



# How parametric re/insurance can support the development of insurability

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# Agenda

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 **Intro into Parametrics**

 Case Studies

 Towards the new frontier of parametrics

# Background and motivation

## INSURANCE MARKET IS EVOLVING BUT KEY CHALLENGES REMAIN:

### Protection Gap

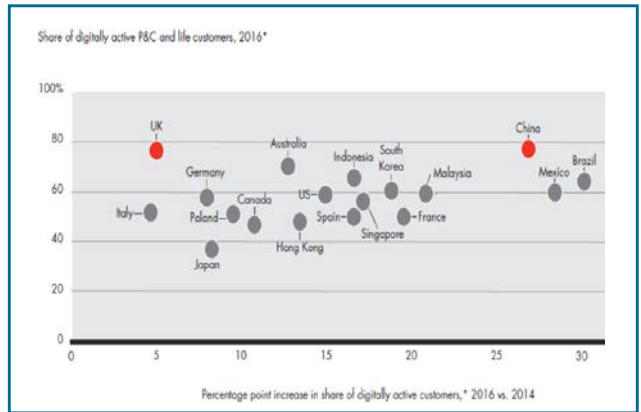
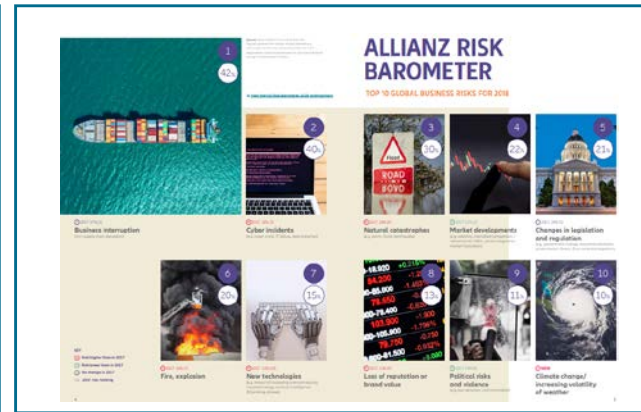
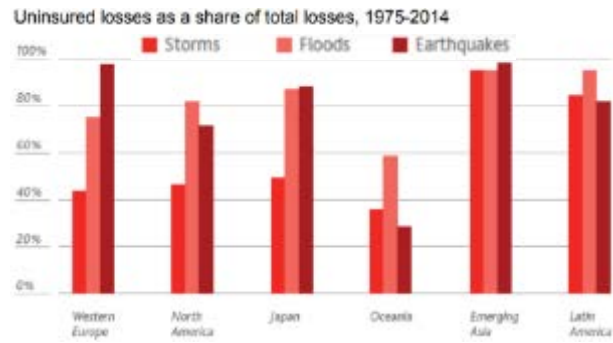
- 90%+ of Emerging Asia cat losses uninsured
- Quake losses largely uninsured worldwide
- Gap increasing over time

### Corporate risk landscape evolving

- Business Interruption top by 42% risk managers 6<sup>th</sup> consecutive year
- Insurance as liquidity management vs risk transfer tool
- Speed of settlement and clarity of trigger still a concern

### Rise of Digital and Internet of Things

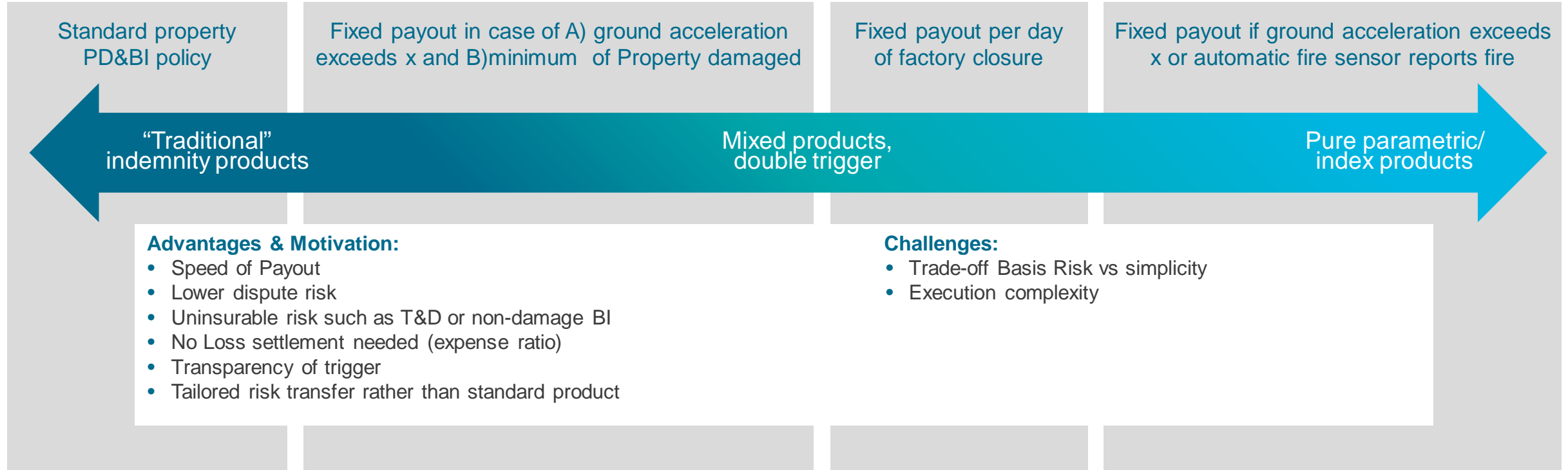
- Nr of connected devices grew by 31% to 8.4bil from 2016 to 2017
- Estimated 20bil connected devices 2020
- Enabling increased pricing precision, faster settlement, lower costs



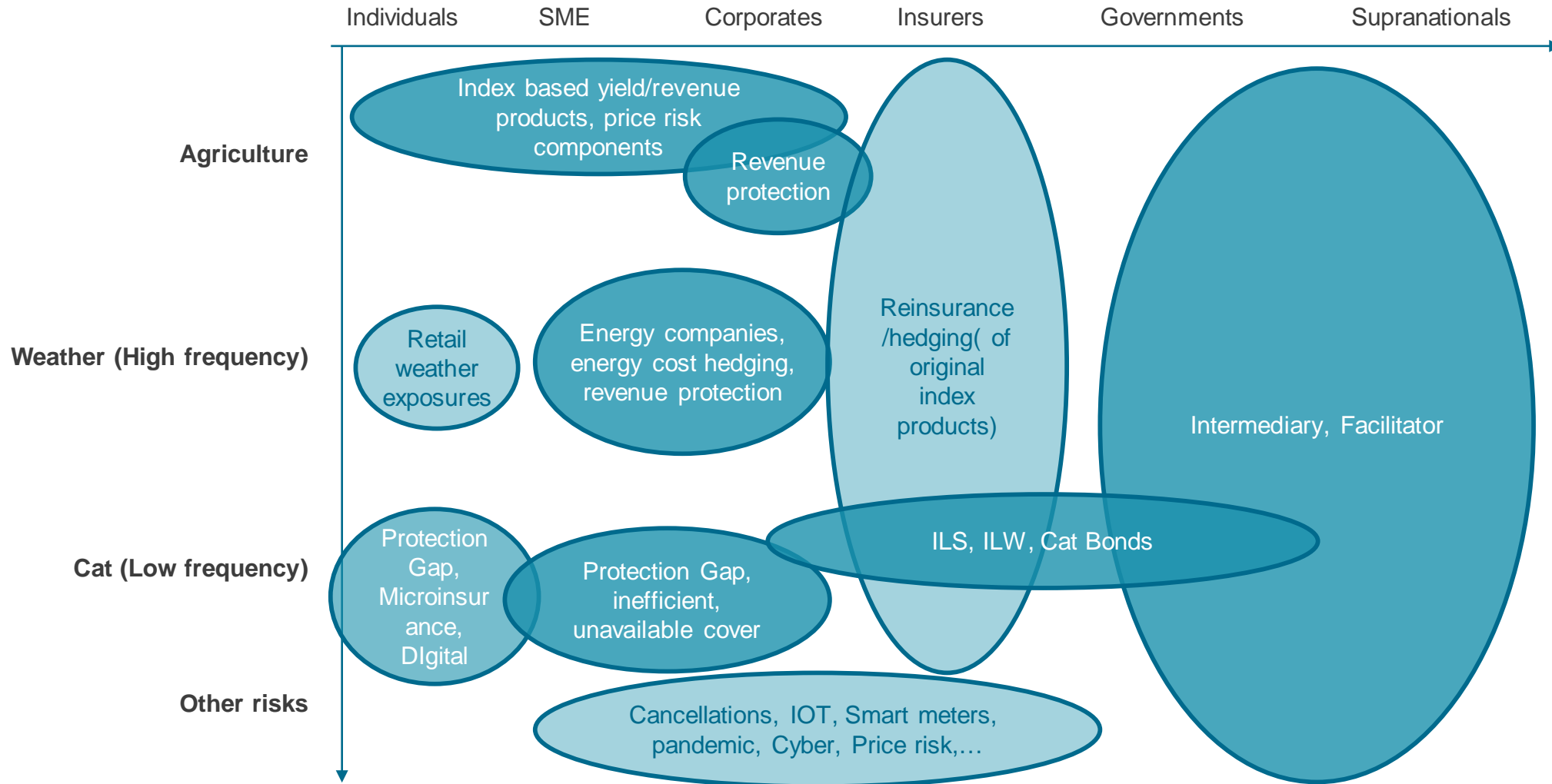
➔ Parametric approach is one of the answers...

# What is parametric?

- World Bank: *Index, or parametric, insurance pays out benefits based on a pre-determined index for the loss of assets and investments as a result of weather or other catastrophic events. In contrast, traditional insurance relies on assessments of the actual damage.*
- SCOR: Insurance or derivative product with a payout structure that does not solely depend on protection buyer's incurred loss but rather is linked to an externally observable variable or index, e.g. weather, market loss, prices.



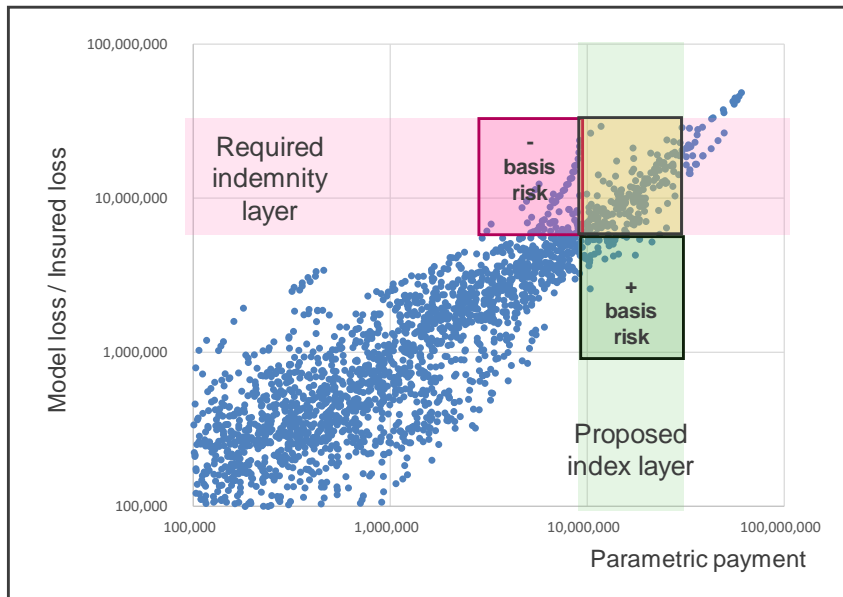
# Parametric market by buyer & peril



# Basis risk management is key for the efficiency of parametric solutions

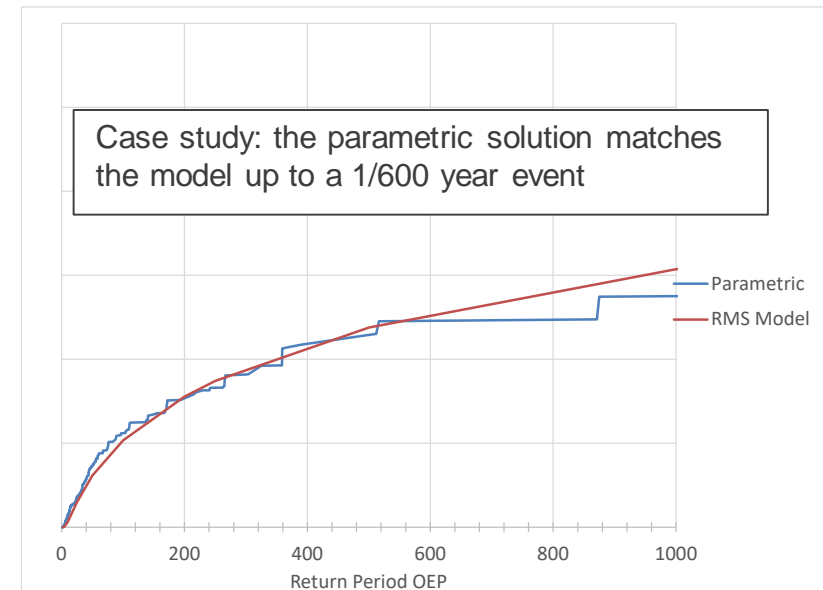
## Basis risk

- Basis risk = difference between the parametric payment and the ultimate losses of the covered portfolio
  - Negative basis risk: no index payout but high losses
    - no recovery when needed
  - Positive basis risk: index payout but limited loss
    - impact on pricing



## Optimization

- Basis risk reduction algorithms are essential to the relevance of the solution for the (re)insured
- SCOR has developed a state-of-the-art optimization tool to fit parametric pay-outs with expected model losses



# Agenda

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 Intro into Parametrics

 **Case Studies**

- Support for Innovative Power Technologies
- Support for Economy in Disruptive Regions
- Collaboration with Governments and Supranationals

 Towards the new frontier of parametrics

# Parametric solutions for corporate clients



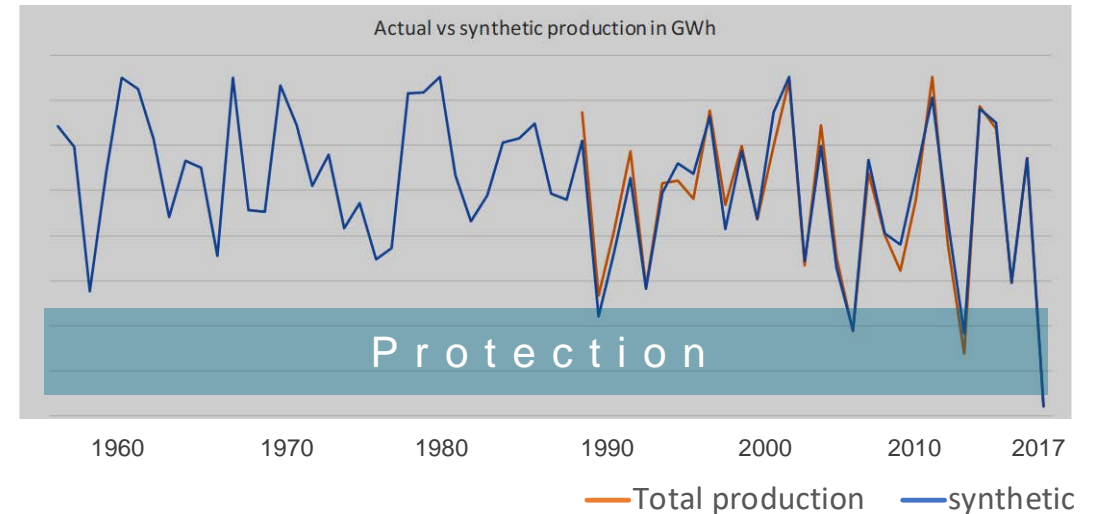
Sector	Risk factor	Consequences
Energy	Rainfall, Temperature, Wind, Sunshine	Energy demand by consumers Production capacity
Agriculture	Rainfall, Temperature	Impact on yields
Construction	Temperature, Wind	Work interruption Extra costs and late penalties
Sports, Events	Rainfall	Cancellations
Retail	Rainfall, Temperature	Decrease of sales
Transportation	Ice, Snow	Access, Cancellations
Travel, Leisure	Rainfall, Snowfall, Temperature	Customer satisfaction
Public Authorities	Rainfall / Snowfall, Temperature	Costs of snow removal, salting



# Case study: Revenue shortfall protection for hydro power generation

## Client profile

- Turnover from hydro generation dropped by over 2/3 following a catastrophically dry year. Power prices did not compensate the shortfall. Client interested in limiting similar impact in the future and willing to consider



## SCOR solution

- Protecting revenue directly difficult due to moral hazard and regulatory interventions redirecting flows
- Parametric Index developed based on river flow data exhibiting 95% correlation with actual production
- Payout based on defined layer and fixed price per GWh
- Term 1 to 5 years
- Considered financing through upside in “good years”, similar to a swap structure

## Benefits

- Revenue floor:** Transparent min guaranteed revenue
- Multi Year volatility management:** Use inherent volatility up&down to its advantage
- Financing flexibility:** can pre- or post-finance losses

# Case study: Combining traditional and parametric coverage for Solar Park

## Client profile

- Investor into a 100MW solar park wants to protect its cashflows against the impact of standard property damage, consequential loss, but also lack of solar irradiation loss.

## SCOR solution

Combine traditional coverage, structured elements and parametric approach:

- Property Damage and Consequential Loss coverage on All Risk wording
- Other bespoke coverages included and sublimited
- Solar irradiation shortfall:
  - Based on 3rd party estimate of annual irradiation
  - Shortfall below 85% of expected irradiation
  - Payout covering approx. 30% of actual financial shortfall
  - Reflect negative correlation temperature vs irradiation



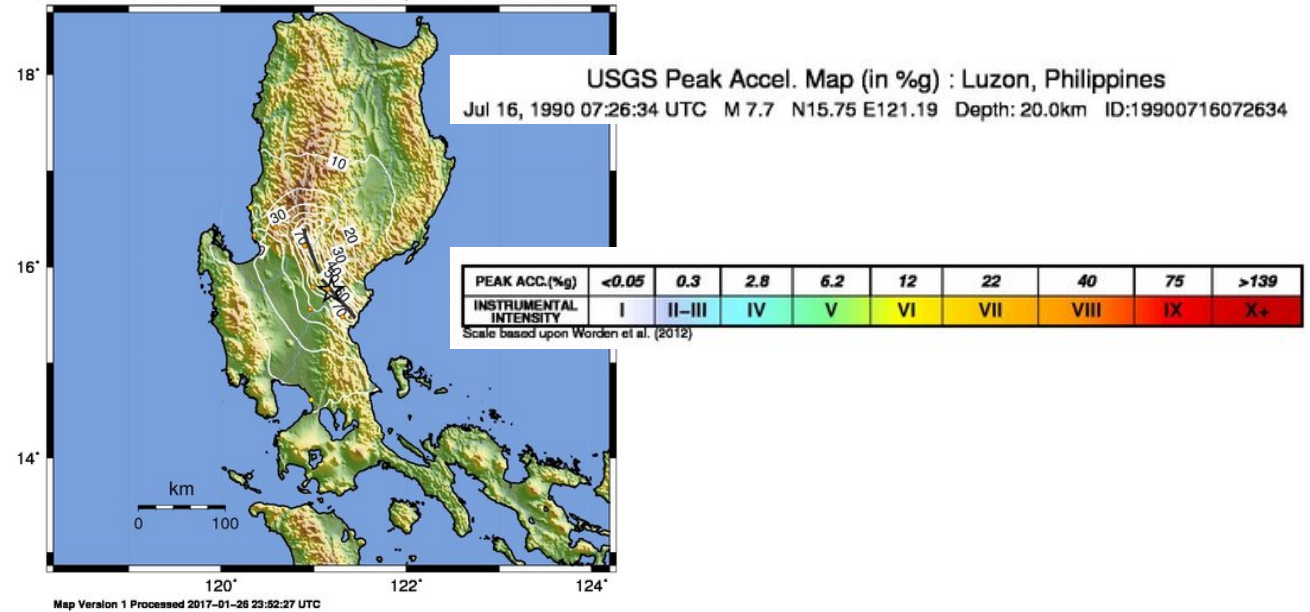
## Benefits

- **Fixed cost:** Cost can be budgeted for the whole project duration
- **Hollistic coverage:** Combining traditional and parametric elements
- **Structuring flexibility:** Uninsurable risks can be financed over time

# Case study: Cat protection for T&D Lines provides budgeting certainty

## Client profile

- Transmission & Distribution network in the Philippines exploring alternative ways of buying a cover for its Wind and Quake cover. Parametric approach preferred as T&D traditionally considered uninsurable with unpredictable loss potential.



## SCOR solution

- Bespoke **parametric index** developed by peril to proxy actual damage
  - Earthquake based on US Geological Survey Shakemap post event measurements
  - Windstorm index based on extrapolated windspeed field from the observed typhoon track
  - Rain index following typhoon based on satellite imagery

- Localized approach with exposure represented by Province weights
- Term:** 3 years

## Benefits

- Cash flow:** Fast settlement based on available weather/cat measurements
- Cost predictability:** Fixed cost advantageous for a government owned/run business
- Structural flexibility:** implement any deductibles or bespoke “rain following typhoon” structures

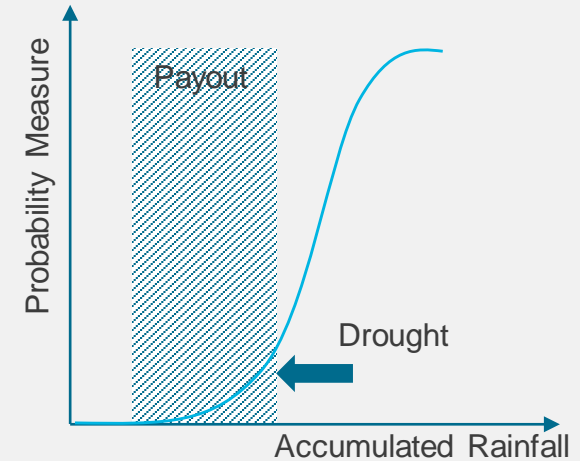
# Case study: Solar Power Plant Cover Against Lack of Rainfall

## Client Proposition

- A solar power plant requires water to cool down its innovative mechanism and engines
- It faces the paradox not to be able to operate following long-term drought
- Empty water reservoir hinders it to benefit of sunny and warm days.

## SCOR solution

- Considering accumulation of rainfall over multi-year periods
- Structuring a Put Option paying if rainfall falls below a given Strike point
- Commensurately to a fixed Tick Value
- Rolling over calculation periods



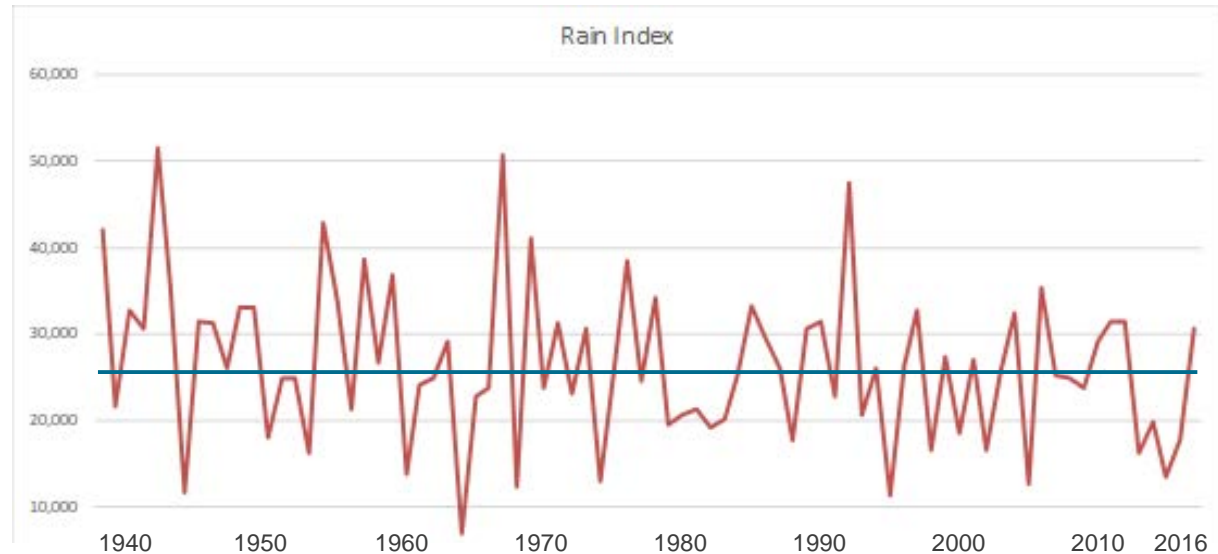
## Benefits

- Compensate lack of revenue from inoperative plant

# Case study: Attendance Shortfall at Water Park due to Rain

## Client Proposition

A worldwide operator of Entertainment Parks reports a volatile attendance profile on a Water Park in recent years. They want to protect their revenues from fluctuation due to shortfall caused by frequent rain.



## SCOR solution

- Definition of an **Index**
- Number of days with rain level higher than a given threshold
- For each, accumulate X% of the average daily attendance plan
- The total over a season from June to September is the Index
- A **Payout** is agreed per attendance shortfall measured in the Index
- Historical measures indicate that recent years are not so exceptional, leading to a relatively expensive cover → SCOR suggest to limit coverage in excess of a threshold
- Cover premium in the one-digit percentage of the limit

## Benefits

- Revenue Protection against Weather risk
- Fixed costs and budget certainty
- Manageable Basis Risk through Index-Shortfall alignment

# Wild Fire Parametric Cover of Forestry

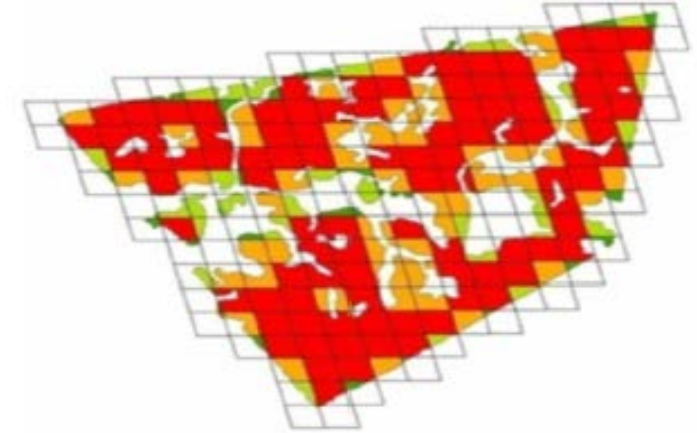
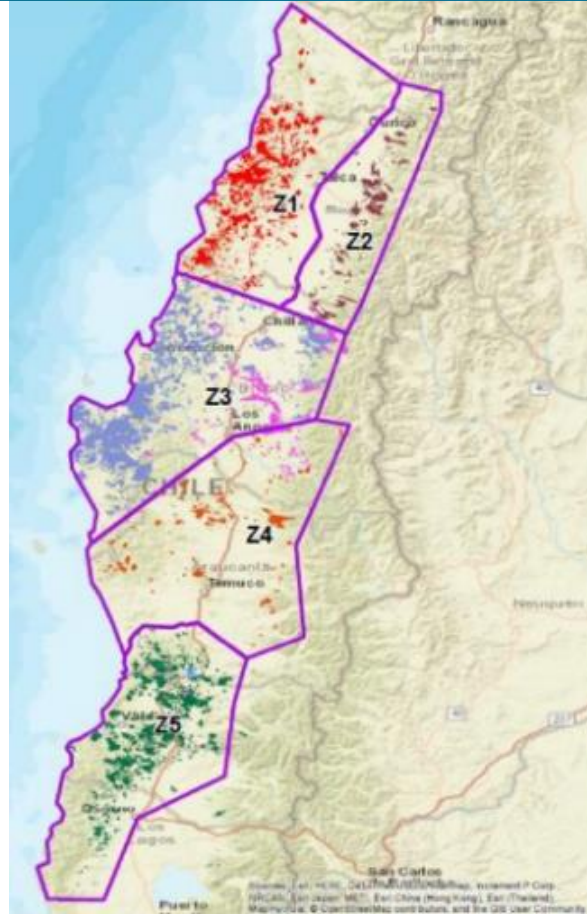
## Support to the local economy in sensitive regions

### Client Proposition

- Forest exploitations suffer from wild fires
- Wide-spread plantations display diverse ages and species at locations
- Delays in liquidation and disputes over volume or salvage levels create insecurity on actual losses

### SCOR solution

- Exploiting daily satellite pictures by picturizing every single hectare burnt
- Defining payout by zone depending linearly on the extent of the zones burnt
- Agreeing on a Calculation Agent analysing satellite data
- Setting excess-layer on loss index



### Benefits

- No dispute on settlements
- Fast access to liquidity
- Very good alignment between actual losses and structured index

# Case study: Multiple-Trigger Coverage for Volcanic Eruption

## Example of support to the local economy in disruptive regions

### Client Proposition

- Volcanic regions are also centres of intense economic activities
  - Some volcanoes shelter tourism like Mounts Fuji, Bandai and Zao
  - Mount Sakurajima hosts the activities of the large city of Kagoshima
- Evacuation or Warning for eruptions is prejudicial to tourist industries or SME



### SCOR solution

- Considering warning level in relation to the normal level of volcanic activities
  - Mounts Fuji, Bandai and Zao are less active but a warning level of 4 out of 5 can drag tourists away
  - Mount Sakurajima is very active but evacuation (level 5) would paralyze the economy
- Building an index combining warning level, effective eruption and evacuation order
- For an immediate fixed payout to policyholders

### Benefits

- Protection and support of industry and services in catastrophe-exposed area
- Fixed costs and budget certainty
- Manageable Basis Risk through double trigger

# Case Study: Parametric earthquake reinsurance in Taiwan

**Client:** Insurance Company, Taiwan

**Territory:** Taiwan

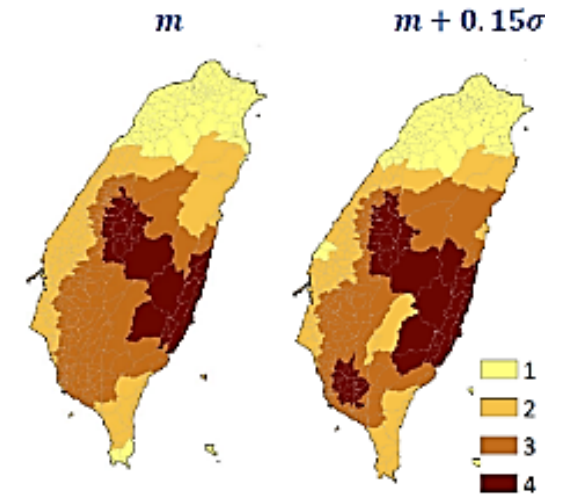
**Form:** QS reinsurance of a parametric EQ product, targeted at SME, residential

**Trigger:**

- Earthquake  $M \geq 7.0$  in Taiwan
- Payout decreasing function of distance to epicenter

Rate (‰)

Trigger Magnitude	$M_L 7.0$	
	$m$	$m + 0.15\sigma$
1	0.23	1.01
2	1.06	3.62
3	1.79	5.70
4	2.80	7.76



$m = \text{mean} ; \sigma = \text{standard deviation}$



# Case Study: Large Cities coverage

**Client/Reinsured:** Chinese insurance company

**Original Insured:** City governmental bodies in Guangdong province

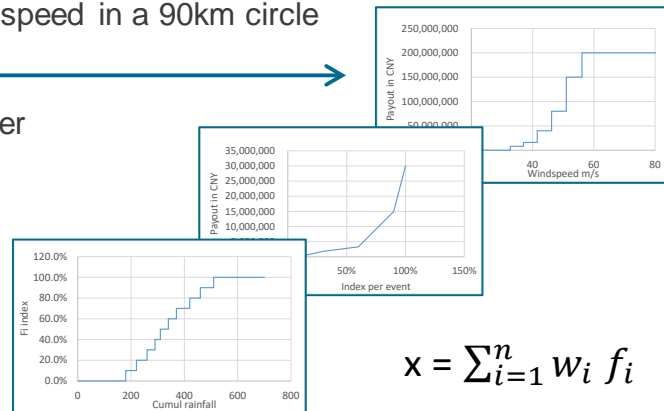
**Form:** QS reinsurance of underlying product

**Term:** 3 years



## Trigger/Coverage example for 1 city

- **Typhoon:** max 2min average windspeed in a 90km circle
- Payout based on a table
- Measurement National meteo center
- Premium 8.6mil CNY (4.3% ROL)



$$x = \sum_{i=1}^n w_i f_i$$

- **Rainfall:** 47 stations in Shantou City, measure from A to B
  - A when any station 3 day cumul >50mm
  - B when all stations cumul <50mm
  - Index for each event
  - $w_i$  county weights,  $f_i$  severity based on cumul rainfall
  - Payout based on Index  $x \rightarrow$
  - Additional payout for stations with daily rainfall >300mm
  - Measurement Hydrological Bureau

# Philippines Parametric Cover based on Post-event Emergency Loss

## Example of collaboration with government and supranational entities

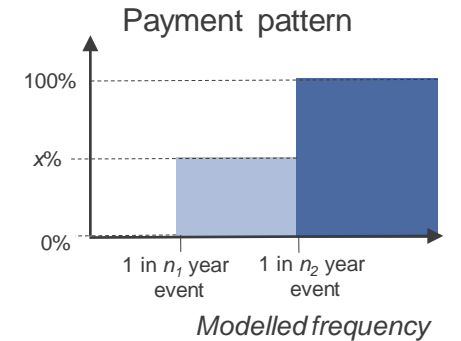
### Risk

- Philippines regularly swayed by natural catastrophes like typhoon, earthquake, flood
- Immediate recovery is key for local economy to get back on their foot
- Hazard map is very broad due to distribution of islands.



### SCOR solution

- Wide-spread coverage, covering 25 provinces most impacted by climate disasters
- Reduced basis risk thanks to targeted modelling for climate resilience. Post-event emergency loss model tuned for Asia Pacific by Air Worldwide
- Defined pay-out by provinces and overall as a function of the modelled return period
- Fast pay-out



### Coverage program

- Government of Philippines (GSIS) launched a 1 year program in July 2017
- The World Bank IBRD acts as an intermediary to transfer the risk to a panel of international reinsurers
- 206 m\$ coverage against losses
- May be renewed by the end of 2018

# CCRIF Parametric Protection



- CCRIF (Caribbean Catastrophe Risk Insurance Facility) is a «pool» sponsored by 20 Caribbean and Central American Governments (Haiti, Bahamas, Jamaica, ...)
- Following Hurricane Ivan in 2004, these Governments rallied urgently to establish a disaster risk protection mechanism.
- A parametric protection contributes to the financing of the pool. It covers the risks of tropical cyclones, earthquakes and excessive rainfall.
  - First WB sponsored 30M\$ Cat Bond issued in 2014
- Benefits from parametric protection are calculated from a fixed payment table. The table reflects the expected intensity of the events.

## 2017 Hurricanes



- Hurricanes **Irma** and then **Maria** triggered the cover in 2017.
- ✓ 50+ millions USD have been paid in the aftermath of the storm season
- ✓ All payments made within 14 days (partial payments within 7 days)

## Latest developments

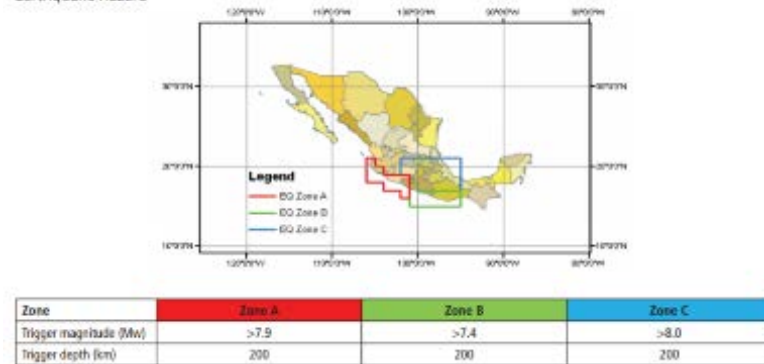
- All of the members have renewed their parametric risk transfer protection for the 2018-19 policy year
- 12 of the governments have increased their coverage
- 3 new members have joined the pool (British Virgin Islands, Montserrat and St. Maarten, 2018)

# Mexican FONDEN Parametric Protection

## FONDEN

- FONDEN (Natural Disasters Fund), Mexico's fund for natural disasters, established in the late 1990s to support the rapid rehabilitation of federal and state infrastructure after disaster.
- FONDEN resources are leveraged with market-based risk transfer instruments (parametric Cat Bonds and parametric reinsurance)
- Payment parameters are based on the magnitude of the earthquake or the minimum pressure for a storm.

Earthquake hazard



## Latest issuance

- IBRD / FONDEN 2017 multi-peril cat bond issued in August 2017
- \$360 million covering for 3 year
  - 150 million for earthquakes,
  - 100 million for a storm on the Atlantic side,
  - 110 million for a storm on the Pacific side.

## 2017 earthquake



- A magnitude 8.1 earthquake has struck off the coast of Mexico in September 2017
  - ✓ triggered the parametric protection for the maximum sum of 150 million
  - ✓ yet limited losses

# Agenda

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 **Towards the new frontier of parametrics**

# Towards the new frontier of parametric insurance



Phase 1 Minimal	Phase 2 Stressed	Phase 3 Crisis	Phase 4 Emergency	Phase 5 Famine
More than four in five households (HHs) are able to meet essential food and non-food needs without engaging in atypical, unsustainable strategies to access food and income, including any reliance on humanitarian assistance	Even with any humanitarian assistance at least one in five HHs in the area have the following or worse:  Minimally adequate food consumption but are unable to afford some essential non-food expenditures without engaging in irreversible coping strategies.	Even with any humanitarian assistance at least one in five HHs in the area have the following or worse:  Food consumption gaps with high or above usual acute malnutrition OR Are marginally able to meet minimum food needs only with accelerated depletion of livelihood assets that will lead to food consumption gaps.	Even with any humanitarian assistance at least one in five HHs in the area have the following or worse:  Large food consumption gaps resulting in very high acute malnutrition and excess mortality OR Extreme loss of livelihood assets that will lead to food consumption gaps in the short term.	Even with any humanitarian assistance at least one in five HHs in the area have an extreme lack of food and other basic needs where starvation, death, and destitution are evident.  (Evidence for all three criteria of food consumption, wasting, and CDW is required to classify Famine.)

**Weather-linked protections developing for corporate needs, insurers and governments.**

## Emerging trends:

- **Parametric insurance solutions for individuals**
  - e.g. Individual trip cancellation insurance, based on temperature or other weather-linked index
- **Parametric covers for other perils, based on advanced modelling and synthetic triggers**
  - e.g. famine risk
  - e.g. cyber risk