Hurricane Catastrophe Fund estimated last month it would have $10 billion in losses from Ian
- Reinsurance costs and availability were a problem in the Florida market before Ian. During a May special legislative session, lawmakers agreed to spend **$2 billion in tax dollars** to temporarily provide **additional reinsurance coverage** to insurers

04

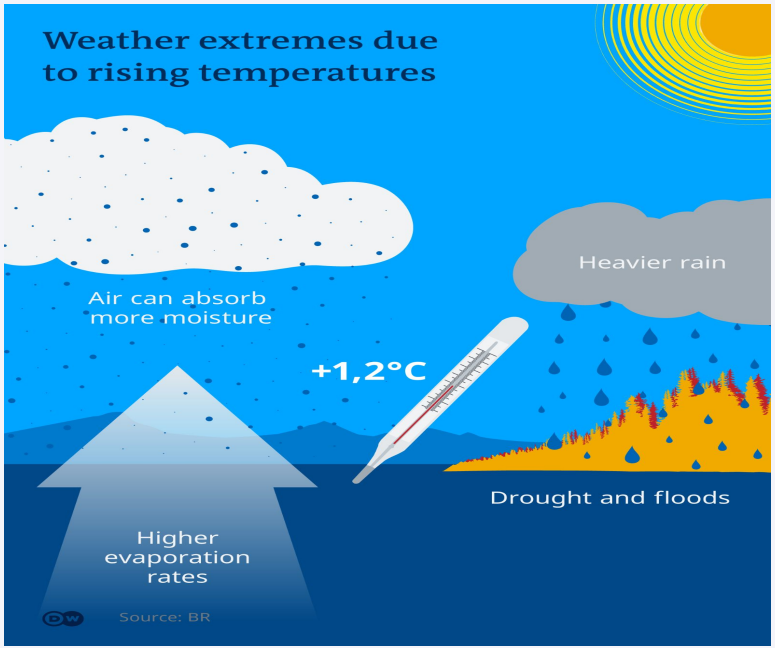
Conclusion

Solutions

- Research and development
- Collaboration
- Help mitigate climate risk
- Launch new products
- Diversify portfolio
- Consumer Responsibility

Research & Development

- **Revised business model:**
  Stress-testing —> quantitatively look at total exposure against projected weather trends regularly
- Update insurers' current **models** to account for **interconnectivity of risk**
  - To inform pricing & portfolio adjustments, insurers should analyze effect of natural catastrophe for a particular address and the macroeconomic effects of this risk
- Use social media info, cost modelers & data analysts



Collaboration

- Primary insurers can **build committees** with **multiple insurers**
- **Open source** to come up with solution
- Industry should have better consideration of effect of natural catastrophe – lack thereof causes loss estimates to be inaccurate
- Some stakeholders provide **global insurance coverage**, disregarding geographic limitation
- Insurers can work with **government** to place **restrictions** on building in areas prone to climate risk – i.e. avoid flood risk

Help mitigate climate risk

- **Organizational level**: should focus on **risk engineering**
  E.g., one NA insurer gives homeowners wildfire-defense services

- **Individual level:** insurers can offer **consumers incentives**
  E.g., providing rebate for use of construction materials that are climate-resistant – reduces extent of incurred damages and prevents stakeholders from issuing claims

Launch new products

Launch new products to address climate related risks that are **new and more commonplace** (i.e. wildfires, reduced crop yields)

- Build resilience by evaluating low-probability events
- Insurers could adopt parametric pricing – an insurance policy whereby payouts are made based on the set magnitude instead of the value of the losses incurred
- RIsk model should assume non-stationary risk and place less evidence on historical data

Diversify portfolio

- Diversify portfolio by considering effects of climate risks on **different organizations** and **geographic locations**

- New products serve consumers affected by these catastrophes of systematic risks like heat waves that affect livelihood and crops & conditions in which employees cannot work outdoors due to inclement weather

Consumer Responsibility

- Day-to-day consumer can adopt eco friendly practices
- Reusable water bottles
- Individuals don’t need 2,3 cars → Carpool
- Be mindful of carbon tax
- Build more eco friendly houses
- Council should educate consumers → Penalize consumers if not helping the cause

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Thank You!



Do you have any questions?