Session 2-1: Introduction to risk analytics principles and approaches

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Introduction to climate and disaster risk analytics principles and approaches

7 December 2023

Risk information for supervisors

Supervisors should increase understanding of climate risk and capabilities to

evaluate activities toward climate resilience

IAIS, 2018, Issues paper of climate change risks to the insurance sector

- Solvency, business model viability: e.g., higher claims burden

- Access, affordability: availability, capacity, uninsurable assets

- System-level stability: e.g., stress tests / scenarios (current and future)

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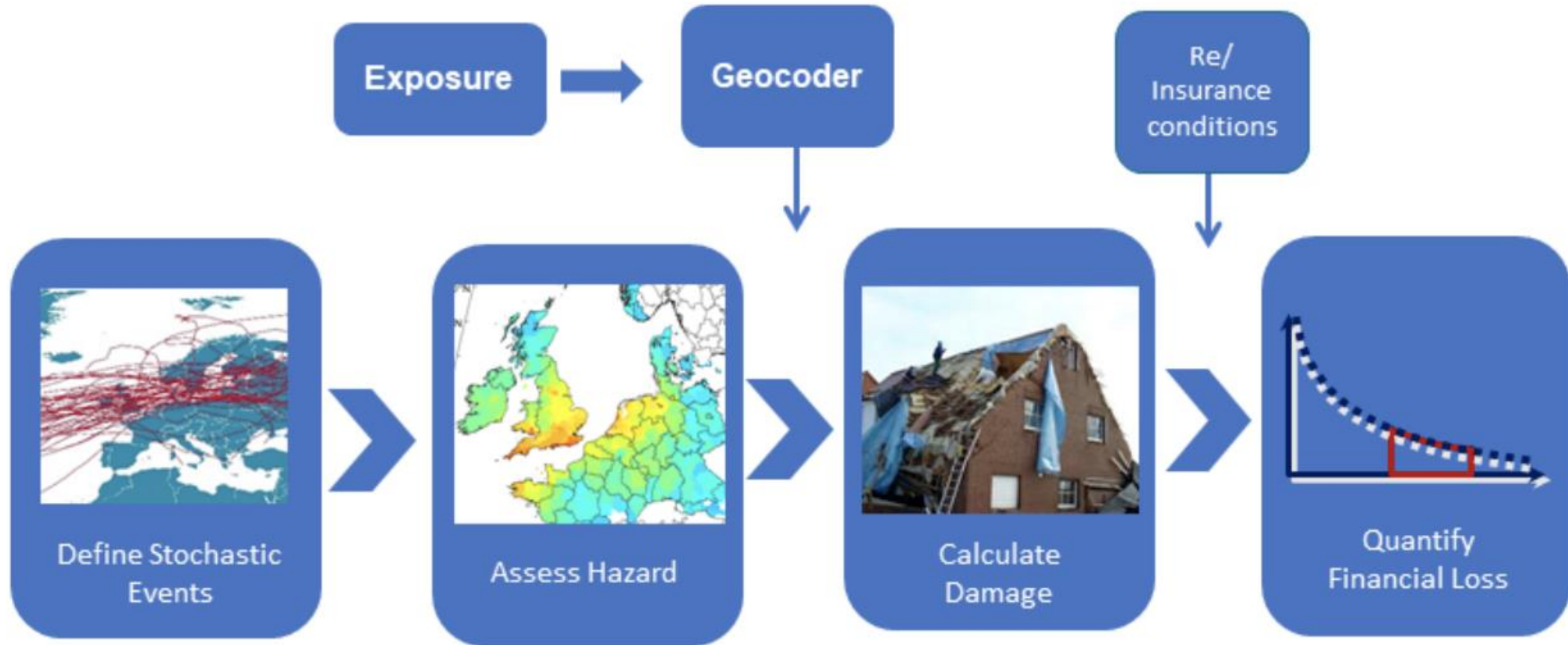
Catastrophe model framework

Historical event information is not always complete.

On its own it is not a reliable guide to the future.

Models give a more complete picture of risk by simulating other plausible events

that could occur in the future.

| 1960s Initial research | 1980s First commercial models | 1990s Growing demand for models | 2000s More regulation, more providers | 2010, 2020s More integration, new technologies, wider application |

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Catastrophe model framework

Exposure → Geocoder

Re/ Insurance conditions

Define Stochastic Events → Assess Hazard → Calculate Damage → Quantify Financial Loss

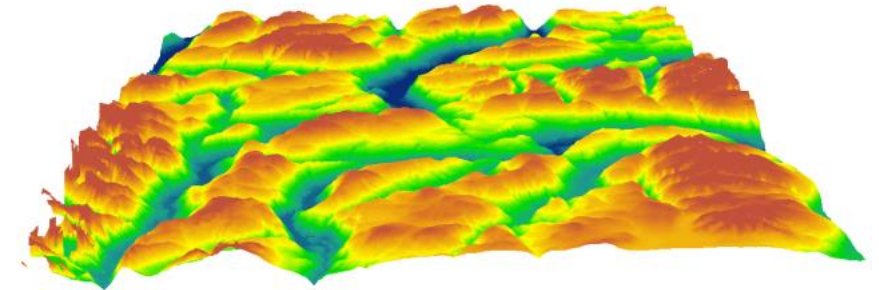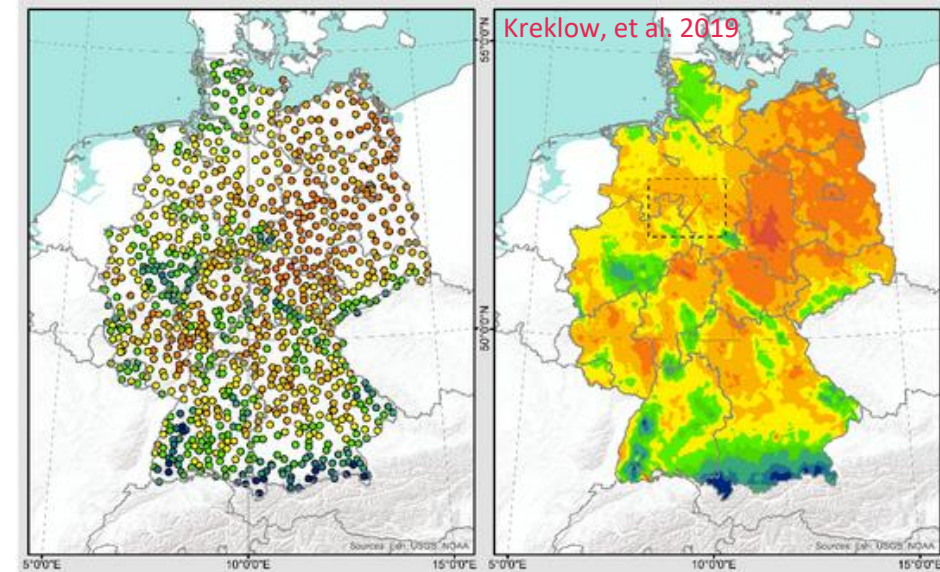Source: Oasis

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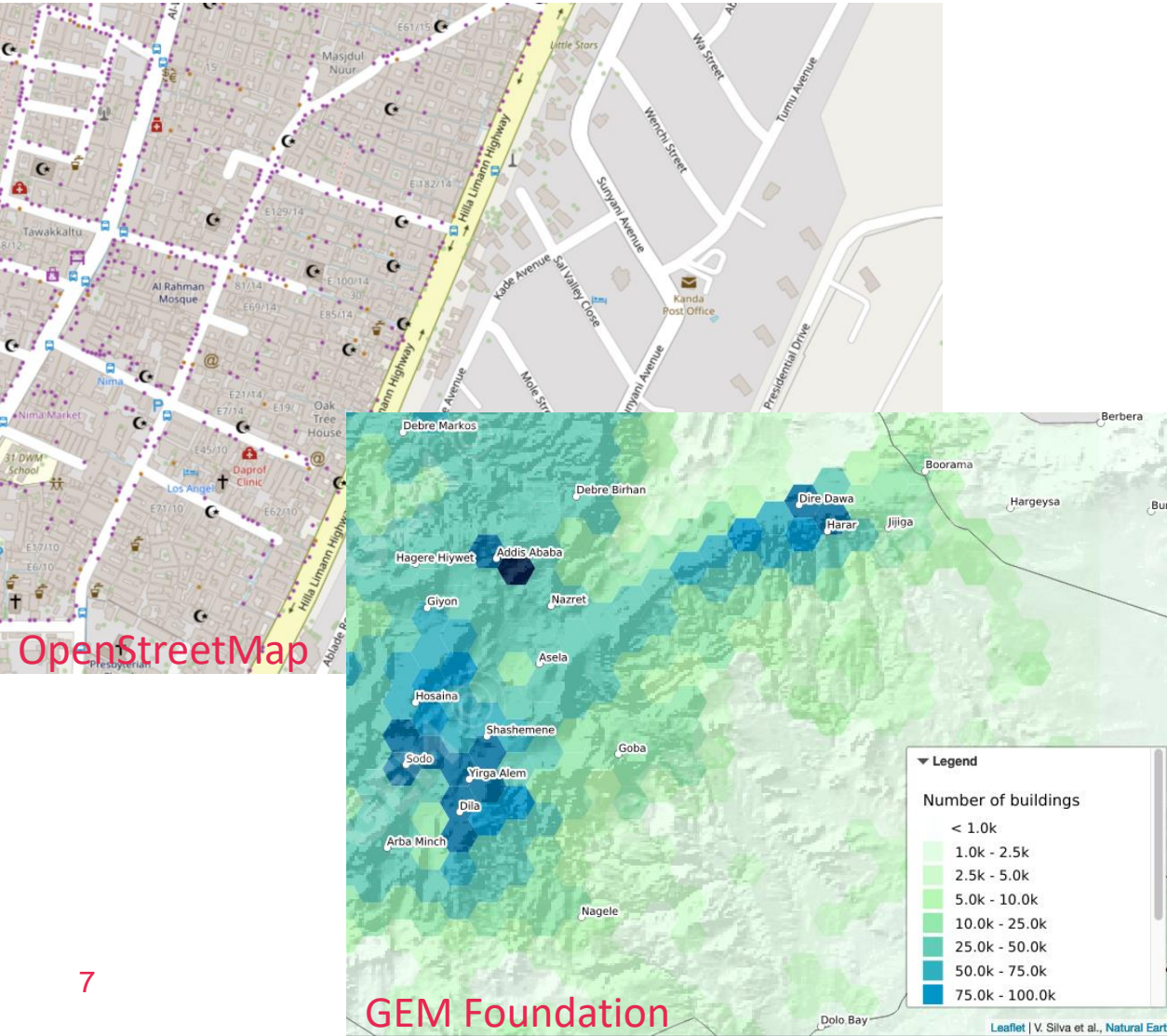
Data quality – hazard

Hazard inputs

- **Observations – past events, weather data, climate projection**
- **Environment features**
- **Protection standards**

Influences

- **Event set frequency, correlation**
- **Event footprint: intensity, extent**

Kreklow, et al. 2019

Data quality – exposure

OpenStreetMap

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Number of buildings
- < 1.0k
- 1.0k - 2.5k
- 2.5k - 5.0k
- 5.0k - 10.0k
- 10.0k - 25.0k
- 25.0k - 50.0k
- 50.0k - 75.0k
- 75.0k - 100.0k

- **Location (address, postcode, district, state…)**

- **Replacement cost / insured value**

- **Usage (occupancy)**

- **Construction materials**

- **Structure type and features**

- **Number of people, demographics**

- **Up to date?**

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Data quality – vulnerability

- **Relationship between hazard intensity and impact**

- **Cost of damage, fatality or injury rates**

- **Analytical, empirical, judgement based**

- **Local information or based on global assumptions?**


EEFIT, 2012

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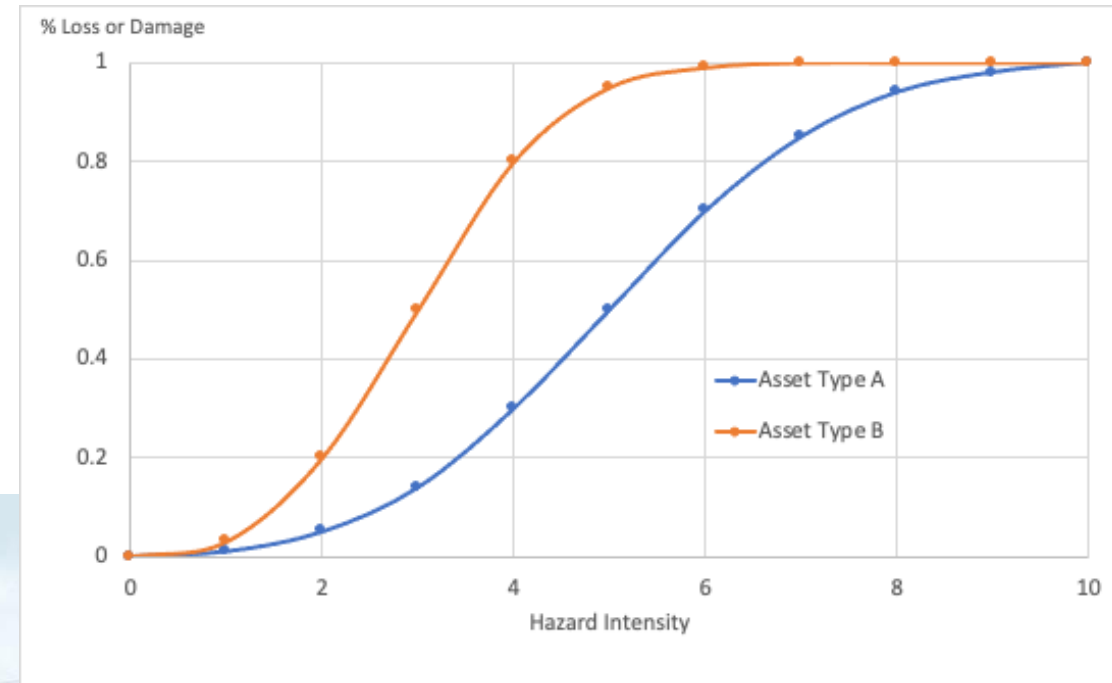
Commonly used risk metrics

- **Scenario Loss**

- **Event Loss Table (ELT) or Year Loss Table (YLT)**

  - **Annual Average Loss / Annual Expected Loss**

  - **Exceedance frequency**

  - **Occurrence Exceedance Probability**

  - **Aggregate Exceedance Probability**

 - **Return Period Loss / Probable Maximum Loss**

  - **Value at Risk**

Event	Annual rate	Mean Loss	Standard Deviation
1	0.01	605,000	1,200,000
2	0.05	252,000	900,000
3	0.02	456,000	1,750,000
…	…	…	…

Exceedance Probability (EP) Curve - Aggregate

Source: Verisk

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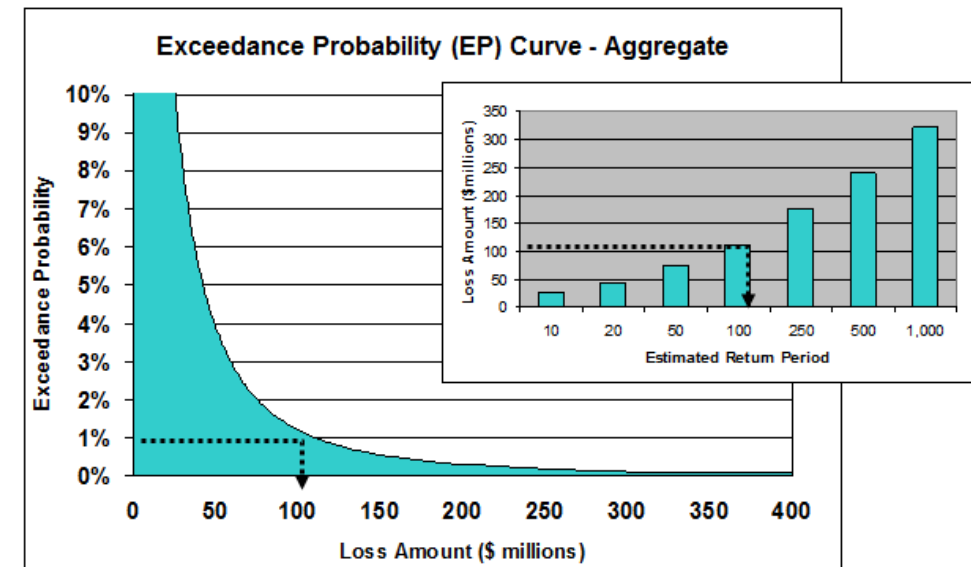
Projecting future risk

- ## Climate change
  - Scenarios / emission pathways
  - Frequency / severity of events adjusted
  - Non-linear change in loss estimates

- ## Socio-economic change
  - Location, types of future development, population, value

- ## Compare current loss vs. 2040, 2060…
  - Large uncertainty – projections are indicative
  - Several projections and climate models

Sung et al., 2021

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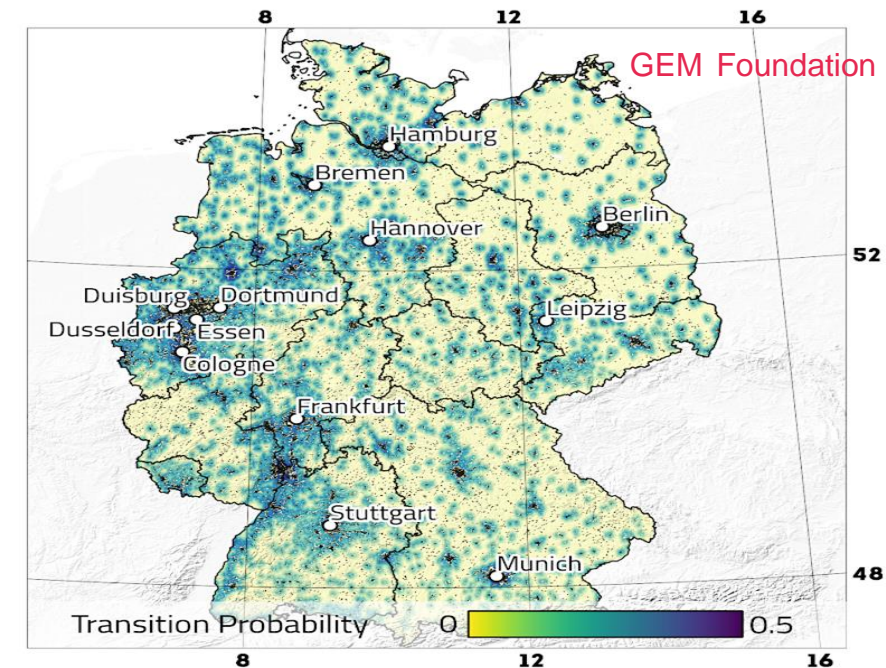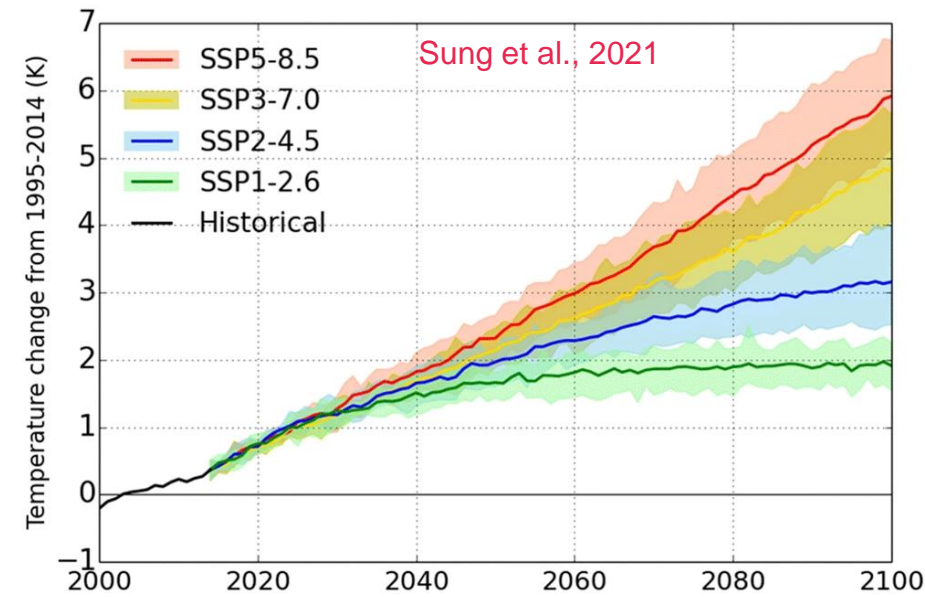
Challenges in modelling

- Quality of information to validate and improve models

- Understanding and communicating uncertainty

- Understanding what is not included in models

- Access to models

- Open modelling and collaboration can address some of these

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Further open resources
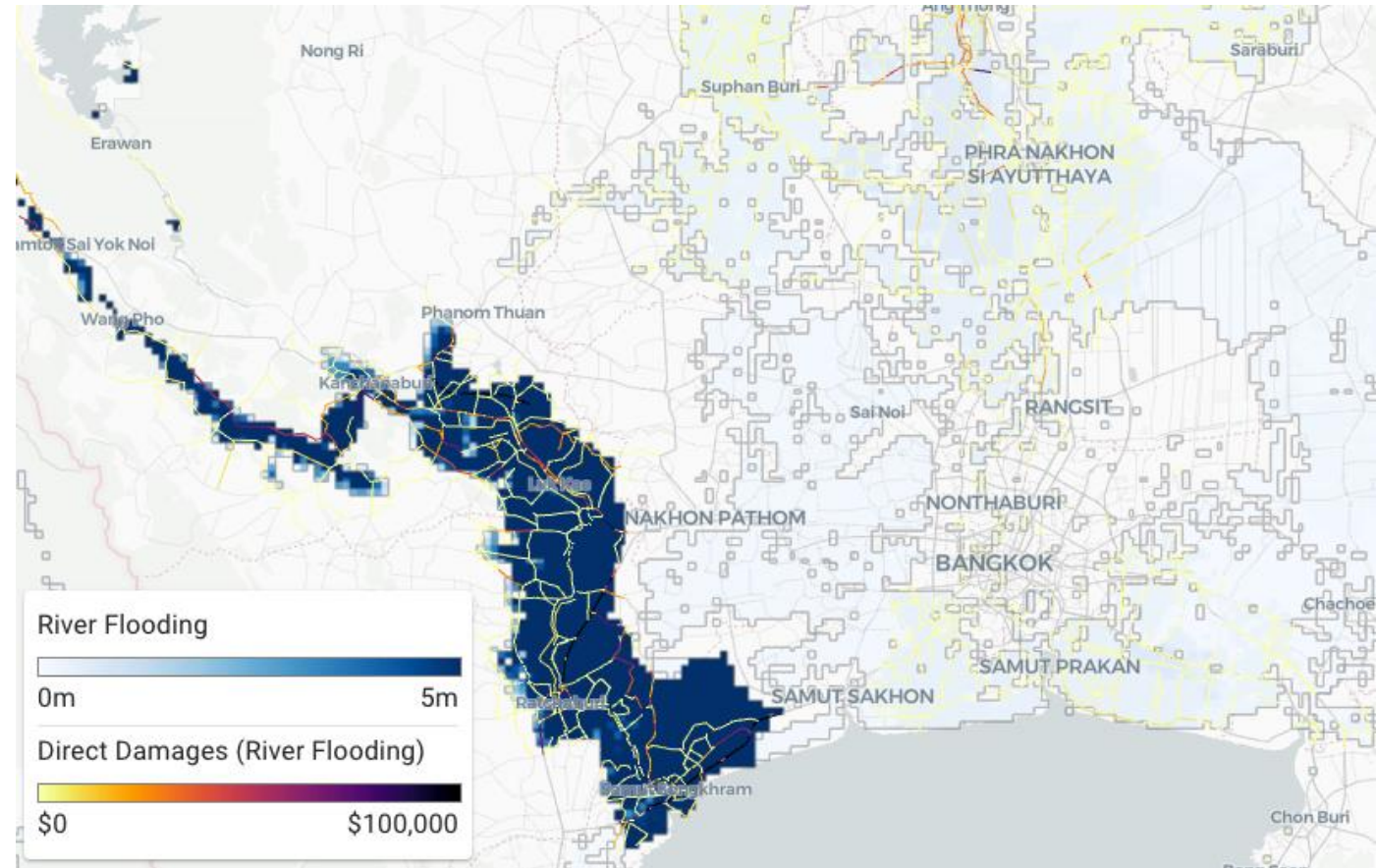
insdevforum.org/rmsg-tools

Oasis Risk Explorer – self-guided tutorial on parametric analysis

CatRiskTools – find available catastrophe models for your country

Further open resources

Resilient Planet Data Hub
resilient-planet-data.org/

Global Risk Viewer
global.infrastructureresilience.org

River Flooding

0m — 5m

Direct Damages (River Flooding)

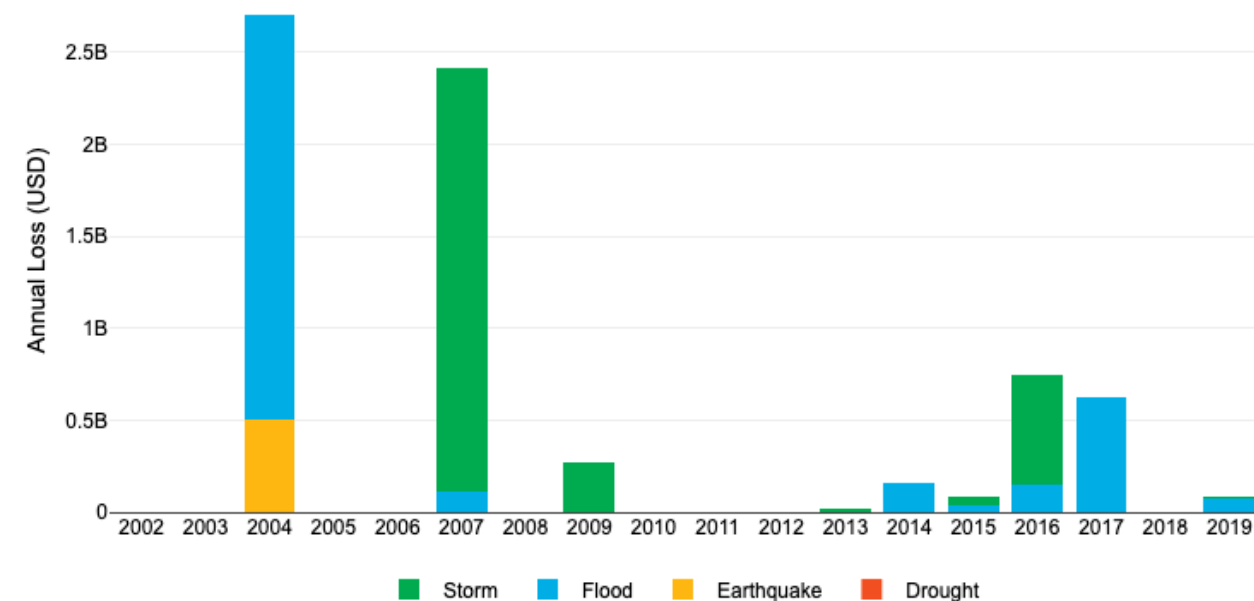$0 — $100,000

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Further open resources

World Bank (DRF) Analytics Tools
financialprotectionforum.org/disaster-risk-financing-drf-analytics-tools

From historical losses

To estimated losses