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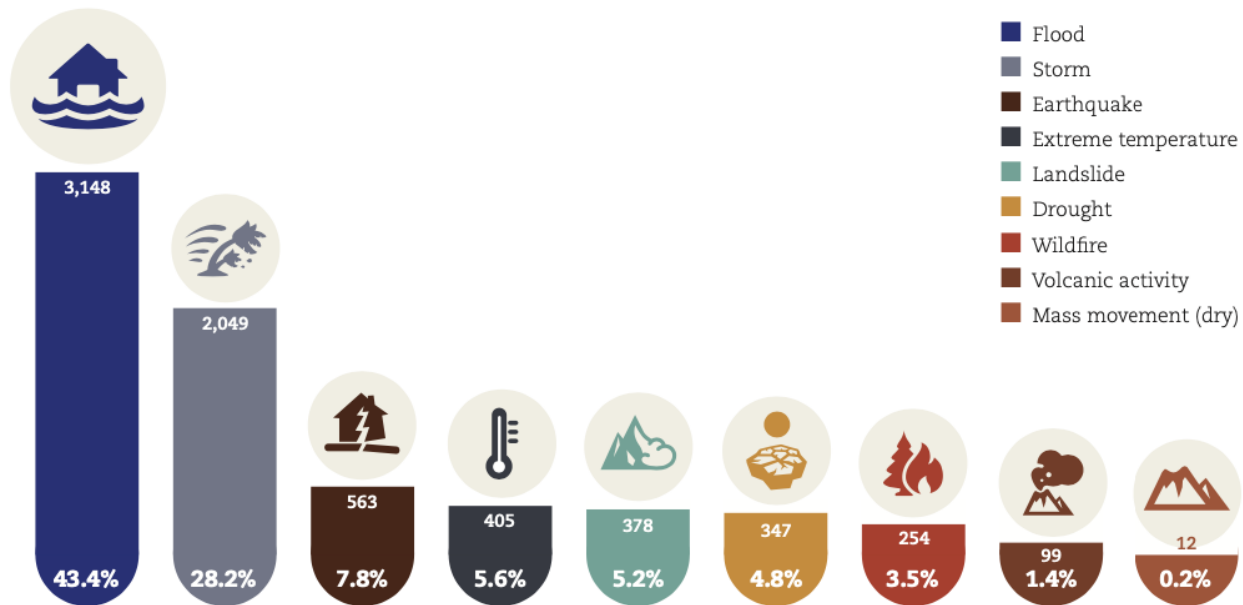
# ON FLOOD RISK MANAGEMENT ACROSS SOCIO-ECONOMIC ENVIRONMENTS

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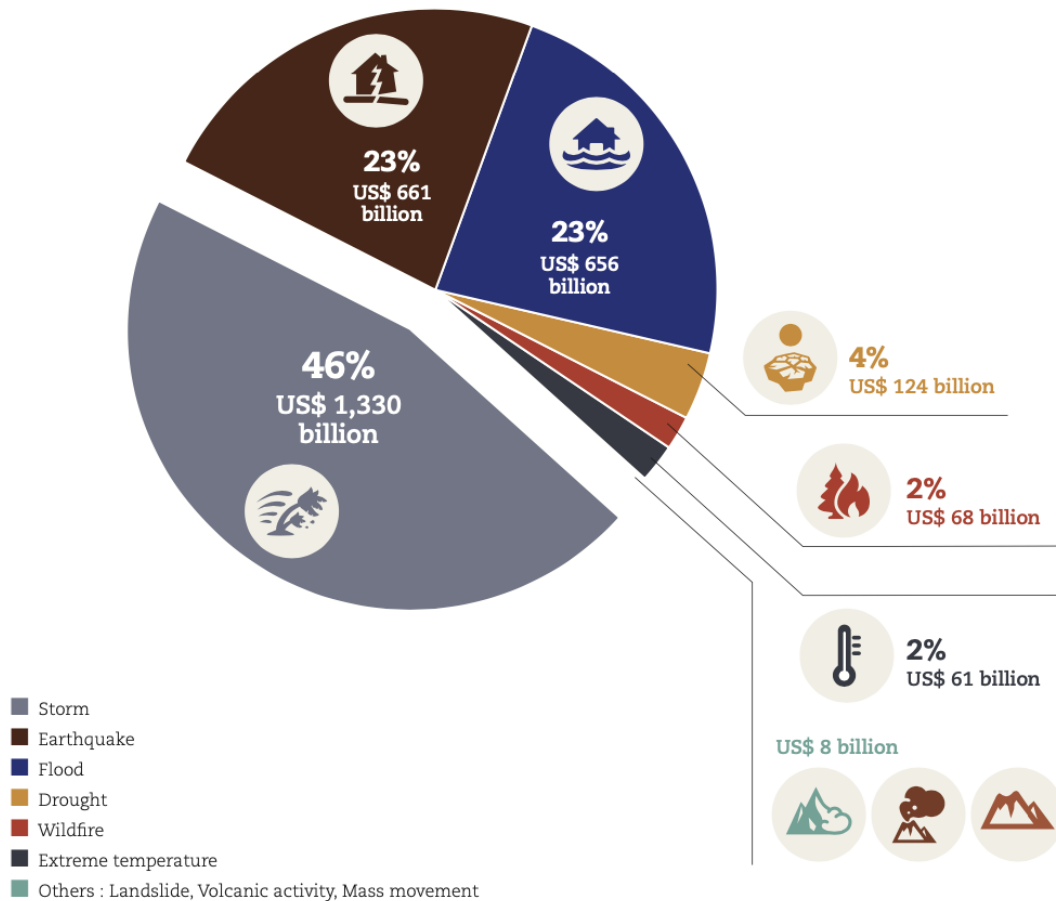
# Figure published in a 2018 report by UNISDR and CRED

Numbers of disasters per type 1998-2017



# Figure published in a 2018 report by UNISDR and CRED

Breakdown of recorded economic losses (US\$)  
per disaster type 1998-2017



Flood risk = hazard \* values \* vulnerability

**Hazard** - the flood, its intensity and probability of occurrence.

**Exposure/Values** - the population and assets at risk.

**Vulnerability** - the ability of the exposed to deal with the hazard.

Kron (2005) *Water International* 30(1):58–68.

# Flood insurance

- Insurance provides a method for transferring risks associated with **extreme floods** away from the exposed.
- Insurance penetration varies by country and is **positively correlated** with income level.
- The most vulnerable countries are often heavily reliant upon governmental and **international aid**.

## Improve penetration

- Mandatory insurance
- Bundling
- **Risk pooling** - Individual entity contributes regular premiums to the pool >> event occurs >> **risk pool** covers the cost.

NOTE:

Traditional risk management - event occurs >> **individual entity** covers the cost.

# Benefits of risk pooling

- Improves the predictability of funding flows and allows for the spread of disaster costs.
- Increases the efficiency of disaster response.
- Facilitates information sharing, research and development opportunities between members.

Successful examples of existing multi-country risk pools include:

- Caribbean Catastrophe Risk Insurance Facility (CCRIF SPC)
- Pacific Catastrophe Risk Insurance Pilot and the African Risk Capacity.



# Data collection

## Data set:

**Catastrophic event data from 1903 to Aug 15, 2020.**

**5341 flood events.**

## Preliminary steps:

- Combine economic losses within the same geographical area.
- Filter out all areas with less than 5 flood incidences and calculate aggregated economic losses per year for the 70 remaining areas.
- Normalise the loss data per area by the corresponding gross domestic product (GDP).

# Data Analysis

Group 1					
Algeria	Canada	Honduras	Malaysia	Romania	United Kingdom
Argentina	Chile	India	Mexico	Russia	United States
Australia	China	Indonesia	Nepal	South Africa	Viet Nam
Bangladesh	Colombia	Iran	New Zealand	Spain	
Bolivia	Ecuador	Italy	Nigeria	Sri Lanka	
Brazil	France	Japan	Pakistan	Tajikistan	
Cambodia	Germany	Korea	Philippines	Thailand	

Group 2				
Afghanistan	Fiji	Laos	Peru	Turkey
Austria	Georgia	Malawi	Poland	Ukraine
Bulgaria	Greece	Morocco	Portugal	Venezuela
Costa Rica	Hungary	Mozambique	Slovakia	Yemen
Czech Republic	Jamaica	Niger	Sudan	
Dominican Republic	Kazakhstan	Panama	Taiwan	
Ethiopia	Kenya	Paraguay	Tunisia	

## Strategy for risk pooling

By pooling countries together, their aggregated Value-at-Risk (VaR) is minimised.

Intuitively 99.5% VaR = 1mil  
1 in 200 event of losing more than 1mil.

Continent	Africa	Asia	Americas	Europe
Sum Var	15.1	695.1	283.8	1182.8
Aggregate VaR	2.5	86.8	30.7	57

# Jamaica

Losses from all members in a cluster in the same calendar year are aggregated, per continent.

Cluster	Countries	Individual EmVaRs	Sum EmVaR	Aggregate EmVaR
1	Jamaica	174.58	378.26	208.32
	Paraguay	203.68		
2	Costa Rica	399.09	8,504.00	4,649.08
	Honduras	201.95		
	Peru	3,192.55		
	Venezuela	4,710.41		
3	Dominican Republic	62.44	157.30	96.59
	Panama	94.86		
Total			9,039.58	4,954.00

# Risk pooling at the continental level

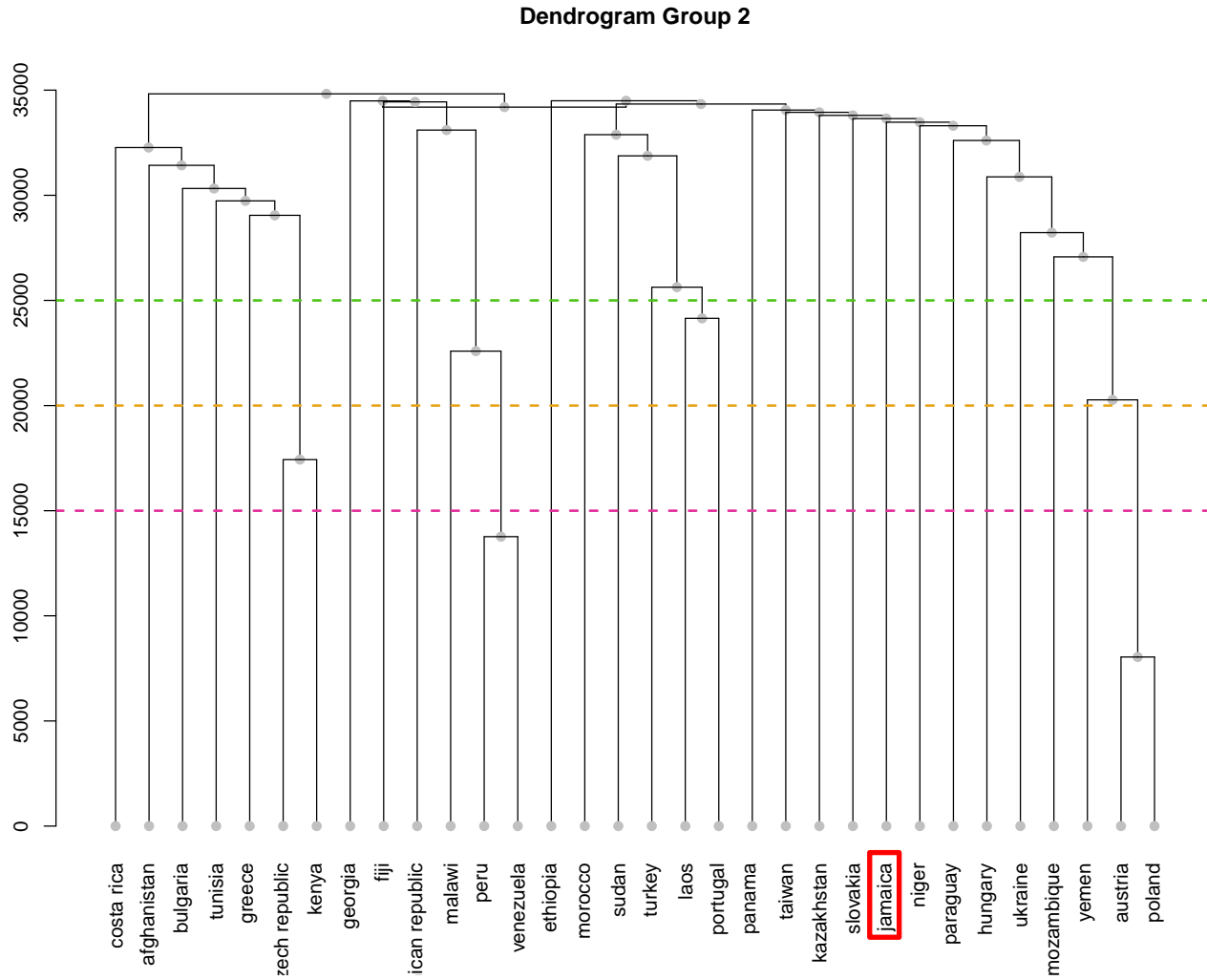
Anguilla  
Antigua & Barbuda  
Barbados  
Belize  
Bermuda  
British Virgin Islands  
Cayman Islands  
Dominica  
Grenada  
Haiti  
**Jamaica**  
Montserrat  
St. Kitts & Nevis  
Saint Lucia  
Sint Maarten  
St. Vincent & the  
Grenadines  
The Bahamas  
Trinidad & Tobago  
Turks & Caicos Islands  
Guatemala  
Nicaragua  
Panama

**Jamaica**  
Paraguay

Costa Rica  
Honduras  
Venezuela  
Peru

Dominican  
Republic  
Panama

# Risk pooling at the global level



## Key takeaways

- Equal partnerships.
- Widespread immediate financial response to a disaster.
- Vulnerable communities better financially shielded from the aftermath of natural disasters such as flooding.
- We advocate for risk pooling between regions as a mechanism for reducing risk premiums and increasing efficiency in disaster response.

# References

1. Henshaw, K., & Constantinescu, C. (2021). Rethinking Flood Risk Management  
<https://environmentjournal.online/articles/rethinking-flood-risk-management/>
2. Ni, W., Henshaw, K., Zhu, W., Wang, J., Hu, M., & Constantinescu, C. (2020). On flood risk management across socio-economic environments. Revista Anales del Instituto de Actuarios Españoles.  
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