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IACPM
INTERNATIONAL ASSOCIATION OF CREDIT PORTFOLIO MANAGERS

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Chicago

Climate Change and the Insurance Sector:

Evolving Insurance Coverage and Implications for Credit Portfolio Managers

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Munich Re's climate risk analysis

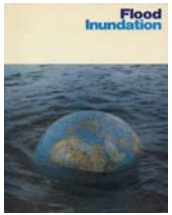
Assessing natural hazard and climate risks

1978
First edition of MR „World Map of Natural Hazards"

2017
Risk Management Partners (RMP)

2022
Climate expected loss (CEL)

1973
MR's first global warming alert



2011
NATHAN
Risk Suite

2020
Climate Analytics

Source: Munich Re

Munich Re's climate risk support for financial institutions

We support banks / asset managers on their climate journey

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Identify

Balance sheet screening to identify key exposure to climate risk

- Exposure of the portfolio to key natural disasters under the present climate
- Growth in risk expected with climate change
- Identification of spatial concentrations

Measure

Climate impact model to assess financial impact

- Calculate climate expected loss
- Use key climate risk concentrations to quantify potential financial impacts to asset
- Report on climate risk according to regulation (e.g., TCFD; EU Taxonomy)

Manage

Risk transfer in case risk management decides not to accept, avoid or adapt

- De-risk existing loan and asset portfolio
- Protect earnings and cost of capital
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- Act as innovative partner and pioneer
- Differentiate offerings towards peers
- Create new revenue streams

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Assessing physical climate risk

Leveraging IPCC risk propeller concept

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IPCC AR6 WG2 risk propeller

- **Exposure**: For all assets, define scope and metrics to measure the risk
- **Hazard**: For all locations relevant for the analysis, assess which natural disasters can occur (intensity x probability) under current and future climate
- **Vulnerability**: For all assets exposed, how much damages could be caused by a natural disaster of a given intensity

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What does climate risk mean?

Extreme weather events are becoming more likely

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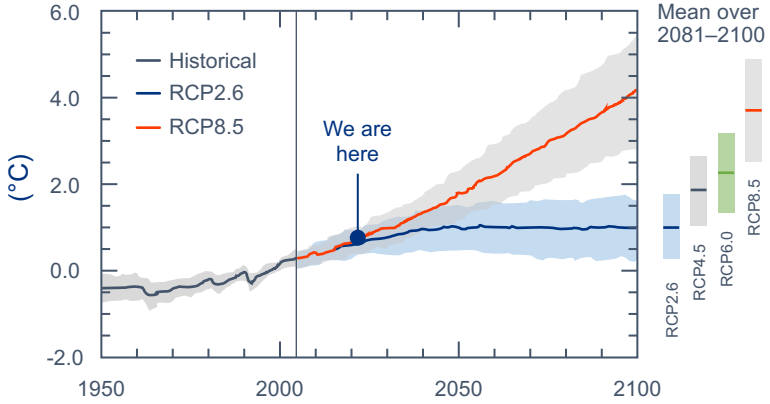
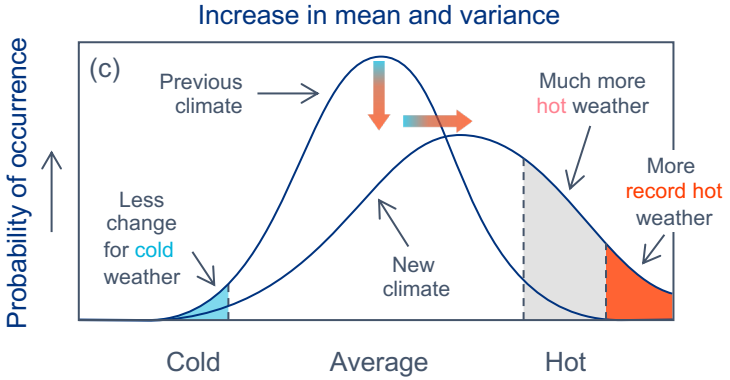
Global temperatures are increasing



Global Average Surface Temperature Change

As temperatures warm, the likelihood an extreme threshold is exceeded increases dramatically



Probabilities of Extreme Weather Events Increase

The probability of extreme (tail) weather events is significantly increased by climate change

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Location Risk Intelligence

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Munich Re's solution helps to understand and measure climate risks

Location Risk Intelligence

Munich Re's solution helps to understand and measure climate risks

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Location Risk Intelligence (LRI)

Identify

Natural Hazard Edition

Current physical risk – status quo based on science and historical data

12 hazards

Earthquake risk

Earthquake	Volcano	Tsunami

Storm risk

Tropical storm	Extratropical Storm	Tornado
Hail	Lightning	

Flood risk

River Flood	Flash Flood	Storm Surge

Wildfire risk

Wildfire

Climate Change Edition

Risks of future climate change – projections of future risk using IPCC[1] or RCP/SSP[2] scenarios

9 hazards

Storm risk

Tropical cyclones

Flood risk

River Flood	Sea-level Rise
Storm Surge	

Atmospheric risk

Heat Stress	Precipitation Stress
Fire Stress	Drought Stress
Cold Stress	

Measure

Climate Financial Impact

Financial impact caused by natural hazards

Metrics

Risk Score

Overall Risk Score	Earthquake Risk Score
Storm Risk Score	Flood Risk Score

Climate Expected Loss (CEL)

- Tropical Cyclone
- River Flood
- Storm Surge
- Extratropical Storm

Current and future climate risk exposure on location level (low-high risk)

Climate financial impact metrics for different asset classes and perils

1) IPCC: Intergovernmental Panel on Climate Change
2) RCP/SSP: Representative Concentration Pathway/Shared Socio-economic Pathways

Single location analysis

Current natural hazard profile along with projected

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Hazard Score:

Assess exposure to broad range of perils to screen for material risks and identify mitigation strategies

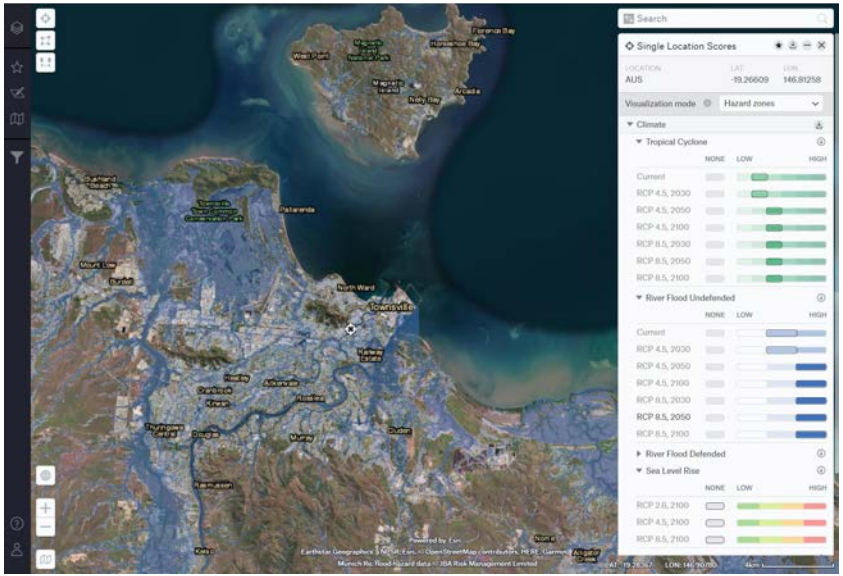
NATHAN Hazard Score Rating

Hazard zoning values for significant natural hazards

	low	high	hazard rating
Earthquake			Zone 1: MM VI
Volcanoes			No hazard
Tsunami			No hazard
Tropical Cyclone			Zone 2: 185 - 212 km/h
Extratropical Storm			No hazard
Storm Surge			Zone 100 year return period
Tornado			Zone 2:
Hail			Zone 2:
Lightning			Zone 3: 4 - 10
Wildfire			Zone 1: low
River Flood			0
Flash Flood			Zone 6: high

Climate Score:

Understand long-term risk by evaluating how exposure to key perils will change in the future under various emission scenarios



Source: Munich Re's Location Risk Intelligence Platform showing the river flood hazard zones in 2050 und RCP 8.5. The river zones come from Munich Re's future projections which builds on JBA's river flood model.

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Portfolio granular analysis

Hazards & climate scores

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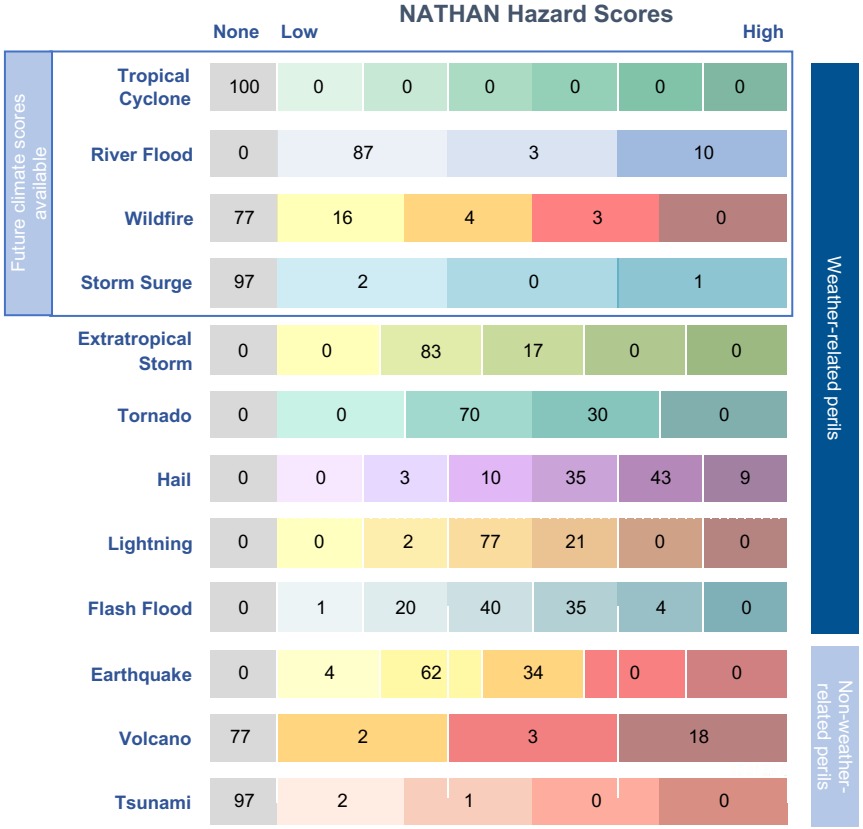
ⓘ A portfolio is assessed for natural hazards and categorized into hazard classes.



Source: Munich Re's Location Risk Intelligence Platform

Heat stress will increase significantly in parts of the **United States** over the next 25 years…

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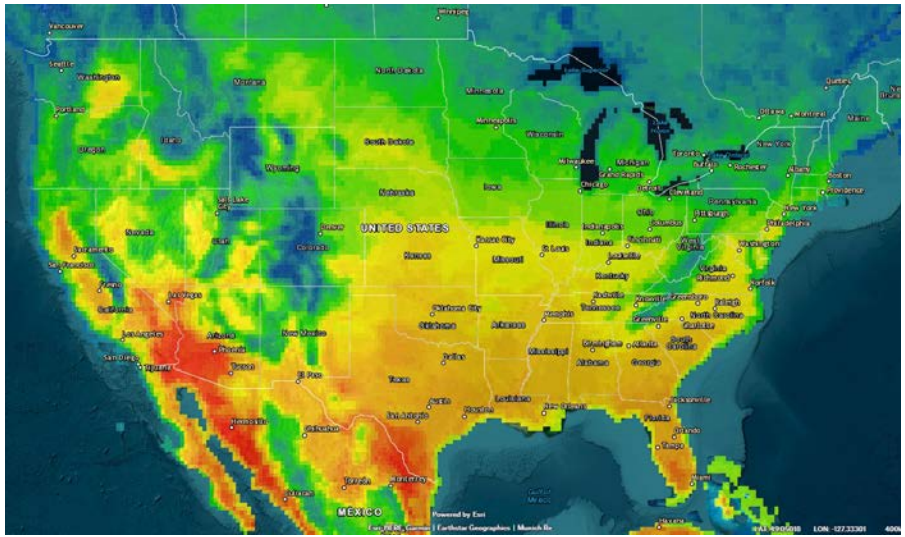
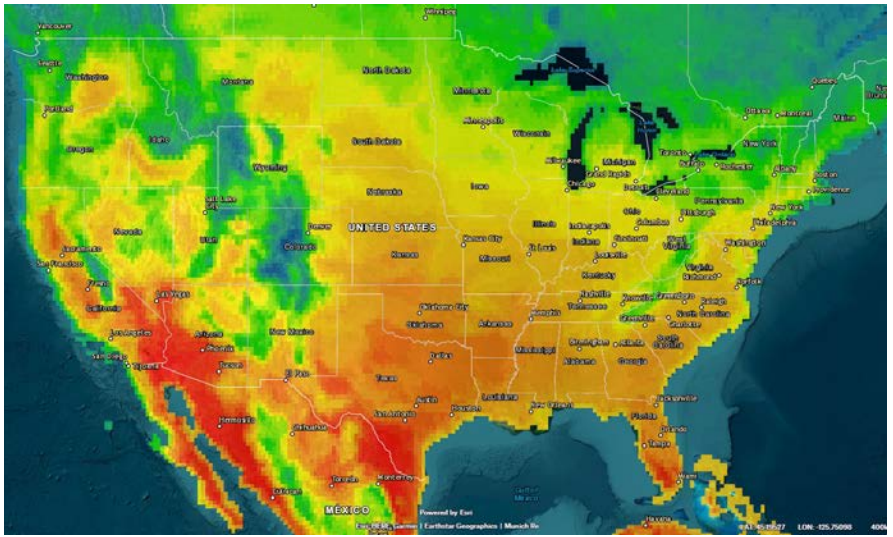
Heat Stress Index Current



Heat Stress Index RCP 8.5, 2050



No Exposure (0) Blue	No/Very Low Exposure (1) Green	Low Exposure (2) Yellow	Medium Exposure (3) Orange	High Exposure (4) Red	Very High Exposure (5) Dark Red

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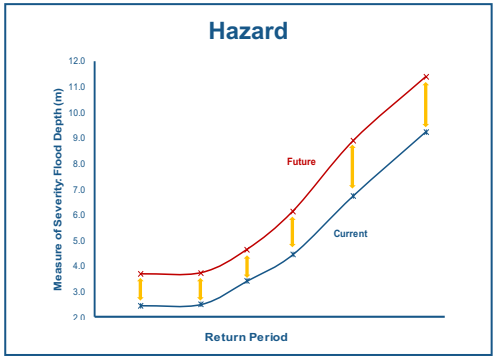
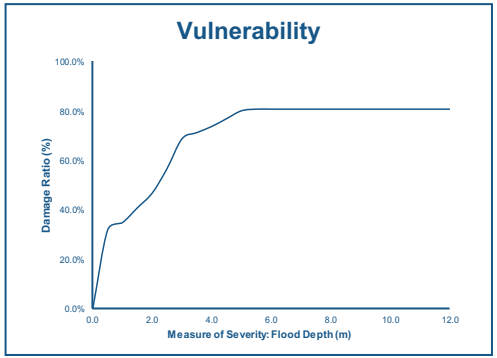
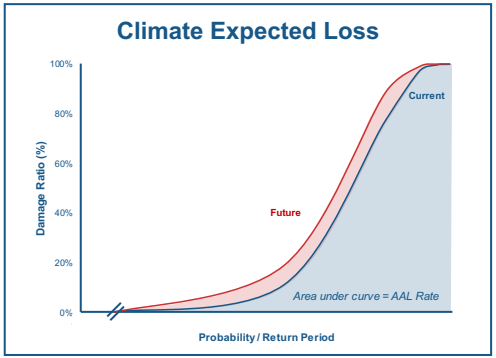
Integrating climate risk in banking

Climate Expected Loss

- **Climate Expected Loss (CEL)** captures the annual expected damages from natural disasters to a physical asset under current and future conditions under various IPCC or RCP/SSP scenarios and time horizons.
- CEL is calculated at **individual location level** by combining Munich Re Climate models with asset vulnerability relationships, accounting for regional building characteristics. It is expressed as **percentage of damages** to be applied to building value.







Munich Re Climate Models

Munich Re Insurance expertise

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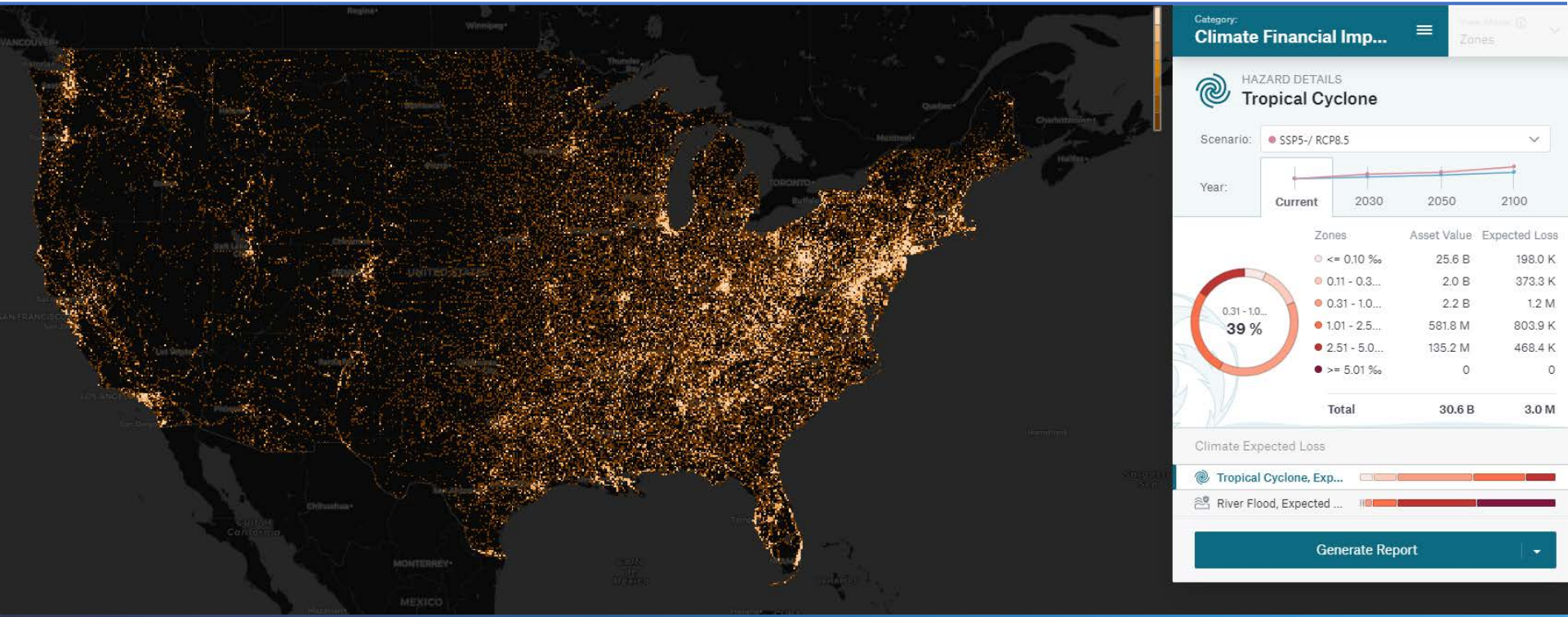
Financial impact scores – climate change

- Evaluate how the financial impact of losses due to select perils will change in the coming century using Climate Expected Loss



Integrated approach as climate risk is a business risk

Understand the relevant transmission channels

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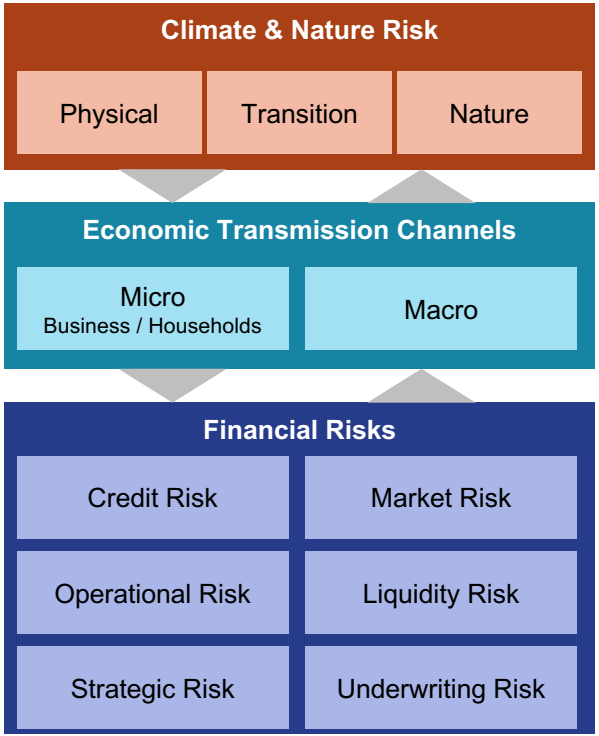
Climate & Nature transmission channels



Integration into all core processes

Origination	Business Management	Reporting
Client engagement	Risk Modelling	Disclosure compliance
Strategy setting	Capital Management	Stakeholders engagement
	Portfolio steering	

Assessment of all portfolio types

Residential mortgages | **Corporates & Agriculture** | **Real Asset & Infrastructure**

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Physical climate risk transmission channels

Application to residential lending

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Impact drivers	Current Climate	Future Climate
Reduced Disposable Income (Probability of Default)	High insurance premium for exposed assets	Higher insurance premium / affordability issues
	Uninsured damages from natural disaster	Inadequacy of building standards
	Impact on local economy post natural disaster	Long term impact on local economy
Depreciation of collateral (Loss Given Default)	Unrepaired damages from natural disaster	Inadequacy of building standards
	Temporary land depreciation post natural disaster	
	Priced-in land depreciation for exposed assets	Reduced liveability in certain areas

Banks must adequately assess their exposure or face the risk of being anti-selected

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Integrating climate risk into credit risk modelling

Combine MR Climate Data with Location Risk Intelligence to analyze exposure to climate risk

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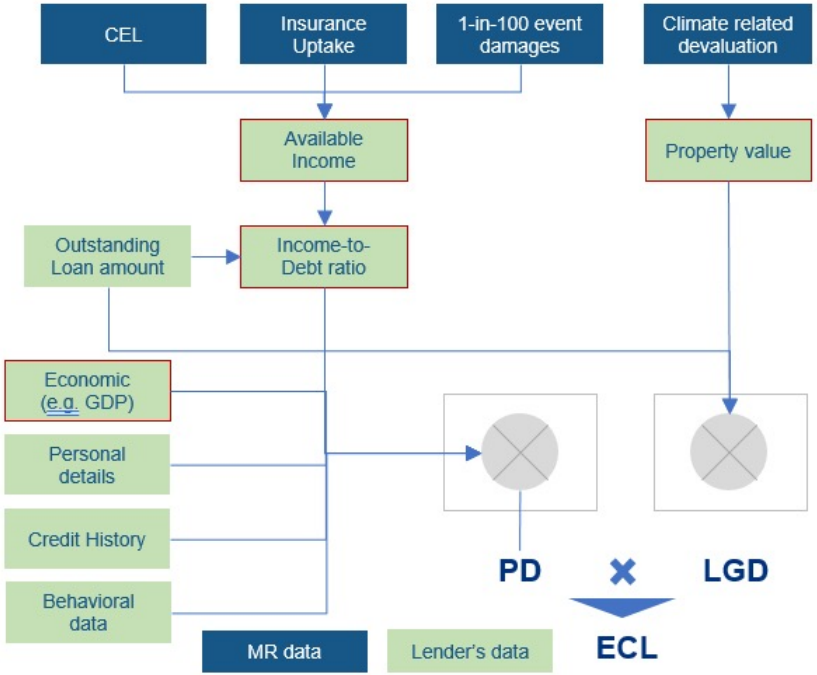
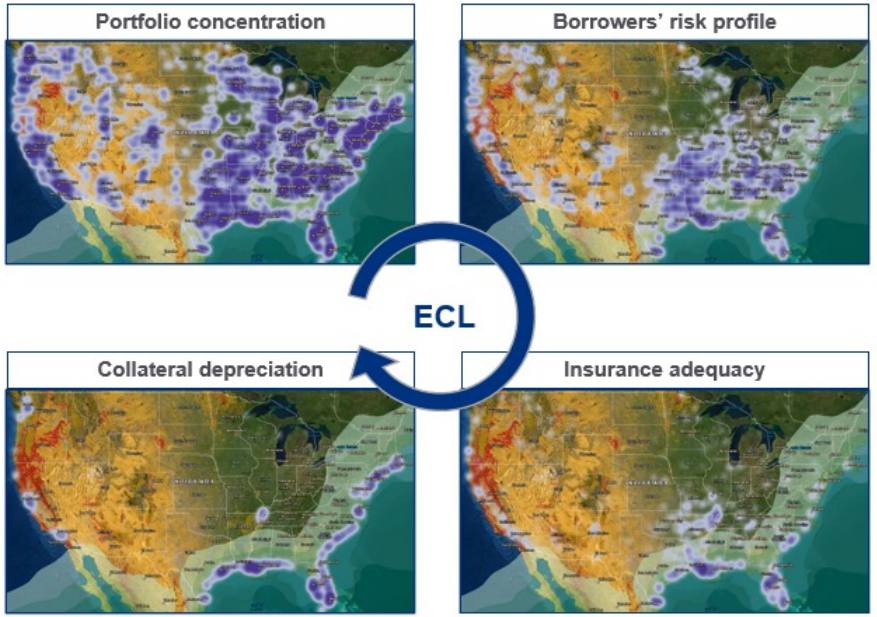
Integrating **MR Climate data** into credit risk models



Analyzing outcomes in **Location Risk Intelligence**



Corporate exposure assessment

Integrating MR climate solutions into UNEP-FI framework

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Munich Re Hazard Scores

12 Natural hazards

9 Climate Stresses

Sensitivity matrix 1

8 Vulnerability Indicators

- Natural resources
- Energy supplies
- Climate sensitive supplies
- Transport routes
- Assets and processes
- Market demand
- Environmental and social impact
- Labor health and productivity

Sensitivity matrix 2

Economic Sectors

50 Level 1/2 sectors mapped

Location specific sectorial risk scores to be applied to Lenders' corporate exposure

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How to factor physical risk at loan origination?

From strategy setting to execution

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Decide risk management approach

Accept

- Active if not material
- Passive = unknown

Avoid

- New business only
- Regulatory scrutiny

Adapt

- New business & in-force
- Product & Process

Transfer / Hedge

- In-force & New business
- (Future) Capital relief

Incorporating physical climate risk in loan origination

Increase risk awareness of your customers:
Discuss exposure to physical climate risk to ensure informed investment decision

Adjust product offering based on exposure:
Limit exposure via stricter lending conditions (e.g. capped LVR, reduced DSR to reflect higher costs of insurance)

Review underwriting process
Allocate underwriting responsibility to specialized credit risk officers for at-risk collaterals

Partner with insurers to transfer unwanted exposure
Secure risk transfer solutions tailored to physical risk exposure

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A simple solution for complex exposures

Parametric covers hedge against natural catastrophes

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With the increasing impact of climate change, the risks of natural catastrophes and weather-related risks are as well on the rise. These lead to even more underinsurance and insurance gaps due to lack of insurance affordability. Yet, physical risk exposure such as flood, storm, hail, drought and heat stress within banking portfolios is increasing.

Challenges

- Loan books and assets exposed to risks of natural catastrophes
- Clients' financial solidity such as natural catastrophe driven liquidity constrains
- Consequences of underinsurance

Opportunities for financial institutions

- De-risk existing portfolio
- Protect earnings and cost of capital
- Mitigate operational disruption
- Wrapping individual loans and loan portfolios
- Act as innovative partner and pioneer
- Differentiate offerings towards peers
- Create new revenue streams

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Main benefits of parametric covers

Indemnity insurance: Pay-out based on actual damages
Parametric insurance: Pay-out based on hazard or calculated index value

Speed

Parametric triggers ensure rapid recovery thanks to a simple and quick pay-out process that provides liquidity when you need it most.

Transparency

Independent third parties provide the data needed to trigger payment based on a simple, verifiable and unambiguous process.

Bespoke

In tandem with our experts, parametric solutions are tailor-made to the customer's exposures, risk appetite and legal environment.

Closing gap

Traditionally difficult to insure or uninsurable risks can now be covered at a reasonable price, based on customer's needs.

Parametric solutions are particularly useful seeking
prompt payment post event and **flexibility of using payments.**

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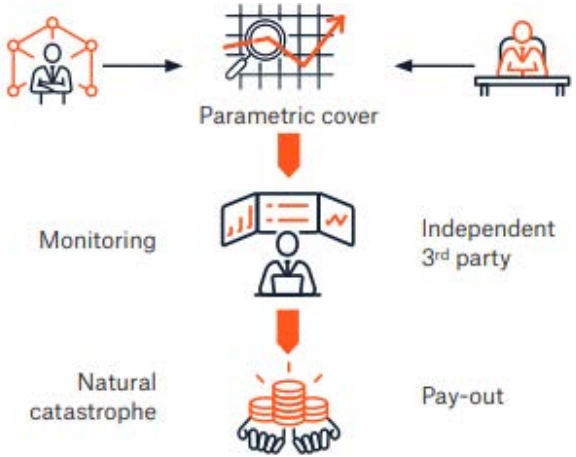
Parametric trigger

Indemnity insurance: Pay-out based on actual damages
Parametric insurance: Pay-out based on hazard or calculated index value

Parametric insurance presumes strong correlation between hazard or index value and (typical) damages.



Pricing:

Requires sufficient **historic or modelled data of the *parameter*** to allow probability calculations of parameter to exceed the trigger threshold(s).

Claims process:

(Near) **real-time query of *parameter*** data needs to be ensured to guarantee pay-out in case of a trigger event. Data can be provided by independent authorities (such as USGS, NOAA, etc.) or the whole process can be organized through independent third-party agencies (e.g. with sensors).

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Basis Risk - Deviations between trigger pay-out and actual loss

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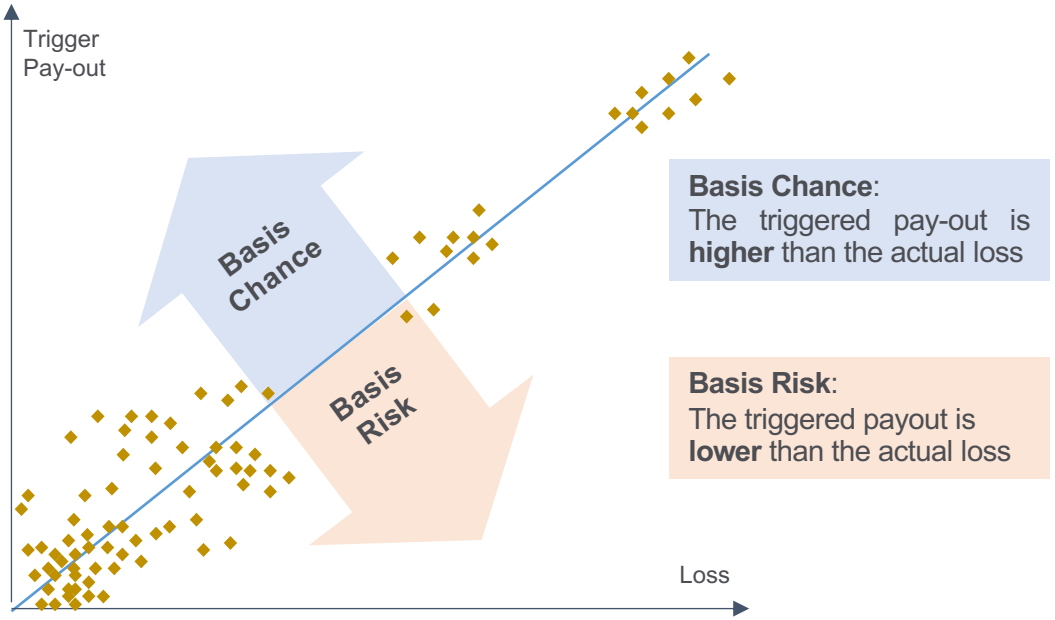
The issue of **basis risk** needs to be fully understood by both, insurer and insured:

In contrast to an indemnity-based product, many parametric products contain the risk that a loss has occurred, but no pay-out was triggered. This can happen if…

- the trigger definition is simply bad and not "problem-adequate"
- the uncertainty in the peril / trigger set-up is huge and cannot be overcome

The contrary is possible as well (called **basis chance**), triggering a larger pay-out than the actual incurred loss.



Great solution, that requires some sophistication to build.

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Perils covered worldwide

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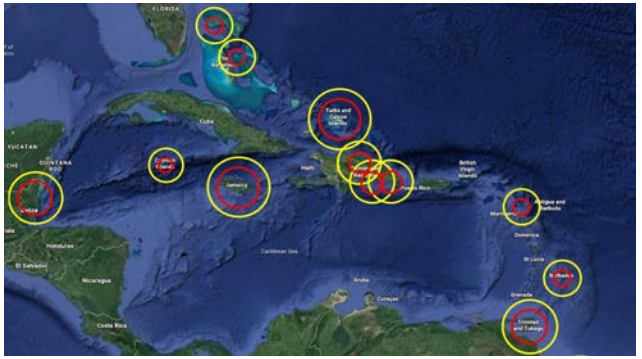
Parametric coverage of **mortgage defaults** due to natural catastrophes

Situation

- A bank has concerns about **mortgage defaults** could significantly **increase after a hurricane or an earthquake**
- The bank fears that their mortgage customers have not sufficient property insurance for their secondary houses in the Caribbean

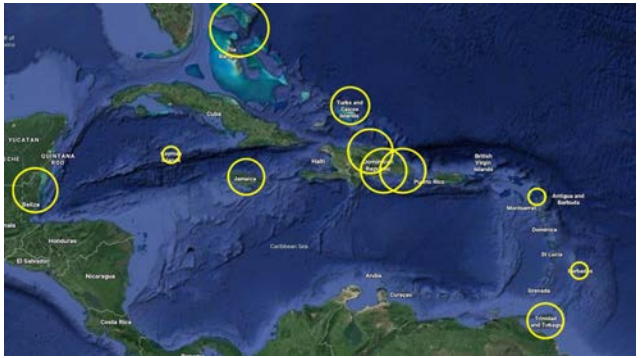
Solution & Benefits

- Under a cat-in-a-box cover, if a named storm track / epicenter of an earthquake occurs within the specified covered circle, the bank makes a claim, gets paid according to the agreed payout.
- The policy trigger depends entirely on the pronouncements of the NHC / USGS – not Munich Re. The NHC specifies the track of the storm and its windspeed. The USGS publishes information on Earthquakes occurring globally.
- A hurricane may trigger several individual countries. Payouts of countries are aggregated, subject to the applicable limits.



Hurricane

Payout Structure	Radii of circles 25 km	50 km
Cat 3	0%	0%
Cat 4	50%	25%
Cat 5	100%	75%



Earthquake

Payout Structure	Radii of circles 100 km
> 7.0 Mw	25%
> 7.5 Mw	50%
> 8.0 Mw	100%

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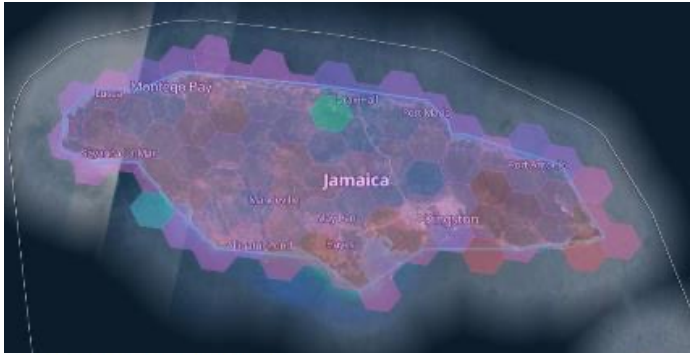
Parametric coverage of **loan defaults** due to hurricane in Jamaica addresses **liquidity at lender**

Situation

- **Farming is the main source of income for around 18% of Jamaicans.**
- ~ 100,000 smallholder farmers rely on Jamaican Co-operative Credit Union League for working capital loans to cover the cost of essentials, seeds, livestock and farm equipment.
- The JCCUL sought protection from loan defaults after a major hurricane.
- **JCCUL would need to issue new loans, so would need new capital and liquidity.**

Solution & Benefits

- Developed a **fast-payout-protection** in cooperation with **Skyline Partners** and the London-based **broker Howden protecting JCCUL from default on micro-loans from cat 4+ hurricane straight after the event**
- Skyline designed a unique **parametric cover** triggered if the NOAA-based **"fat-track"** of a hurricane – a following wind field – passes over Jamaica, which was divided into hexagonal regions, each with a predefined trigger



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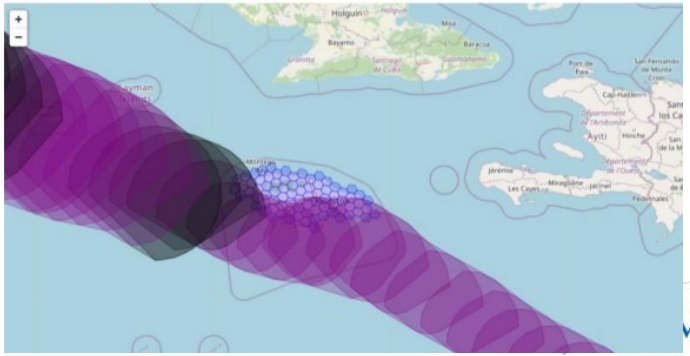

Munich Re supports climate-driven and embedded “white labeled” consumer **loan relief** product in Colombia

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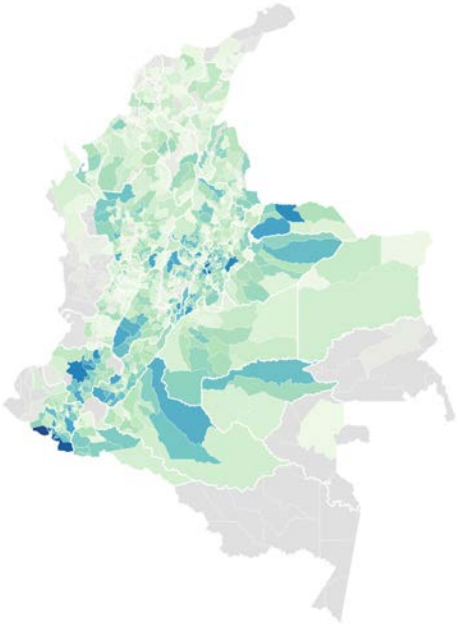
Situation

- Economic activity in **Colombia is vulnerable to a wide range of extreme events**: **drought, excess rain and flood.**
- A bank in Columbia sought a **new embedded product** they could offer to borrowers that provided **loan-forgiveness in case of drought, rain, or flooding** and could be scaled across the entire country.
- Targeting over 2.38 million customers and over 140K loans a year.



Solution & Benefits

- **Raincoat** designed the **product, acts as calculation agent,** and provide the **technology that enables the solution.**
- Unique 3rd party data provider is used for the flood component.
- The bank in Colombia has begun mass roll out with its customers.

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Munich Re supports FloodFlash's parametric flood insurance providing fast pay-out via **sensor-based technology**

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Situation

- UK & USA Binder Target Group: SMEs seek for property and business interruption protection against flood events
- Nothing similar exists to help the businesses in the same flood exposed areas

Solution & Benefits

- **Munich Re via MR Syndicate (MRSI 1840)** is the sole capacity provider
- Trigger process:
  - ✓ High-accuracy, ultra-sonic depth measurement
  - ✓ Long-life battery to last 7-12 years
  - ✓ Internet connectivity to send up-to-date flood data (IoT) (5 mins)
  - ✓ Memory chip to store data for when networks fail
  - ✓ Tamper and storm resistant
  - ✓ Simple, fast installation
  - ✓ **Payout within maximum 7 days after triggering**

Munich Re supports **the West-African Development Bank to wrap its sovereign lending against disaster risks**

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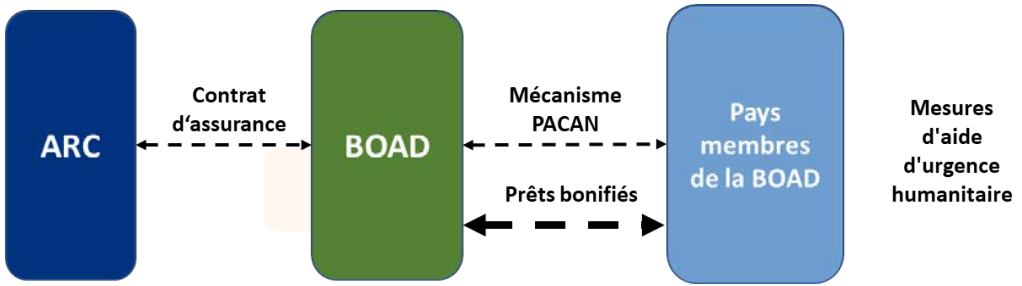
Situation

- Member countries of the West African Development Bank (BOAD) are exposed to drought, flood and epidemic/pandemic risk
- Member countries require debt financing to stimulate sustainable economic growth
- KFW seeks to grow refinancing of BOAD's lending while avoiding unstainable debt burden when countries are hit by disasters
- BOAD seeks to offer its member countries debt embedded risk transfer solutions

Solution & Benefits

- On behalf of KFW and BOAD Munich Re, Frankfurt School and ARC ltd develop parametric risk wrappers for the loan portfolios of BOAD member countries
- When disasters strike (drought, extreme precipitation, pandemics) BOAD waives the payment obligation of member countries to serve its debt (repayment of interest and principal) for the insured credit portfolio for one year
- **Main idea: Sustainable debt for West African Countries**



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Munich Re's climate risk analysis for financial institutions

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Identify

Measure

Q&A

Manage

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Thank you and let's talk again!

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