Flood Risk - Navigating the deluge in Europe

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Agenda

- Recap of 2024 extreme weather events in Europe
- UK
  - Impact of Flood Re
  - Changes in the insurance market
- France and the Netherlands
  - Flood Monitoring tool
  - Flood Modelling :
    - ➢General framework
    - ➢Catastrophe tool
    - ➢Scenario Analysis tool
- Conclusion and Q&A

Recap of 2024 extreme weather events in Europe

- 2024 was the warmest year on record
  - European temperature 2.92C above the pre-industrial level
- Across Europe, flooding stood out as the most prevalent and expensive peril
  - Some estimates suggest close to 50 named storms occurred during 2024
  - Central European floods in September – EUR 2.2 billion
  - Southern German floods in May – EUR 1.6 billion

Floods in Europe

€20 Billions

2002 Central European floods

€10 Billions
200 lives

2021 Western European floods

20% population

Estimated at risk for flood in Europe

€7 Billions

Annual average economic cost of European flood

+50 %

Flood frequency by 2100 according to the IPCC

+200 %

Annual average economic cost for European flood by 2050

United Kingdom

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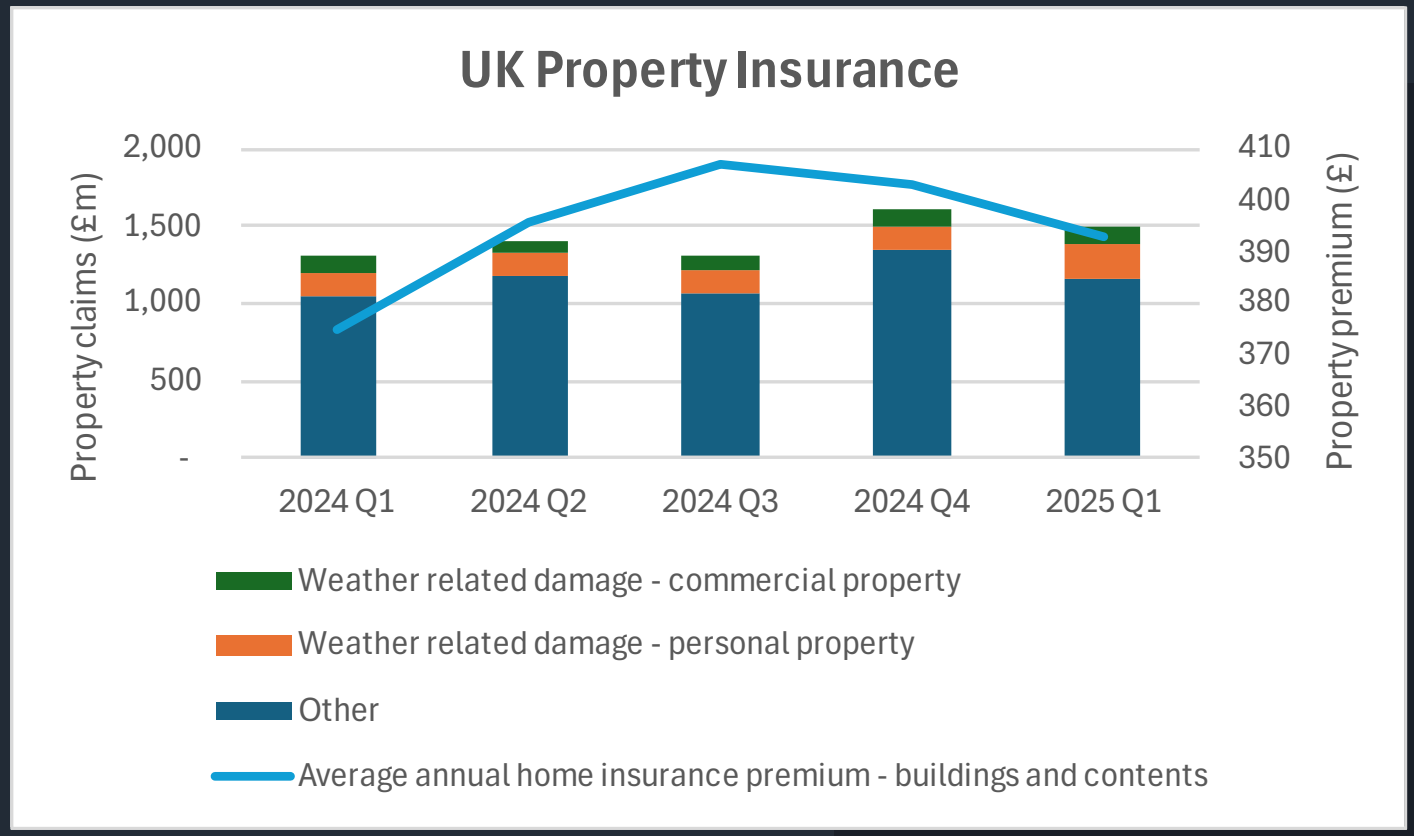
UK property premiums and claims



Source: ABI data

Inflation adjusted average premiums are below the levels observed between 2013-2017, but average claim paid is > 50% more expensive than 2017

Impact of Flood Re

- Joint industry and government initiative that provides flood cover for properties in high risk areas in the UK
- In 2022, Build Back Better launched
- In the year ending 31 March 2024,
  - £241.6 million paid claims. A third of all claims since Flood Re's inception were received in 2023/24, in the wake of storms Babet, Ciaran and Henk
  - A third of claims for recent storms included Build Back Better provisions
  - Number of policies ceded to the scheme increased by 9% to 288,567
- End date of 2039

Source: Flood Re

UK property insurance market

Current situation

- Flooding, especially in the face of climate change, remains a big risk
- ABI stresses the importance of adequate annual investment in flood defences
  - The government has committed to investing £2.65 billion over the next two years towards building and repairing over 1000 flood defences.
- Many new homes continue to be built on flood plains
- Many insurers are increasing premiums and reducing the level of cover they provide
- Improvements continue to be made in flood risk modelling

What does the future hold?

- Government is in the driving seat
- Collaborative approach, led by government?
  - Home building needs, cost of building and maintaining flood defences, and latest flood modelling information
- Risk-reflective premiums post 2039?
  - Will some properties become uninsurable and unsellable?

France and the Netherlands

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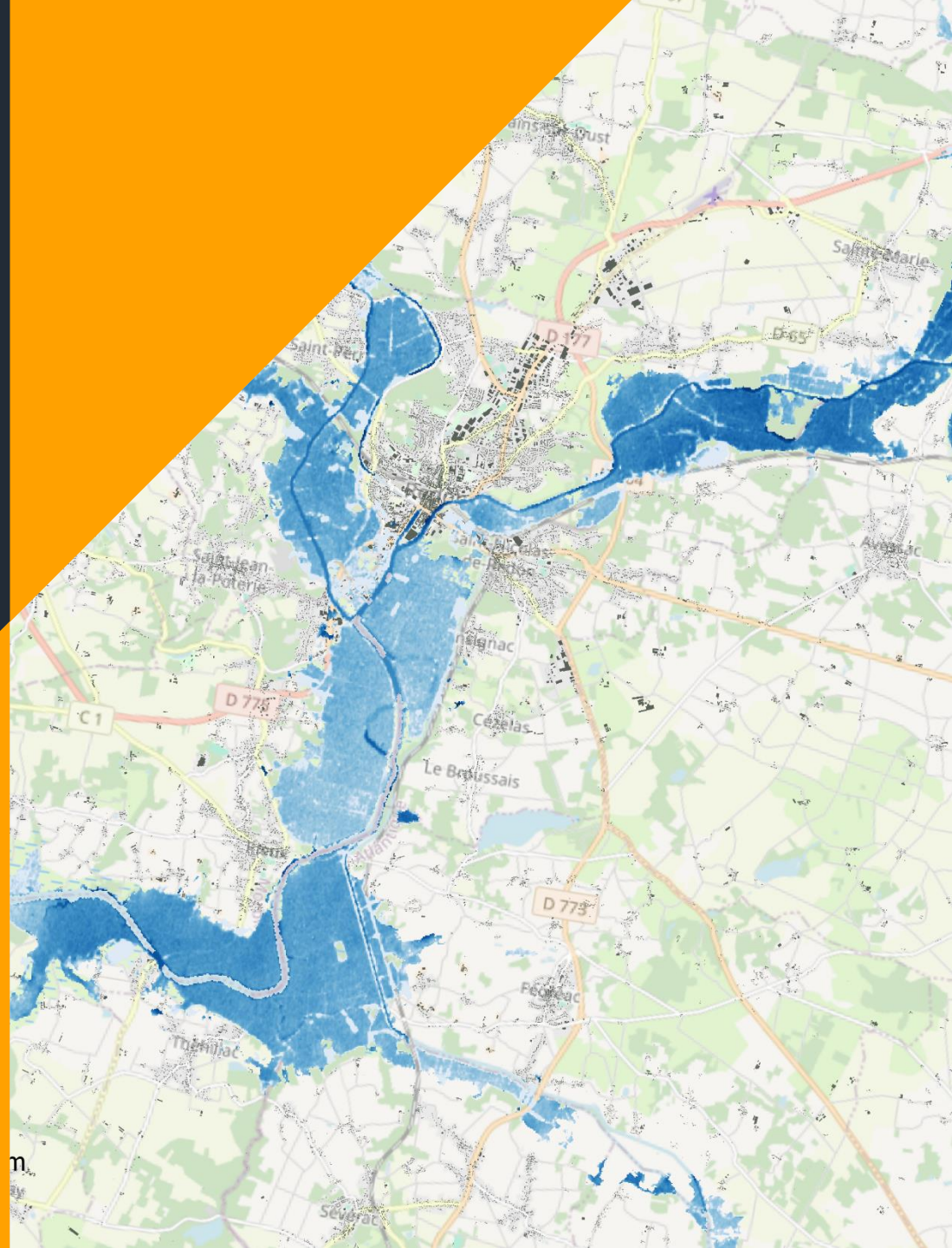
Flood Monitoring Tool



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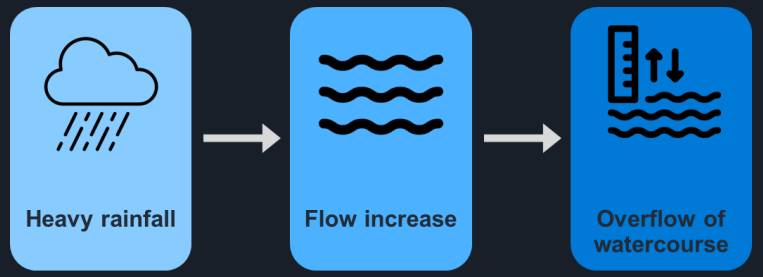
Background

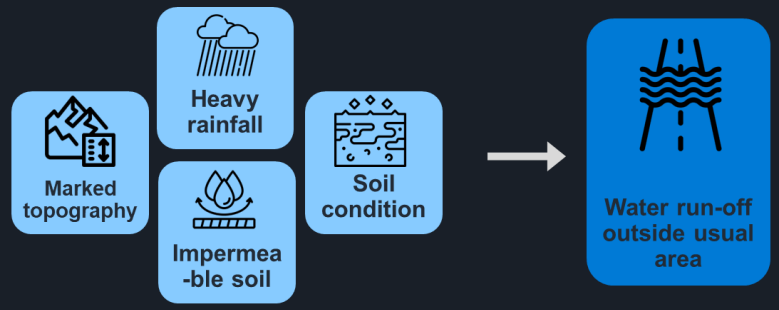
Different types of floods

Fluvial (river floods)



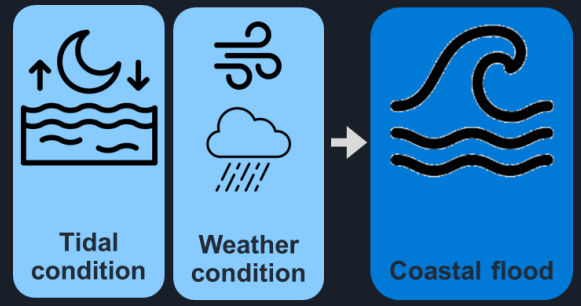
- Dependent on snowmelt, rainfall, dams & dikes and soil and terrain composition.
- When a river overflows, the effects depend on the floodplain's characteristics.

Pluvial (flash floods)



- Occurs when a large amount of water overloads the local drainage system.
- Such a flood can, in theory, happen in any area, irrespective of geography or nearby water bodies.

Coastal floods



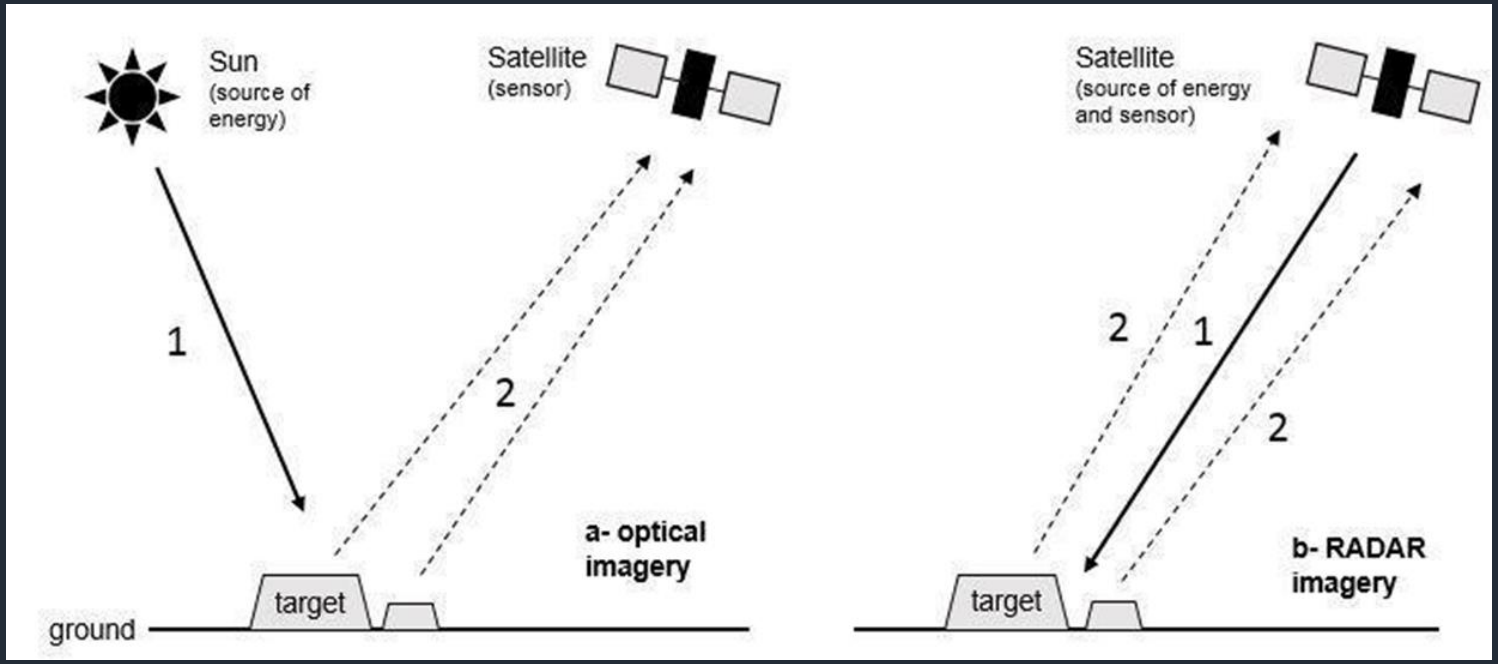
- Occurs when coastal defense systems are not able to withstand forces coming from the sea.
- Such a flood usually occurs when high tides are combined with high winds and storm surges.

Copernicus Sentinel-1

Synthetic Aperture Radar

- Organization : PROGRAMME OF THE EUROPEAN UNION — co-funded with esa

- Mode of operation :

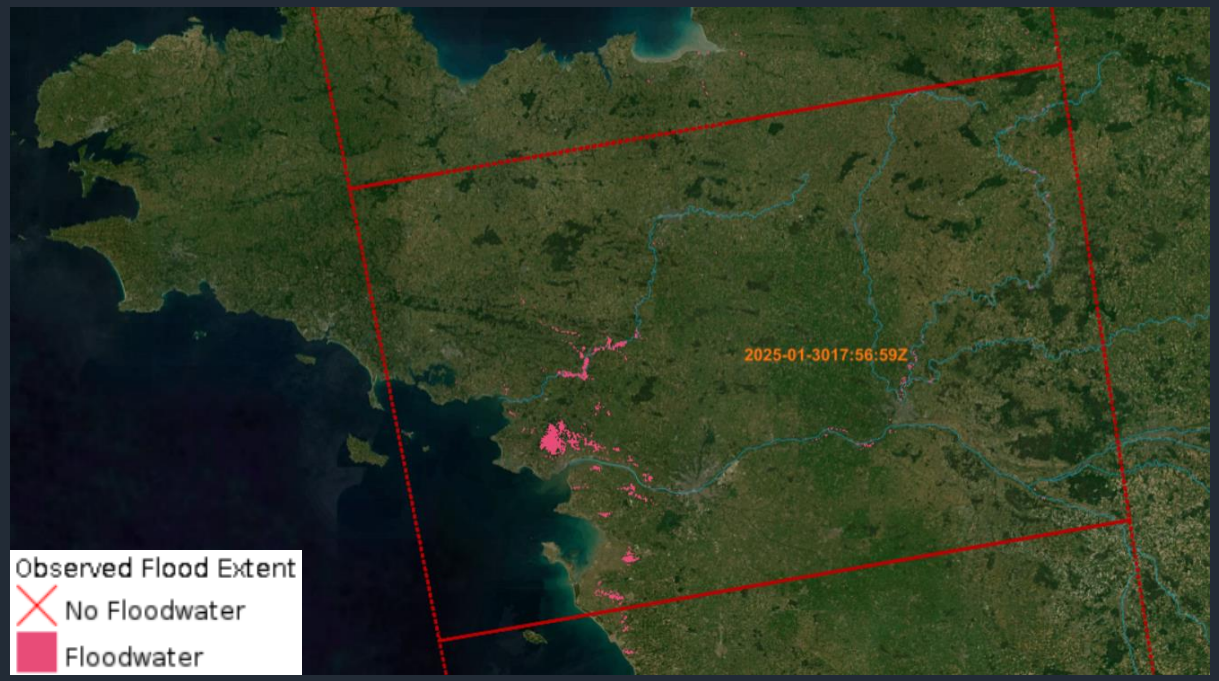


Source : Catry et al (2018).

- Benefits : -Day and night -All weather conditions -Effective to discriminate water on the ground

Global Flood Monitoring Data

Observed flood extent and likelihood



Observed flood extent

Flood likelihood

Source : GloFAS

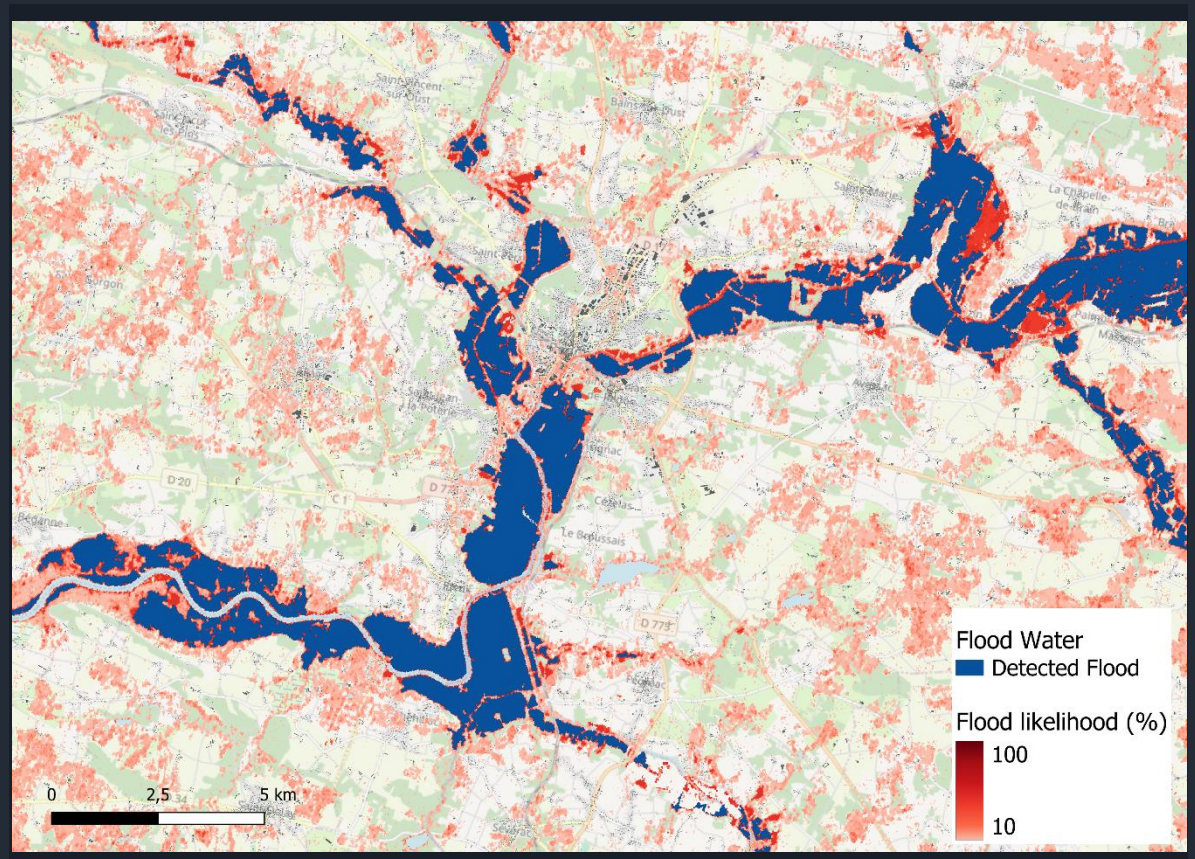
Estimating Water Depth

Framework

Pre-processing of flood data

- Input historical flood data from GloFAS : Detected water and Likelihood
- Choice of the region of interest
- Reprojection of the geospatial layers

Flood in Redon, France, 30 January 2025



Milliman Map : April 2025 – Sources : GloFAS, IGN

Estimating Water Depth

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Expansion of flooded areas

- Use of the likelihood to extend the flood in urban areas, poorly covered by the radar

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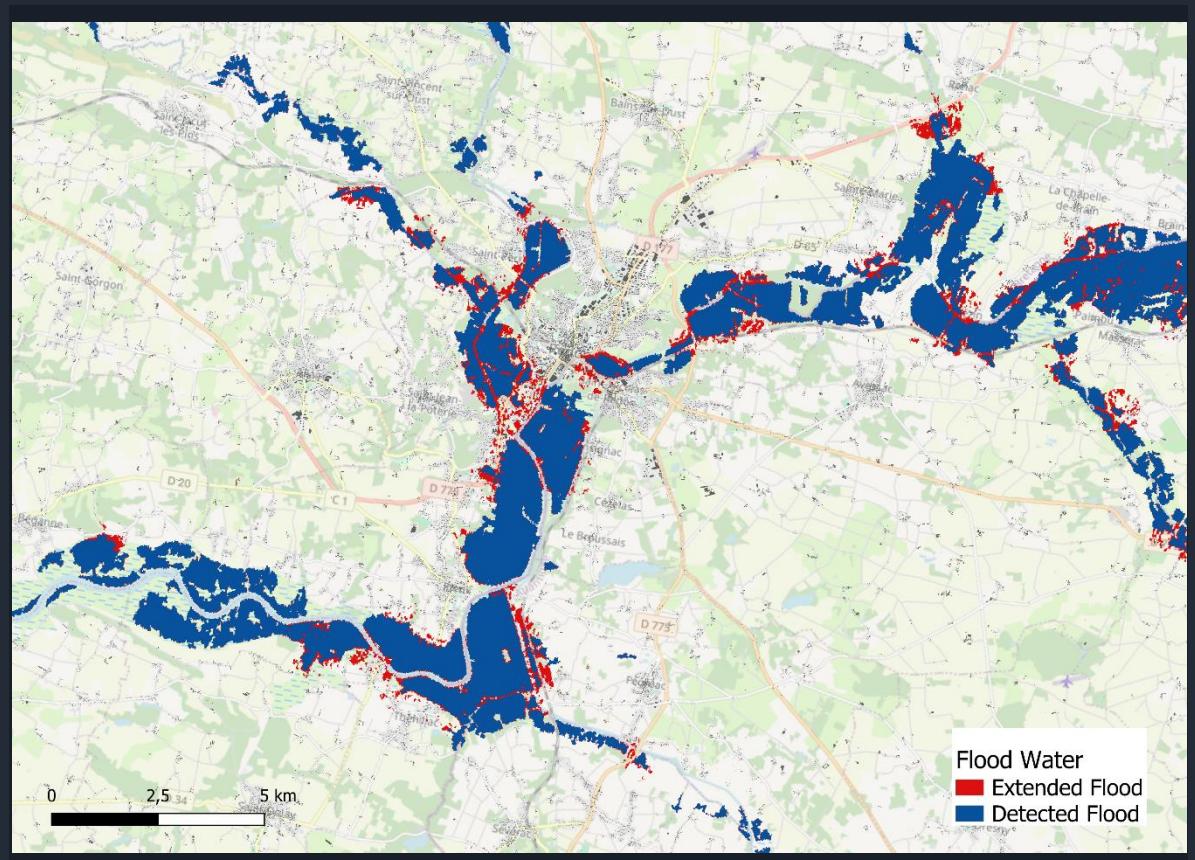

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Estimating Water Depth

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Computation of the water depth estimate

- Water depth estimated according to flood extent and area topography
- Exclusion of outliers

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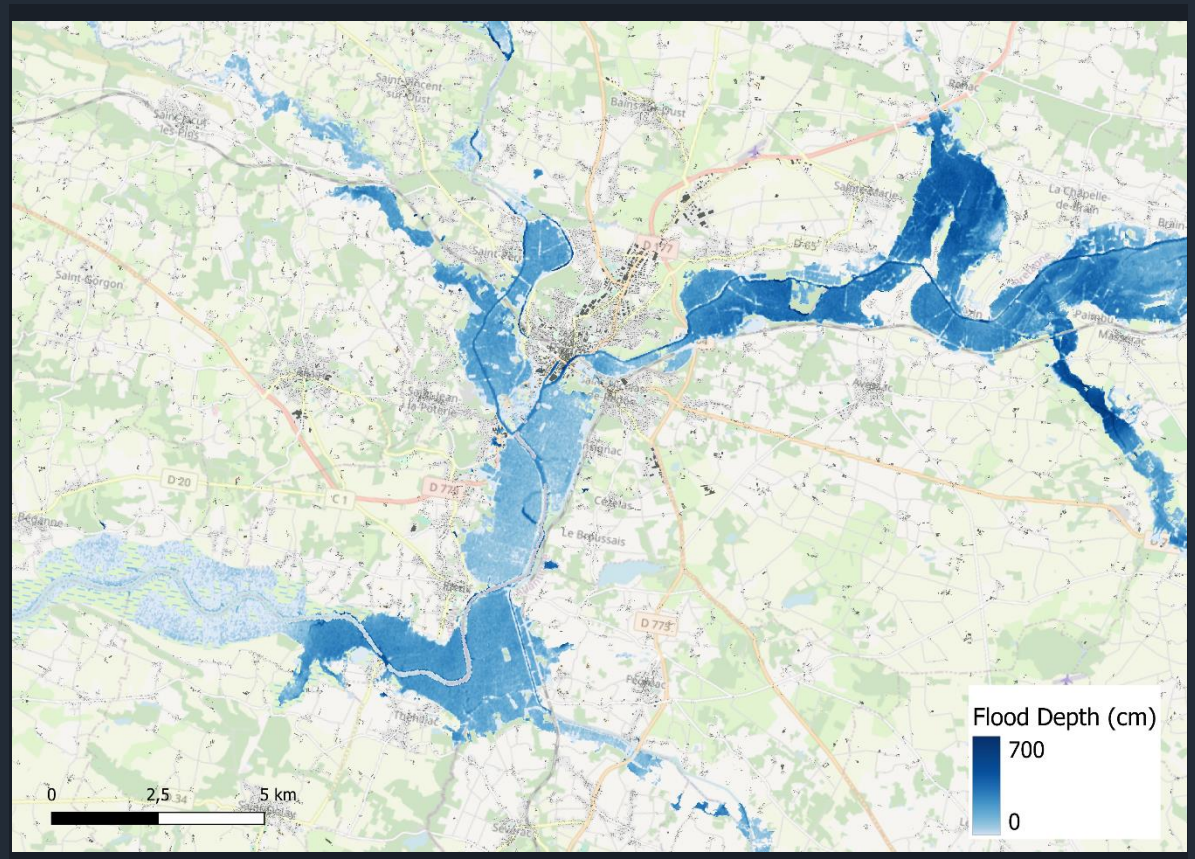

Milliman Map : April 2025 – Sources : GloFAS, IGN

Flood Modelling : General framework

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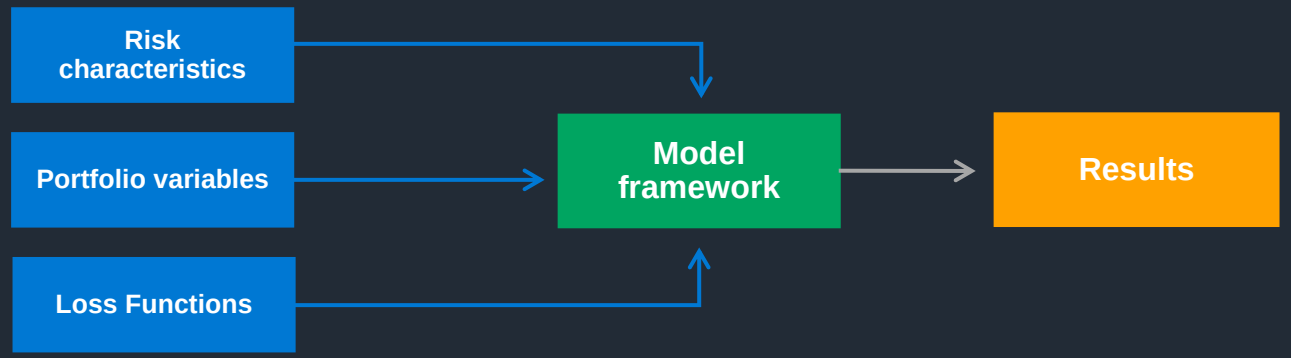
General framework

In more detail

How it works



Flood depths

Current state of the climate
Freely available risk maps that show flood depths in the case of a flood event, provided by local government agencies.

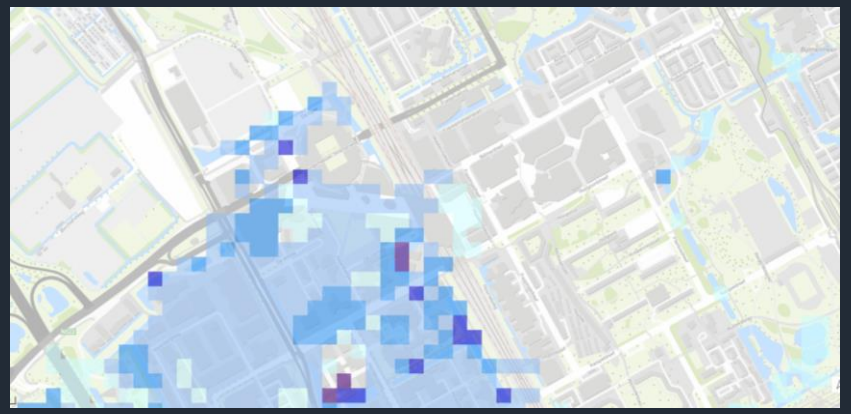
Future climate change scenarios
Global flood depth maps under several climate-change scenarios

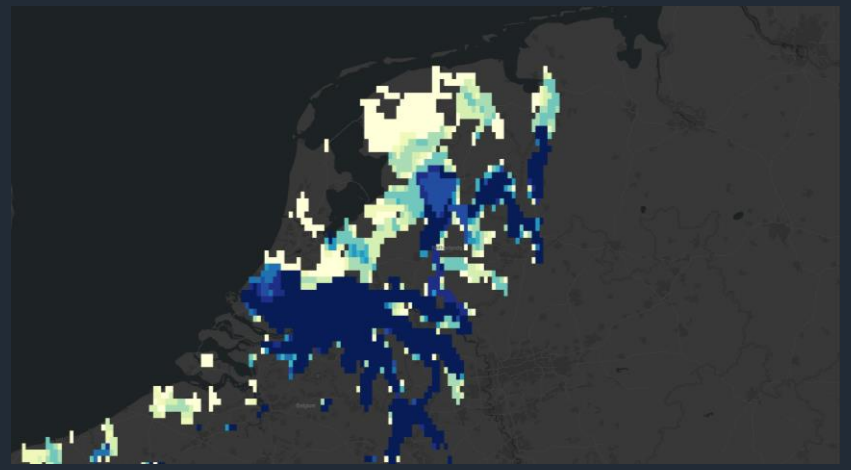
Other data and parameters

Rebuild value – calculated based on building characteristics available in open data

‘Depth damage curve’

Impressions of the data





Flood depth data

Data-agnostic framework applied on open data

Current state of the climate

- Risk maps provided by government agencies which are freely available under the EU's flood directive
- Provide flood depths for events with a 1-in-X year return period

Climate change scenarios

- Flood depth maps with yearly maximum flood depth for the period until 2100.
- One simulation done with each climate and hydrological model, for 3 emission scenario's (RCP 2.6, 5.0 and 8.5)

Catastrophe tool

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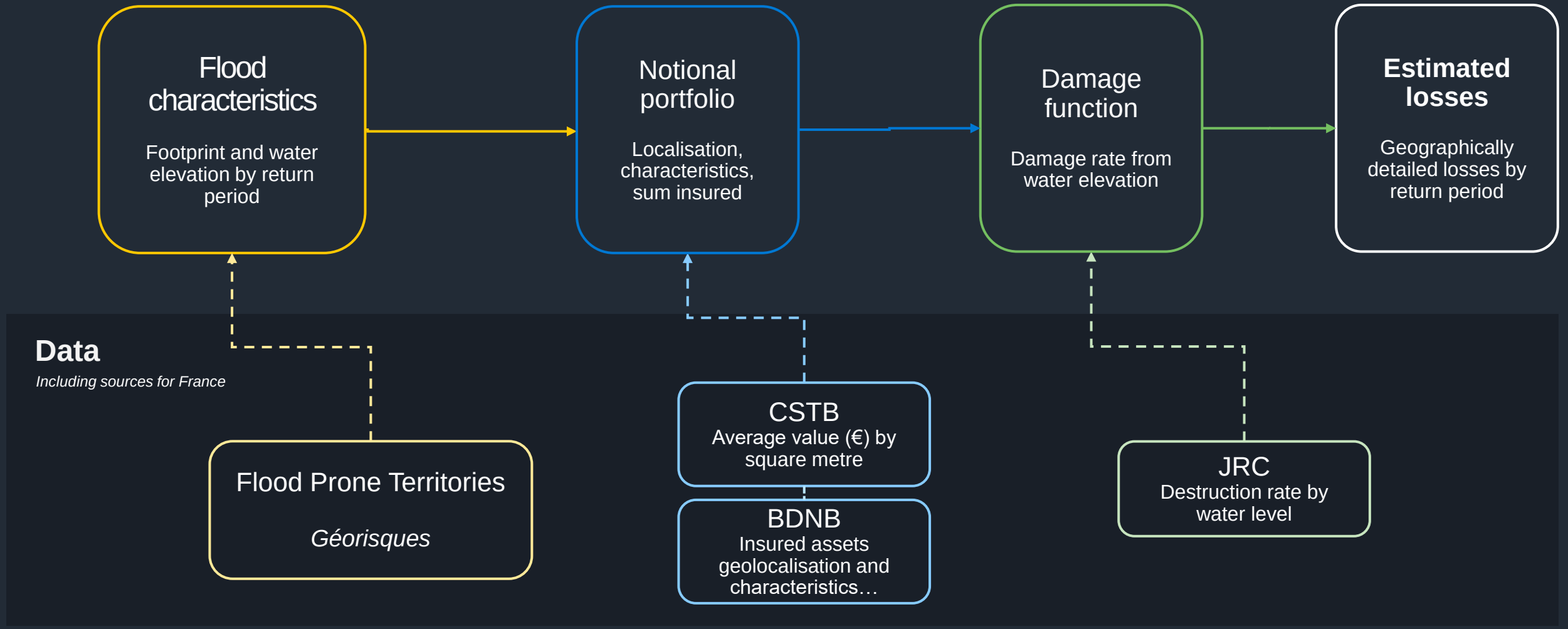
Catastrophe tool

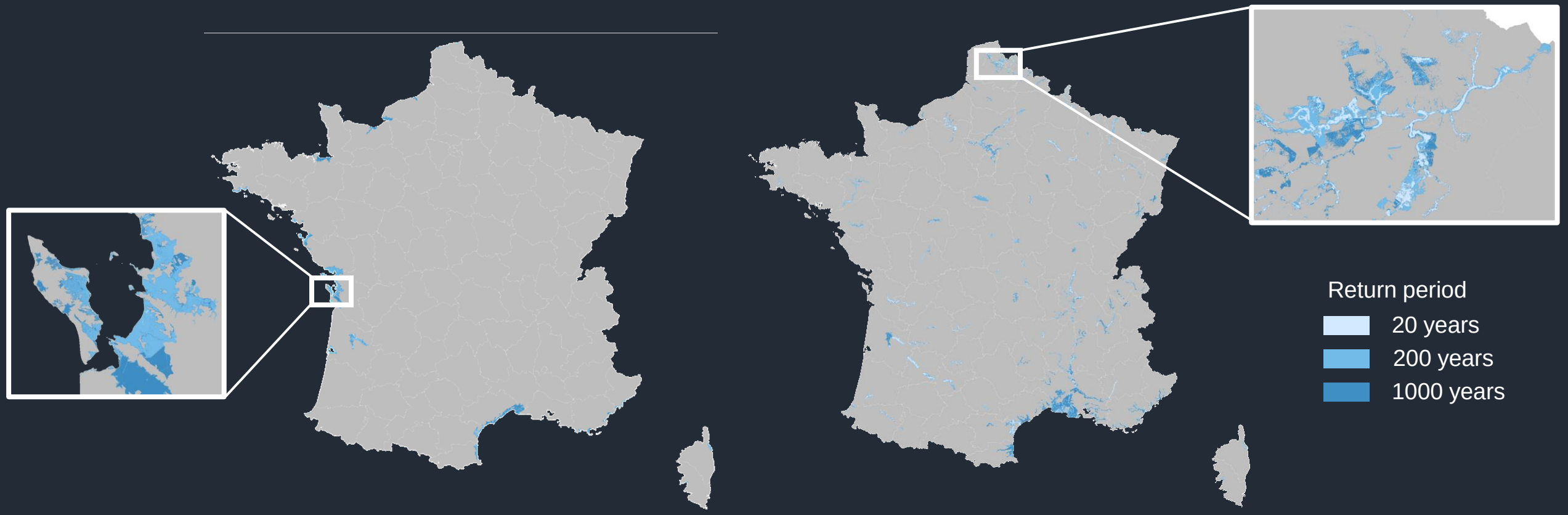
Workflow



Floods characteristics

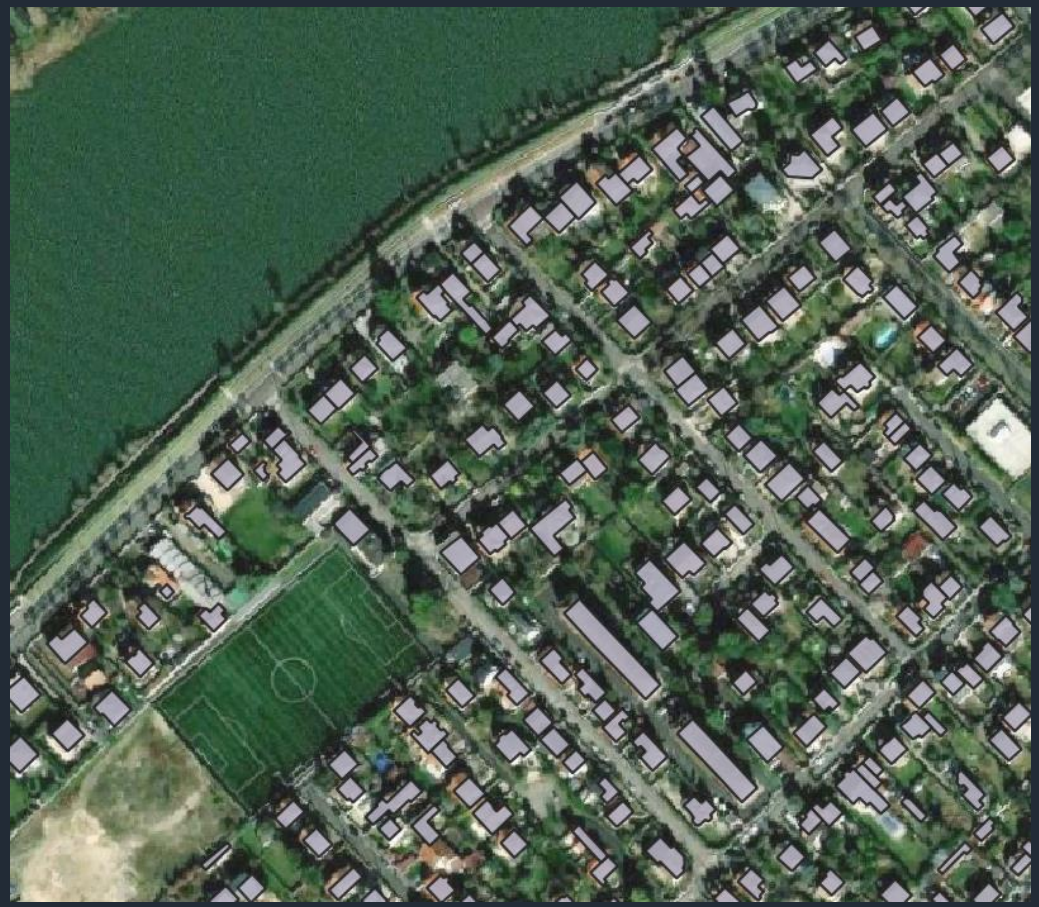
Coastal flood footprint

Fluvial flood footprint



Source : Géorisques

Notional portfolio



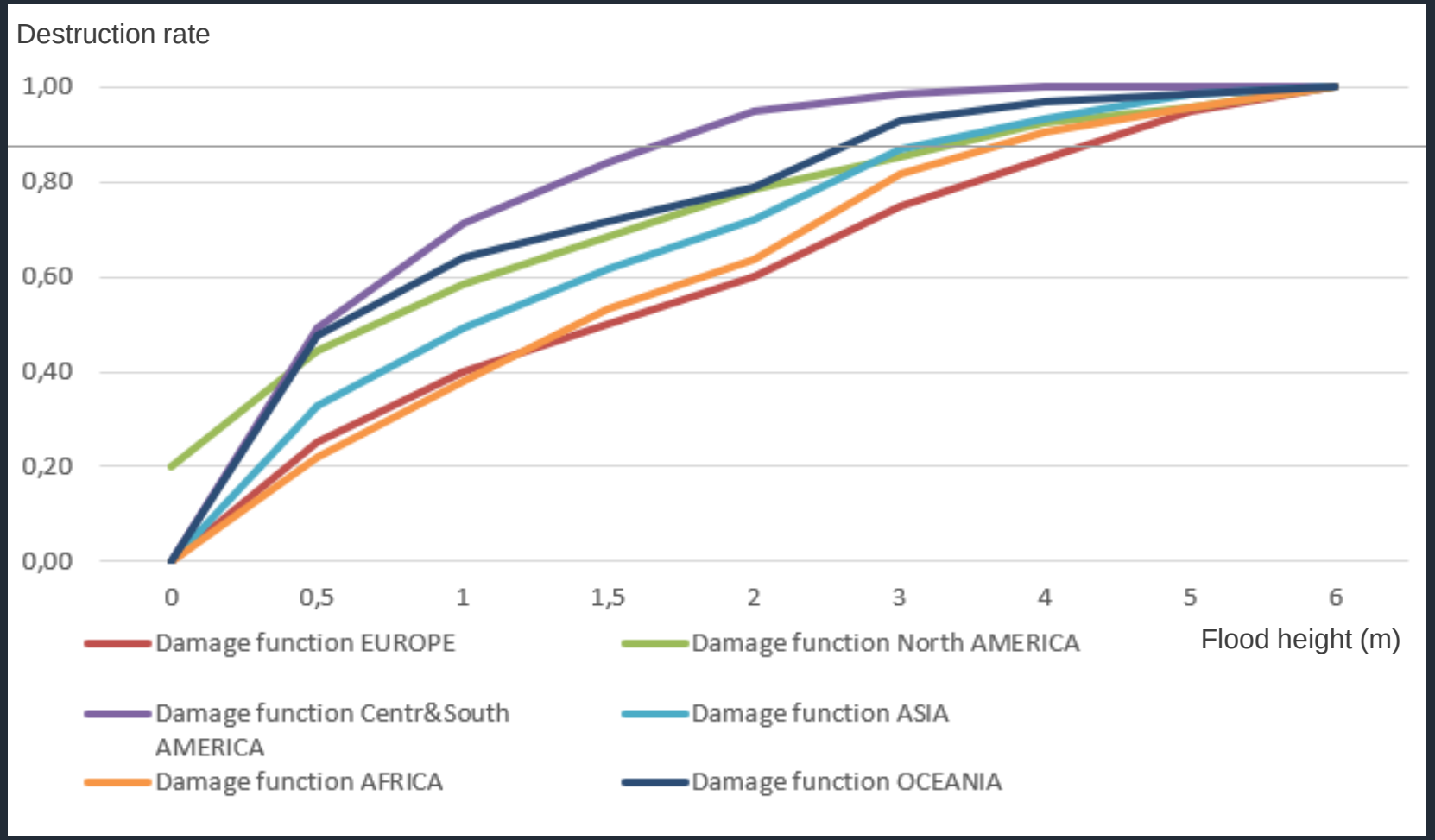
Buildings :

- Location
- Area
- Height
- Construction date
- Wall type

Source : ESRI, IGN

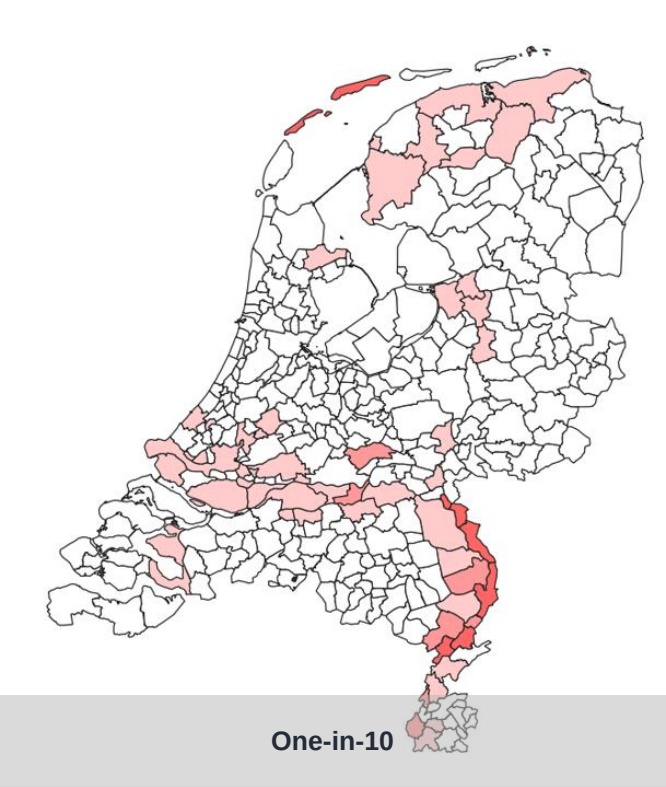
Damage function

Destruction rate for residential building by flood height

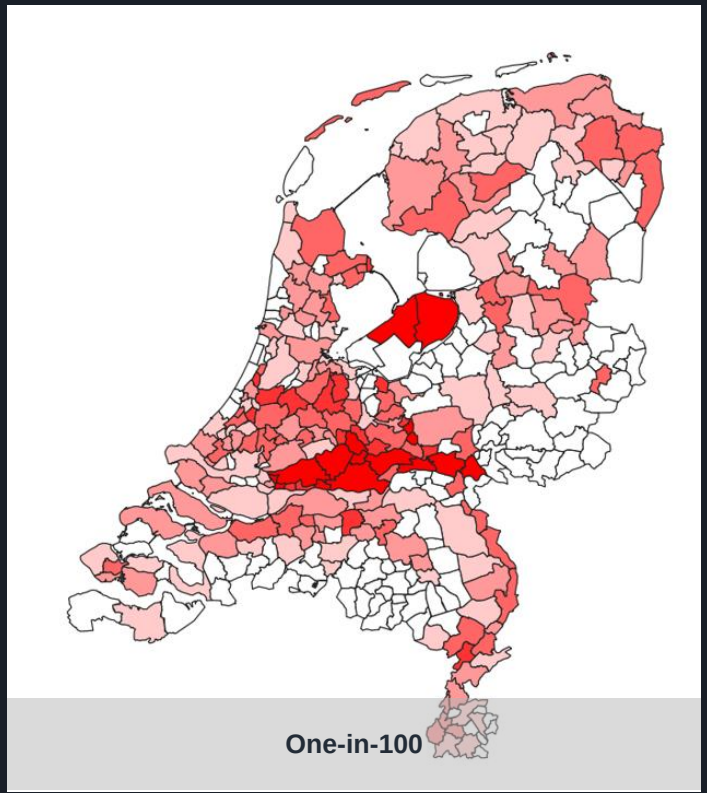


Results

The Netherlands



One-in-10

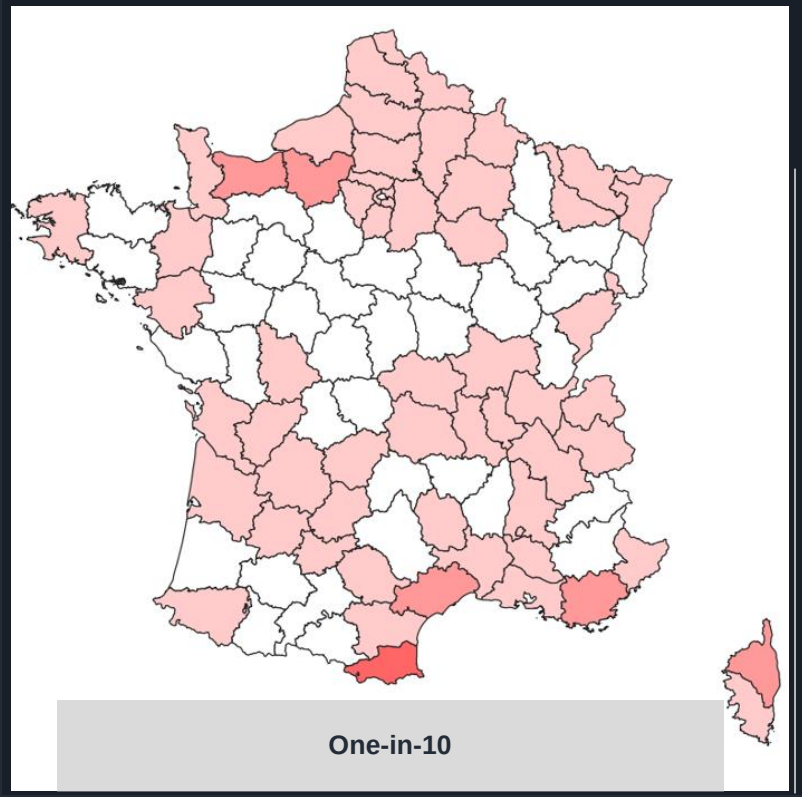


One-in-100

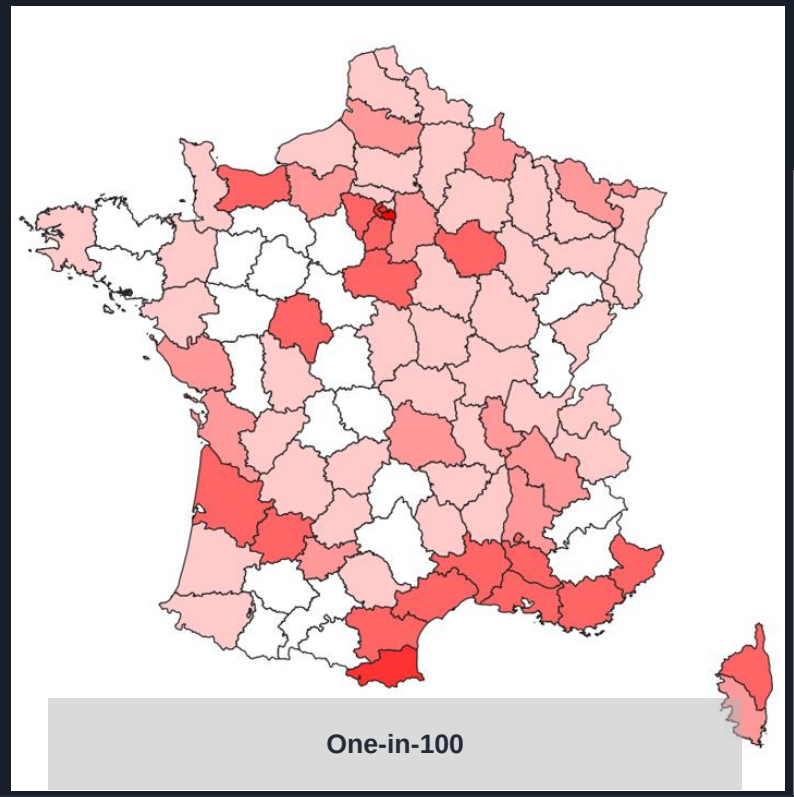
Return period	Insured loss	Per EUR 1,000 insured amount
1-in-10	EUR 36 mln	2.4
1-in-100	EUR 826 mln	55.1
1-in-1,000	EUR 2,352 mln	156.8
1-in-10,000	EUR 3,607 mln	240.5

Results

France



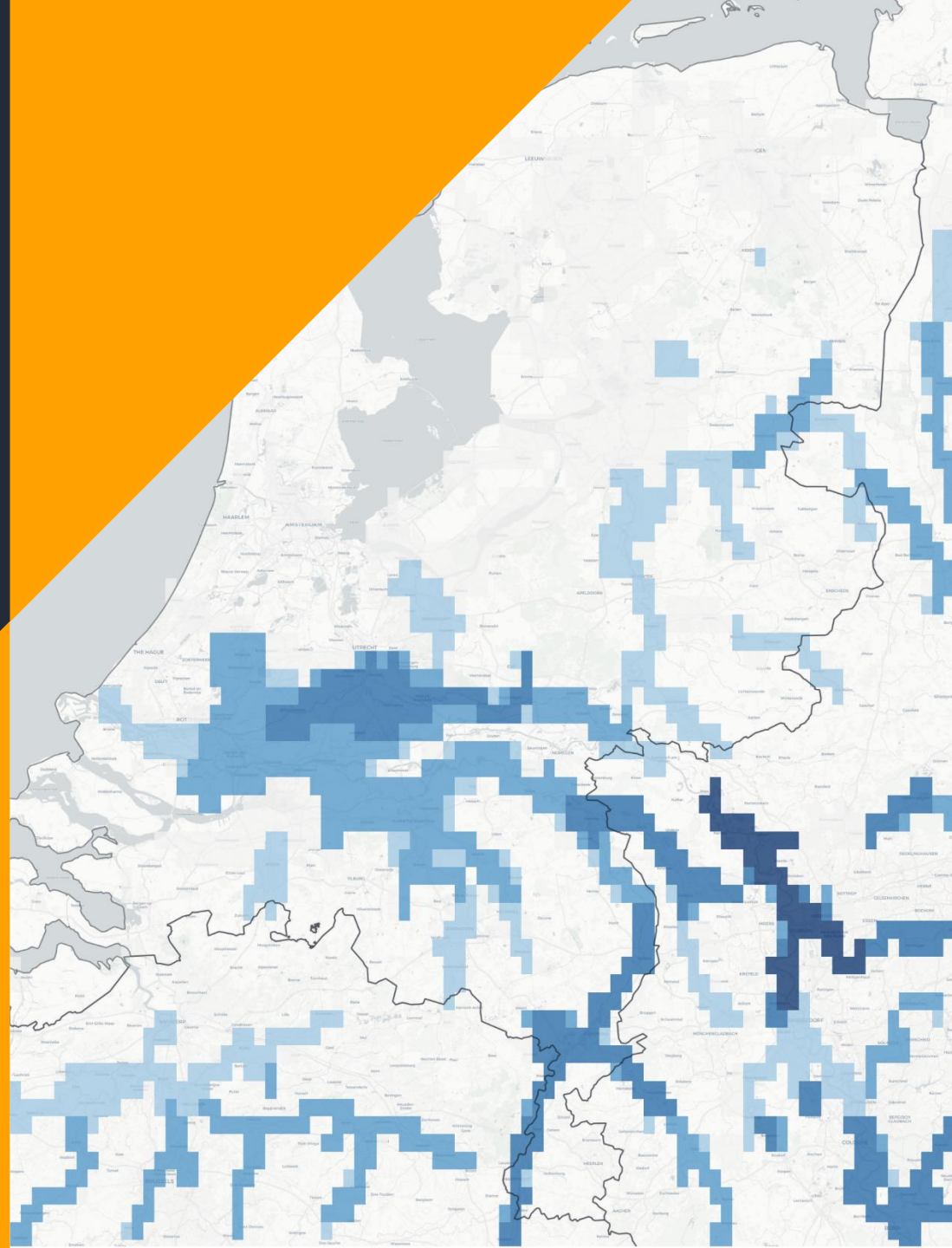
One-in-10



One-in-100

Return period	Insured loss	Per EUR 1,000 insured amount
1-in-10	EUR 165 mln	3.2
1-in-100	EUR 1,067 mln	20.9
1-in-1,000	EUR 2,445 mln	47.9

Scenario Analysis tool



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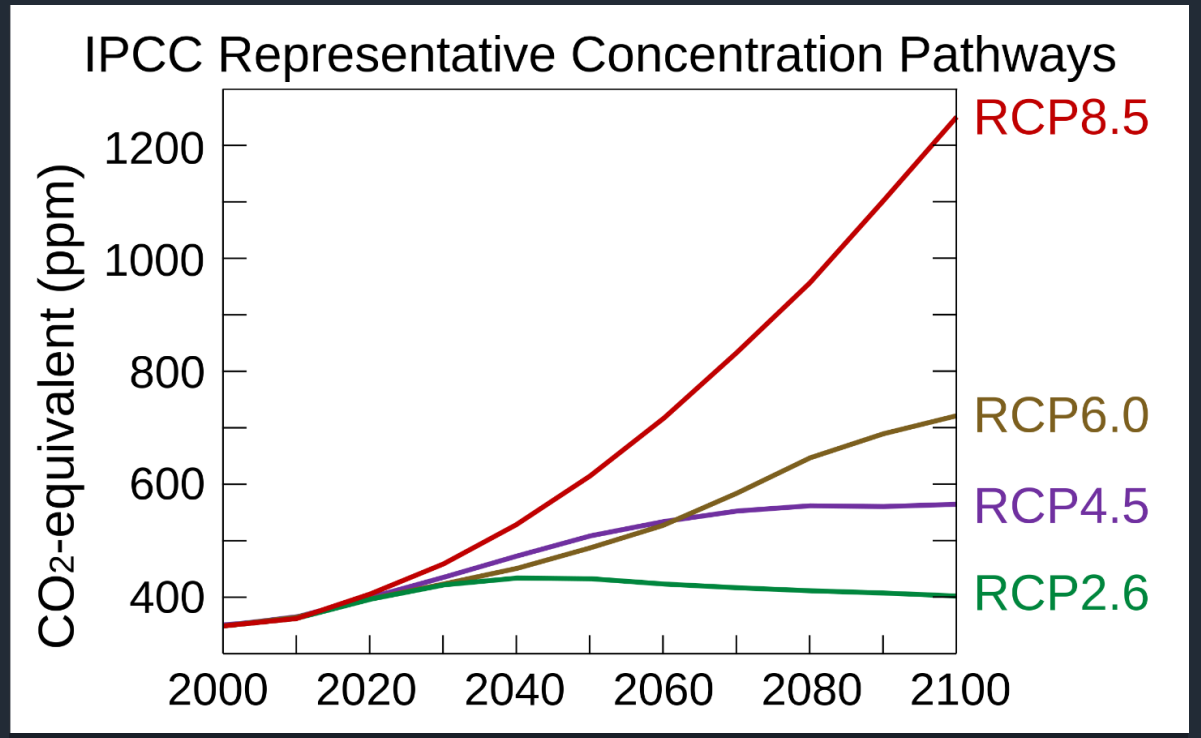
Flood depth data

Quantifying the effects of climate change

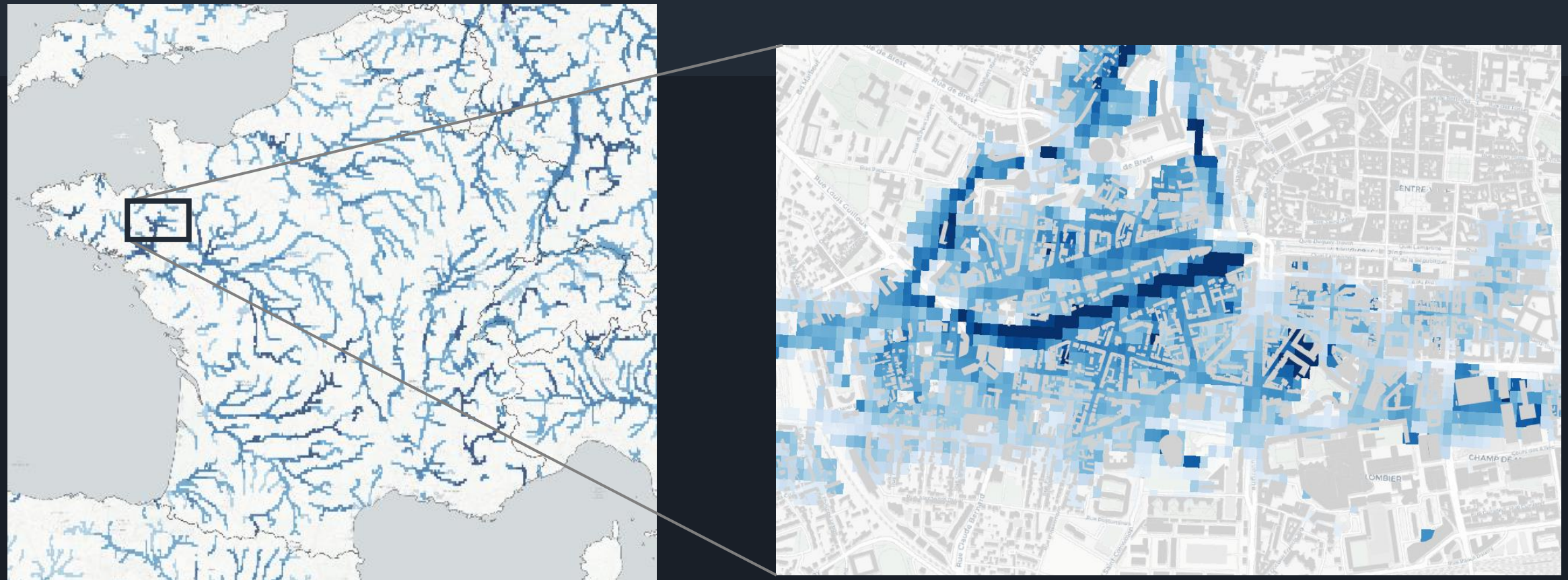
- To quantify the effects of climate change, some assumptions need to be made:
- What will the future emissions be? Three concentration pathways (RCP 2.6, RCP 6.0 and RCP 8.5 are considered).
- What's the quality of our defensive systems? There are two levels under consideration: "1-in-100 year" protection and "FLOPROS" protection.



Source: Wikimedia

Focus on France

Downscaling

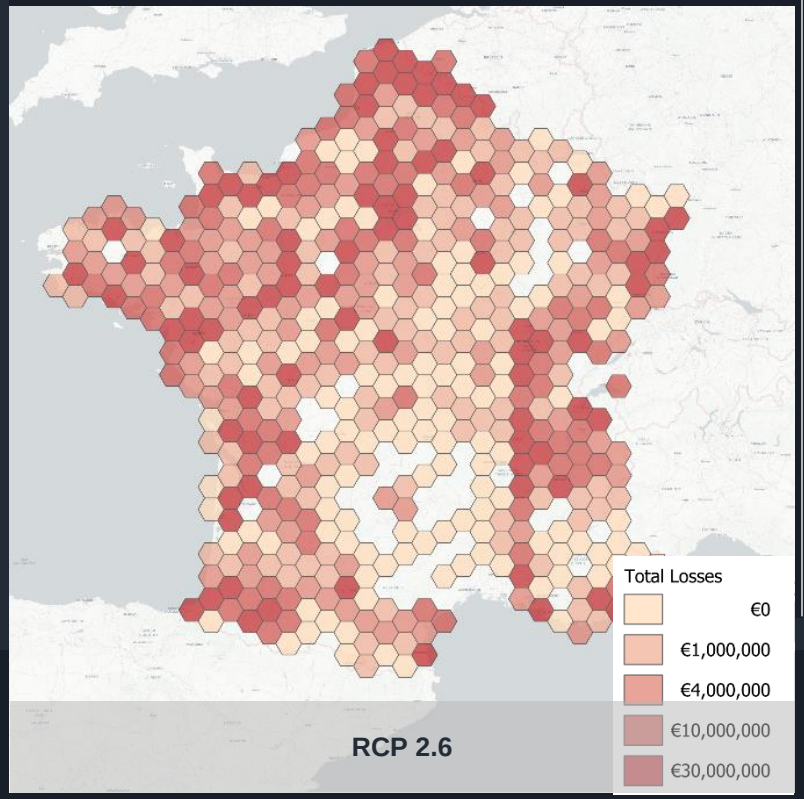


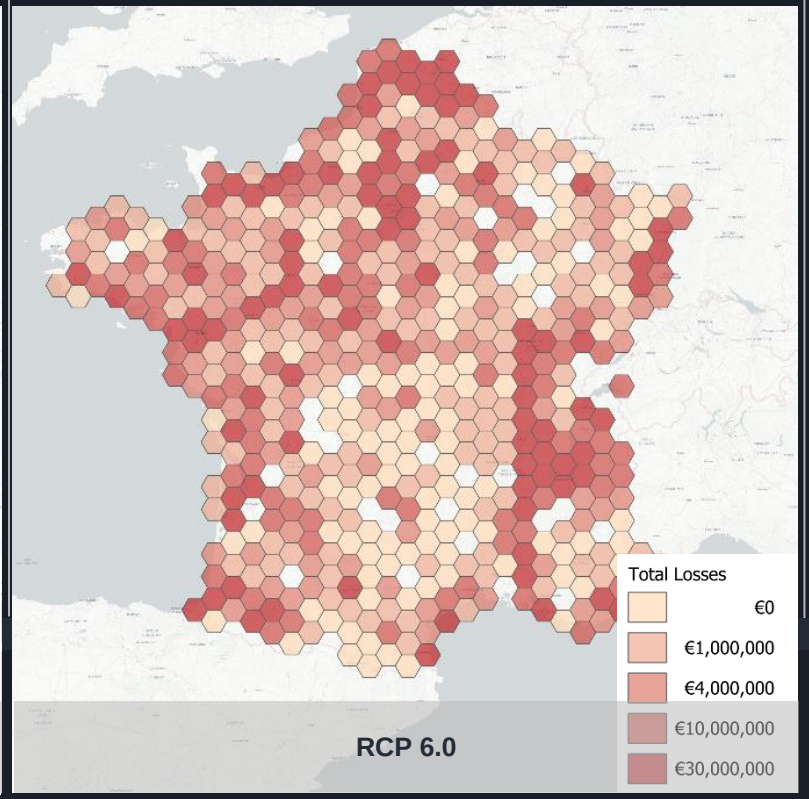
Maps Milliman – Sources : ISIMIP, IGN

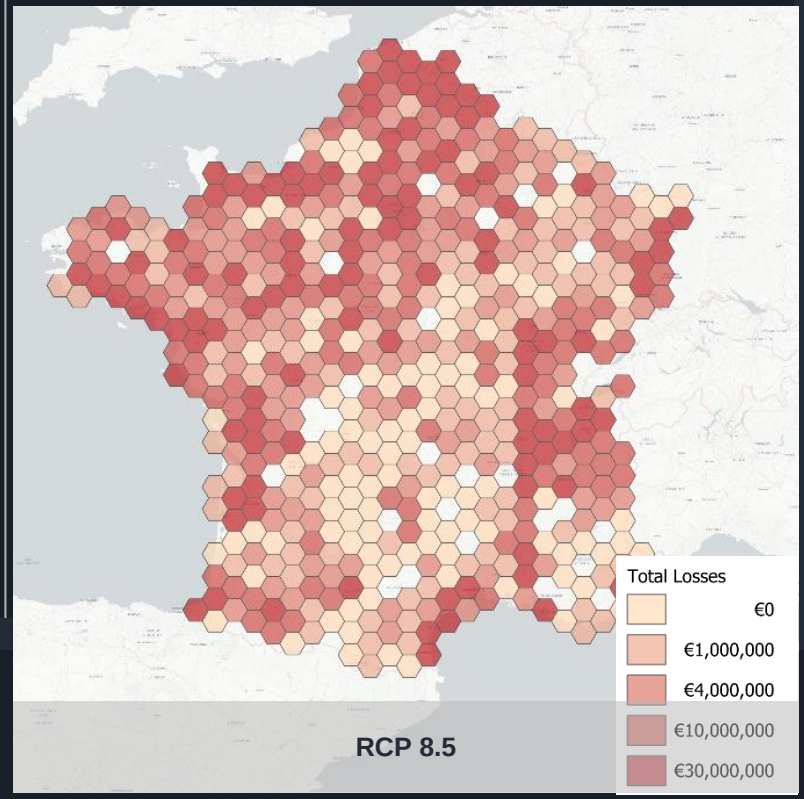
Results

France

- These maps show a summed annualized loss in each hexagon, in the period from 2024 – 2060, assuming protection against all 1-in-100 year events.
- In RCP 6.0 and 8.5, new areas are exposed to flood and little affected territories tend to be more damaged.
- We can highlight the Rhone Valley, which is particularly hit in every scenario.







Catastrophe and scenario analysis tool

Both tools serve their own purpose and complement the other

Characteristic	Catastrophe tool	Scenario analysis tool
Flood depths	1-in-X-year events	Simulated from climate/impact model combinations
Flood types	Fluvial, coastal	Fluvial
Climate change scenarios	No	Yes
Protection levels	Actual	Varying : [No, one-in-100, FLOPROS]
Horizon	As-is	2024-2060
Output and interpretation	Losses from an event of certain likelihood (1-in-X-year flood events)	Yearly losses corresponding to the maximum yearly flood event observed, within the scenario considered

Conclusion and Q&A

Thank you

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