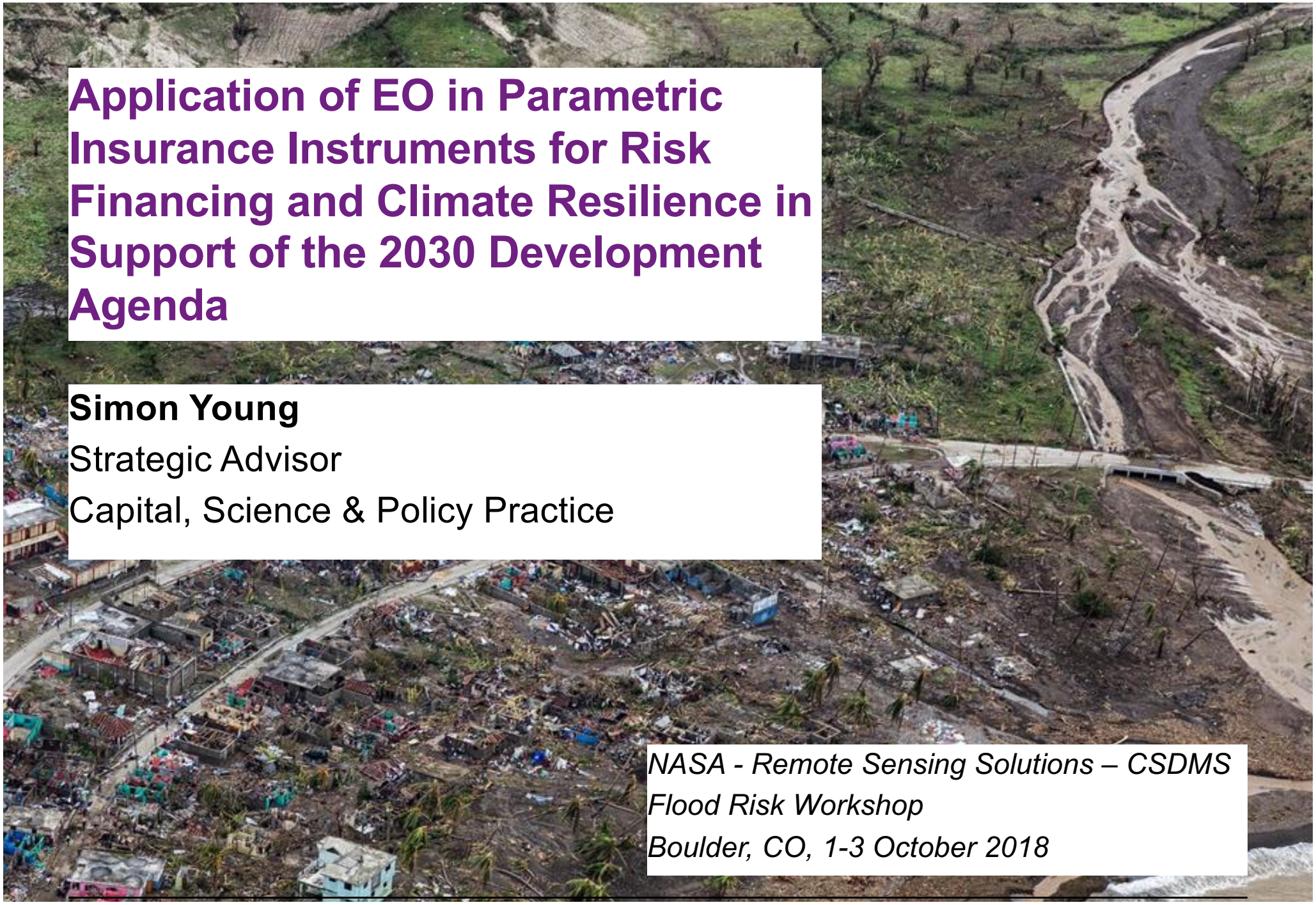

Application of EO in Parametric Insurance Instruments for Risk Financing and Climate Resilience in Support of the 2030 Development Agenda

Simon Young
Strategic Advisor
Capital, Science & Policy Practice

NASA - Remote Sensing Solutions – CSDMS Flood Risk Workshop
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Willis Towers Watson

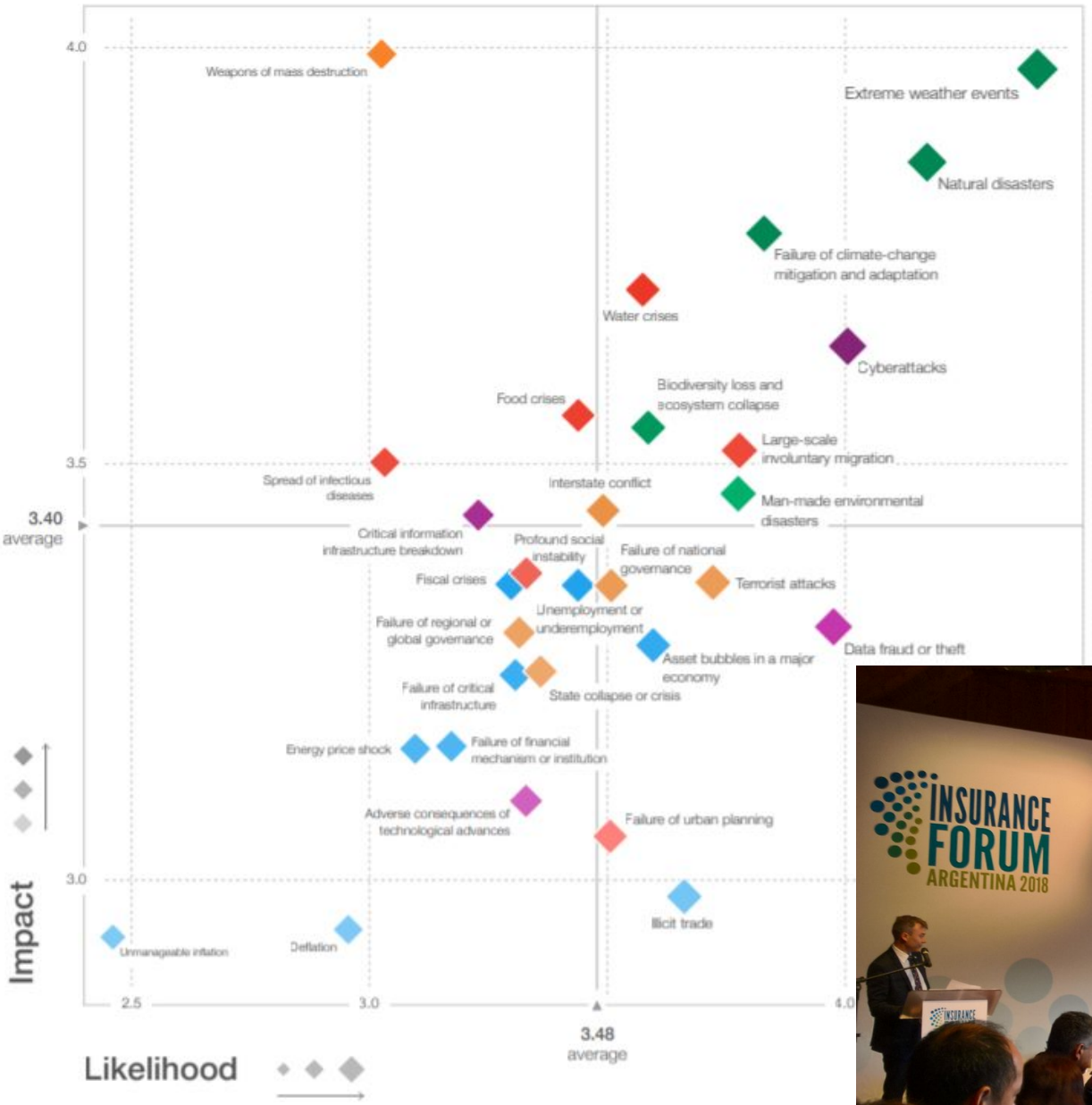
Overview

- Global setting for disaster risk management and financing
  - Applications in the development and humanitarian sectors
- Introduction to parametric insurance
- Practical examples of EO being used (or conceptualised) for parametric risk transfer in the development context
- Opportunities for and challenges to growth

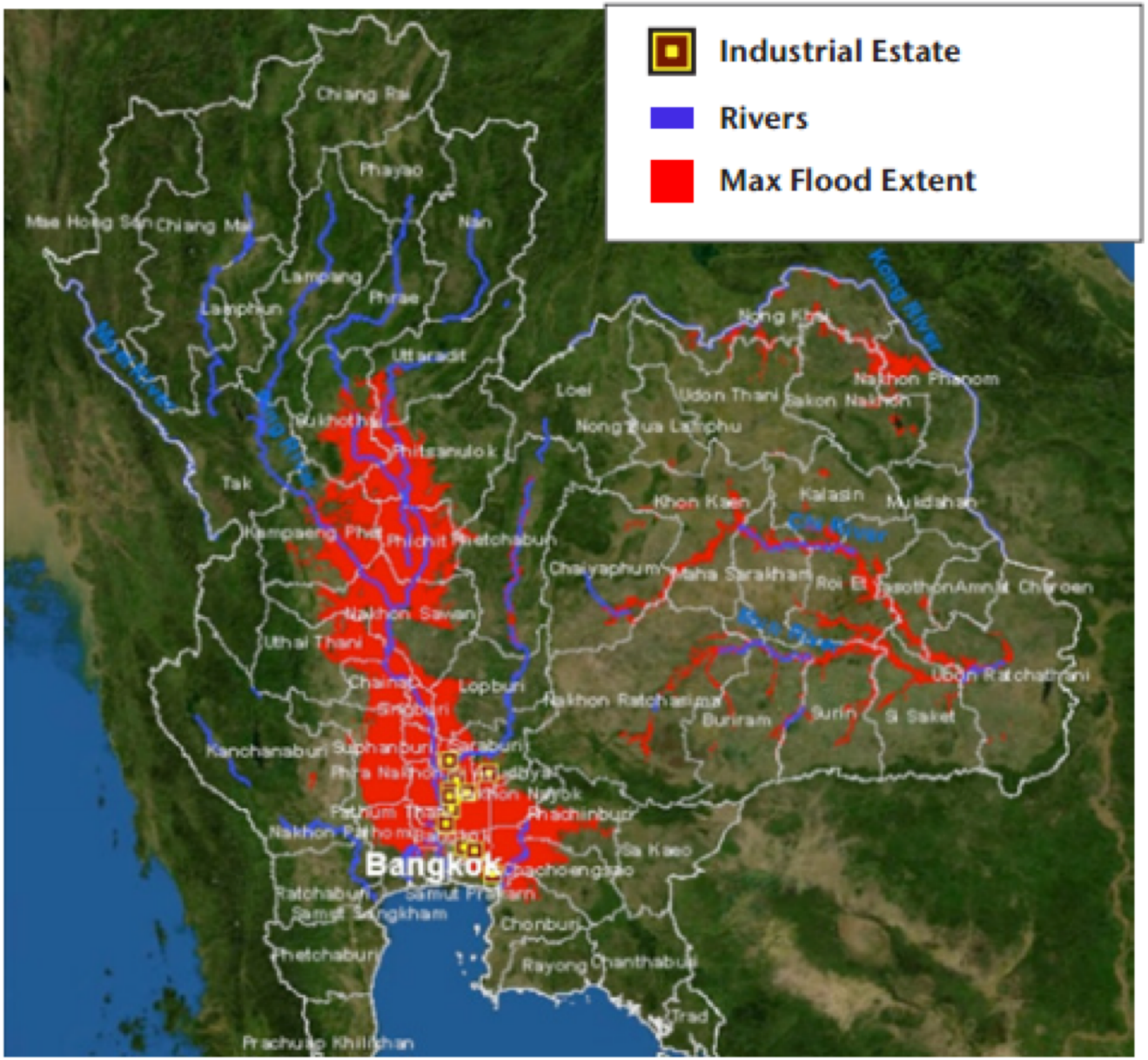
Global setting for natural disaster risk management and financing

Increased political profile of natural disaster risk

- A rapidly growing of awareness around increasing climate risk, and an urgent need for practical tools to manage the consequences through building resilience, have catapulted natural disaster risk management to the top of the global economic agenda
- WEF's Global Risk Outlook for 2018 places environmental risks at the top of its list
- First-ever G20 insurance forum was held last week in Bariloche
- Emerging and developing economies
  - SDGs recognise risk and the need for resilience at a macro level
  - The Paris Agreement identifies insurance as the key element of managing loss and damage as part of the broader adaptation effort
  - InsuResilience is a G7 initiative aimed at increasing climate risk insurance coverage by 400 million vulnerable people in the developing world by 2020



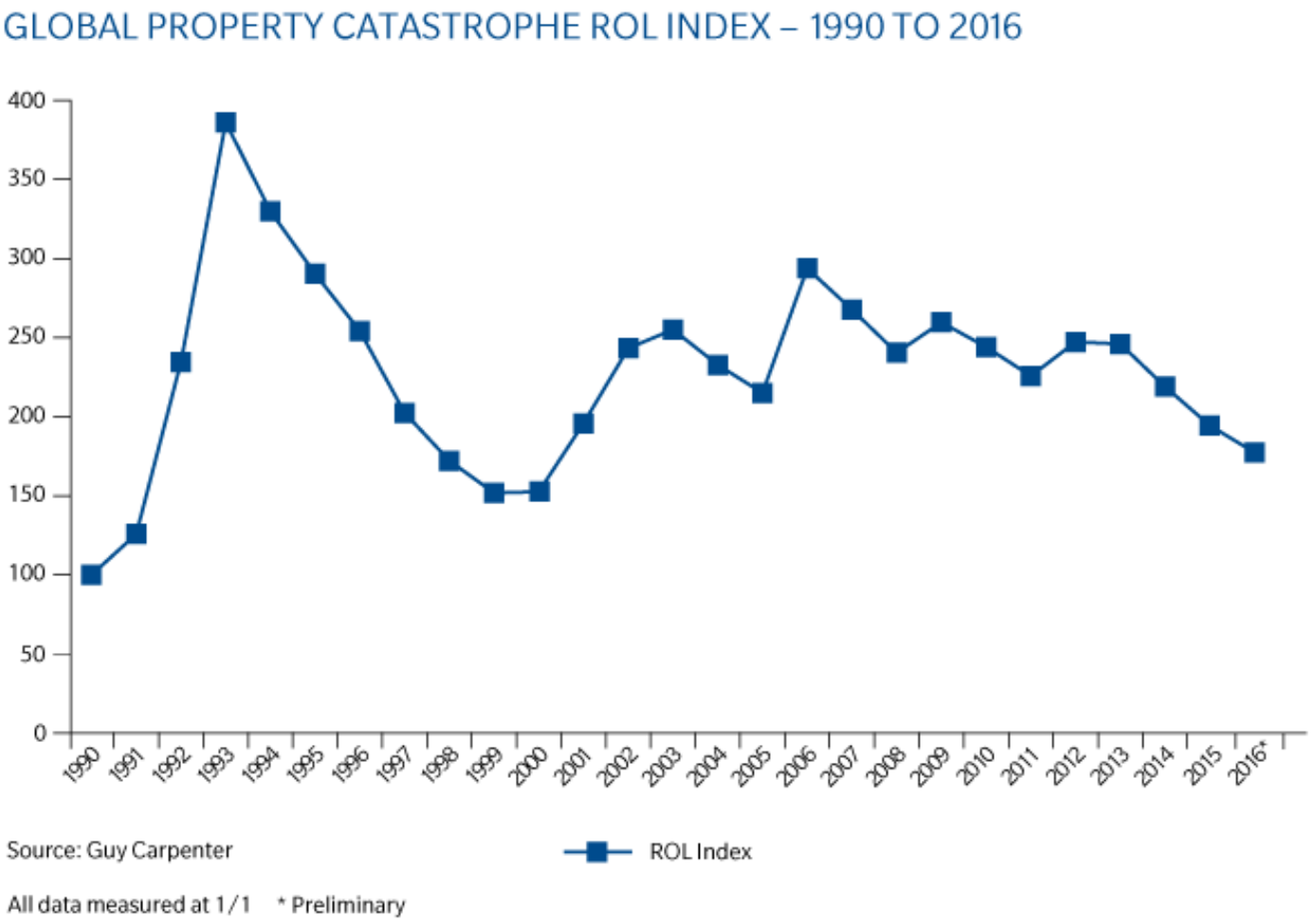
Thai floods 2011; wake-up call for climate risk to global supply chains



Increased ability to assess and understand natural disaster risk

- Catastrophe risk modelling, born in the late-80s, has evolved rapidly and is now fully mainstreamed into the global re/insurance markets which hold the vast majority of insured natural disaster risk
  - This has led to much greater stability and efficient capital deployment
  - It has also opened up a new investment asset class
- Deployment of such models is expanding, particularly in the support of climate risk assessment
  - Task Force on Climate-related Financial Disclosures (G20)
  - Regulatory developments in asset management and banking
- The ability to assess and quantify “acts of God” is bringing to the fore duty of care responsibilities for sovereigns to its citizens, and for corporates to its investors
  - *Force Majeure* as a concept in contract law is being redefined, as “100-year floods” can no longer be claimed as being unforseeable

Capital efficiency leading to lower and more stable pricing of global catastrophe risk



Disaster risk in the development context

- Natural disasters force 26 million people further into poverty each year and economic development is set back
  - Disasters cost $29bn a year across 77 of the poorest countries
  - International assistance covers about 8% of this – insurance absorbs around 3% - the rest is born by people, businesses and governments
- People with little financial protection are forced to sell their assets and their children stop going to school
- Government budgets are stretched
  - Investment in hospitals, schools and roads stalls
  - Development takes a step back

Adding the humanitarian element

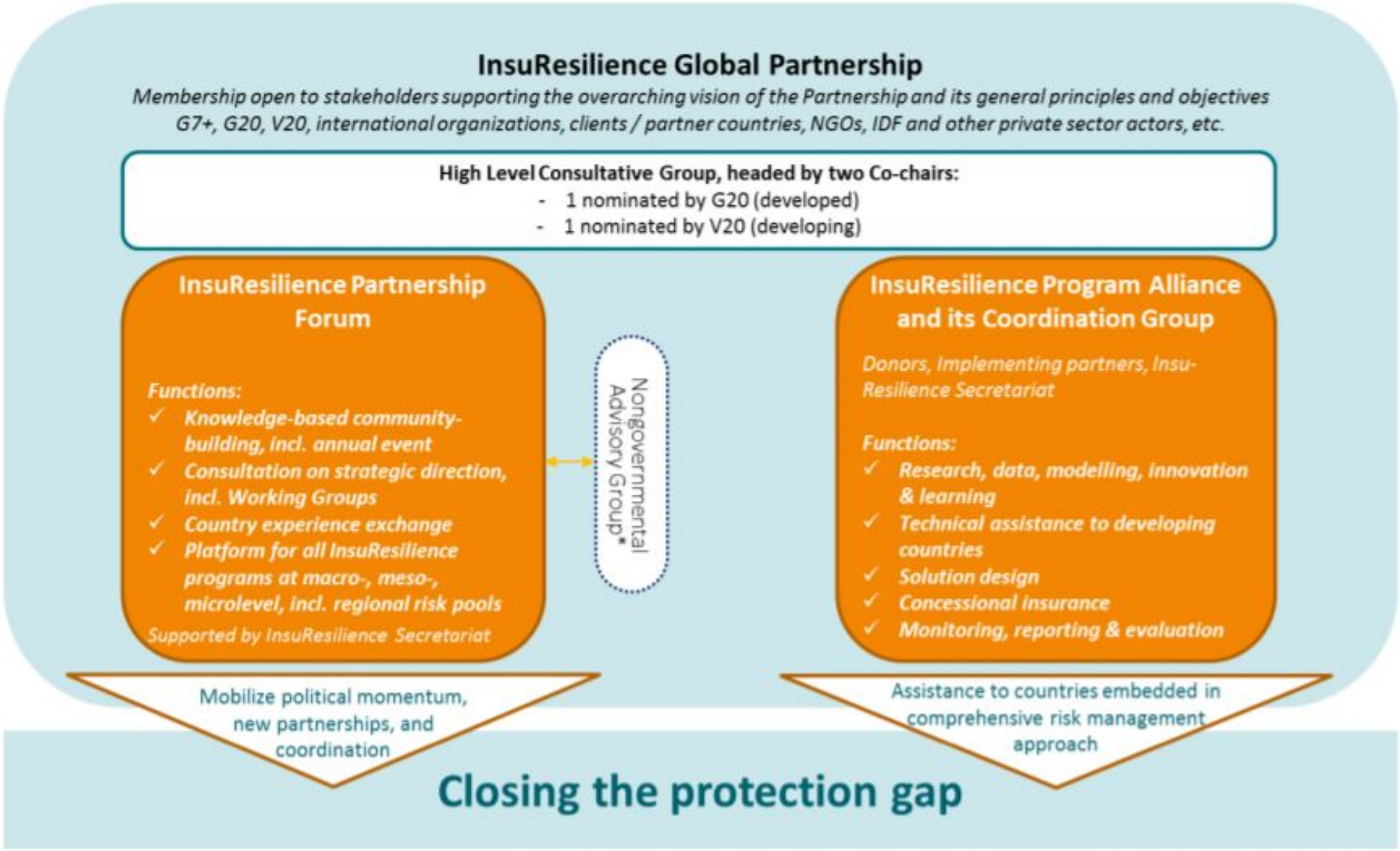
- In a recent book, “Dull Disasters” (Clarke & Dercon, 2016), the authors outline the key elements of an effective approach to disaster preparedness and crisis response:
  - **Coordinated plan for post-disaster action agreed in advance**. Need for a single, credible disaster response plan which explicitly defines stakeholder responsibilities (who or what will be protected, against what, and who will pay for what), is supported by a clear decision process, and clarifies risk ownership (e.g. between a sovereign government, development and humanitarian partners, individuals, households & communities)
  - **Fast, evidence-based decision-making process**. Identifies in advance objective and transparent rules to guide decision making, supported by investment in early warning and post-disaster data and information gathering
  - **Pre-planned financing to ensure that the plan can be implemented**. Funds to cover implementation of a plan are critical, and *ex ante* risk financing ensures funds are available quickly when, and only when, they are needed, and also binds in partners to respond in the agreed way

Global development policy context

- The post-2015 development agenda has embraced disaster risk management and financial protection as key elements for building resilience and securing development gains as summarised below
  - The **Sendai Framework for Disaster Risk Reduction**, adopted by UN Member States in 2015, guides global efforts to prevent new and reduce existing disaster risk through 2030 and highlights financial protection as a key element of resilience
  - The **Addis Ababa Action Agenda**, adopted in July 2015, lays out the level of ambition for financing the Sustainable Development Goals (SDGs), which were adopted in September 2015. Climate and disaster resilience are mainstreamed across the SDGs and their associated targets, ensuring that global development priorities over the next 15 years will integrate climate and disaster risk management considerations
  - The **Paris Agreement** of the UN Framework Convention on Climate Change, which entered into force in October 2016, recognises, in Article 8, the need for comprehensive risk assessment and management, including the use of insurance, to address loss and damage from climate change
  - The **World Humanitarian Summit** in May 2016, where a structured risk management approach including risk financing was discussed as an important tool in 'fixing' the global humanitarian system

Sustainable Development Goals

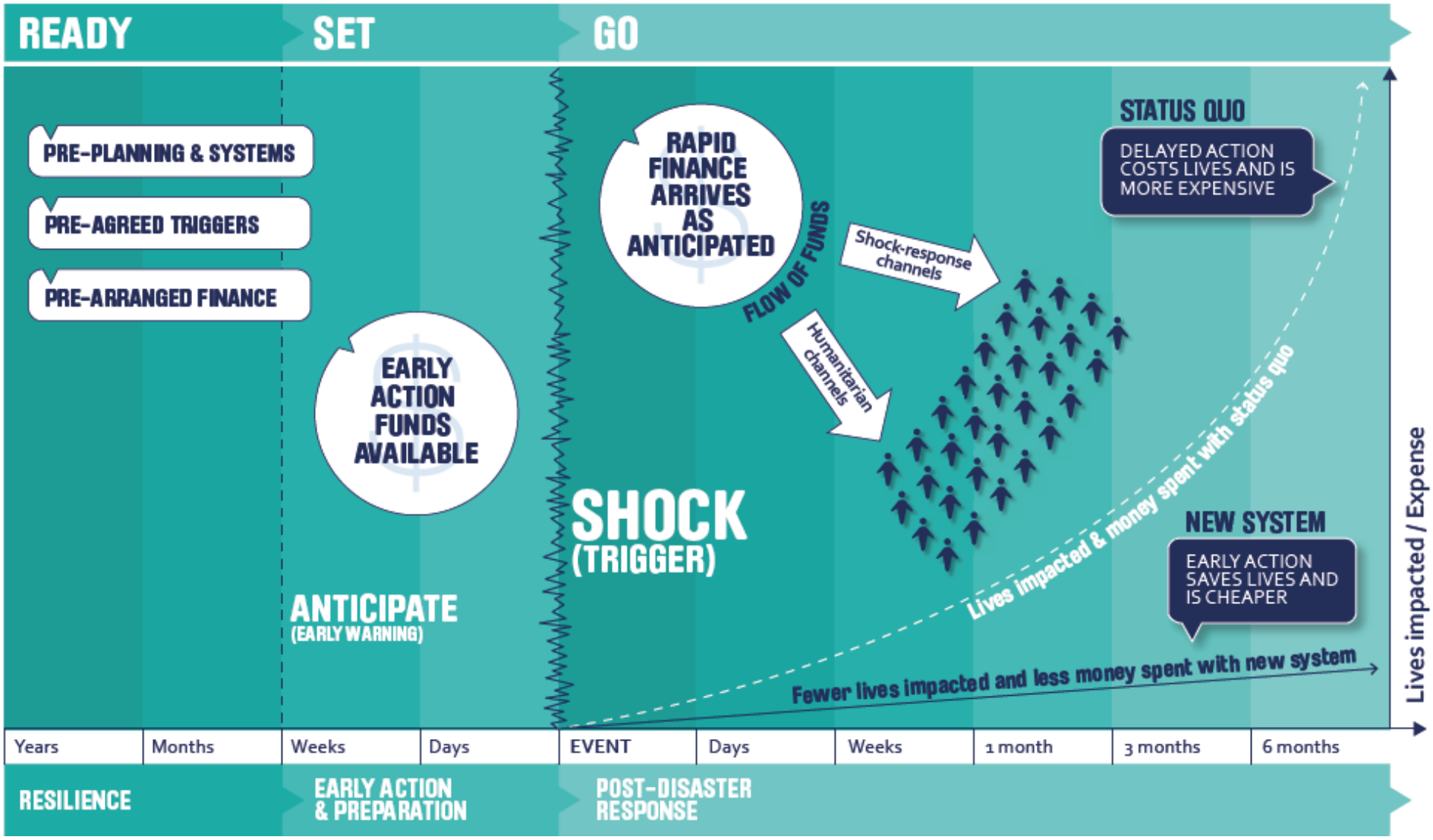
InsuResilience Global Partnership
London Centre for Global Disaster Protection



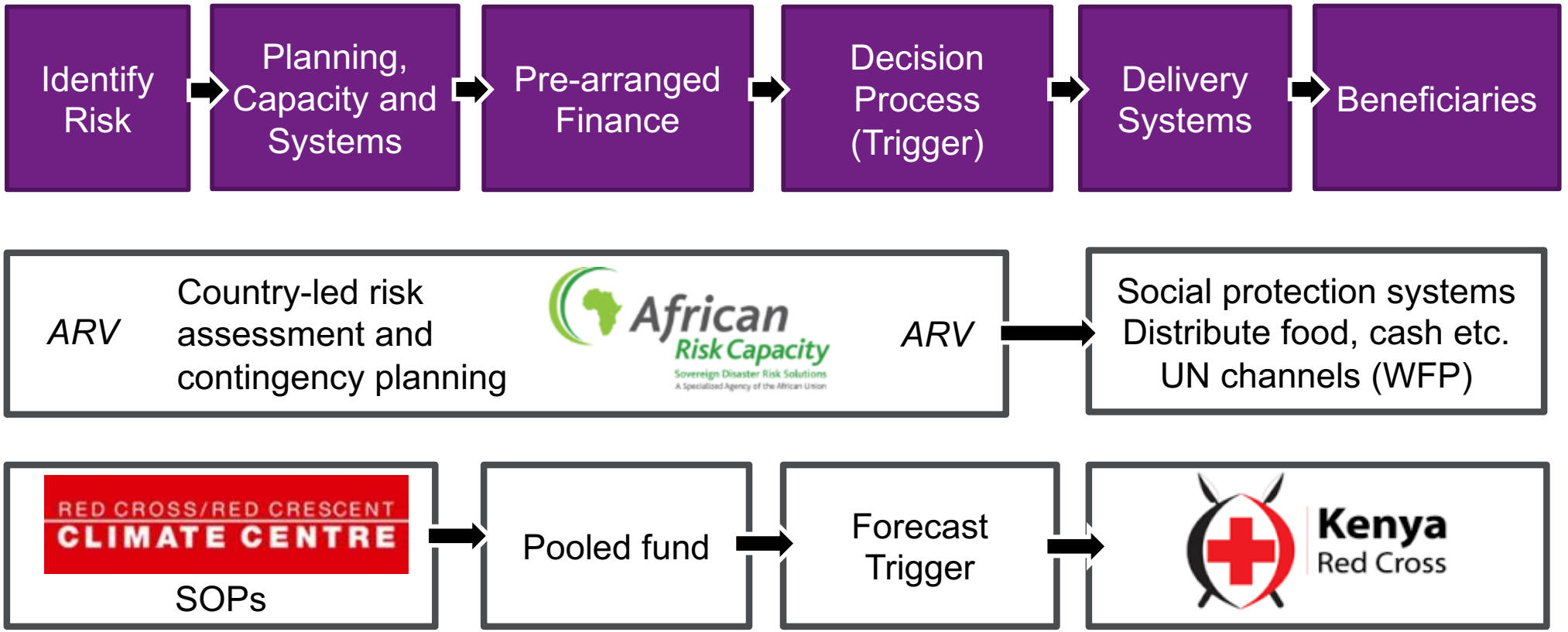
Developing and emerging sovereign and sub-sovereign engagement

- Nationally, many developing world governments are either participating in or have knowledge of sovereign risk pools in Africa (ARC), the Caribbean & Central America (CCRIF SPC) and the Pacific (PCRIC)
  - This brings exposure of relevant Ministers to index insurance tools
- Assessment of natural disaster risk (through engagement with a sovereign risk pool) allows a discussion on ownership of risk
- Once risk ownership is established, appropriate risk management tools can be identified to:
  - Incentivise risk reduction by the risk owner (because they will directly reap the benefits)
  - Implement the most cost effective risk financing solution
- The sharing of risk between individuals, communities and cooperatives, local and regional government and the national government is critical to reach a sustainable risk management strategy

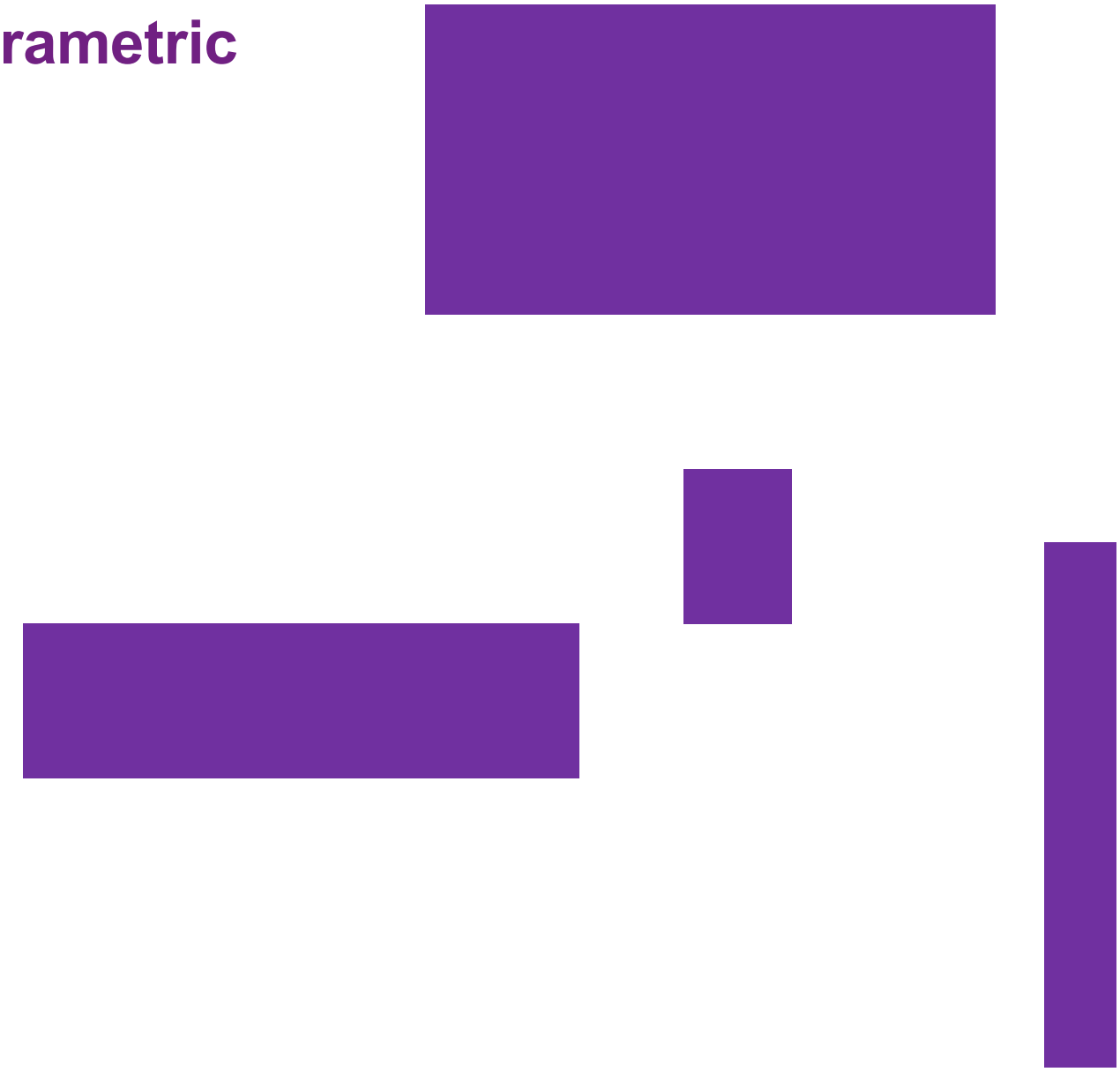
A new response model, needing data



Practical examples; theory to action



Introduction to parametric insurance



New kid on the insurance block

- Losses from natural disasters have been mitigated through insurance for hundreds of years
- Traditionally, this had been through indemnification against actual losses incurred by the insured
- In the last 20 years, a new form of risk transfer for weather risk and other natural disasters has emerged
- Beginning as derivative contracts for hedging against warm or cold (for the energy industry) and wet or dry (for agriculture) weather, the concept of using a measured parameter of the weather – or other natural peril – as the basis for a financial contract has expanded and now includes a broad range of instruments known as index-based or parametric insurance

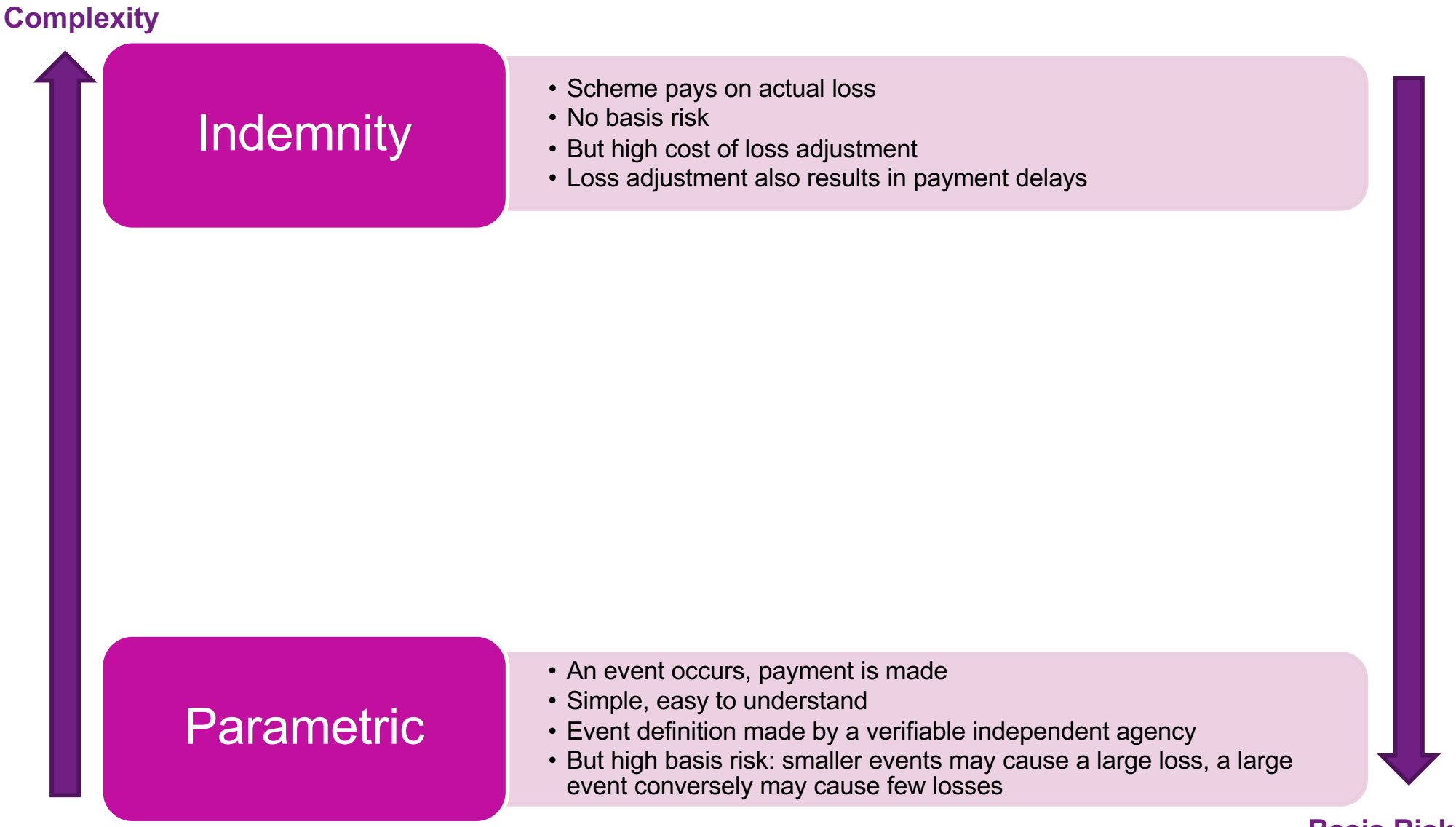
Key principles

- Parametric policies respond to movements in an index
  - Payments are made on an agreed scale based on the movement of the index
  - The index is selected such that it is an effective proxy for loss, damage or impact
- For example, rainfall quantity may be the independent measure
  - A drought parametric responds to a lack of rainfall: if less than 100ml of rainfall falls over a pre-defined period of time in a specific area, a pay-out of a pre-defined amount is triggered
  - Rainfall in the area of interest is constantly monitored in real time (e.g. via EO), and if the trigger threshold is met, the pay-out is released
- Indices are typically measured and/or verified by “trusted” third parties
  - Rainfall estimates from satellites are objective, reliable, have some length of historical time series, and are delivered in real time
  - Data sources are often in the public domain, providing additional transparency

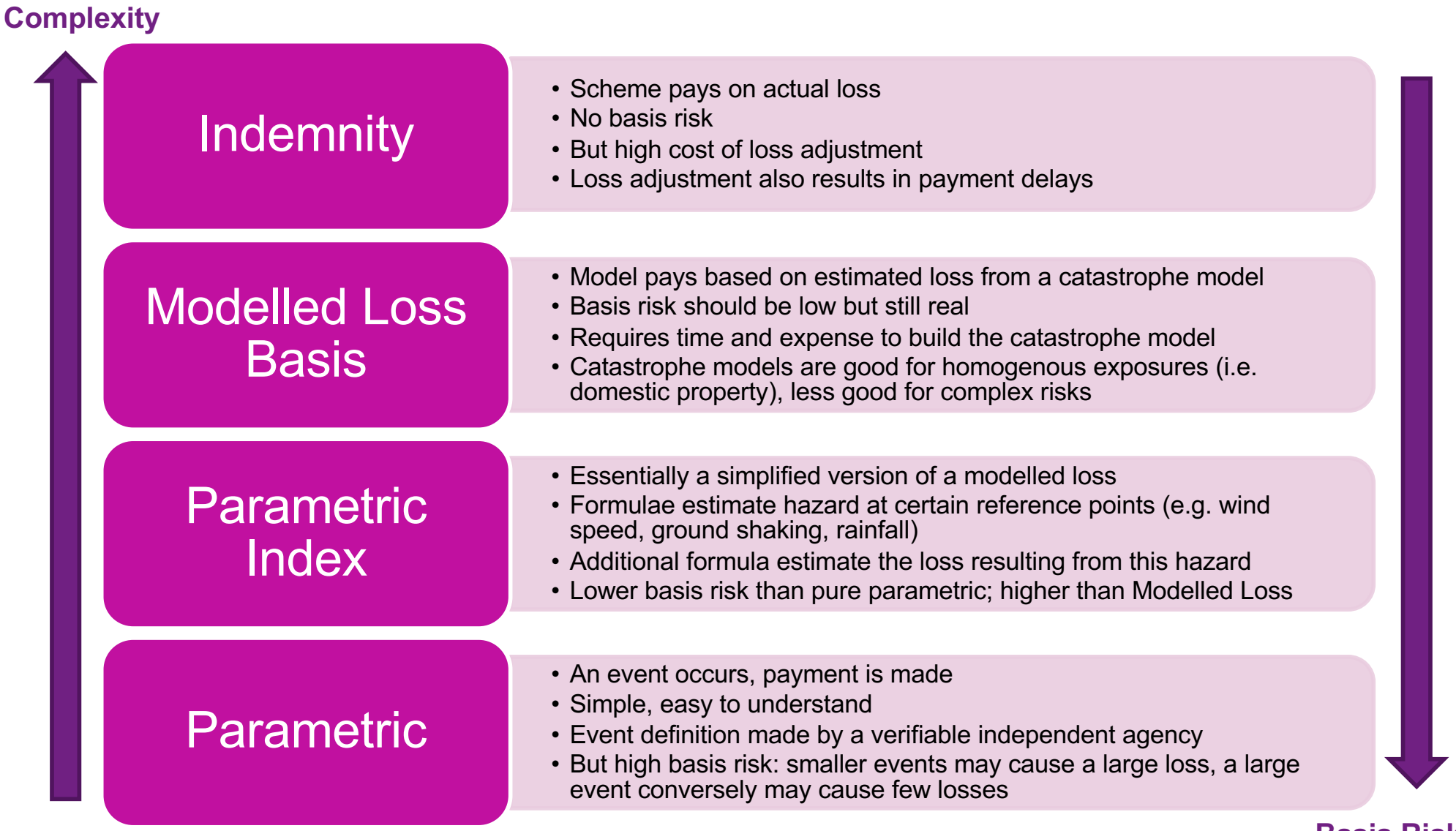
Key advantages

- Parametric instruments are particularly effective for disaster response finance
  - An event's occurrence, including the metrics associated with the event, is recognised and verified using an automated and fully objective approach
  - Pay-outs can be made quickly, offering much needed liquidity in the immediate aftermath of an event
  - The performance of the index dictates pay-out amounts, offering immediate and clean contract settlement
  - Instruments are increasingly being developed to respond to forecasts, allowing for release of funding BEFORE a disaster, to help with preparedness
- Parametric insurance is bespoke
  - The contract structures are highly flexible, dependent on risk appetite and budget of the buyer, risk exposure and geography of the risk
  - Parametric contracts do not require indemnification of specific assets, and proceeds can be used for purposes which do not have to be pre-identified

Parametric vs Indemnity



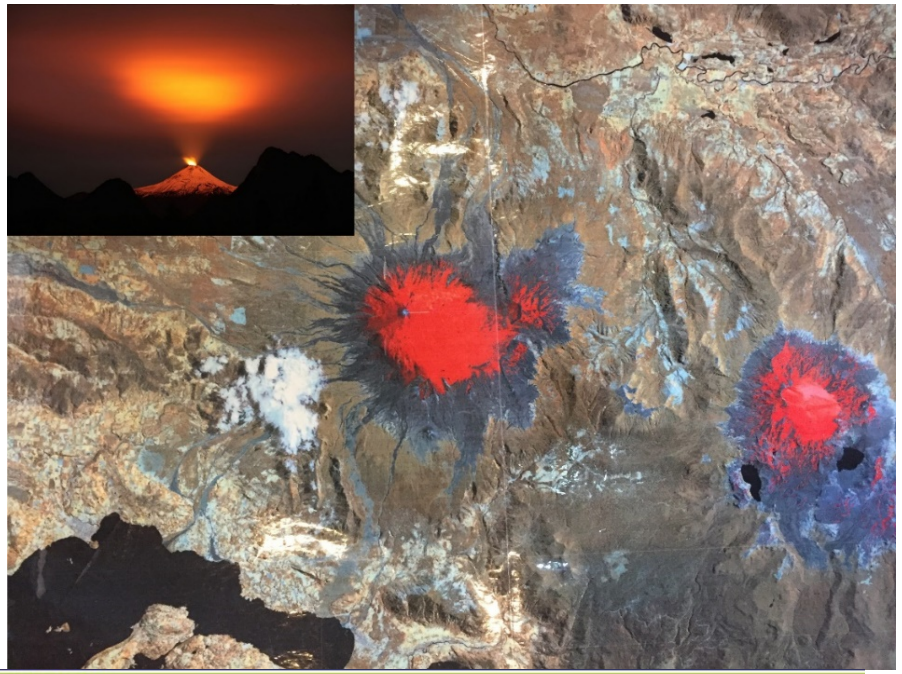
Parametric vs Indemnity or something in between

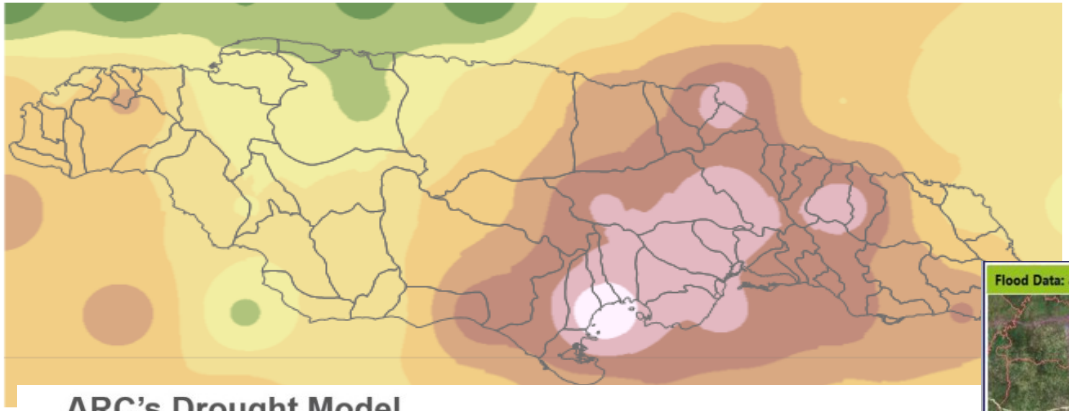


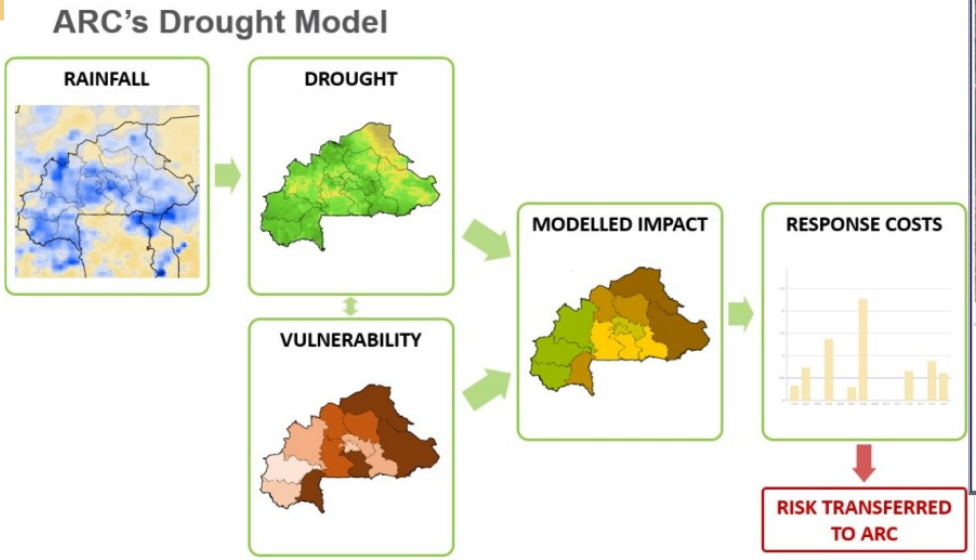
Parametric insurance take-aways

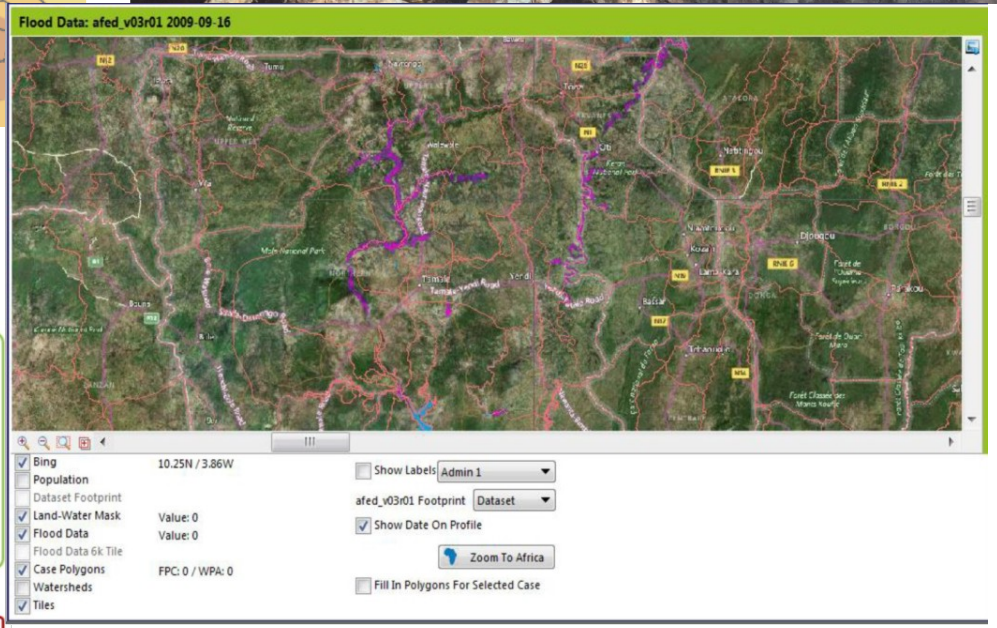
- Parametric insurance represents a major breakthrough in the accessibility of risk financing for natural disasters
- Instead of compensating for actual assessed loss, parametric insurance instead uses measurement of the hazard itself as a proxy for loss, paying out a pre-agreed amount for an event with certain intensity, location and, sometimes, duration
- This allows for rapid settlement and reduced costs
  - Of claims adjustment / processing
  - In the margin added by risk takers for uncertainty in projected outcomes
- The quantitative, independent and objective nature of EO data, and also its availability in real time, makes it ideal as a basis for parametric insurance, particularly in the developing world where claims data for policy pricing is non-existent

Practical examples of EO being used for parametric risk transfer in the development context



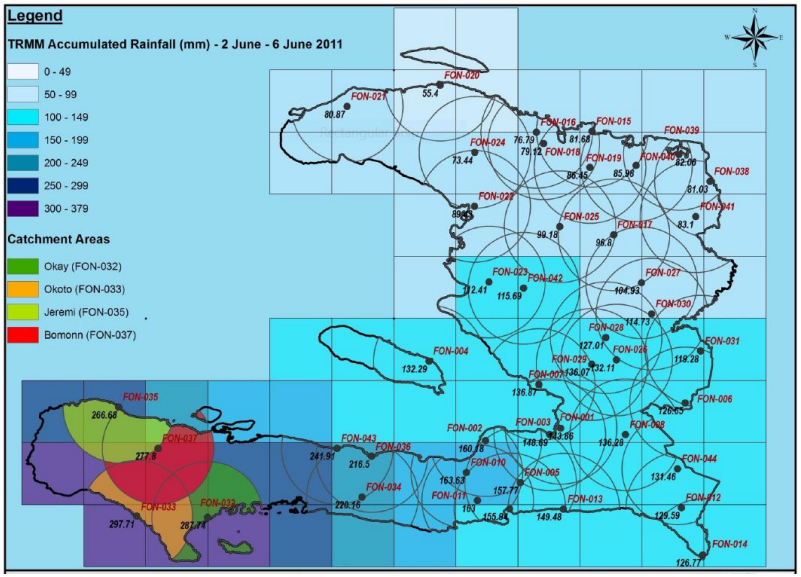






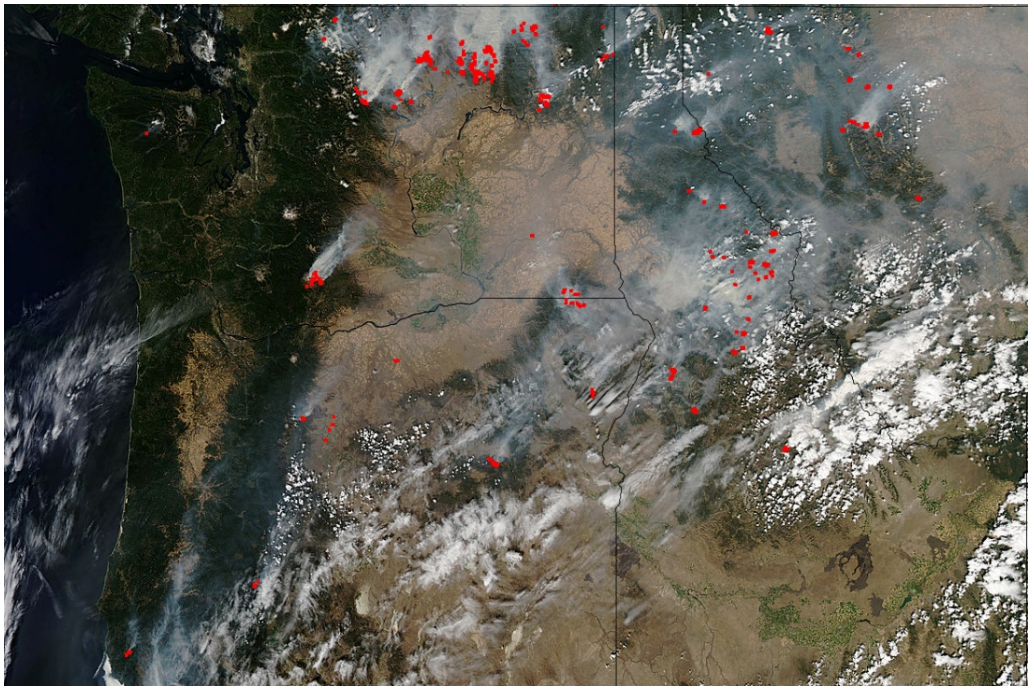
Rainfall

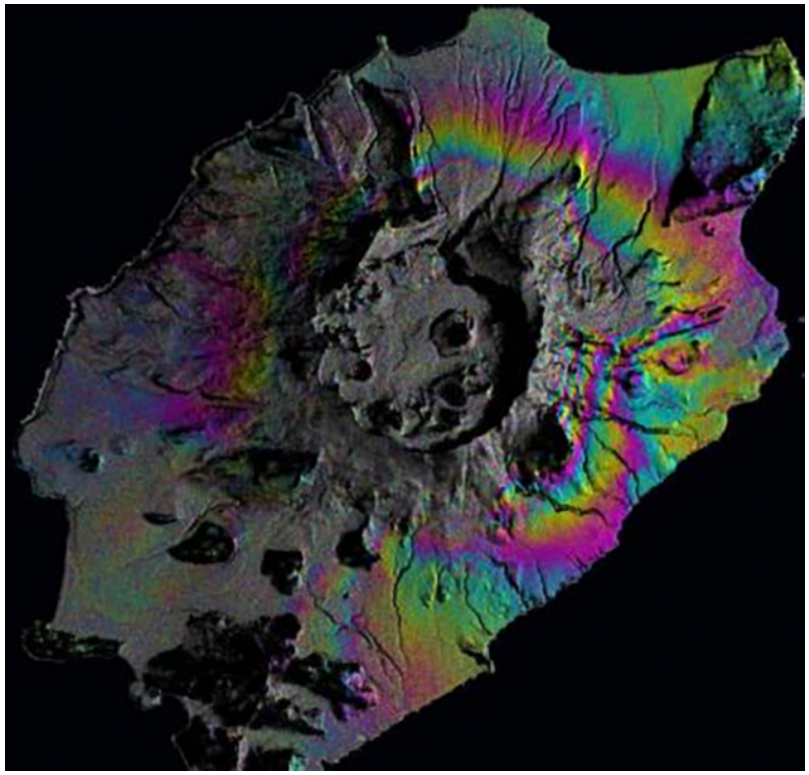
- MiCRO in Haiti
  - TRMM for extreme rainfall
  - (also included EQ and TC)
- NDVI for dairy farmers in the Dominican Republic
- WRSI based on ARC2 & RFE2 satellite rainfall data for ARC



Still on the drawing board

Wildfires, Volcanoes, Reefs





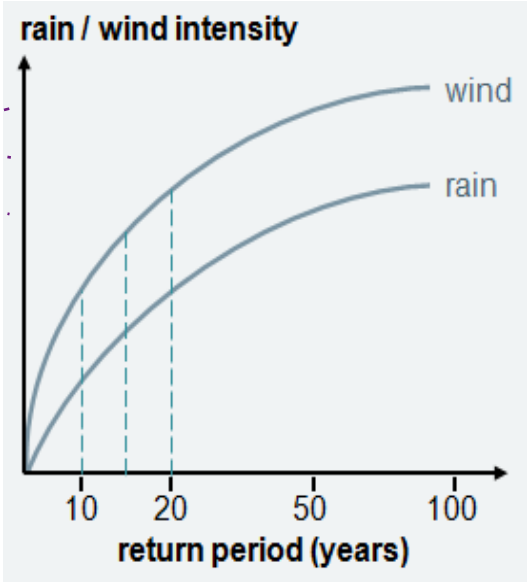
Home insurance covers damage from a volcano, but not a flood

Published: Sept 25, 2018 3:34 p.m. ET

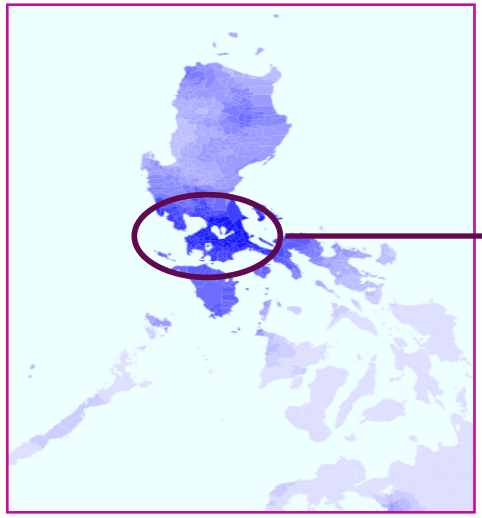
Data and Modelling Requirement
Example: PRISM (Philippines)

The exceedance of a defined rainfall amount or wind speed triggers a payment
The payment is based on a calculated return period

1. Return period calculation per LGU*



2. Actual event monitoring

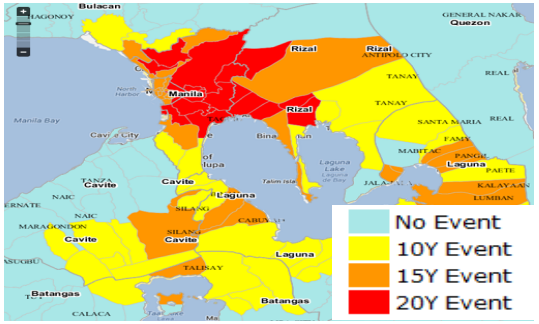


Real time monitoring (meteorology)

- 3 hourly rainfall (daily aggregation)
- 6 hourly wind speed (daily max)

Categorization of intensity

3. Trigger payment per LGU*



Payout example	
Trigger Category	Payout (% of average LGU income)
	5
	10
	20

*PRISM concept suggests payout as percentage of LGU (= local government unit) tax income class and based on state of calamity declaration

Parametric multi-sovereign pool

CCRIF: The Caribbean Catastrophe Risk Insurance Facility

- An insurance pool operated on behalf of member governments and issuing parametric policies
  - Established in 2007 with 16 countries, and recently extended to Central America
  - Protects against perils of tropical cyclone, earthquake and excess rainfall
- Enables Caribbean governments to receive immediate post-catastrophe funding
  - CCRIF has delivered funds within two weeks of every triggering event
  - Plugs the gap before slower to arrive aid
  - In 11 years of operation, CCRIF has paid out 21 times to 10 countries, totalling $130.5m
- Pay-outs have been used for:
  - Emergency costs
  - Maintain state liquidity
  - Damage to government buildings / infrastructure
  - Loss of tax / tourist income

State of the art: African Risk Capacity

Parametric insurance driving risk discipline

- Each ARC country is required to submit a Contingency Plan for disaster response prior to being allowed to take out insurance, outlining how insurance pay-outs will be spent to minimise loss of life, maintain livelihoods and replace lost assets
- Plans are developed following written guidelines and in consultation with ARC experts and other stakeholders, and are submitted to other members for confirmation that they meet agreed standards, allowing sharing of best practice
- The *Africa RiskView* platform allows for ongoing monitoring of rainfall and provides early warning of potential crop failures and food insecurity
- In the event that a pay-out is triggered near or at the end of the covered growing season, a Final Implementation Plan is required, refining the Contingency Plan to outline a precise plan of action to maximise the societal benefit of the pay-out received. Only on approval of the FIP is the pay-out actually delivered, and implementation of the FIP is monitored and audited to ensure compliance and to build best-practice

- The process of engaging in risk management is arguably as important as the policy itself

Finally a flood example

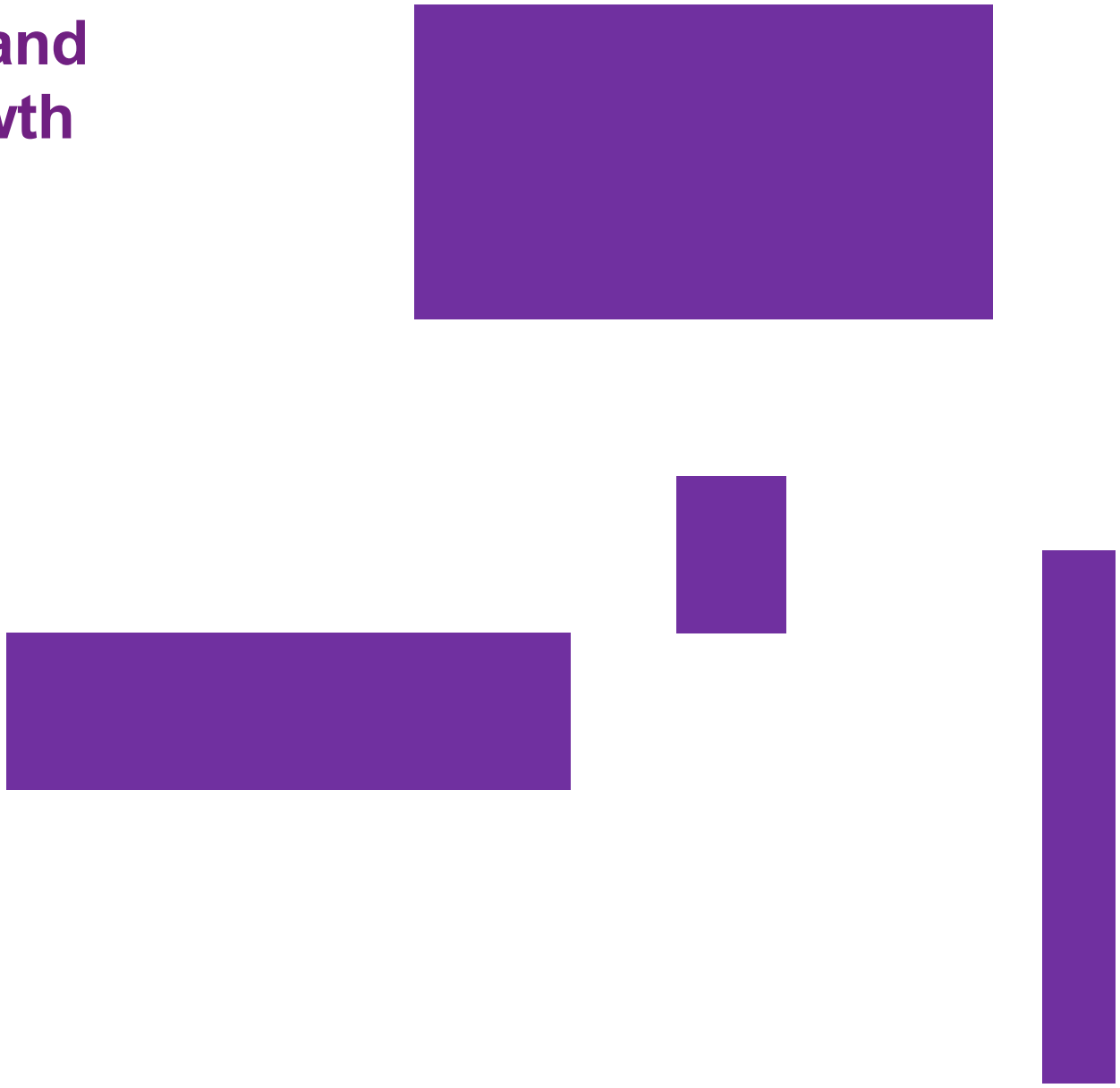
Post-Harvey Houston, Levee Improvement District

- Flooding occurred due to rain outside the levees
  - Pumping capacity was maintained, but the water was falling too quickly outside the levee and the river was too high – so pumping capacity was insufficient

Gage at Richmond (ft) (X)	Preceeding 24-hr Rainfall (in) (Y1)	Following 24-hr Rainfall (in) (Y2)	Max 3-hr Rainfall in 48-hr (Y3)	24-hr Rainfall (in) (Z1)	Max 3-hr Rain in 24-hr (Z2)
=/> 45	6	6	1.5	8	3.2
40-44.99	7	8	1.6	9	3.6
35-39.99	9	11	2.3	11	4.4
0-34.99	10	12	2.5	12	4.8

Payout Occurs if either Criteria 1 or Criteria 2 are met	
Criteria 1	(X) and (Y1) and (Y2) and (Y3)
Criteria 2	(X) And (Z1) and (Z2)

Opportunities for and challenges to growth



Expanding the use of EO data in quantitative DRM and insurance applications

- Critical element for insurance is being able to put a probability on an outcome
  - Generally use a time-series of, say, 30 years for relatively frequent events such as floods
  - For parametric cover it is best if the time series uses consistent data to that which will be used for the real-time trigger
  - The more uncertainty there is around the probabilities, the more expensive the cost of risk transfer will be (because risk-takers will always assume the highest probability in a range
- Huge advantage of EO data is the potential for globally uniform coverage, with standardised delivery of fixed datasets upon which indices can be based
  - The weather derivatives market in the US uses this approach, with each client selecting the index or combination of indices which best proxy the need they have
- Forecast-based financing has great potential in the humanitarian space – for no-regrets early action