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Excessive Rainfall Protection: A Parametric, Satellite-based Insurance Solution

Megan Linkin, Ph.D., CCM

Natural Hazards Expert, Swiss Re Global Partnerships

Hydrology and Disaster Response Panel

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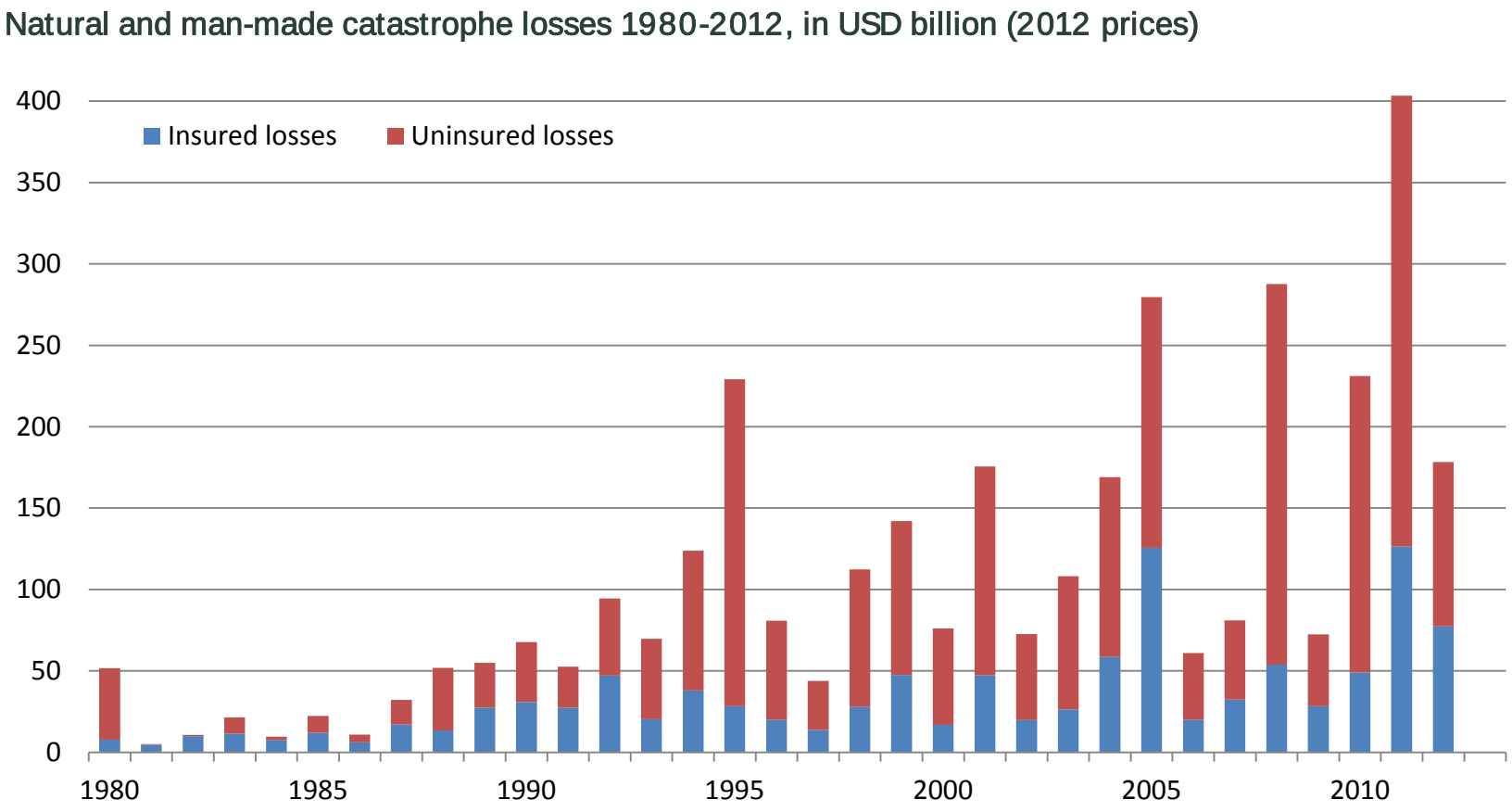
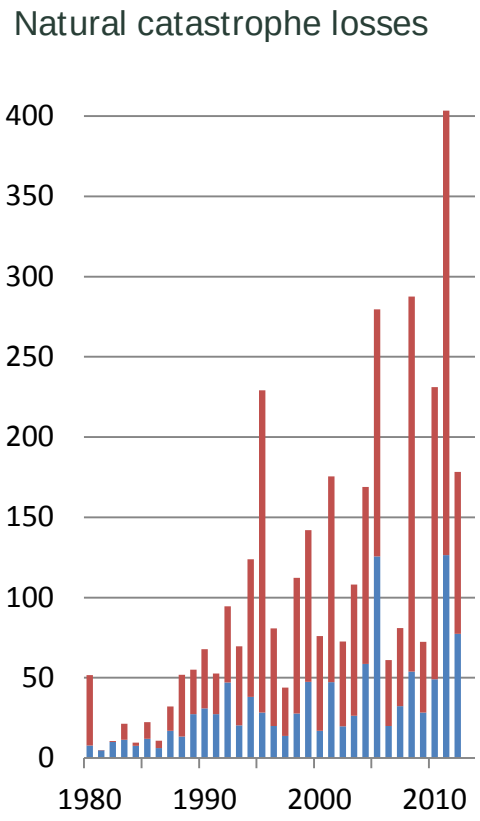
Massive gap between total and insured losses shows insurance potential



Source: Swiss Re Economic Research & Consulting, *sigma* catastrophe database

Disasters place a significant burden on the public sector



- Despite prevention and mitigation efforts, no country can fully insulate itself against extreme natural disasters
- The brunt of economic losses from natural disasters ends up with individuals, corporations and governments, both on national and sub-national level
- Government budgets are impacted by:
  - Primary effects include immediate expenses for emergency relief efforts, costs for rebuilding public infrastructure or loss of capital and durable goods
  - Secondary effects, for instance, include lower economic growth, lower tax and non-tax revenues, budget deficits, increased indebtedness and costs from refinancing, higher inflation or currency movements

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Traditional vs. Parametric – Benefits to buyer

Topic	Traditional Insurance	Parametric Solutions
Use of Proceeds	Intended to cover loss sustained	Used at buyers discretion
Speed of Payment	Subject to loss adjustment (can be slow)	Rapid: 2 – 6 weeks
Loss Adjustment / Administrative Process	Yes - buyer may need own claims adjusters	No – little claims administration needed
Transparency	Loss settlement is complex to explain	Parametric triggers easier to explain
Pricing Flexibility	Limited modifications	Structure can be adjusted to price
Changes in Exposure	Annual adjustments	No adjustment needed

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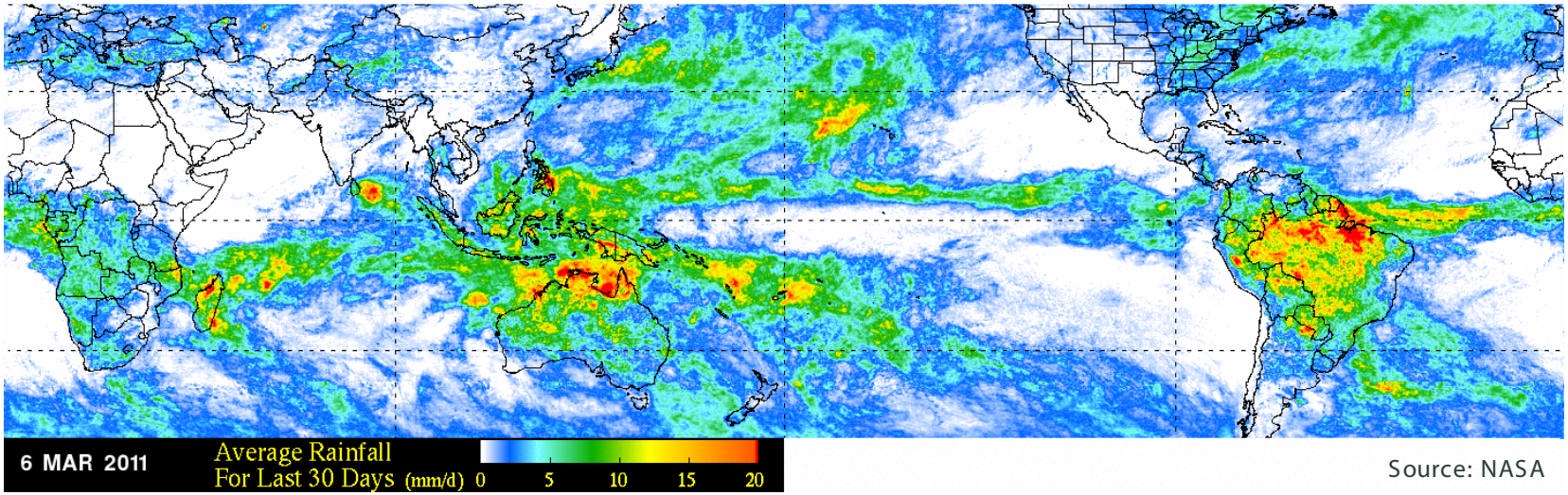
Motivation

- Excessive rainfall and flooding – The only true global peril
- Numerous events in 2013 have demonstrated the vulnerability of urban and rural regions to flooding events.
  - Calgary floods (Canada)
  - Typhoon Utor/monsoon rains (Philippines)
  - Hurricane Ingrid and Tropical Storm Manuel (Mexico)
- According to Swiss Re's *Mind the Risk* report, riverine flood has the potential to affect more people (379 million) in urban areas than any other peril
- Many areas have insufficient or inaccurate in situ weather observations
- Must rely on remotely sensed rainfall to detect excessive rainfall/flood events

Tropical Rainfall Monitoring Mission
Satellite-based Accumulated Rainfall



Source: NASA

- Joint venture between NASA and JAXA.
- Precipitation estimates provided at 3 hour intervals for all longitudes between 60°S – 60°N on 0.25° longitude x 0.25° latitude
- Globally homogenous data available on a near real time basis.
- Captures both extreme events (tropical cyclones) and continuous, consistent rainfall (monsoon-related rainfall).

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Parametric Satellite-based Torrential Rain Cover: *How does it work?*

Overview of potential torrential rainfall cover

Country's citizens
- Claims payment can be used for emergency relief, immediate infrastructure repair, reconstruction, compensation to people etc.

Government

Purchases parametric rainfall cover with Swiss Re

Notify Swiss Re about the torrential rainfall

Obtain claims payment (in 2-6 weeks time)

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Torrential Rainfall

1. Defines the population in flood prone districts
2. Determine the maximum daily/3/5/7 day accumulated rainfall (above a pre-defined trigger) at each grid point
3. Calculate torrential rain exposed population
4. Determine the total payout based on the torrential rain exposed population

Example of a potential torrential rainfall cove

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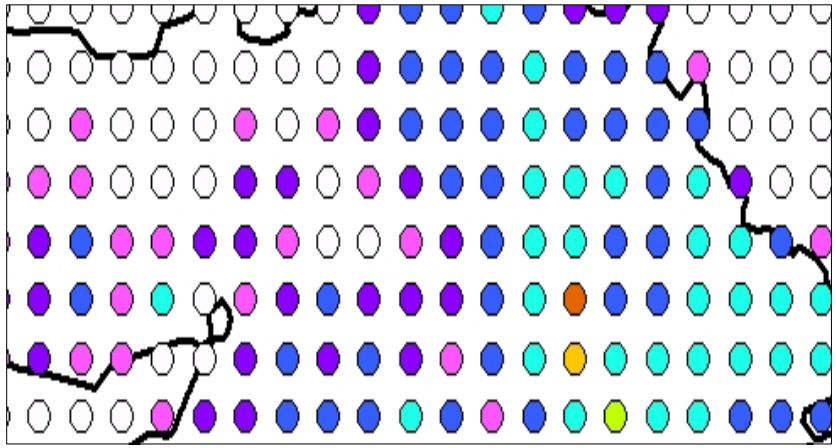
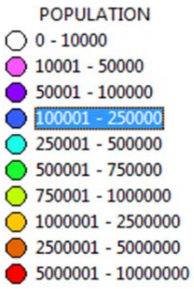
Step 1: Define the population in flood prone district





- The area is defined and divided into grid points.
- Each grid point measures approx. 28km x 28km.
- The population attached to each grid point is based on the Geographic Information System (GIS) population data.

Example of a potential torrential rainfall cover

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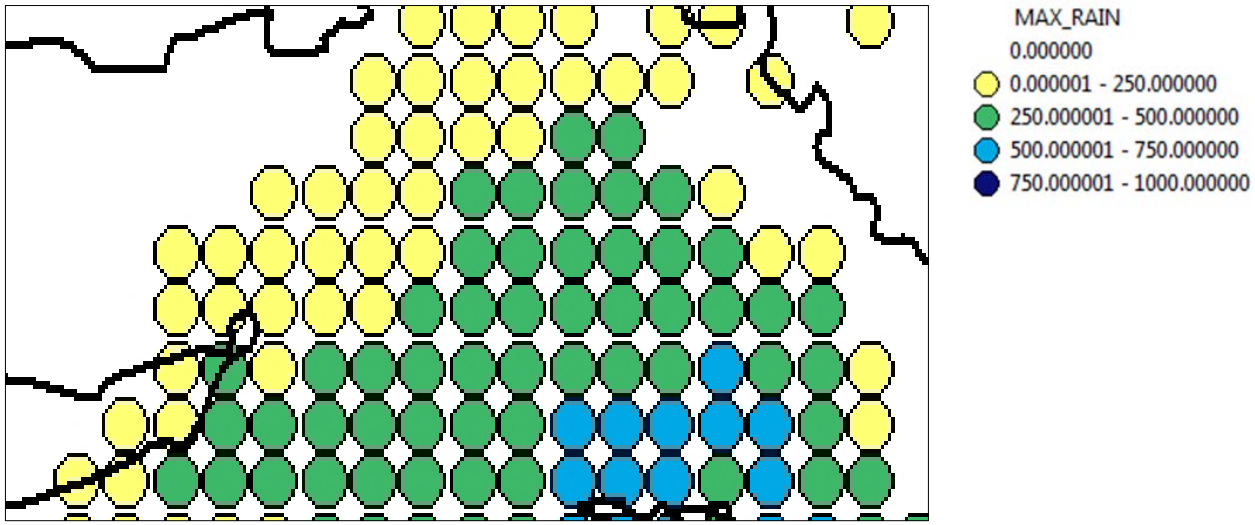
In the event of a torrential rainfall…

Step 2: Determine the maximum daily/3/5/7 dayaccumulated rainfall (above pre-defined amount) at each grid point from satellite-based precipitation for each event

Trigger is based on rainfall intensity as measured by satellite technology (such as TRMM – Tropical Rainfall Measurement Mission, operated jointly by NASA and the Japanese Space Agency).



Example of a potential torrential rainfall cover

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In the event of a torrential rainfall…

Step 2: Determine the maximum daily/3/5/7 dayaccumulated rainfall (above pre-defined amount) at each grid point from satellite-based precipitation for each event

The accumulated rainfall for day (i) is the sum of the rainfall measured on day (i -1), day (i) and day (i +1). For example in grid cell 1, the accumulated rainfall on day 2 in the above table is the sum of day 1 (0.00 mm), day 2 (67.05 mm) and day 3 (118.02 mm).

Illustrative

Day	Grid Cell 1: Daily rainfall (in mm)	Grid Cell 1: Accumulated rainfall (in mm)	…	…	Grid Cell 386: Daily rainfall (in mm)	Grid Cell 386: Accumulated rainfall (in mm)	National Flood Event
1	0.00	67.05			0.00	0.00	×
2	67.05	**185.07**			0.00	11.85	✓
3	118.02	**204.48**			11.85	80.01	✓
4	19.41	**186.90**			68.16	146.46	✓
5	49.47	72.96			66.45	**204.06**	✓
6	4.08	53.55			69.45	140.76	×
7	0.00	91.83			4.86	74.31	×

Example of a potential torrential rainfall cover

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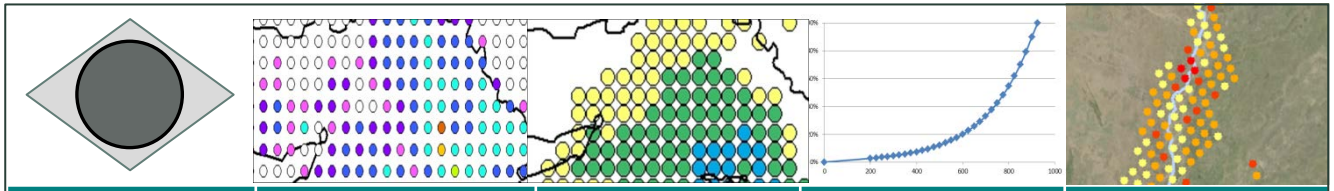
Step 3: Calculate the torrential rain exposed population (using pre-agreed intensity-impact factor relation)



Grid Point No.	Exposed Value (e.g. population)	Maximum Rainfall (mm)	Percentage Impacted (%)	Affected Population
20	117,520	708.28	33.12%	38,922
76	211,958	917.12	90.02%	190,804
124	74,145	248.17	3.08%	2,284
...	...	...	...	...
151	174,171	195.91	0%	0
157	136,969	489.54	10.75%	14,725
...	...	...	...	...
271	458,261	618.56	20.09%	92,065
303	132,110	210.96	2.72%	3,593

Σ → **5,214,157**

Example of a potential torrential rainfall cover

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Step 4: Determine the total payout based on the torrential rain exposed population (calculated in Step 3) and the proposed payout table below

Torrential Rain Exposed Population (as calculated)	Index Value		Payout (Currency Unit)
	From	To	
<50'000	0	0.0049	0
50'000 – 100'000	0.005	0.010	50
100'001 – 250'000	>0.010	0.025	75
250'001 – 500'000	>0.025	0.050	100
500'001 – 1'000'000	>0.050	0.100	250
1'000'001 – 2'000'000	>0.100	0.200	500
>2'000'000	>0.200		1,000

Total Exposed Population (as calculated in Step 3): 5'214'157

Therefore, the government would have received CU 1,000 for the sample event.

Parametric torrential rainfall cover
Pros and Cons

Pros

- Satellite-based precipitation estimates allow for excessive rainfall product development in areas poorly observed.
- Numerous options for exposure base: Population, industrial exposures, infrastructure.
- Globally homogenous, high resolution data allows for consistent product development country to country.
- Historical availability allows for pricing and settling on the same dataset.
- Data availability in real time on a public website facilitates settlement/ claims process.

Cons

- Satellite estimates provide a snapshot, creating the possibility that some very short duration events are missed.
- No consideration of antecedent conditions or runoff patterns, meaning a moderate rainfall event which occurs over saturated ground might not produce a pay out but could produce a flood.

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Thank you

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