Parametric policies: from product design to actuarial pricing

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Parametric policies: from product design to actuarial pricing

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I'm an Actuary with more than 20 years of experience in the insurance and financial sectors. My professional background spans pricing, reserving, risk management, and regulatory frameworks such as IFRS 17 across P&C, life, and health insurance. I currently focus on parametric and specialty insurance pricing, with particular interest in ESG challenges and AI applications in insurance

REVO Insurance S.p.A. is an insurance company based in Italy, active in non-life insurance with a focus on specialty lines and parametric risks and mainly oriented to the SME sector. Is an innovative and cutting-edge player, with an entrepreneurial formula that leverages technological leadership to optimise and make the risk underwriting and claims management process more efficient and flexible with a strong ESG vocation as a key part of its strategic orientation

Parametric Policies

Definition and characteristics of parametric policies

How they work

Differences compared to traditional policies

Complementarity with traditional policies

Key challenges: pricing and product design

Basis risk

Role in climate change resilience

Agenda

01 Parametric Policies

02 Developing a parametric product

03 Parametric Policies and Climate Change

04 Final considerations

01

Parametric Policies

Parametric Policies

How parametric insurance changes recovery after a flood event

🏭 A **manufacturing SME** operating in an industrial area **at risk of flooding**.

📉 The business model is based on **continuous production**: every day of downtime has a **direct impact** on **revenues** and **profit margins**.

TRADITIONAL POLICIES

- *Traditional policy*
- *Indemnity cover*
- *Deductible: 15%*
- *Settlement following assessment*

PARAMETRIC POLICIES

- *Traditional policy + Nat Cat parametric cover*
- *Trigger: footprint of the flood event*
- *Payout: Deductible*
- *Payment within 14 days*

👉 *Two fundamentally different approaches*

Parametric Policies

How parametric insurance changes recovery after a flood event

🌧️ **Extreme weather event (e.g. Emilia Romagna Floods, Italy 2023)**
⚠️ **Delay in assessments due to the scale of the event (many locations affected)**

TRADITIONAL POLICIES

📅 **Hypothetical timeline:**
Day 0 → event
Day 3 → initial report
Day 15 → collection of claim documentation
Day 30 → restart (funded by the company)
Day 90 → assessment completed
Day 150 → payment

🟥 **Critical issues:**
- cash flow pressure
- financial strain
- slow recovery

PARAMETRIC POLICIES

📅 **Hypothetical timeline:**
Day 0 → event
Day 3 → validation by Calculation agent
Day 14 → payment
Day 30 → restart (funded by both the insurance policy and the company)

🟩 **Effects:**
- immediate liquidity
- rapid restoration
- reduced downtime

Parametric Policies

What they are

Index-based insurance policies provide the right to receive **automatic payouts** upon the occurrence of an event that causes damage. The **automatic payment** is triggered because there is a **very strong link between the event and the damage**; therefore, the occurrence of the event is **highly correlated** with the occurrence of damage.

The **relationship between event and damage** is estimated a priori, through a **scientific study** or **empirical evidence**.

In Parametric insurance, **there is no traditional loss adjuster involved,** but there is a **third party**

Calculation agent

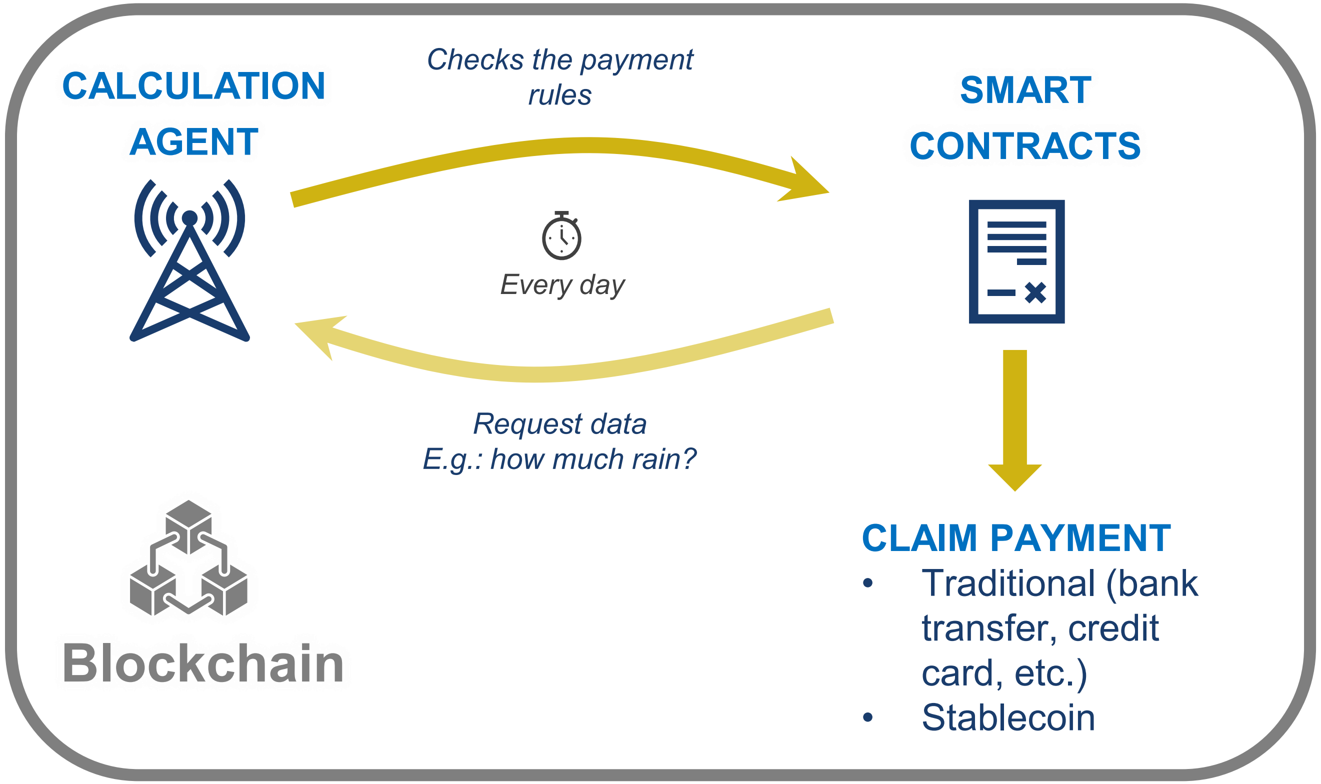
"A third party, independent of the parties, who certifies the occurrence of the event and the loss"

Advantages

1. Ability to cover **risks that have not been covered until now**
2. **Speed** of settlement
3. Better **customer experience**

Parametric Policies
The importance of data

Parametric insurance solutions are based on a **vast amount of data** collected via satellites, IoT, and public and private sources, which are used to **determine premiums** and **digitise the claims settlement process**. The availability of data and new technologies enables the development of new parametric products (e.g. satellite data)



Critical issues

- **Costs** of the Calculation agent and IT infrastructure
- Excessive **customisation**
- **Replicability** issues

Parametric Policies

Key differences from traditional policies

	PARAMETRIC POLICIES	TRADITIONAL POLICIES
Claims settlement criteria	Claim settlement is based on a **predefined parameter** (e.g. millimetres of rainfall). **The rule-based payout** is **paid automatically** when the parameter is exceeded, without the need to prove the actual damage.	Claim settlement is based on **an assessment of the actual damage suffered** by the insured and requires **an inspection or a survey**.
Settlement times	Payment is very **quick and automatic**, as **damage assessment** is generally **not** required. It is triggered as soon as the threshold is reached.	Payment takes **longer,** as an **accurate assessment of the damage** is required (survey by an expert), which can be particularly time-consuming in the event of a concentration of claims (e.g. natural disasters)
Flexibility of cover	They can be **customised according to specific parameters**, adapting to particular local risks (such as natural or climatic events).	They offer **standard cover** that protects against a **wide range of risks**, but require a case-by-case assessment to trigger the payout.

Critical issues

- Product comprehensibility – *trigger ≠ actual damage*
- Mismatch with traditional distribution models – *greater technical expertise*
- Difficulty in positioning the product – *Alternative to the traditional policy? Complementary?*

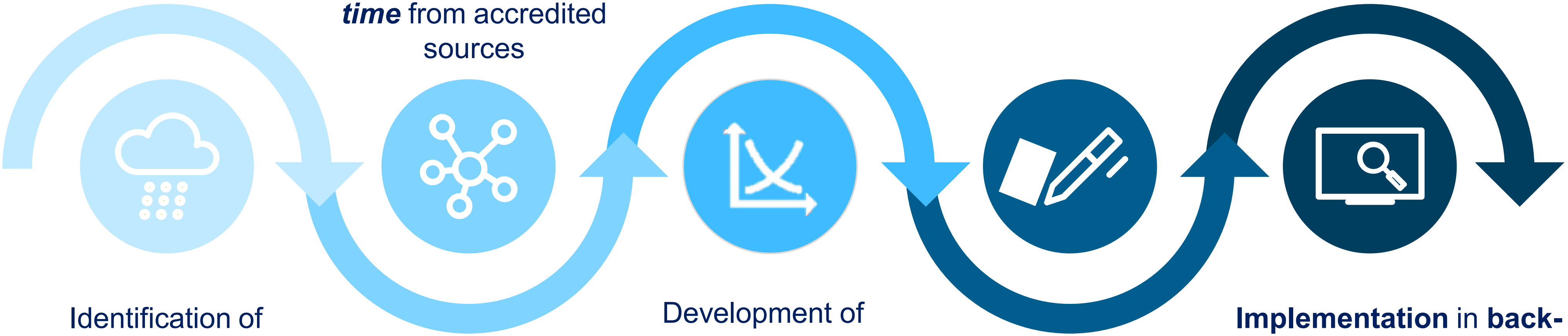
02

Creating a parametric product

Creating a parametric product

Workflow for creating a parametric product

The development of parametric products is based on a **process** that is essentially **divided into five stages.**



Identification of **insurance needs** and product **design**

Selection **of the calculation agent** and indices available ***in real time*** from accredited sources

Development of **indices/models** representing the **event-loss correlation.** Definition of the **trigger** for the insurance solution

Product **pricing** and definition of the **data set**

Implementation in **back-end** systems, **front-end systems and digital purchase funnels**. **Smart contract** development (**blockchain**)

Creating a parametric product

The importance of defining objective parameters

<table>
<tr><th>Product</th><th>Parameter Definition</th><th>Event-damage correlation</th><th>Supply Data</th><th>Calculation Agent</th></tr>
<tr><td>Weather</td><td>mm of rain</td><td>5mm Rain → damage</td><td>Weather provider</td><td>Weather provider</td></tr>
<tr><td>Earthquake</td><td>PGA
(peak ground acceleration)</td><td>30%g PGA → damage</td><td>Openquake</td><td>INGV</td></tr>
<tr><td>Maize drought</td><td>Drought index
(Rainfall, Temperature, Altitude, soil type, …)</td><td><table><tr><th>Index</th><th>Damage (%)</th></tr><tr><td>77</td><td>31</td></tr><tr><td>…</td><td>…</td></tr><tr><td>100+</td><td>100</td></tr></table></td><td>Agro Provider</td><td>Agro Provider</td></tr>
<tr><td>Flood</td><td>Water column</td><td><table><tr><th>Strike</th><th>Exit</th><th>Damage %</th></tr><tr><td>30</td><td>50</td><td>20%</td></tr><tr><td>50</td><td>80</td><td>30%</td></tr><tr><td>…</td><td>….</td><td>…</td></tr></table></td><td>Hydrogeological model
SAR (Sentinel) satellite data</td><td>Hydrogeological model
SAR satellite data (Sentinel)</td></tr>
</table>

This methodology makes it possible to:

1. **define ex ante payout structures aligned with expected losses**
2. **Reduce fraud and disputes**

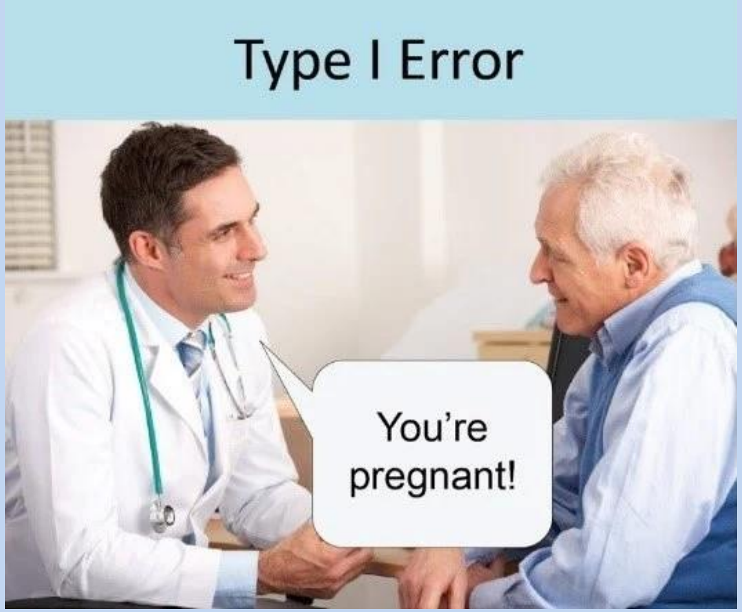
Creating a parametric product

Basis risk: when the trigger does not perfectly match the loss

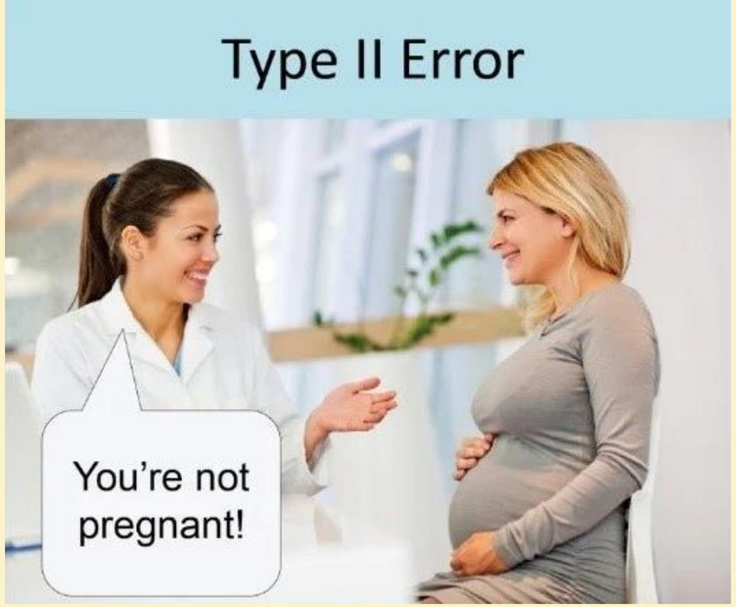
Basis risk is the **discrepancy** between the **compensation** calculated on the basis of pre-established parameters and the actual **financial loss** suffered by the insured party.

👉 ***The lower the basis risk, the greater the correlation between the trigger being activated and the losses actually incurred.***

🟢 **False Positive: Type I error**
Payout **triggered** but **no significant loss occurs**

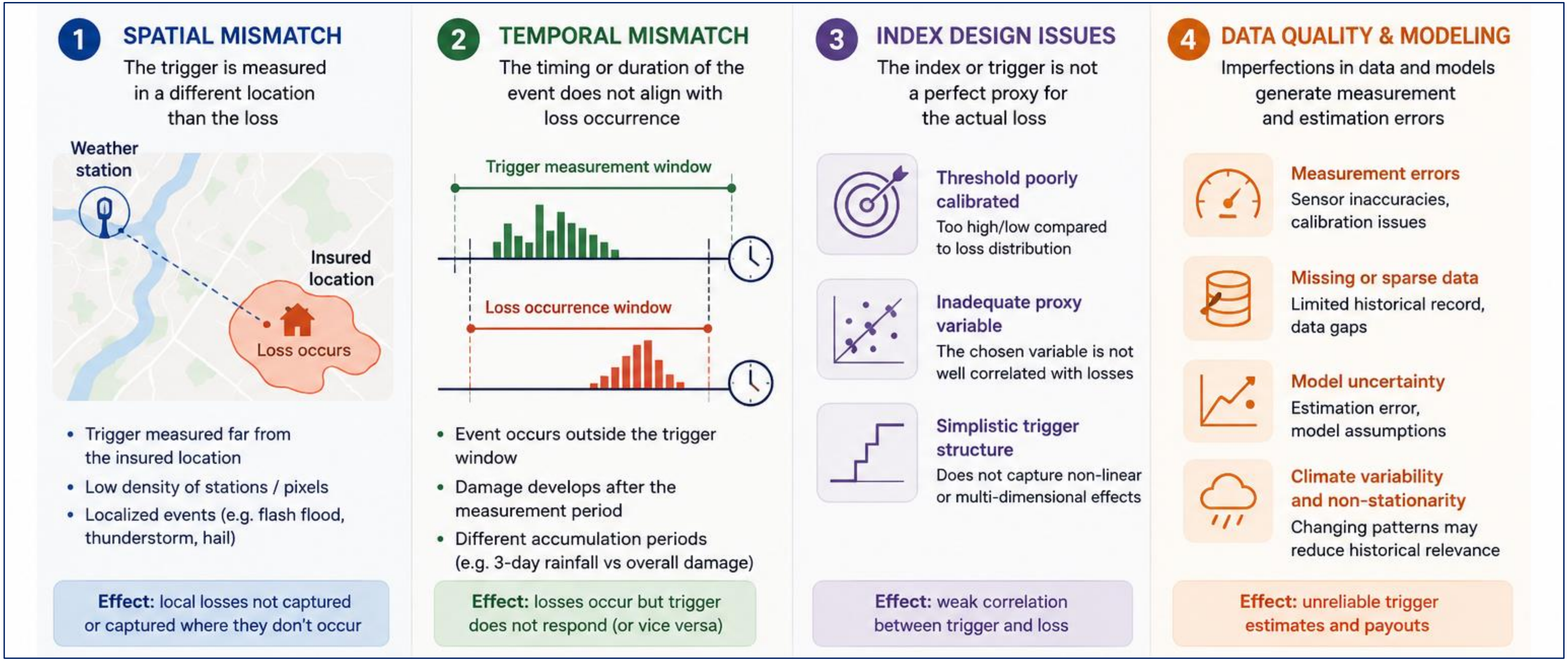


🔴 **False Negative: Type II error**
A **loss occurs** but **no payout is triggered**



Creating a parametric product

Basis risk: why does it occur?



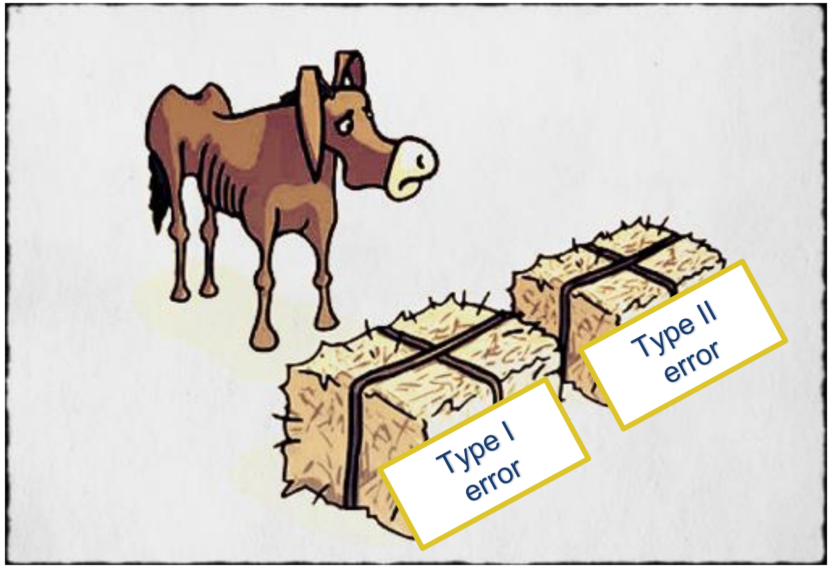
Creating a parametric product

Basis risk: Grape phytopathology example

	Predicted: YES	Predicted: NO
Damage: YES	25%	5%
Damage: NO	5%	65%

False Negative: Type II error

False Positive: Type I error



Optimal theoretical scenario

	Predicted: YES	Predicted: NO
Damage: YES	30%	0%
Damage: NO	0%	70%

Possible levers

- **Revise the model** by adding **variables/information** (e.g. treatments from the field log)
- **Adjust the product type** (compensation -> treatments)
- Bundle with **IoT**

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Parametric Policies and Climate Change

Climate challenges

Physical risks

Acute risks

- Fire risk
- Flood risk
- Hail risk
- Windstorm risk

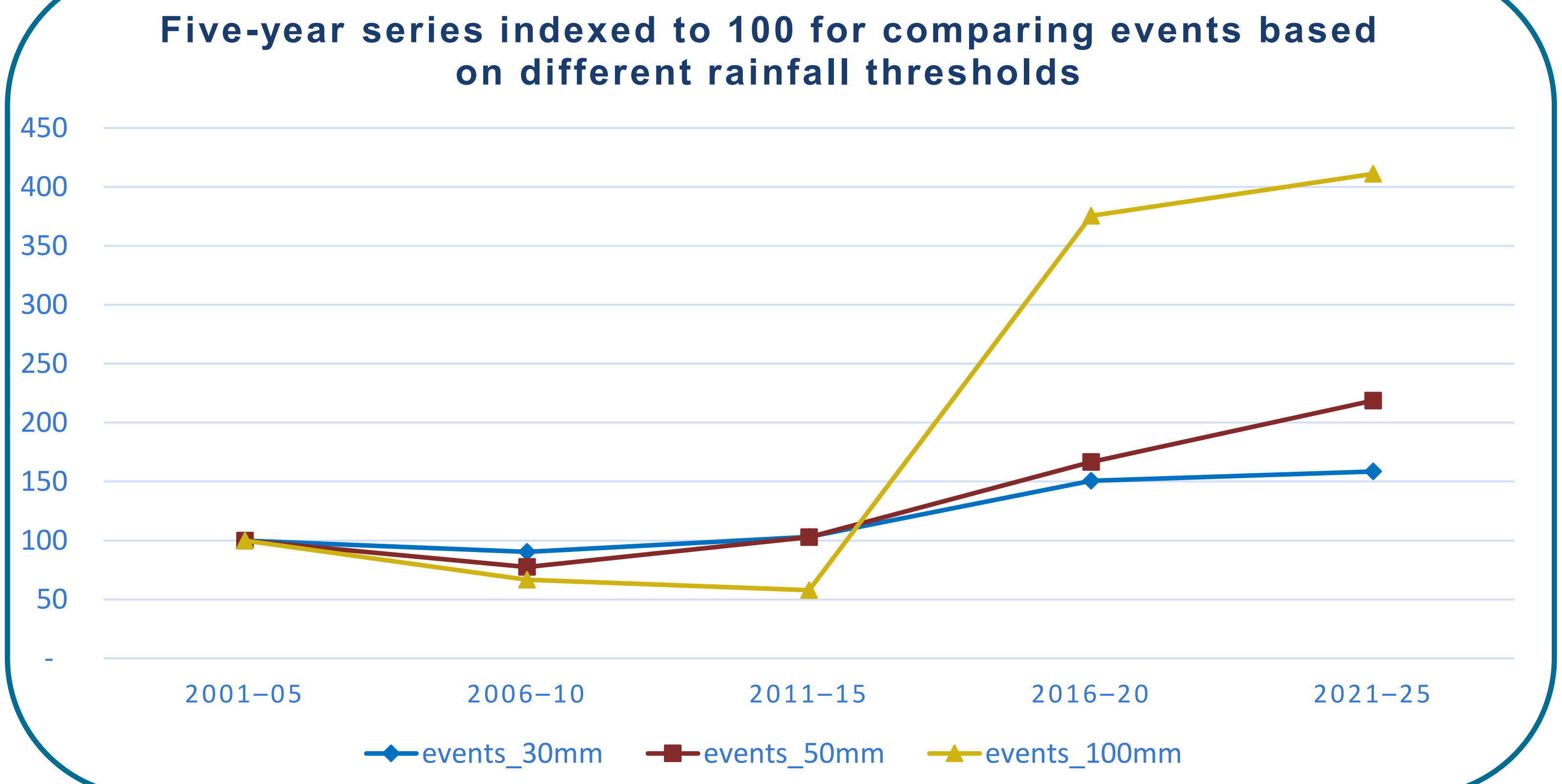
Chronic risks

- Risk of rising temperatures
- Risk of changes in wind patterns
- Coastal erosion risk
- Risk of sea level rise

Climate challenges

Acute physical risks – Flash floods

The **climate change currently underway** can be analysed using the available climate data. In this example, we have divided the analysis into five observation periods: *2001–05, 2006–10, 2011–15, 2016–20, 2021–25,* and three thresholds (*30 mm, 50 mm, 100 mm*). The reference parameter is the **number of events and affected monitoring locations that experienced rainfall > trigger**



% change 21–25 vs 01–05

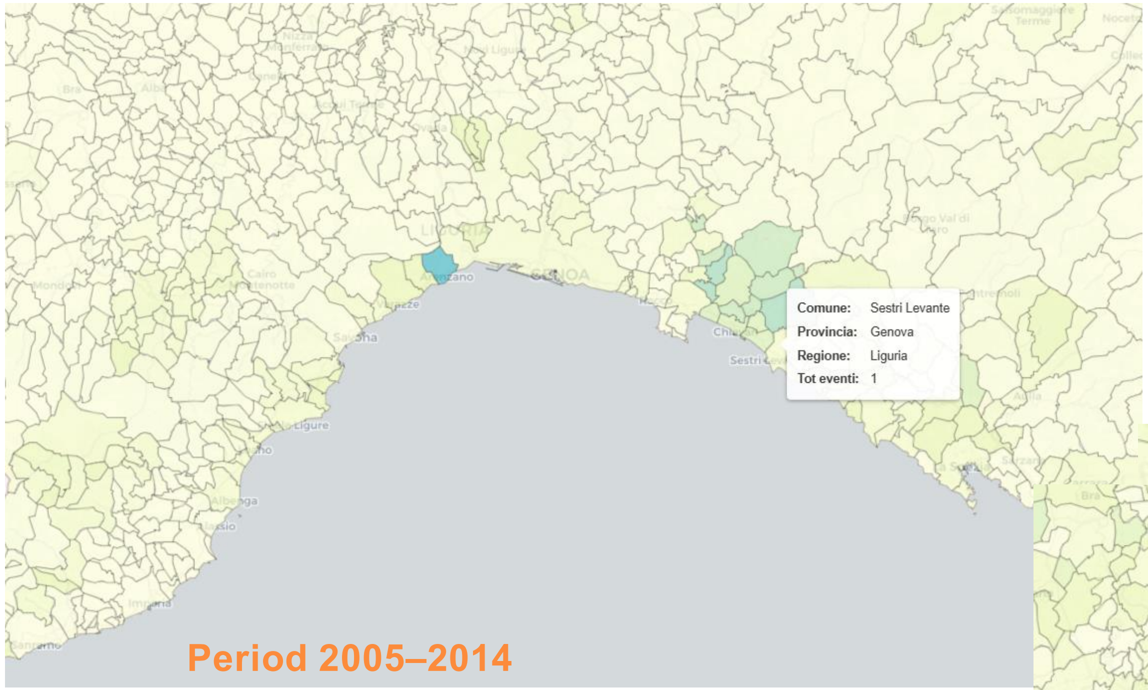
Events	**30 mm +59%** **50 mm +119%** **100 mm +311%**
Affected areas	**30 mm +9%** **50 mm +74%** **100 mm +284%**

Key insights

- **Extreme** rainfall events are **accelerating faster** than **moderate** events
- **100mm events** show the strongest increase
- Climate variability is **increasing**, both in terms of **variability** around the mean and in terms of **spatial extent**

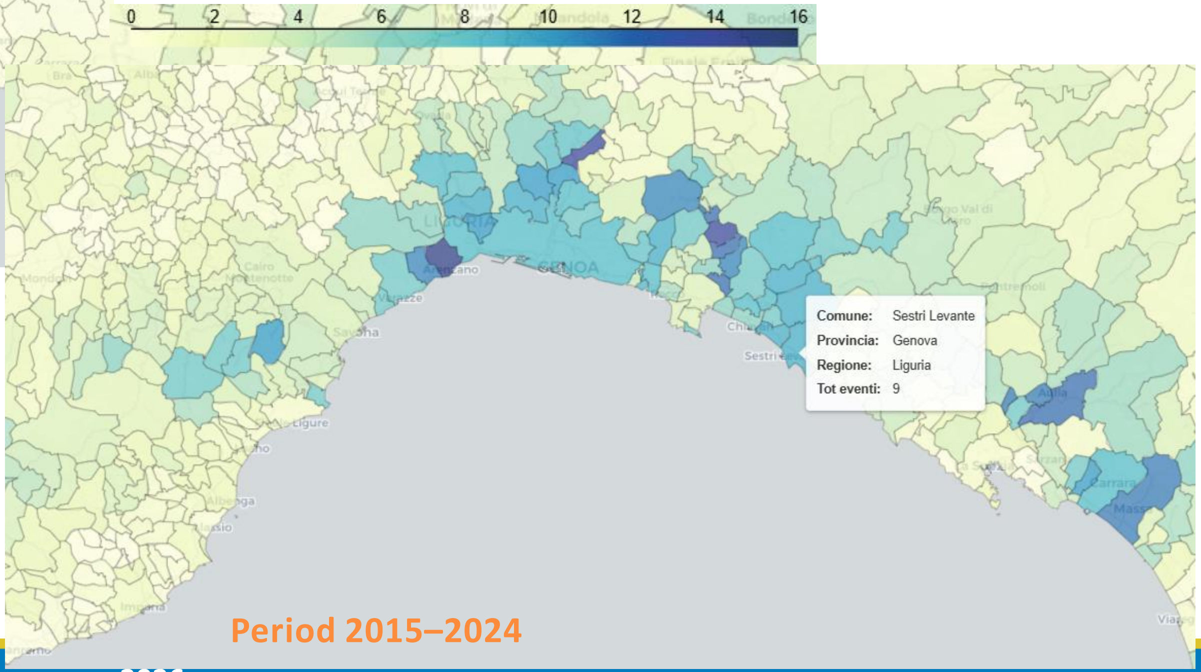
Climate challenges

Acute physical risks – Flash floods



In this example, we have divided the observation period into two: 2005–2014 and 2015–2024.

The reference parameter is the **number of days with rainfall > 30mm in one hour**



In these images, produced on the same scale, a **significant difference** between the two periods can be observed.

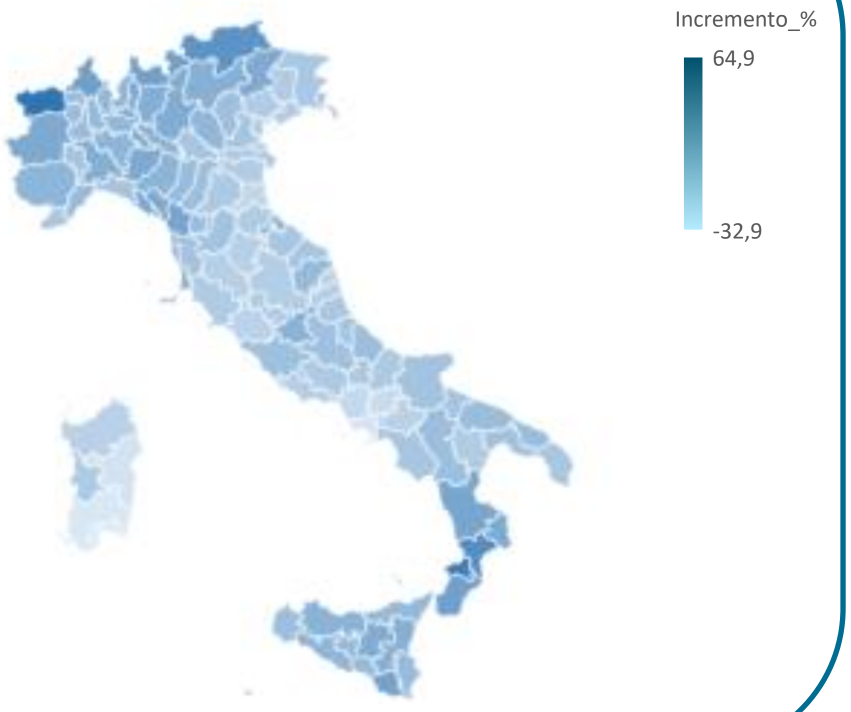
For example, Sesti Levante had only **one** such event in the first period, whereas it had **nine** in the second period

Climate challenges

Acute physical risks – Drought

The **climate change currently underway** can be analysed using the available climate data. In this example, we have divided the analysis into five observation periods: *2001–05, 2006–10, 2011–15, 2016–20, 2021–25,* measuring the CDD (Consecutive Dry Days)

CDD increasing for Italian province (01-05 -> 21-25)



COMPARISON OF LARGE GEOGRAPHICAL AREAS			
Area	**CDD 2001-2005**	**CDD 2021-2025**	**Increase %**
Centre	29.8	28.9	-3.0%
North	28.8	31.1	8.0%
South and Islands	33.0	34.1	3.3%
Italy	**31.5**	**32.5**	**3.2%**

Climate change does not necessarily mean **lower annual rainfall**, but rather **greater variability**, **irregular dry spells and more concentrated rainfall events**:

- **longer** dry periods;
- greater **alternation** between extremes;
- increased **climate volatility**;
- greater **stess** on **agriculture** and **water resources**

Climate challenges

Chronic physical risks

Diseases, plant pathogens
Excessive rainfall and drought

Mollusc farming
Rising sea temperatures

Honey and fruit trees
Unseasonal frost

Cow and milk production
Heatwaves

Wind power
Changes in wind speed

Hydropower
Prolonged periods of drought

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Final remarks

Parametric Policies

Final Remarks

Parametric Products:

- ✓ Significant growth and potential for future development
- ✓ Automatic payout, clear and predefined activation criteria
- ✓ Customisable and innovative cover
- ✓ Promotion of simple products and clear language

Points to note:

- ✓ Implementation costs
- ✓ Basis risk

Actuary:

- ✓ Central role in product development
- ✓ Actuary 2.0 (data science, coding, data management, AI)
- ✓ Dialogue with industry experts, ability to synthesise

Innovation:

- ✓ Opportunity to develop new coverages through the availability of new technologies (satellites, IoT) and data mining
- ✓ Blockchain