



LOSS MODELLING
FRAMEWORK



Swiss Re
Institute

Oasis Conference 2023



Latest on Oasis LMF



Ben Hayes

Chief Technology Officer, Oasis Loss Modelling Framework



Dickie Whitaker

Chief Executive, Oasis Loss Modelling Framework



LOSS MODELLING
FRAMEWORK

Latest On Oasis LMF

Dickie Whitaker, CEO Oasis LMF

Ben Hayes, CTO Oasis LMF

6th September 2023

Topics

- Update on Oasis Software
 - Features
 - Performance
 - Reliability
- Deployment Options
- Oasis Family of Software
 - Risk Explorer
 - Forecasting
 - ++
- Open Data Standards
- Oasis Projects GXM
- Models in Oasis
- Oasis, the future and innovation

Update on Oasis Software – Features (BH)

- Full OED Validation
- Financial Module Completeness
- Memory usage optimisation
- Stochastic Disaggregation
- Post Loss Amplification
- Geocoding Plugin
- Full Documentation rewrite

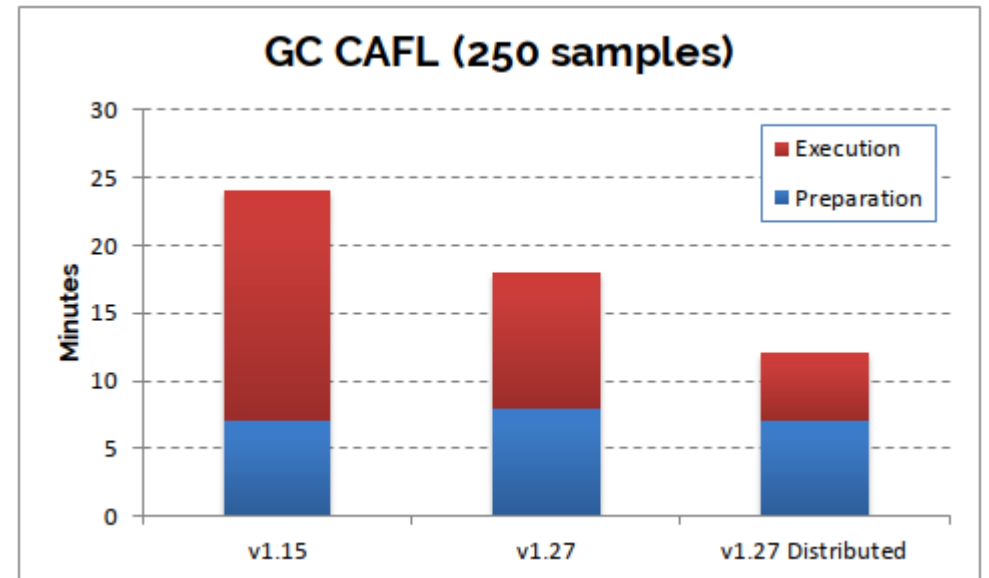
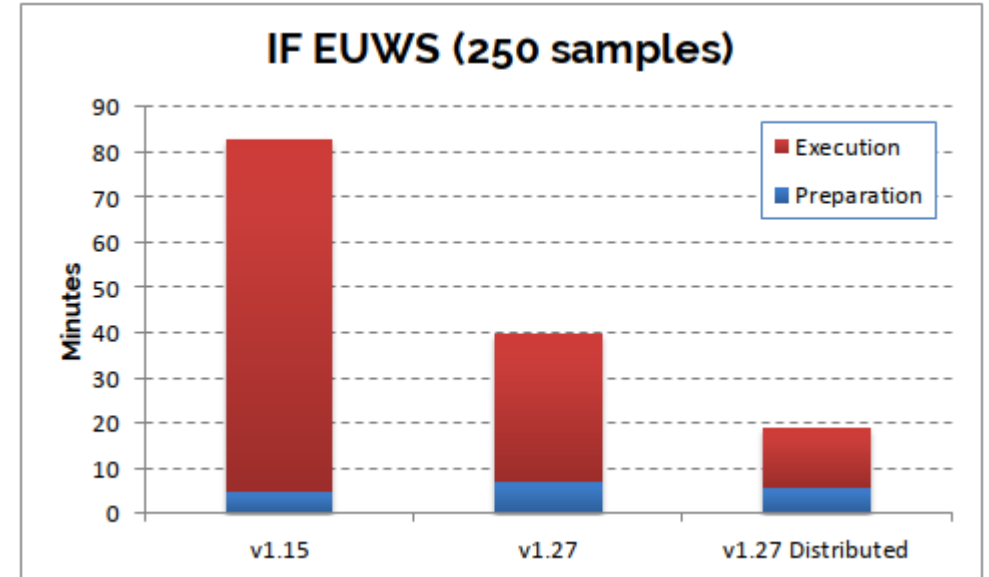
Workflow ID	Task ID	Oasis Workflow	Task	Area	Delivery Phase	Description	Effort	Start	End	Status	Comments
9000	9004	Platform	User Management	Platform	3	platform	H	M	10	100	
9000	9005	Platform	Security	Platform	3	ensure the platform has sufficient security	H	M	10	100	
9000	9010	Enterprise Platform	Data Encryption	Platform	3	data should be encrypted on the platform	H	L	10	0	Implementation option, need to follow up with TSG for exact requirements from Oasis
9000	9011	Enterprise Platform	Connectivity	Platform	3	enable high connectivity to the system	M	L	5	75	We could probably do some more volume testing in Oasis, but no reported issues so far
9000	9012	Enterprise Platform	UI improvements	Platform	3	The standard Oasis UI is intended for evaluation (both system and model) and for small scale use (e.g. small insurance company governments, cities). This needs to be maintained and the UI improved to be more stable and reliable.	H	M	10	50	Ongoing
9000	9023	Enterprise Platform	CI	Platform	3	Integration method of development where any changes to the underlying model data or system software is built and tested automatically to ensure that nothing breaks	M	H	5	75	In progress
9000	9030	Enterprise Platform	Backup and DR	Platform	3	Ensure that platform fits with standard cloud provider Backup and DR practices	L	M	2	0	Implementation option, need to follow up with TSG for exact requirements from Oasis
9000	9009	Platform	API Specification Library	Standards	3	developed	M	L	5	100	
300	301	Pre Analysis Adjustments	Disaggregation (pre-analysis)	Core Oasis	4	Provide better standards for high level Disaggregation by pre-analysis exposure adjustment.	M	M	5	50	Working with Catrisks to build an example implementation. Rolled to Phase 5
300	302	Pre Analysis Adjustments	Rate of Exchange	Core Oasis	4	Develop standard to convert input currencies into analysis/reporting currencies	L	H	2	100	
300	303	Pre Analysis Adjustments	geocoding plugin	Core Oasis	4	Develop standard to allow plugin of external geocoding engine	L	L	2	0	pushed forward to next phase - low priority
1000	1002	gulcalc	Monetary Curves	Core Oasis	4	develop functionality to allow "absolute" rather than relative damage functions	M	L	5	25	Solution dependent on full Monte Carlo approach. Rolled over to phase 5
1000	1005	gulcalc	Post Loss Amplification	Core Oasis	4	develop standard to allow for post loss amplification factors inside of gulcalc	L	L	2	25	specified - to be developed. Rolled over to phase 5
1000	1006	gulcalc	Disaggregation (runtime)	Core Oasis	4	full stochastic Disaggregation in-flow within the calculation engine	H	M	10	50	full mc approach developed. Extra functionality in progress
1000	1009	gulcalc	memory usage	Core Oasis	4	optimise use of memory in ground up loss calculation	L	M	2	100	
1000	1010	gulcalc	performance	Core Oasis	4	improve performance of gulcalc	L	M	2	100	

All driven by Oasis technical steering group

Update on Oasis Software

Performance - Standard Models

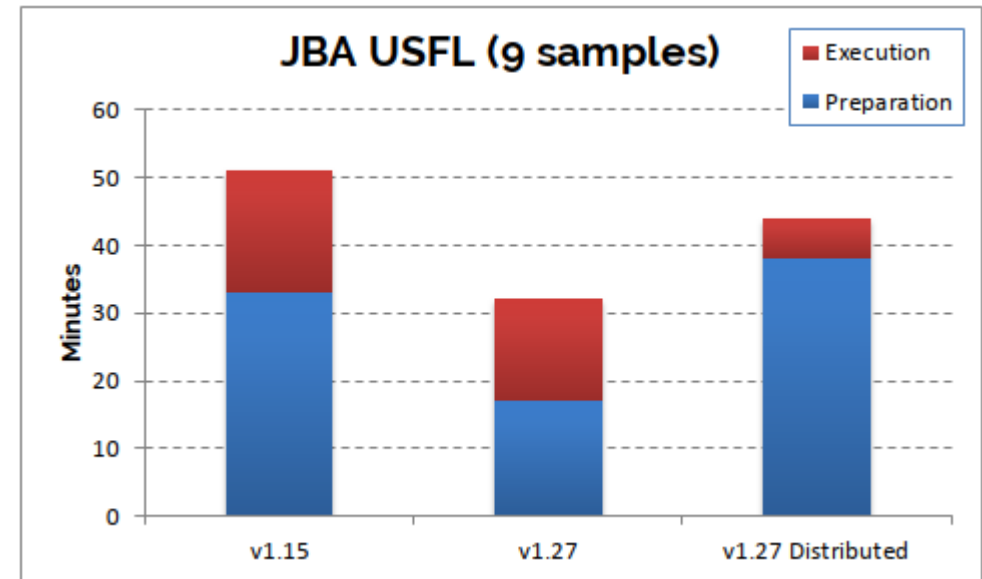
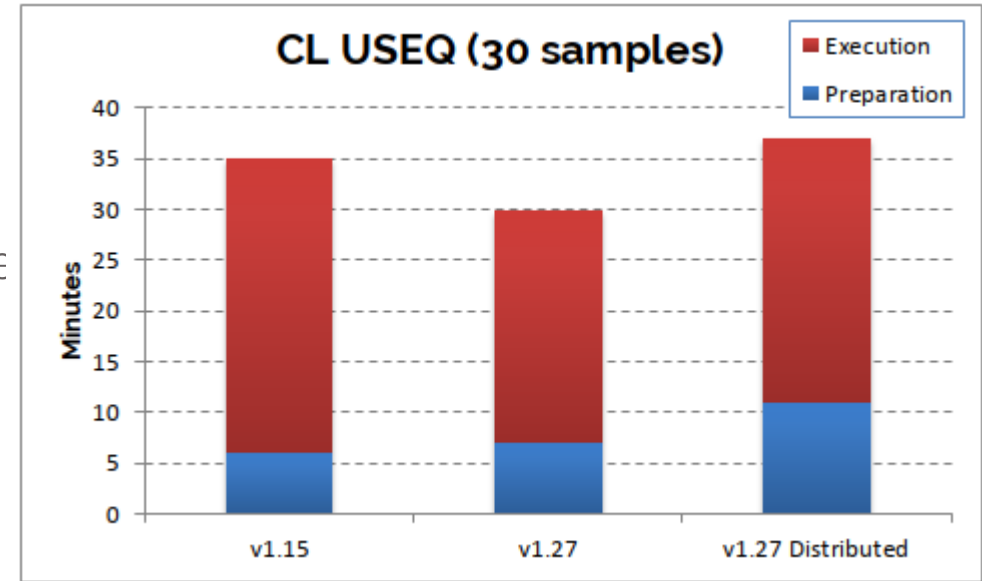
- Benchmark exercise
 - 258,518 location real portfolio
 - 4 production models
 - 2 standard Oasis Models
 - 2 Complex Model implementations
 - GUL, Gross and Reinsurance ELTs
 - Sampled losses
- Comparisons
 - V1.15 (May 2021) vs. V1.27 (Apr 2023)
 - Single server - 1 x 64 core instance
 - Distributed platform - 8 x 32 core instance



Update on Oasis Software

Performance - Complex Models

- Complex models don't use data formats.
- Less pronounced improvements seen.
- More model-specific work required to optimise performance.
 - CL USEQ
 - model runs limited to ~110 chunks.
 - JBA USFL
 - Significant improvement in execution (18m -> 6m).
 - Large data read speed an issue in distributed platform.
 - Lot 3 aims to address this.



Update on Oasis Software – Reliability (BH)

Key metrics from Guy Carpenter Oasis Usage 2022

2,613

- Number of analyses completed

60

- Number of users

14 million

- Average number of locations modelled per week

96%

- 1st time success rate

Update on Oasis Software – Reliability (BH)



Majority of the 4% errors due to incorrectly coded OED files

OED Validation

Input files are now validated on presentation to catch errors early



New tool built to quickly build Oasis environments

Camel

Configurable by model and software version

Allows for rapid deployment of environments for testing & recreating issues



Oasis service to host commercial models and automatically test against new versions of the software

Continuous Integration

Ensures that all models work with all versions of Oasis

Being rolled out to all models throughout 2023

Deployment Options (BH)



Laptop



Cloud

OASIS | LOSS MODELLING FRAMEWORK



On-Prem

Hosted

Moody's  Products Services Solutions Resources Company

Moody's RMS to Enhance Intelligent Risk Platform by Integrating Nasdaq Risk Modelling Platform for Oasis Based Models

 Nasdaq

 XCEEDANCE

IMPACT FORECASTING
Powered by Aon

Oasis Family of Software

DEFINE PAYOUTS AND REVIEW OUTPUTS

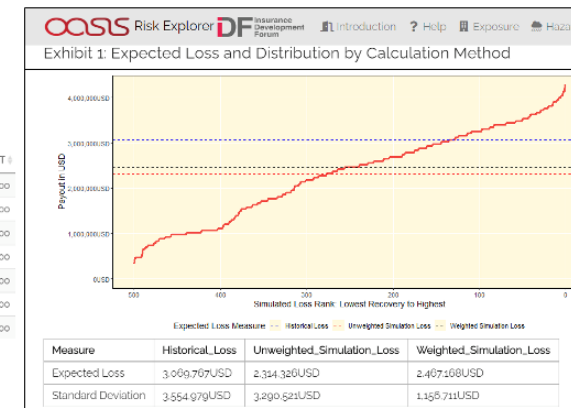
Define trigger levels and payout amount/percentage per trigger

Trigger	Payout_Percentage	Payout_Currency
119.0km/h	20.0%	2,000,000USD
154.0km/h	40.0%	4,000,000USD
178.0km/h	60.0%	6,000,000USD
209.0km/h	80.0%	8,000,000USD
252.0km/h	100.0%	10,000,000USD

SID	SEASON	ISO_TIME	NAME	MAX_WIND_SPEED	TRIGGER_PAYOUT
1	1978e88N10185	1978	1978-10-25T11:30:00Z	RITA	222.2 USD8,000,000
2	1980z01N08155	1980	1980-07-23T8:30:00Z	KIM	130.4 USD2,000,000
3	1980z02N05365	1980	1980-11-03T06:00:00Z	BETTY	185.2 USD6,000,000
4	1981z05N10150	1981	1981-09-18T06:00:00Z	CLARA	129.6 USD2,000,000
5	1981z10N07163	1981	1981-11-23T10:45:00Z	IRMA	192.5 USD6,000,000
6	1981z05N07449	1981	1981-12-25T03:15:00Z	LEE	139.7 USD2,000,000
7	1983z17N12153	1983	1983-11-20T07:00:00Z	ORCHID	131.2 USD2,000,000



Interrogate results and drivers, sensitivity test different assumptions, download results



OASIS RISK EXPLORER

Open-source, web-based tool: an insurance simulation model to quantify risk and test potential insurance covers

- Tool is transparent, open-source and support capacity development in risk analysis; understanding of uncertainty; enable end-users to embed their own assumptions and local data and knowledge
- Cover all perils globally for user-defined locations
- Users choose from standardised historical data sets, upload their own data or use stochastic event sets from catastrophe models
- Users define own vulnerability levels and test impact of different assumptions on potential payouts
- Support end-users in developing their understanding of risk modelling through an interactive UI and full documentation

June 2022 Version 1 demo for Tropical Cyclone released - welcome additional end-user engagement to refine the design and functionality to finalise full multi-peril version for release in October/November 2022



Oasis Forecasting

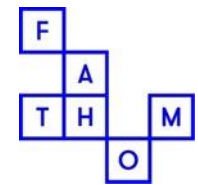
ODS – Steering Committee

- The ODS SC meet 3-4 times a year and is chaired by Oasis LMF. The following companies are represented at the SC.
- Governed using Github semantics for raised on Github Repo.
- Starting to put together sub “working groups” to focus



Oasis Model Coverage

Over 100 models from various providers



* JBA - 'Global flood model' available on the Oasis platform (except An
CoreLogic - Committed in making all models available on the Oasis platform

Innovation

- Global Exposure model / IED
- Validation
- Models

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LATEST **PRESS AREA** AIRMIC TV

BIG TICKET LAUNCHES FIRST CLIENT-FACING 'OPEN BANKING' INFRASTRUCTURE FOR INSURANCE

19th June 2023

Shared corporate data platform that will transform the \$1tn global commercial insurance industry by revolutionising the 'broken' renewal experience for risk managers, brokers and carriers

- Big Ticket is an industry-backed renewal data platform shared between clients, brokers and insurers
- Client-first approach will radically improve the corporate customer experience, facilitate stakeholder management and empower innovation
- Provides enhanced bank-grade data quality and security; putting clients in control of their data
- Provided free-of-charge to any risk manager or insurance buyer, Big Ticket will deliver annual industry-wide operational savings at renewals of up to US\$25 billion
- Technology ecosystem was developed with founding partner Mastercard and Global Advisory Board members including Aon, Aviva, Oasis and Zurich

Big Ticket enables process and product innovation.

Powered by 'API first' neutral digital infrastructure connecting the entire commercial insurance value chain.

OASIS LOSS MODELLING FRAMEWORK

Digital infrastructure for the global commercial insurance industry



Simos Koumoutsaris

*Global Head of Cat Research & Development,
SCOR*



Paul McEwan

*Risk Analytics Director,
Sompo International*

Using Oasis in Practice



Using Oasis in Practice

Simos Koumoutsaris
Global Head of Cat R&D
06/09/2023

Oasis Insight Conference 2023, Zurich

Outline

- OasisLMF is a mature product now that is being used in an operational setting.
 - Examples of how Oasis is used in insurance: Guy Carpenter, SCOR
- The «Nazare» project
- Some key points to consider for adopting Oasis
- ODS

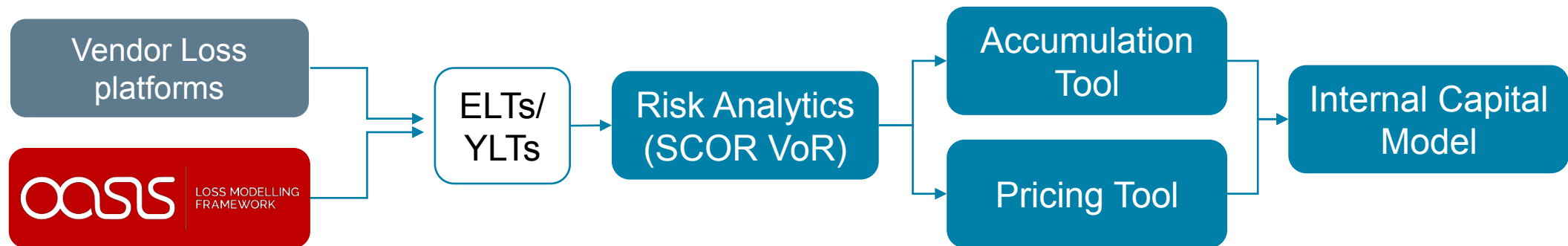
Oasis at SCOR

- Operationally effective multi-vendor modelling approach developed over the last decade.
 - Gives us access to more models and provides a more comprehensive View-of-Risk including a measure of uncertainty and helps to build confidence internally and with clients.
- OasisLMF is key for our multi-vendor modeling strategy:
 - a) Develop our own in-house cat models (e.g. California Wildfire)
 - b) License 3rd party models



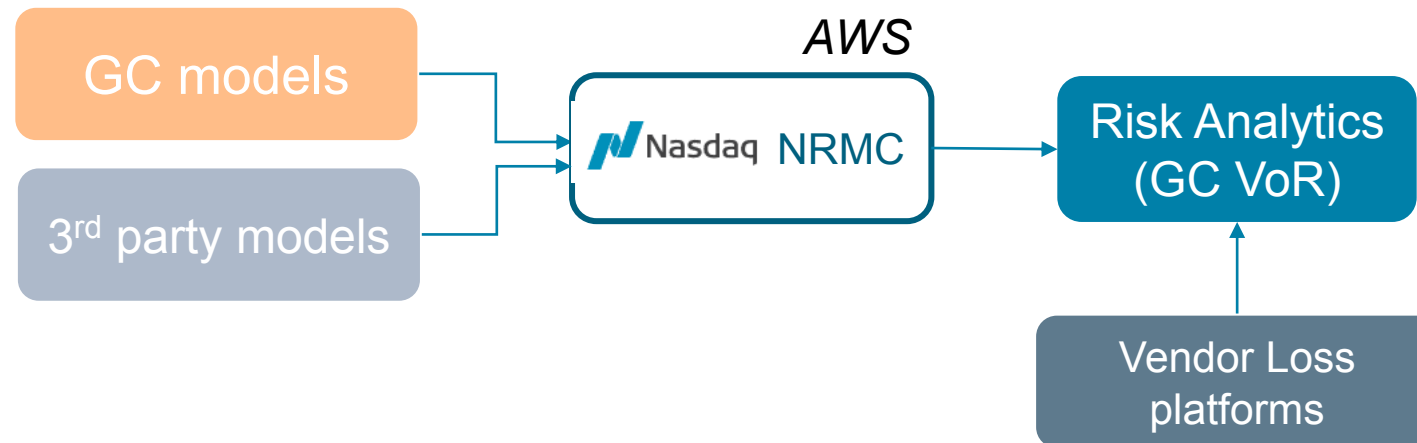
Oasis at SCOR

- Currently, we host a small internal OasisLMF environment.
- Operationally embedded in our pricing and accumulation workflows, including a high level of systems integration.
- Looking at implementing the new Oasis distributed platform in-house.



Oasis at GC

- Need for an efficient platform where a broad range of in-house produced and 3rd party models could be hosted and run.
- Externally hosted environment, +50 users, +100 analyses per week

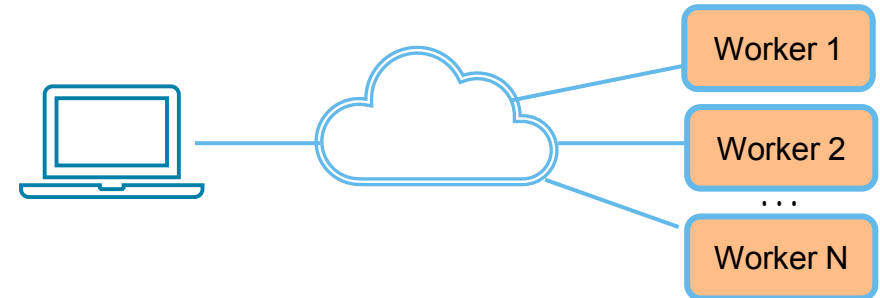


The «Nazare» project

- Financial and resource support in Q2 2021 from Oasis members in order to accelerate the development of the Oasis platform.
- Technical Steering Group (TSG) was responsible to steer Oasis developments in two directions:

1. Oasis Enterprise platform

- Distributed environment enabling analyses at scale
- Easy deployment into the cloud



The «Nazare» project

- Financial and resource support in Q2 2021 from Oasis members in order to accelerate the development of the Oasis platform.
- Technical Steering Group (TSG) was responsible to steer Oasis developments in two directions:

2. Core Oasis Development

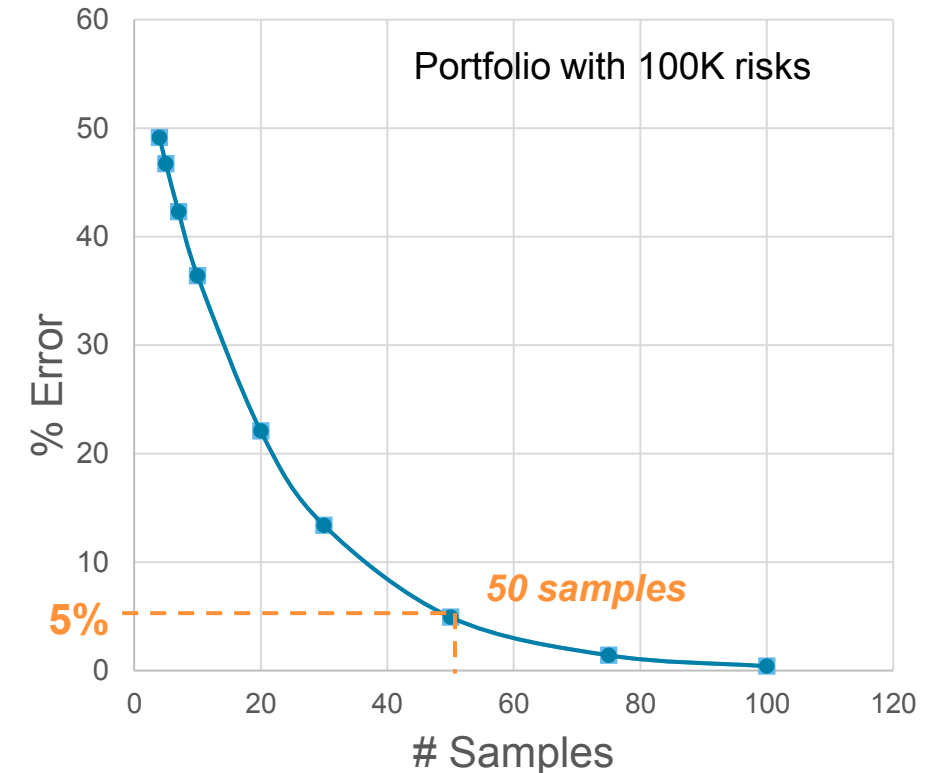
- Prioritization of developments by the Oasis members
- Performance, stability, correlation, disaggregation, convergence, etc.

Which deployment option to adopt?

- Many options available for adopting Oasis: *internal vs. external, stand-alone vs. platform*
- Different needs depending on number of users, number of models, license and/or build models, internal expertise, cost, etc.
- Additional key considerations:
 - Alignment relative to internal approved technologies
 - Expertise on the Oasis technology stack (e.g., docker, linux)
 - Cloud server requirements

How many samples should I run?

- Guidance is not often provided by model developers.
- Depends on the portfolio, the peril-region, the model, the output levels, etc.
- Increasing number of samples increases compute and memory requirements, i.e., closely linked with performance and stability.
- Tools:
 - Convergence tables from Oasis
 - Tests are needed with different portfolio sizes
- Still a challenge: Large portfolios with losses required at granular level.



Efficiency is key

- Open Data Standards brings efficiency:
 - Easy sharing of data,
 - Using multiple models,
 - Switching between vendors
- Provides opportunities to build tools around it (e.g., visualization tools, tools for model evaluation and model calibration, automated documentation, and others).
- The Open Data Transformation Framework (ODTF), which will enable a fully transparent data conversion, is critical to its success.



An aerial photograph of a lush green forest. A dark, winding road or path cuts through the trees, starting from the bottom center and curving towards the top right. In the upper left corner, a dark blue lake is visible, bordered by the forest. The overall scene is vibrant and natural.

SCOR

The Art & Science of Risk

Model Vendor Updates



William Forde

*Senior Director of
Industry Solutions,
CoreLogic*



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Dr. Lauren Mudd

*Senior Engineer,
ARA*



Dr. Joshua Macabuag

*Co-Founder and
Chief Product
Officer, Renew Risk*



Chris Ewing

*Head of Client
Management, Impact
Forecasting*



Harry Vardigans

*Business Development
Manager, Fathom*



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Dr. Lauren Mudd

Senior Engineer, ARA



Applied Research Associates, Inc. (ARA) HurLoss Hurricane Catastrophe Modeling OASIS Insight Conference

Zurich
September 6, 2023

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NATIONAL SECURITY



INFRASTRUCTURE



ENERGY & ENVIRONMENT



HEALTH SOLUTIONS

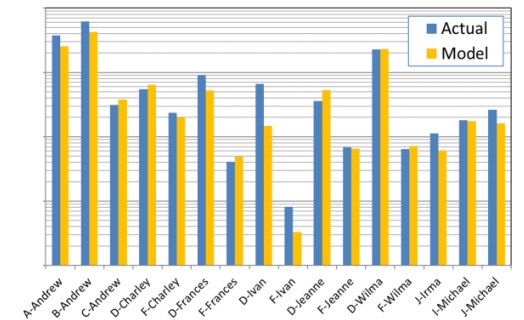
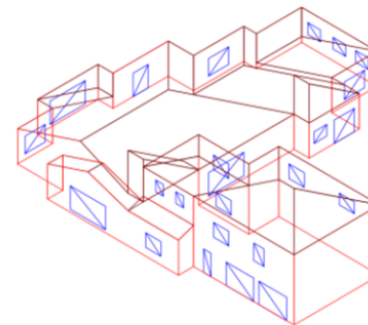


Who We Are

ARA is a **research and engineering company** dedicated to solving critical problems to improve our safety and security

We provide an **independent view** of hurricane risk with many applications, both within and beyond insurance

First Principles – Hazard and loss modeling starts with physics, then claims, not vice versa



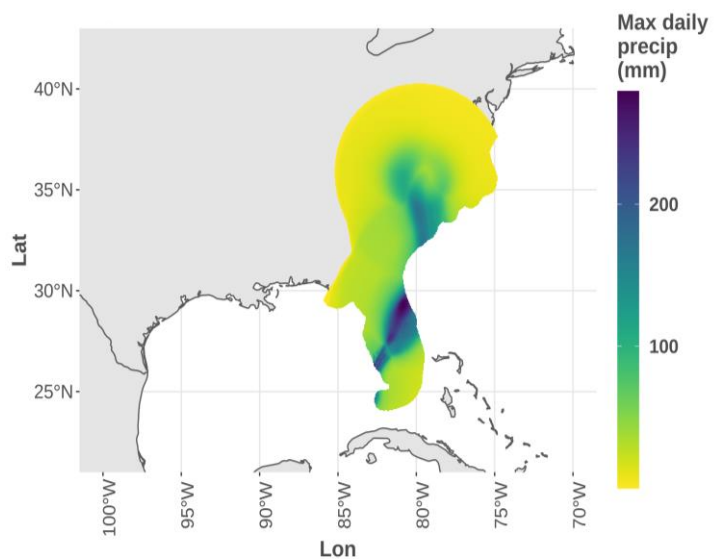


- Hazard model provides a **basis for structural design** (buildings, bridges, offshore wind, solar), not just cat modeling
- Damage based on **3-D computer modeling** – including modeling of individual building envelope components and the effects of building code changes over time
- Able to quantify nonlinear interactions of which cannot
be gleaned from claims data alone

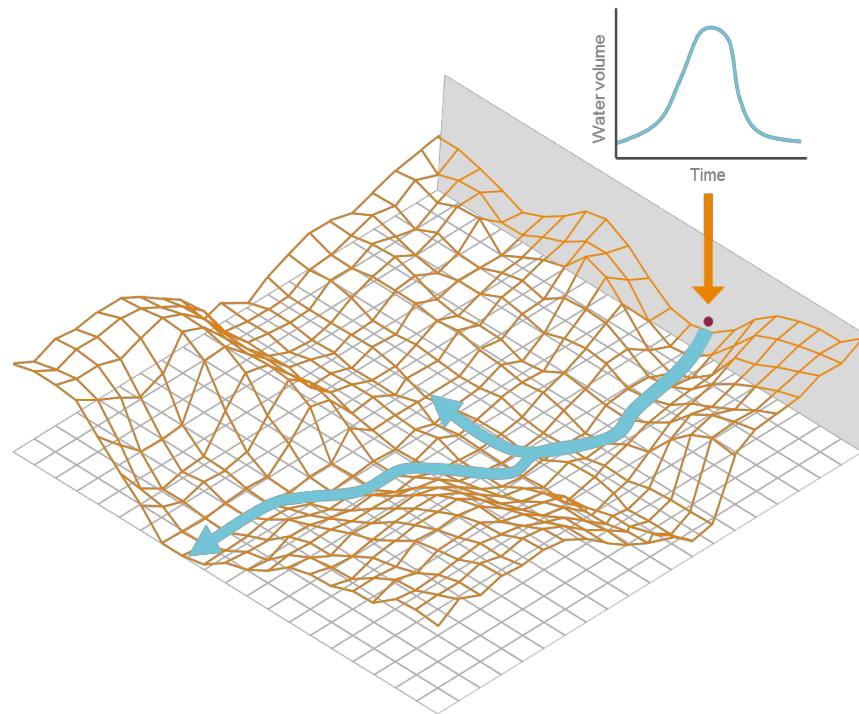




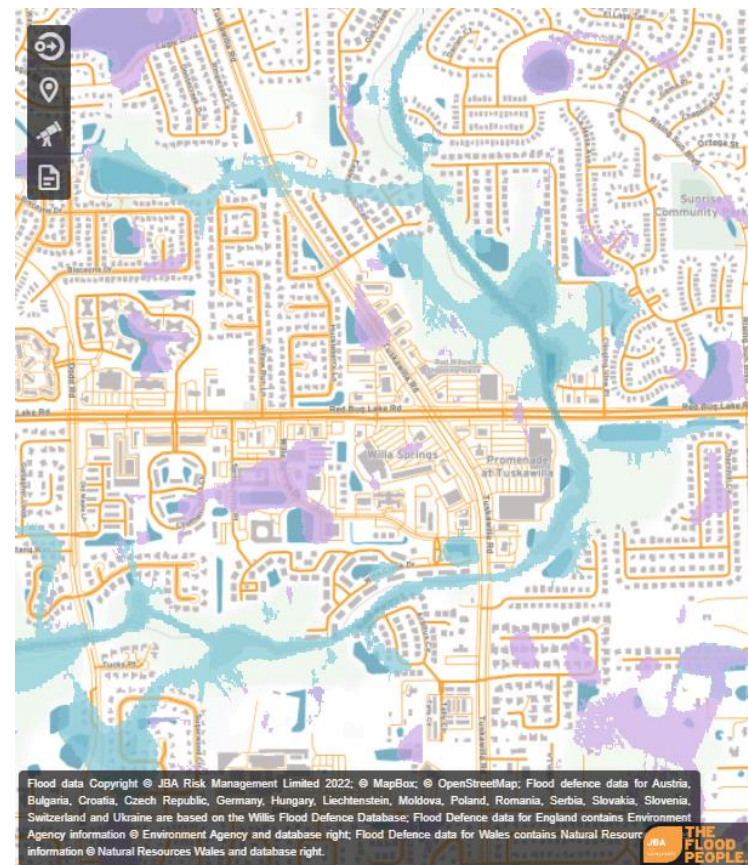
ARA JBA Joint Wind and Flood Model



Tropical cyclone rainfall



Simulation of catchment response

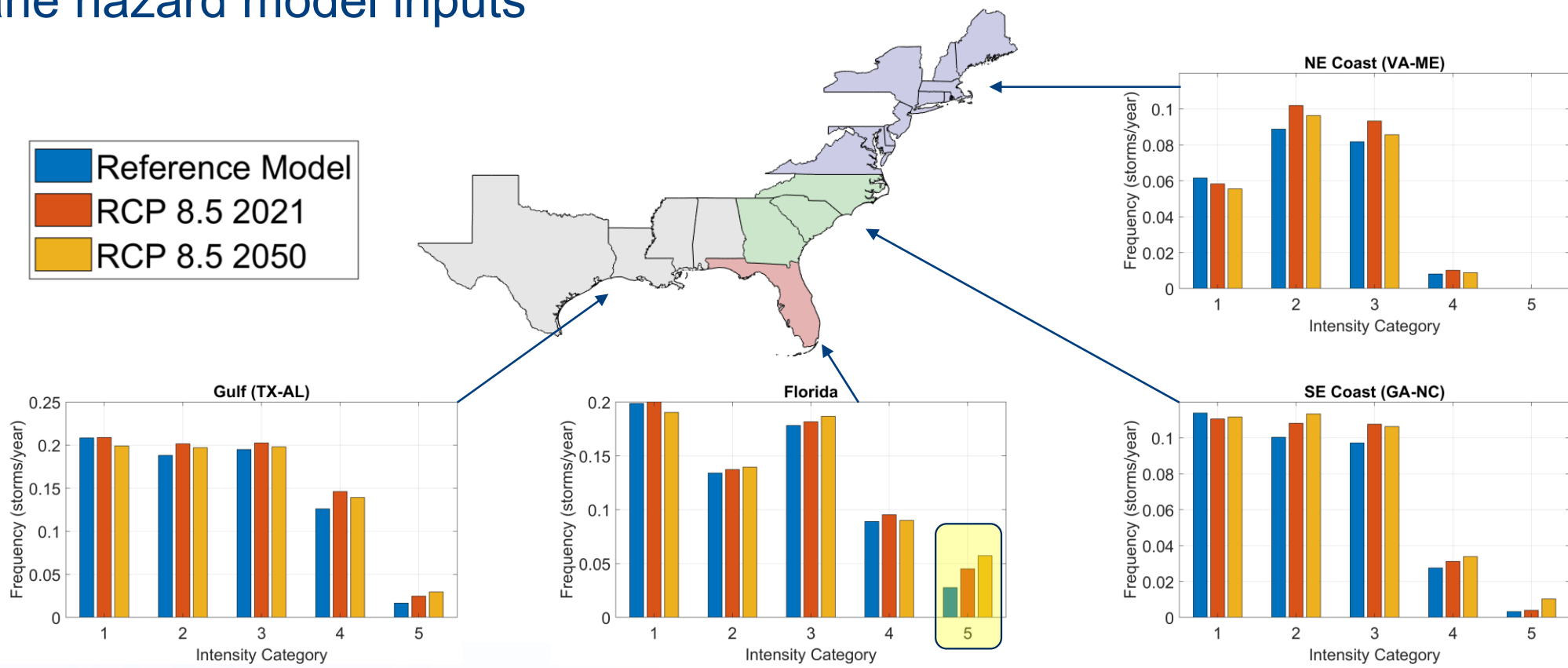


Data Granularity



ARA Introduces Climate Change Effects

- **Climate change:** Direct link between global circulation model outputs and ARA hurricane hazard model inputs

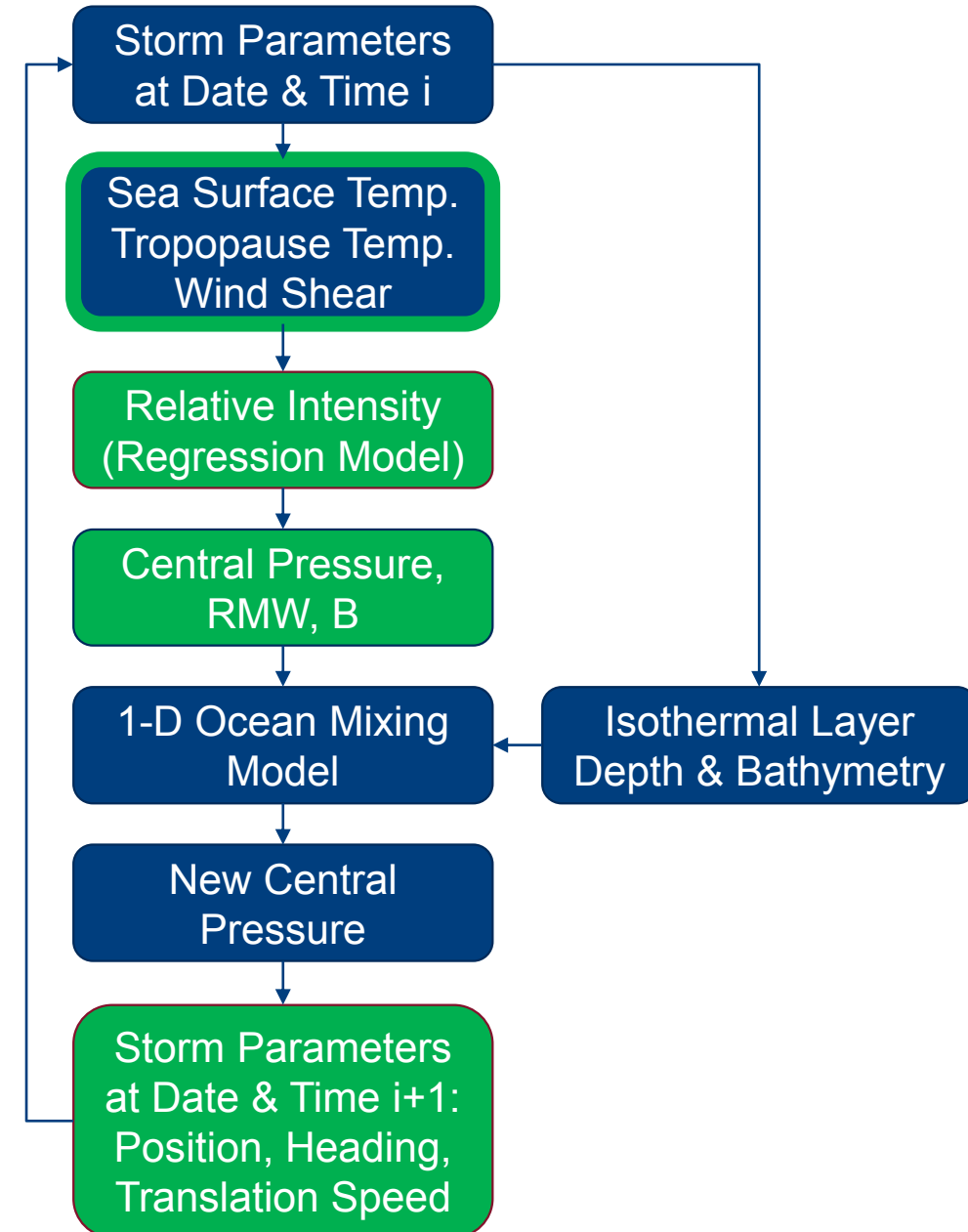




ARA Pioneering Climate Methodology

Couple global circulation model environmental data outputs with hurricane track and wind field models

- *Model is able to quantify the net effect of changes in multiple environmental parameters on the hurricane risk*
 - Increasing wind shear reduces relative intensity
 - Increasing SST reduces RMW and increases B
 - Increasing SST leads to more intense events; increasing wind shear reduces intensity and frequency.





Transparent and Easy to Use

- Most extensively **peer-reviewed** hurricane cat model in both open literature and by government agencies and private institutions



FLORIDA COMMISSION ON HURRICANE LOSS PROJECTION METHODOLOGY



FEMA

- Available on **Oasis**

- **Open platform** with standardized workflow and financial module



- Open Data Standards



- Nasdaq Risk Modelling for Catastrophes



- Moody's RMS Intelligent Risk Platform (c)





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Harry Vardigans

*Business Development Manager
Insurance, Fathom*

F

A

T

H

M

O

Water & climate
risk intelligence



Our values



We are open and transparent



We make a difference



Science is in our DNA



We are dynamic



Our research output

10

pieces of published
research in 2022

9

papers on track
for publication in 2023

79620

combined
research citations of
our team's papers

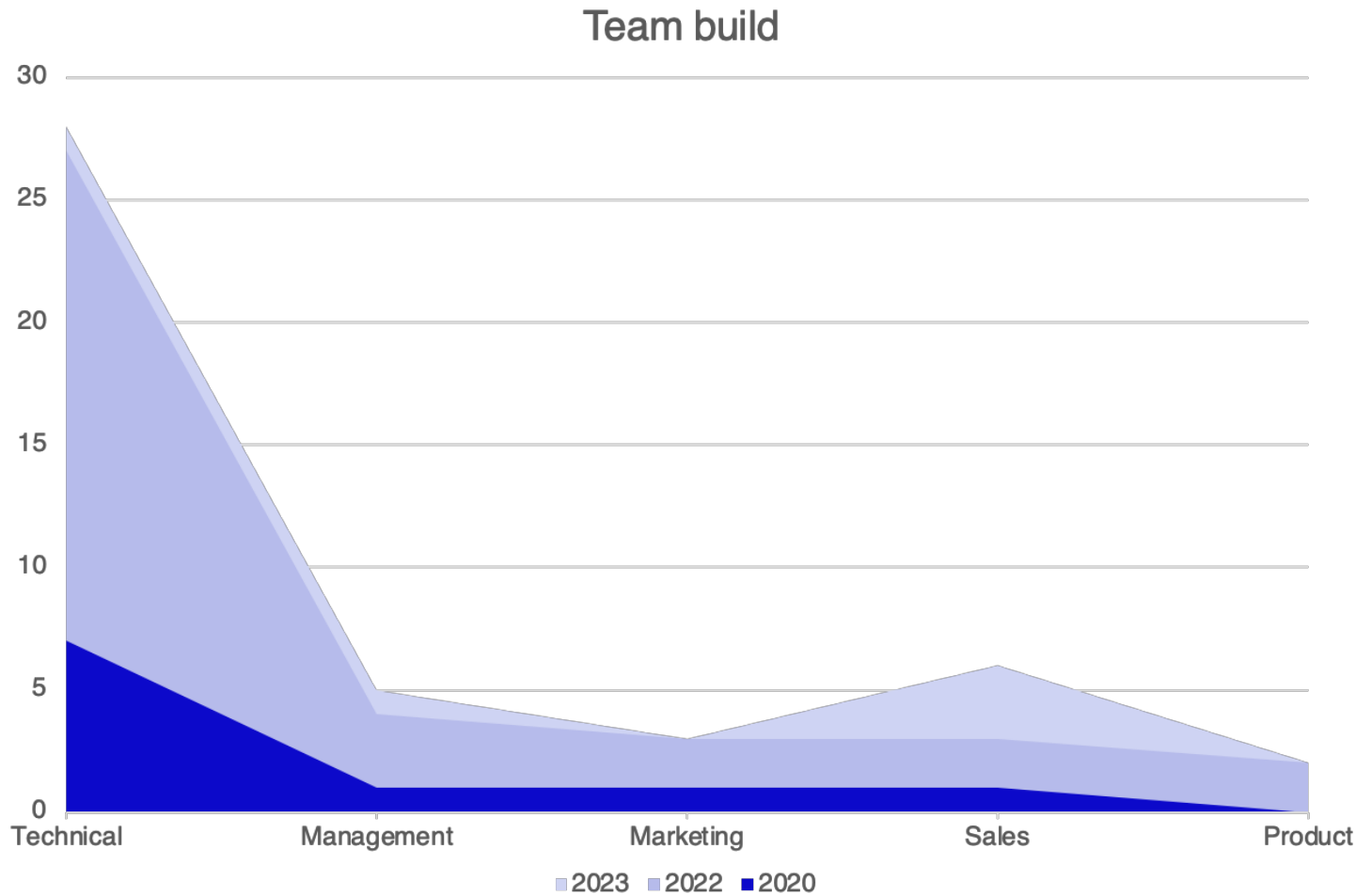
?

ongoing
industry accelerator
projects:
SWOT, FCDO, CReDo,
Met Office etc.

*accurate as of August 2023



How is this possible?



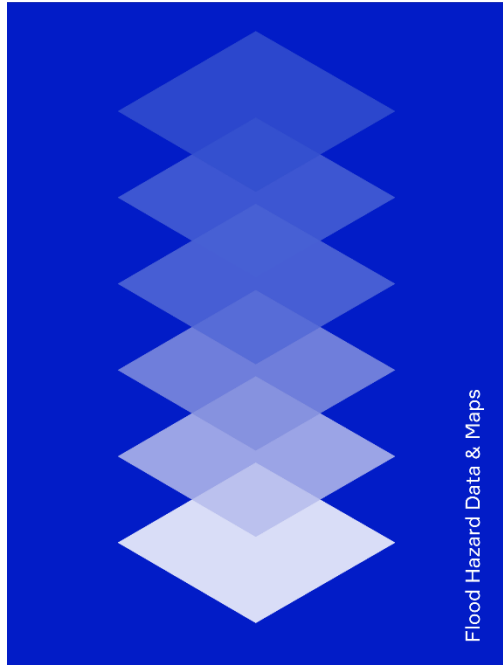
Our team primarily consists of scientists, academics and developers

We're beginning to build out our commercial function

We are getting better at finding new ways of connecting research to industry

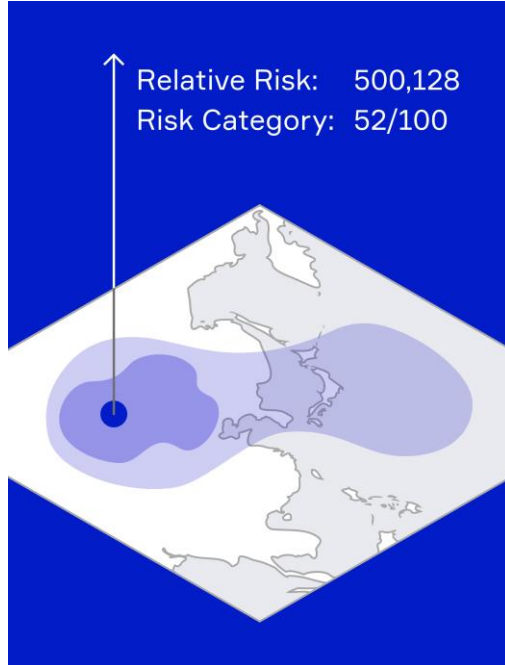


Our products

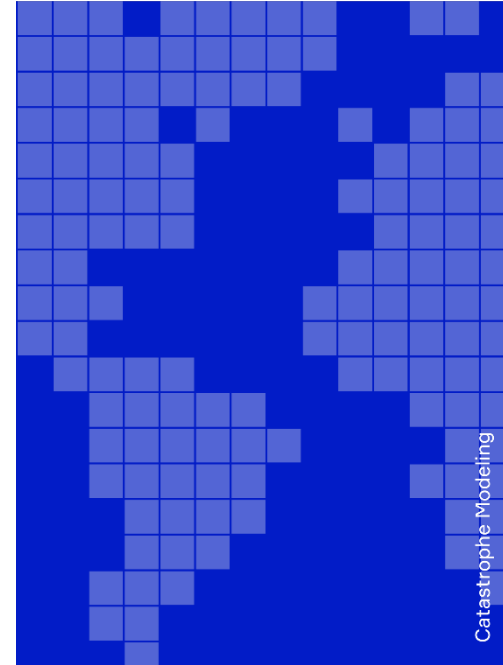


Flood Hazard Data & Maps

Flood Maps

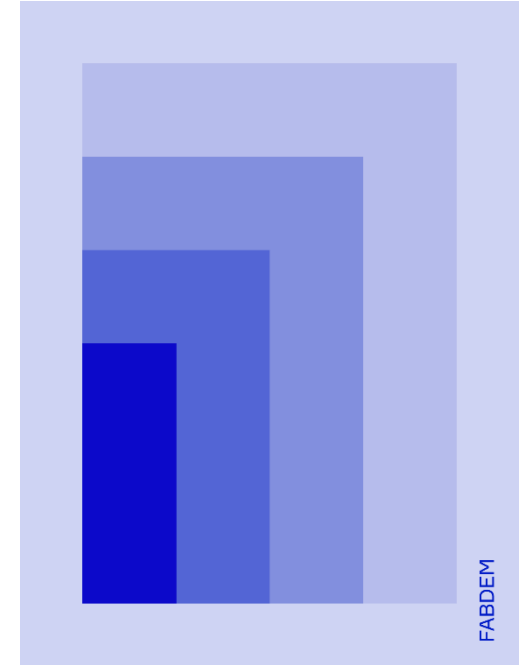


Risk Scores



Catastrophe Modeling

Catastrophe Models

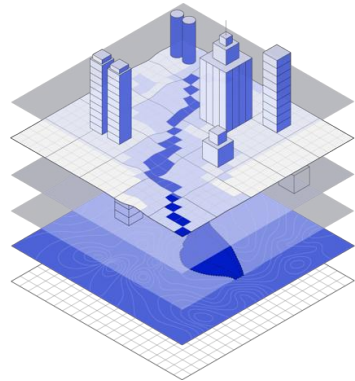


FABDEM

Global Terrain Data



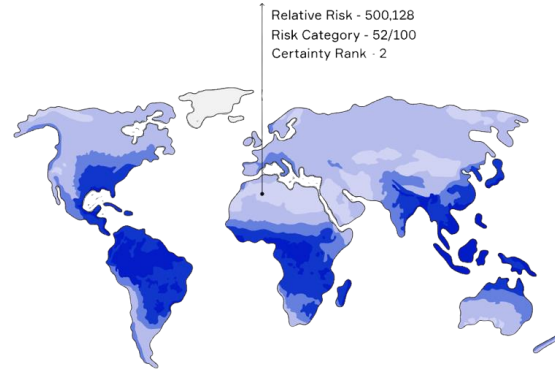
Communicating the complex



Fathom's Product Stack



Methodology docs



Metadata



Customer support



F

A

T

H

M

O

What next?

Focus on closing any gaps in our insurance offering

Working collaboratively with the industry to build relevant and useful products



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Chris Ewing

Head of Client

Management, Impact Forecasting

AON

Impact Forecasting

Oasis Insight Conference

Zurich

September 2023



What do Impact Forecasting offer?

Peak-Peril
Models

Custom
Models

Data for
Underwriting

Climate
Change
Solutions

Event
Response

Impact Forecasting

Global catastrophe model development team



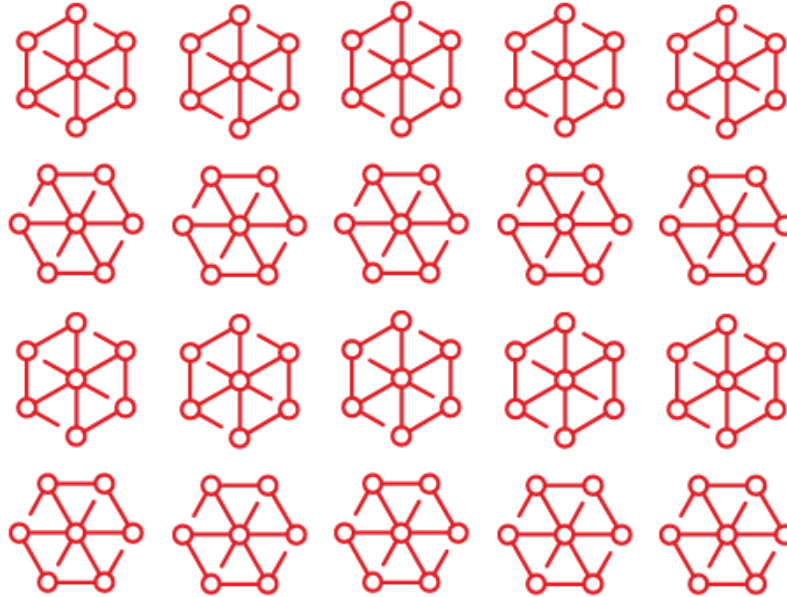
90

Countries



140+

modelling experts over
5 time zones



135+

models

12

Perils



30,000

events

in Cat Insight

database

Supporting the Open Cat Modelling community

A o n a n d I m p a c t F o r e c a s t i n g s u p p o r t t h r o u g h . . .

Using Oasis loss calculation engine

- ELEMENTS
- Oasis LMF, Nasdaq etc.

Hazard and Vulnerability model formats

- Interoperability
- Standardisation

Open Exposure Data (OED) and Open Results Data (ORD)

- Exposure schemes
- Sharing data

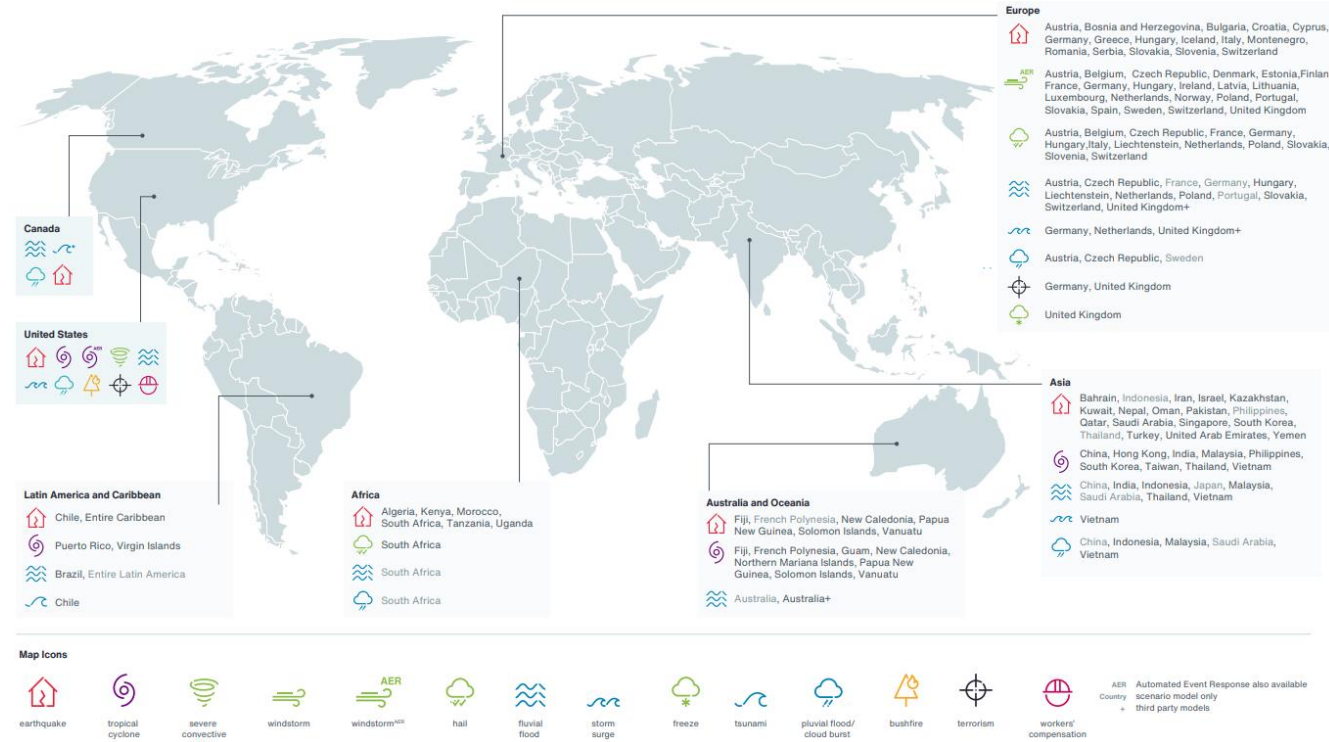
Community Involvement

- Working groups
- Events like this!

Are you concerned about peak peril catastrophe risk?

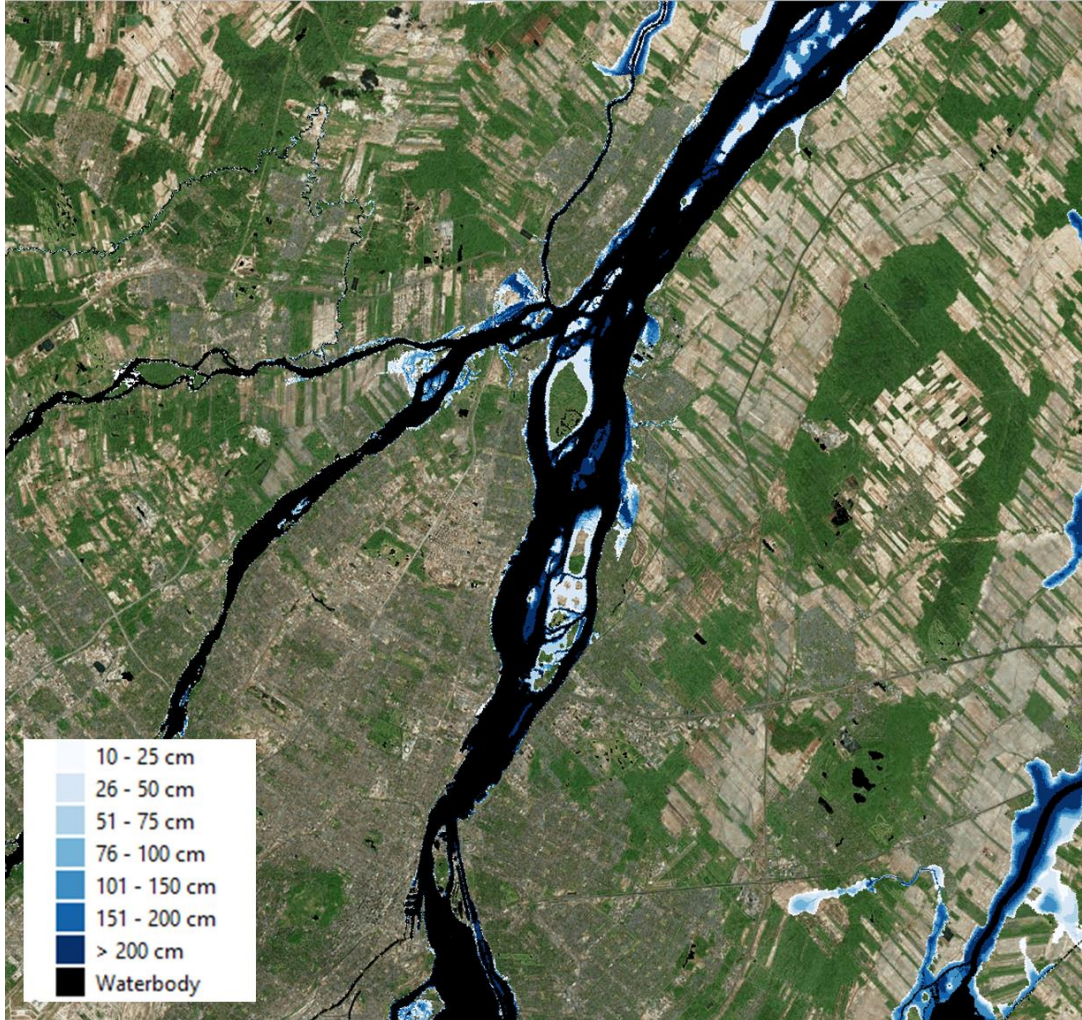
Explore Impact Forecasting's peak peril model

- US hurricane model with Florida recently certified
- US earthquake based on the latest USGS seismic hazard updates
- Europe Windstorm model covering 22 countries
- Japan typhoon model covering wind, surge and flood
- Japan earthquake model used by large mutual insurers



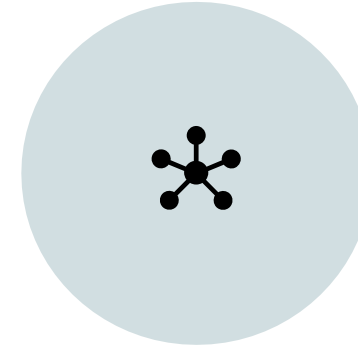
Does low resolution data restrict your ability to price risk?

Access Impact Forecasting's high resolution



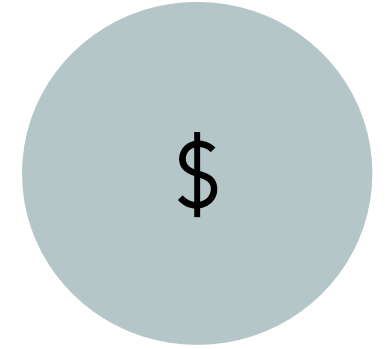
Hazard and risk insights

Hazard and risk maps for flood, wind, convective storm and earthquake at location level



Integration

Access through your systems or Impact Forecasting platforms.



Better Decisions

For risk selection and pricing strategies

Can you quantify climate change impacts on physical risks?

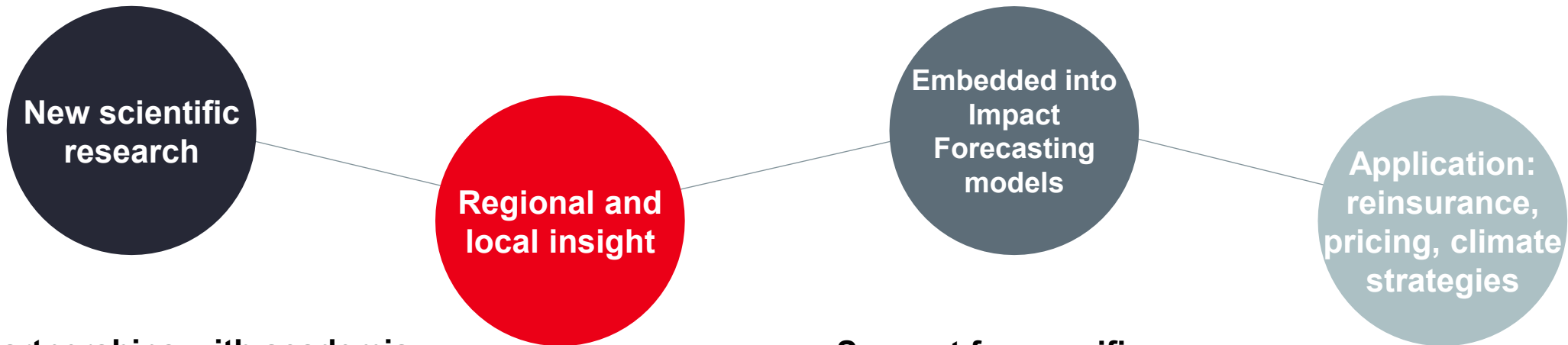
Model climate scenarios to price risk today and tomorrow

Focused Solutions

- Focus on peak territories, physically based studies
- Robust approach with future climate change event sets

Full suite of platforms and services

- Development findings directly incorporated to our platforms
- Full support from Aon and Impact Forecasting teams



Partnerships with academia

- Solutions using the latest research outputs
- Region and peril specific

Support for specific use cases

- Climate adjusted modelled losses provided for specific use cases
- Exposure data and model results in standard format

Are you lacking relevant, up-to-date info on events?

Impact Forecasting's Catastrophe Insight can

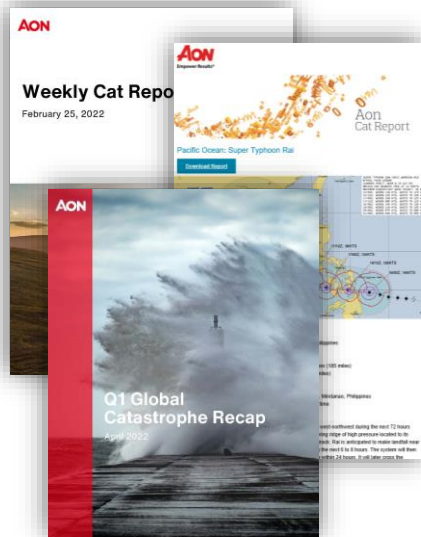
Global Coverage

Available for US Hurricane, Euro Windstorm and Japan Typhoon

Available for modelled perils

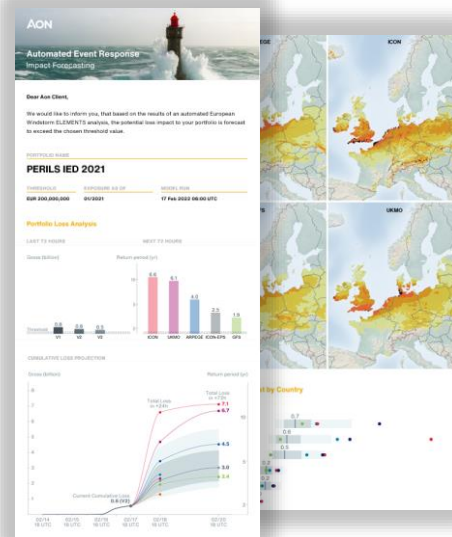
Catastrophe Reporting

Detailed coverage of ongoing natural disasters, providing information, data and scientific background.



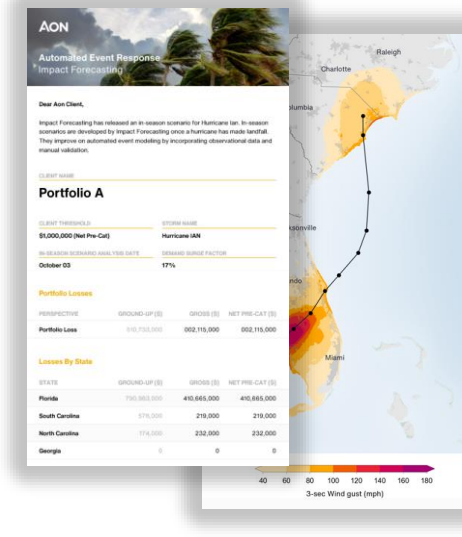
AER Loss Forecasting

Personalized report based on numerical weather prediction data. Includes detailed loss forecast for an impending disaster.



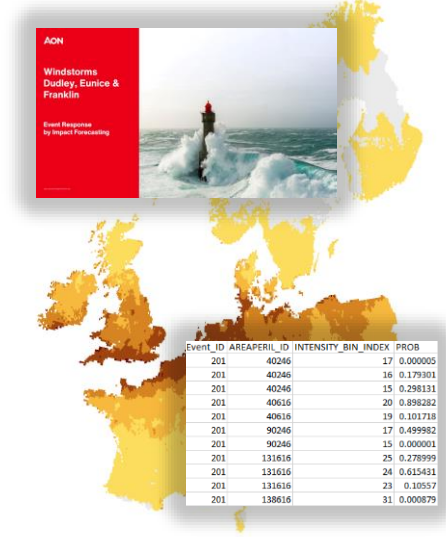
AER Post-Event Analysis

Provides initial loss estimation based on measured data. Usually provided within 24 hours after the event's peak.



Event Response Package

Package with final modelled footprint, includes Event overview document, Shapefile or GeoTIFF footprints, and optionally oasis-format hazard files.



Thank You

chris.ewing@aon.com

www.impactforecasting.com



Dr. Joshua Macabuag

*Co-Founder and Chief Product Officer,
Renew Risk*



Risk Analytics and Modelling for Renewable Energy

Ashima Gupta
Chief Executive Officer

Dr Joshua Macabuag
Chief Product Officer

Prof Subhamoy Bhattacharya
Chief Scientist

Gaurav Chawla
Exec Chair



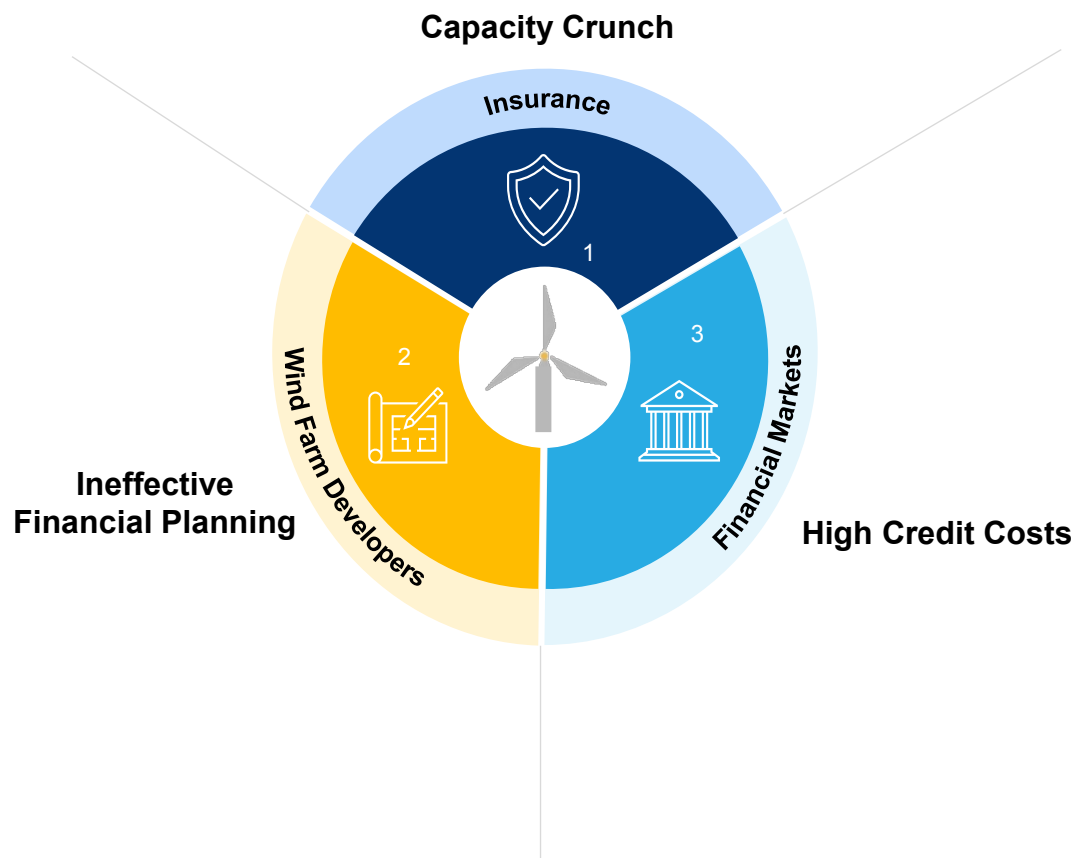
Renew Risk provides world-class risk analytics and modelling solutions for **renewable energy** asset finance and insurance starting from **offshore wind farms**

WHY RENEWABLES?

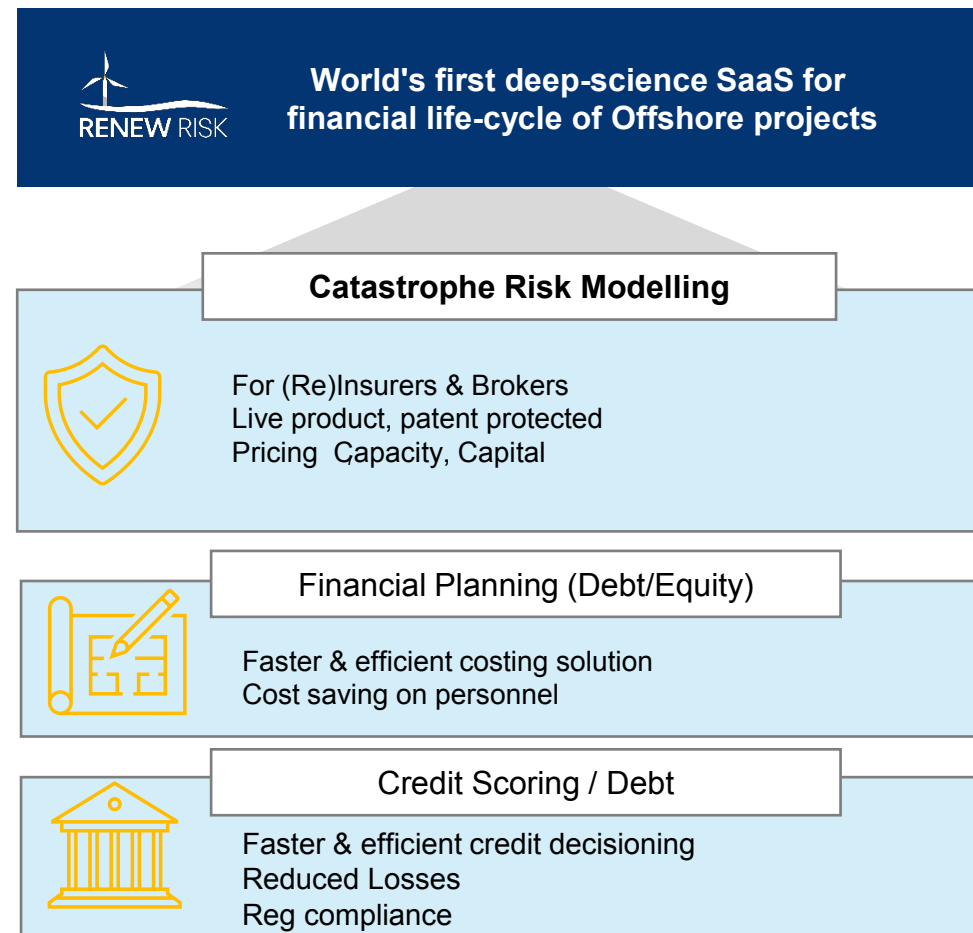


Exponential growth of renewable energy needs financial risk solutions

Problem



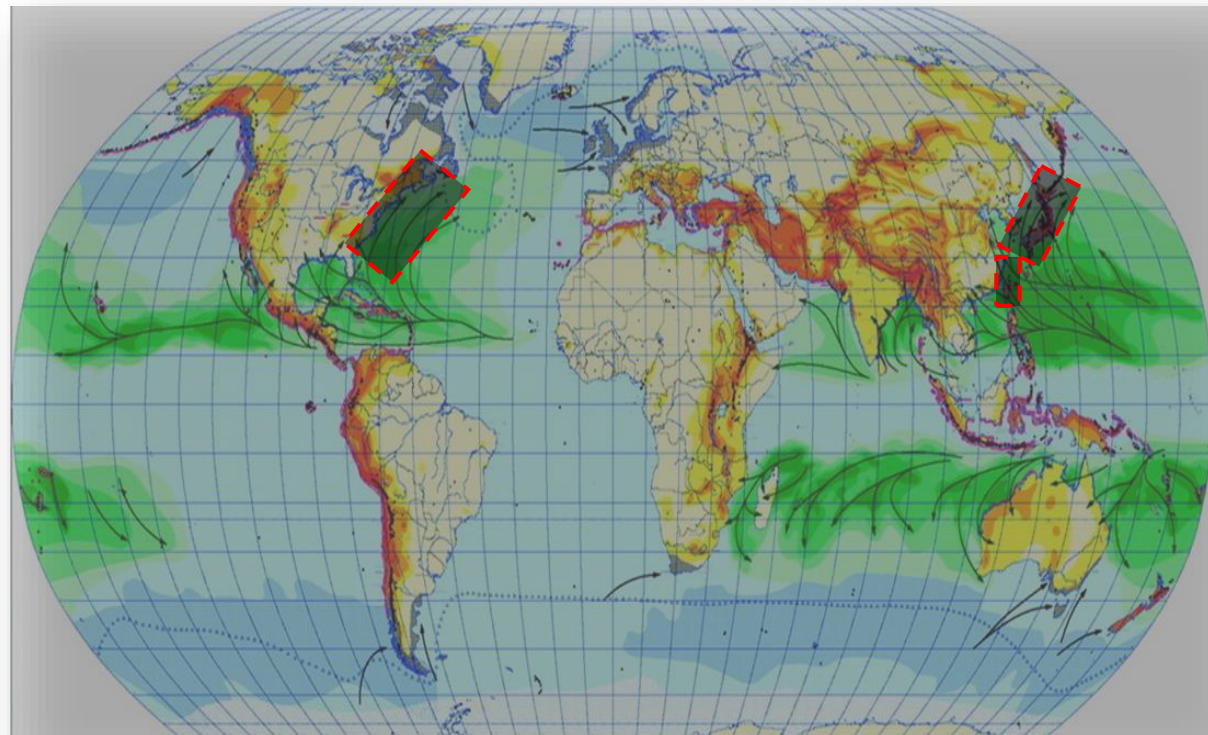
Solution



THE GAP

Models needed for regions of peak exposure growth

- New assets in NatCat regions for first time
- No commercially-available models currently



Offshore-Wind-Specific Cat Models

US Hurricane available now

In development:

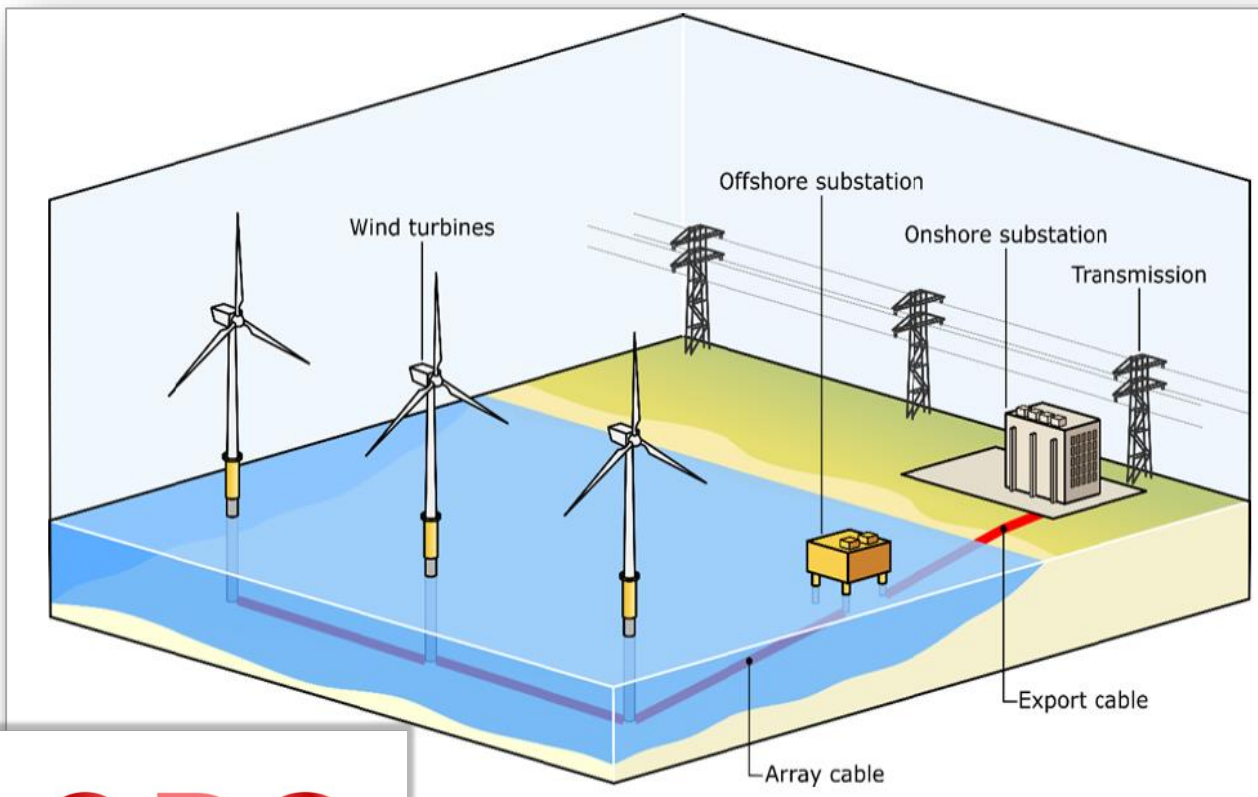
Taiwan Earthquake & Hurricane

Japan Earthquake & Hurricane

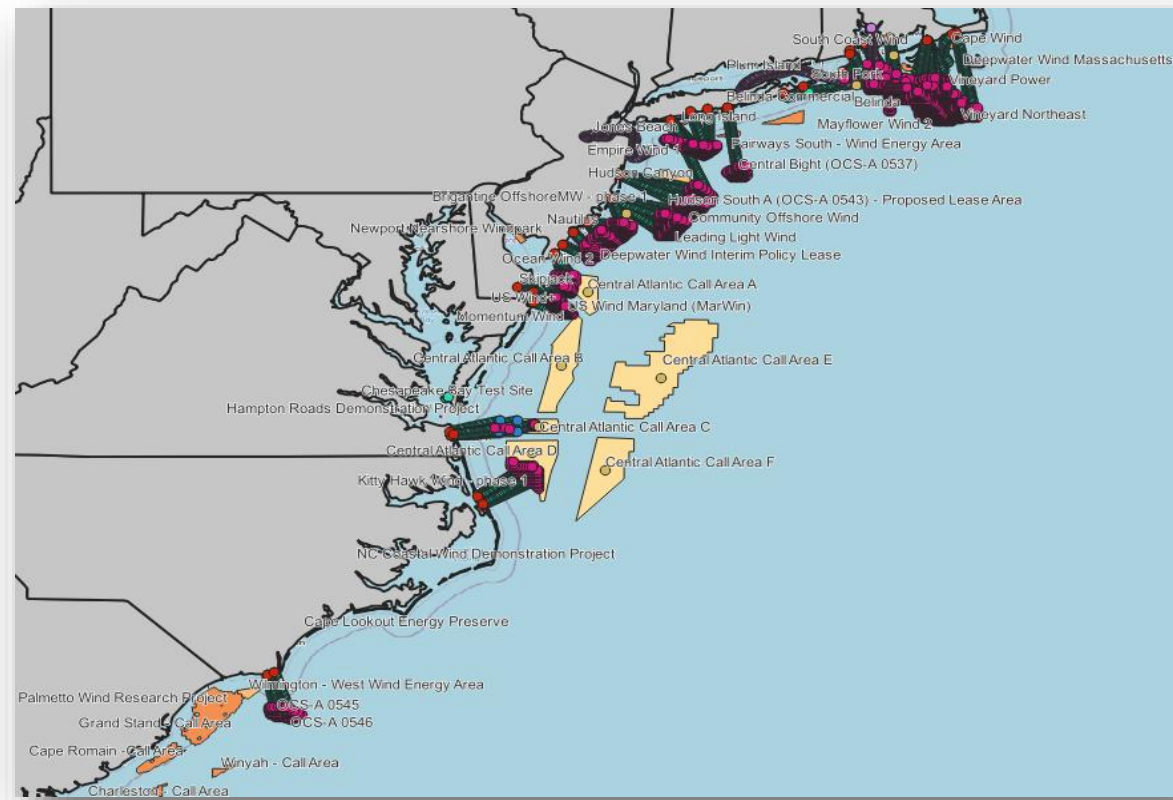
INDUSTRY EXPOSURE DATABASE

Model unique offshore assets

- Turbines, Cables, Substations



- All assets, now and scheduled

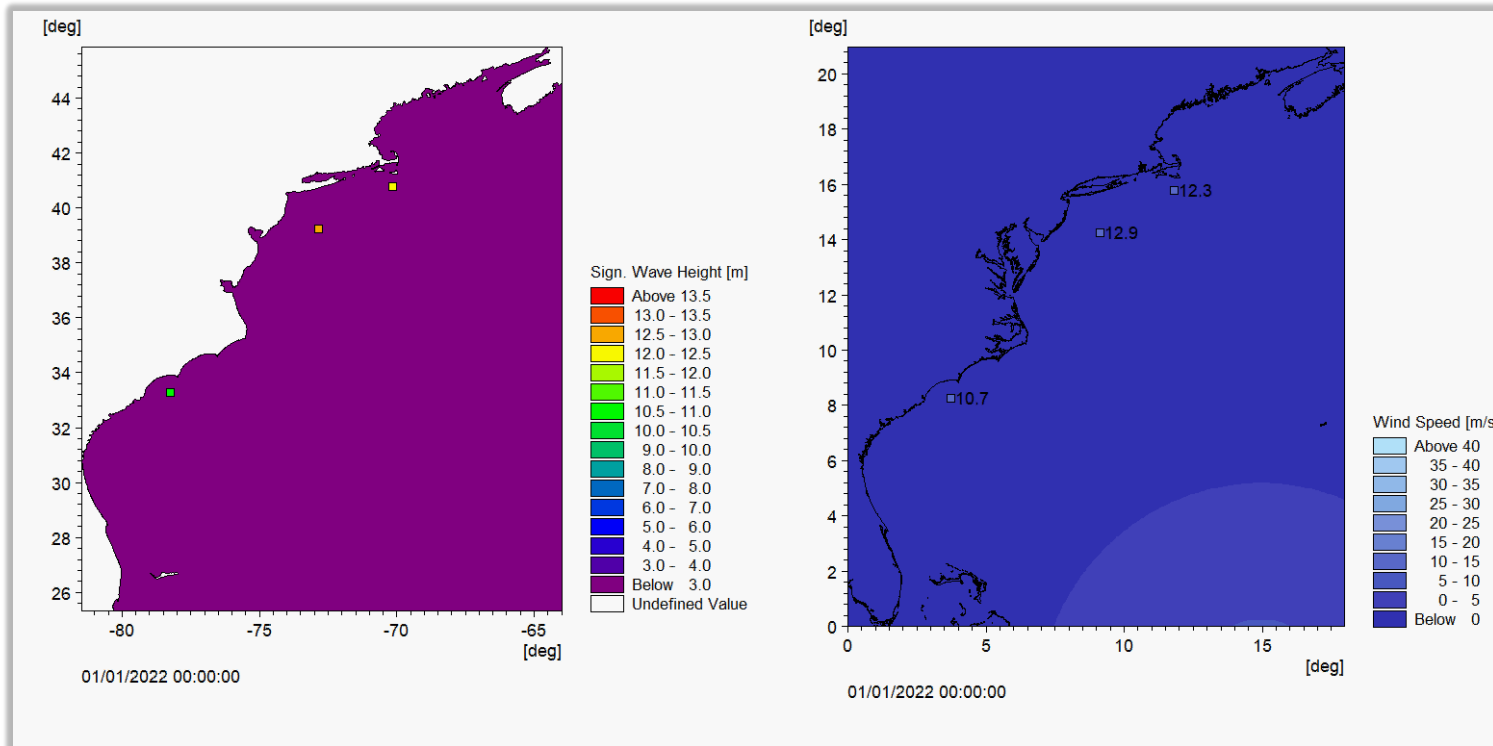


Enables modelling of risks with minimal information
Significantly saves modelling time

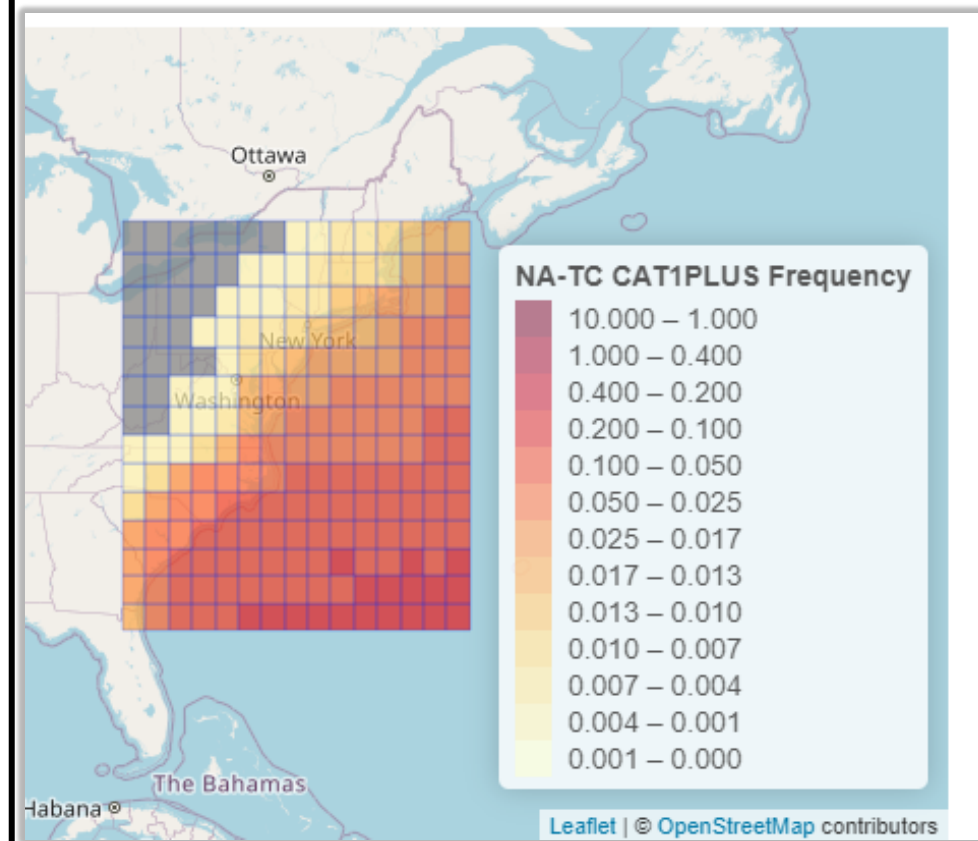
OFFSHORE HAZARD

Unique Offshore Condition

- Hurricane – Wind, Wave & Current
- Earthquake – Shaking, Landslide, Liquefaction
- Wind and sea modelled with global leader:

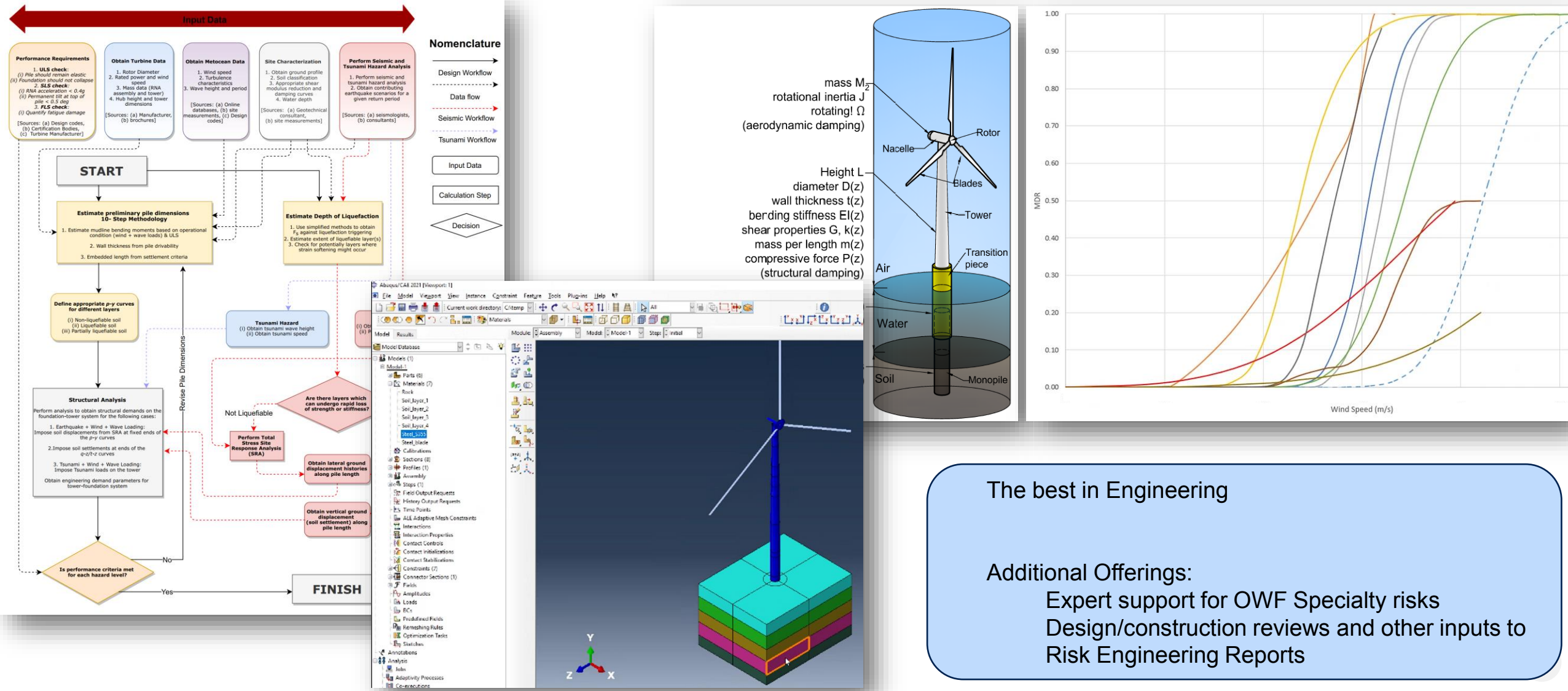


- Independent Validation



VULNERABILITY MODELLING

Limited claims exist, so Engineering Methods
Turbines, Blades, M&E, Cables, Substations

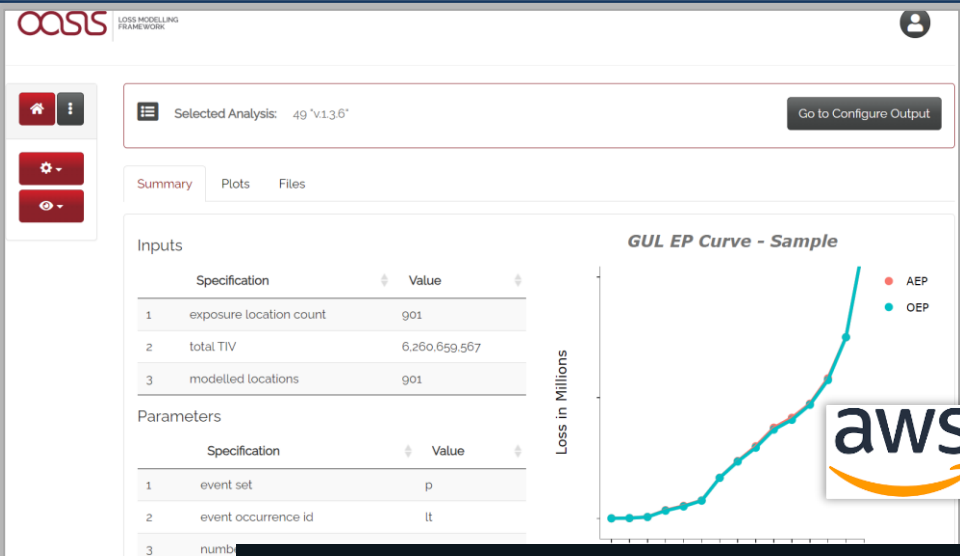


The best in Engineering

Additional Offerings:
Expert support for OWF Specialty risks
Design/construction reviews and other inputs to Risk Engineering Reports

MODEL DEPLOYMENT

Accessible via Nasdaq Risk Modelling for Catastrophes



- Standardized Loss Metrics

- Available on Nasdaq and AWS

Nasdaq Risk Modelling - Catastrophes renewrisk [UAT]

MODELS

Vendor	Model	Perils	Countries	Version	Asset Versions	Supported OED Versions	Description
Vendor filter	Model filter	Perils filter	Countries filter	Version filter	OED version filter		
	NEUSTC		UK	1.3.5	Worker version: 1.3.5 Data version: 1.3.5 Keys version: 1.3.5	3.0.* 2.0.*	NEUSTC WP3

THE TEAM

Skillsets: Risk Modelling, Engineering, Insurance, Fintech Software, Sales and Entrepreneurship.



ASHIMA GUPTA

CEO

Product and client delivery, experience in Insurance & Banking, incl Renewable Energy



PROF SUBY BHATTACHARYA

Chief Scientist

Professor of Offshore Wind
Author two industry-standard books



DR JOSH MACABUAG

Chief Product Officer

Model Validation/Development for:
World Bank, SCOR, Amlin, Argo
PhD in Cat Modelling (WRN)



GAURAV CHAWLA

Exec Chair

FinTech Entrepreneur
Formerly IHS Markit Energy



CLIENTS, PARTNERS AND INVESTORS

Going to market with robust ecosystem of insurance companies, academia, partners and investors

Clients



Investors



Angel Investment



Partners





Improving Renewable Energy Financing

CONTACT US

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Gaurav.Chawla@renew-risk.com

Prof Subhamoy Bhattacharya
Chief Scientist
Suby@renew-risk.com

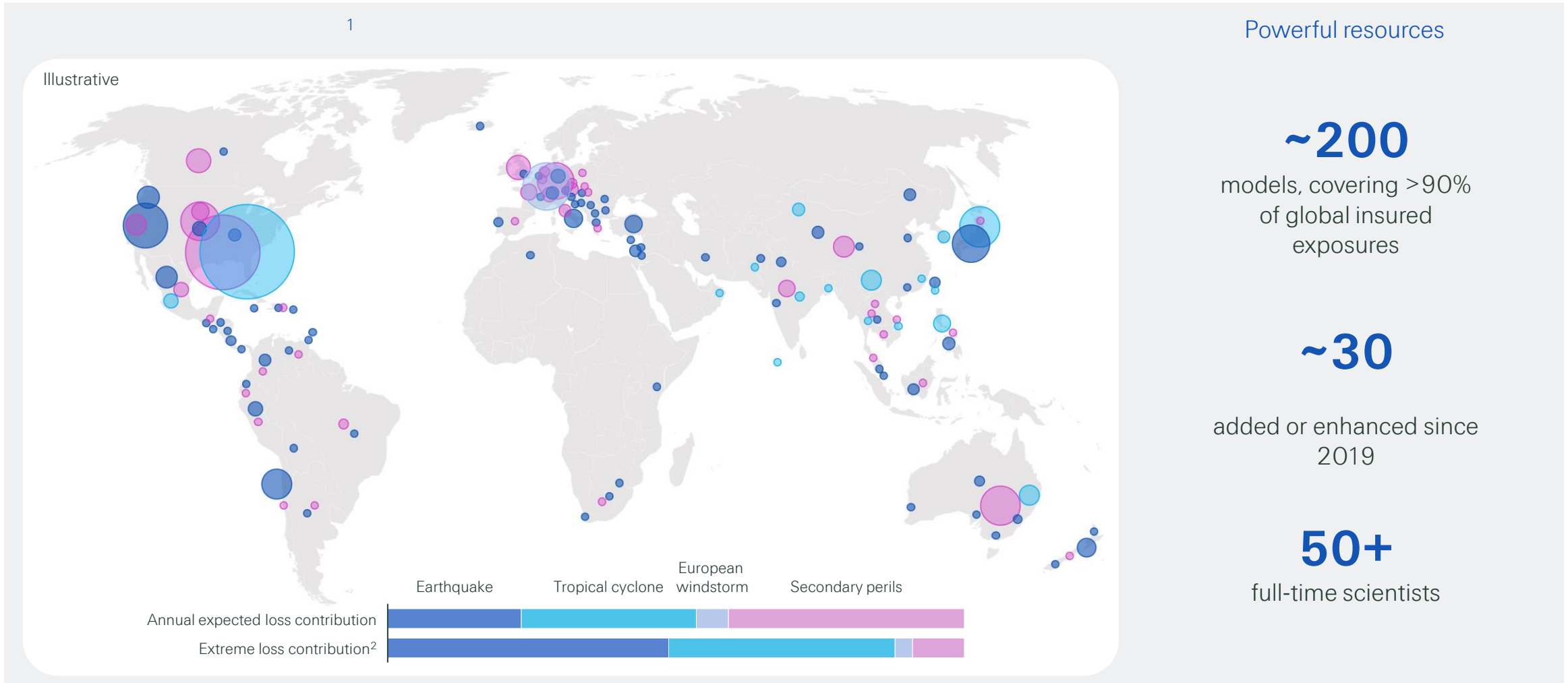
Open Source Assets in Swiss Re: A Glass Half Full or Half Empty?



Martin Bertogg

Head Cat Perils, Swiss Re

Covering the Globe with nat cat modelling capabilities: A need to find new ways of procurement of risk insights





2023 - a very full glass for Swiss Re in Nat Cat Modelling

Earthquake
China:
GEM & OASIS
as game
changers

Technical
Steering Group:
Industry
learning on
neutral
grounds

Flood
modelling
capabilities:
**enabling co-
development**

An underwater photograph of a young child and a woman, both wearing swimming goggles. The child is in the foreground, looking towards the camera with a slight smile. The woman is in the background, also looking towards the camera. The water is clear and blue, with light filtering through from above.

Accelerated learning and better
outcomes at a lower price point...

-> **Give it a try!**

New Ways to look at
Flood Risk at the
Location Level



David Schenkel

*Head of Product,
REOR20*

REOR in Latin means think and compute

%20 is the URL encoding symbol for the white space

REOR20

AI is the new flood defence

David Schenkel
Head of Product
david@reor20.com


Scale 1:85,000,000 at 0°
Miller cylindrical projection
Zurich, 11.09.2023

 **esa** business incubation centre
Zurich, Switzerland

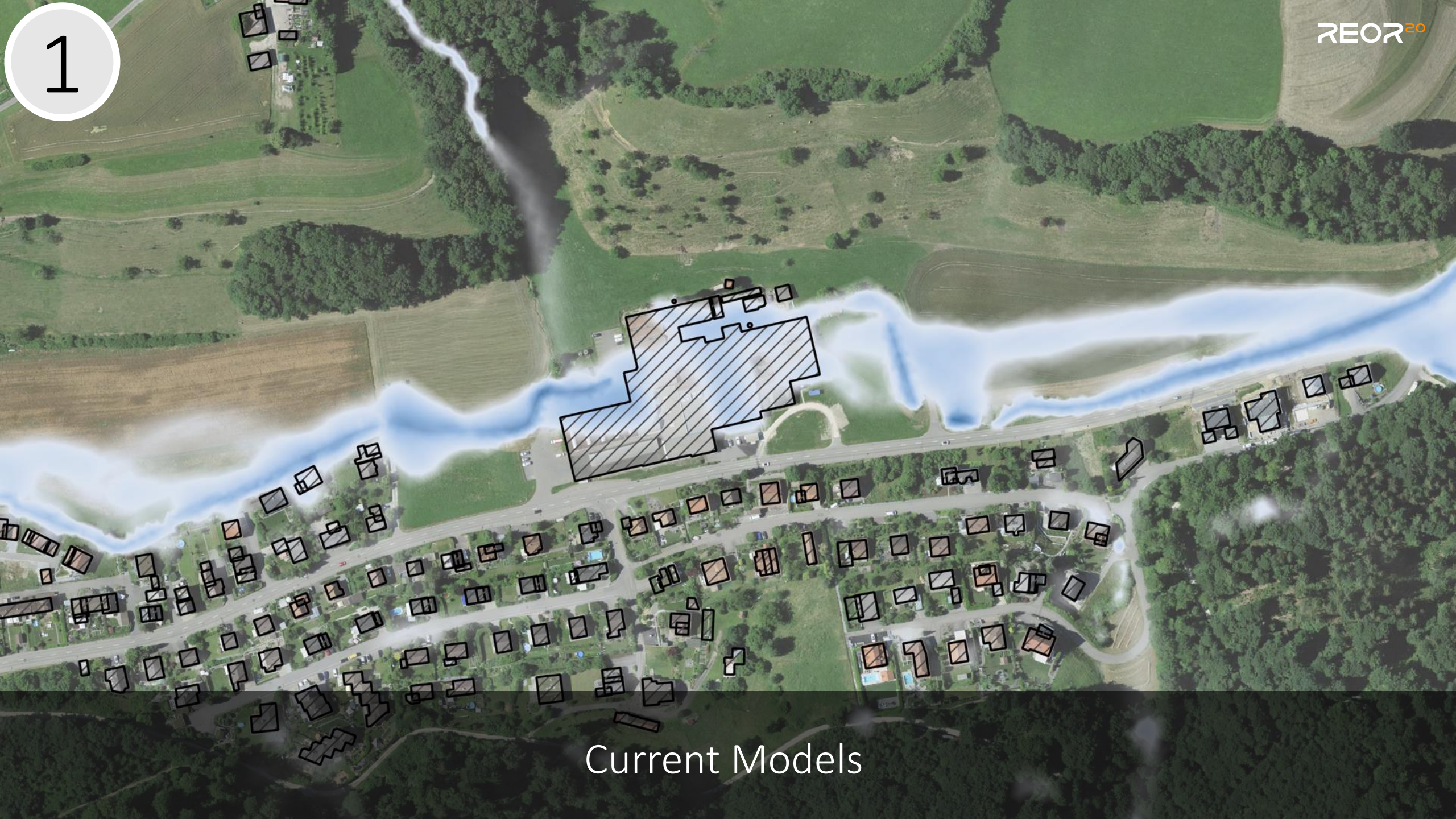
 **Lloyd's
Lab**
Coordinated Unit of the Swiss Re Group
Lloyd's Bank Group

 **UPScaler**
SWISS ENTREPRENEURS FOUNDATION

REOR20 All rights Reserved



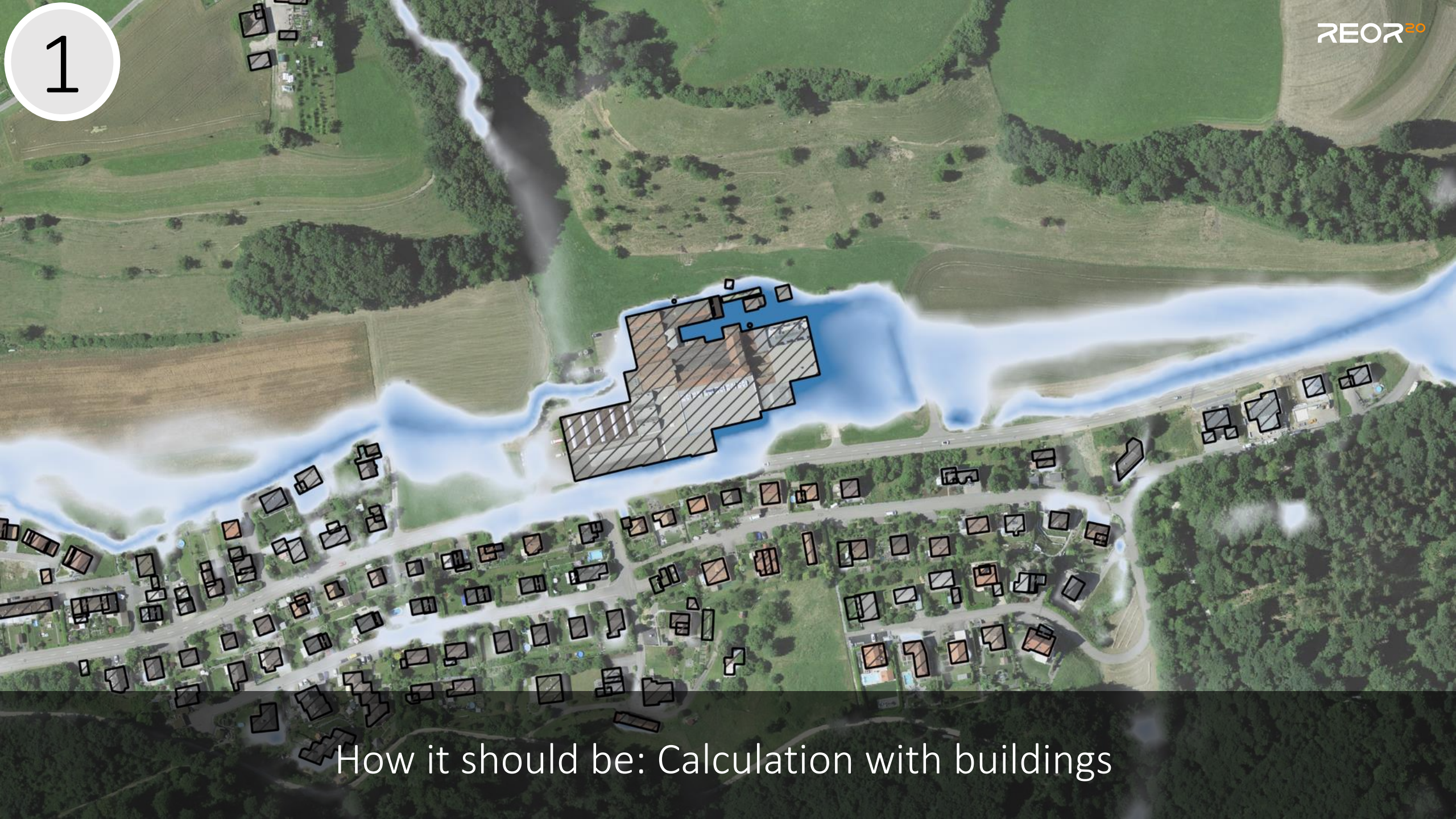
3 major issues with flood risk models to understand risk at the location level



1

Current Models

1



How it should be: Calculation with buildings

1

Maximum depth

2.00m

X

with buildings

1.00m

0.25m

X

without buildings



2

Average depth over time around the building

2.00m

1.00m

0.25m

with buildings

without buildings

Time



3

1

same depth

1

same risk?

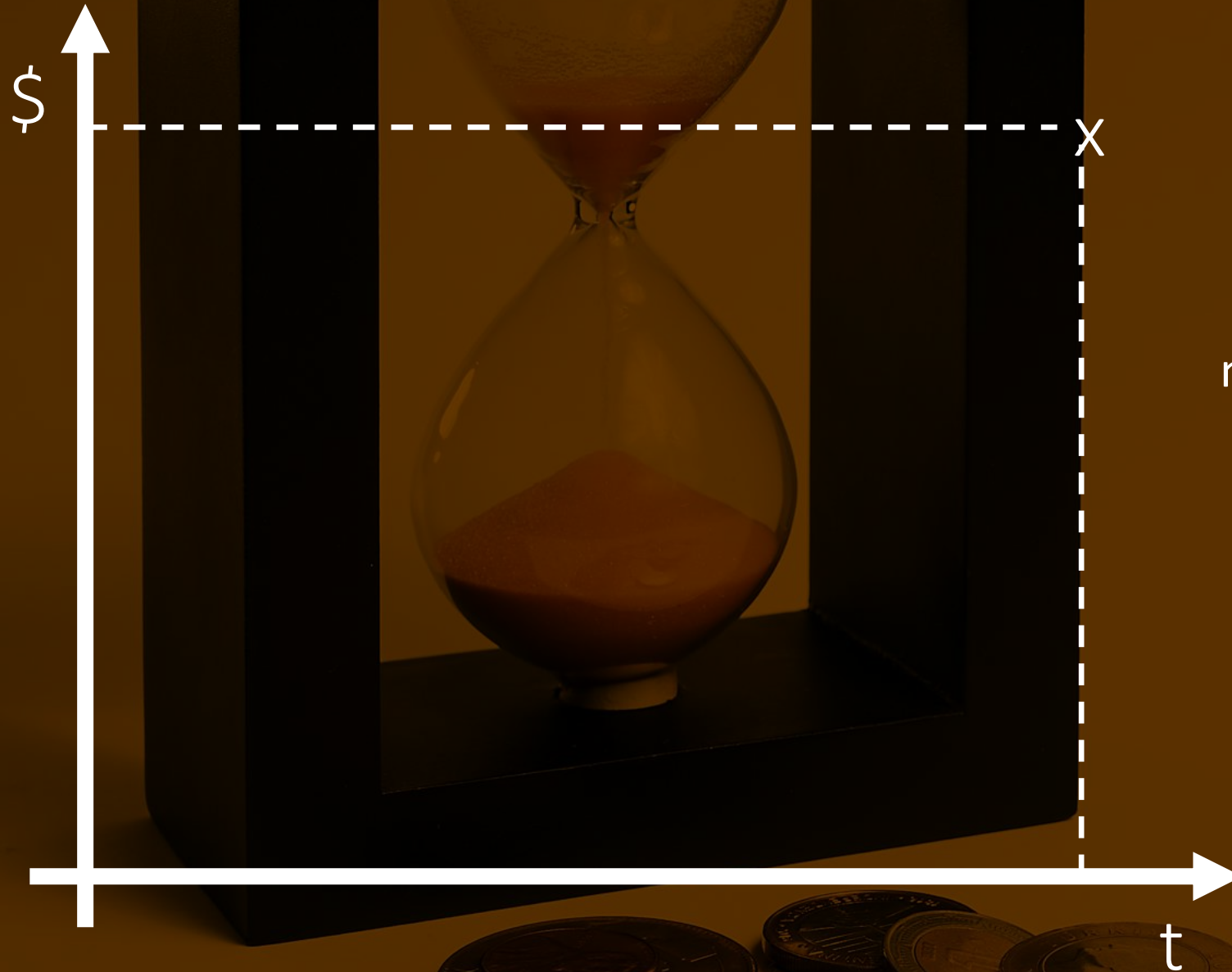
2

2

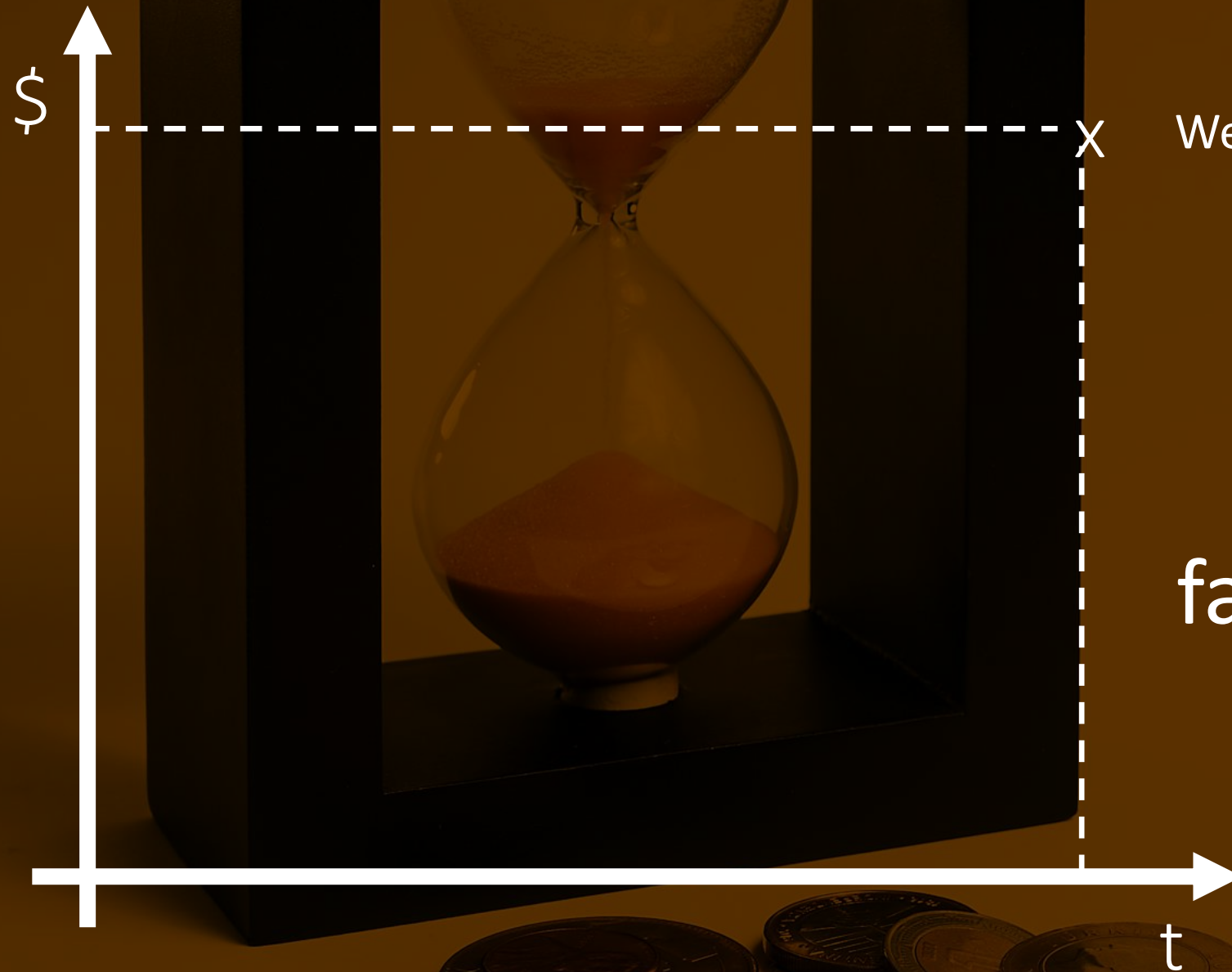


3





High Fidelity Modelling:
Expensive, tedious - and
nearly impossible to scale



We taught an AI the physics of
flood

making it

faster & simpler



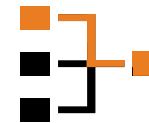
Visual risk exploration for Deepdives
 Provide rich set of data on the risk in the vicinity of the property to better assess and de-risk



Location & Property Characteristics

Risk Scoring	
Factor	Score
Depth	Medium 6 / 10
Force	High 9 / 10
Duration	Low 2 / 10

API returns property-specific REOR20 risk scores



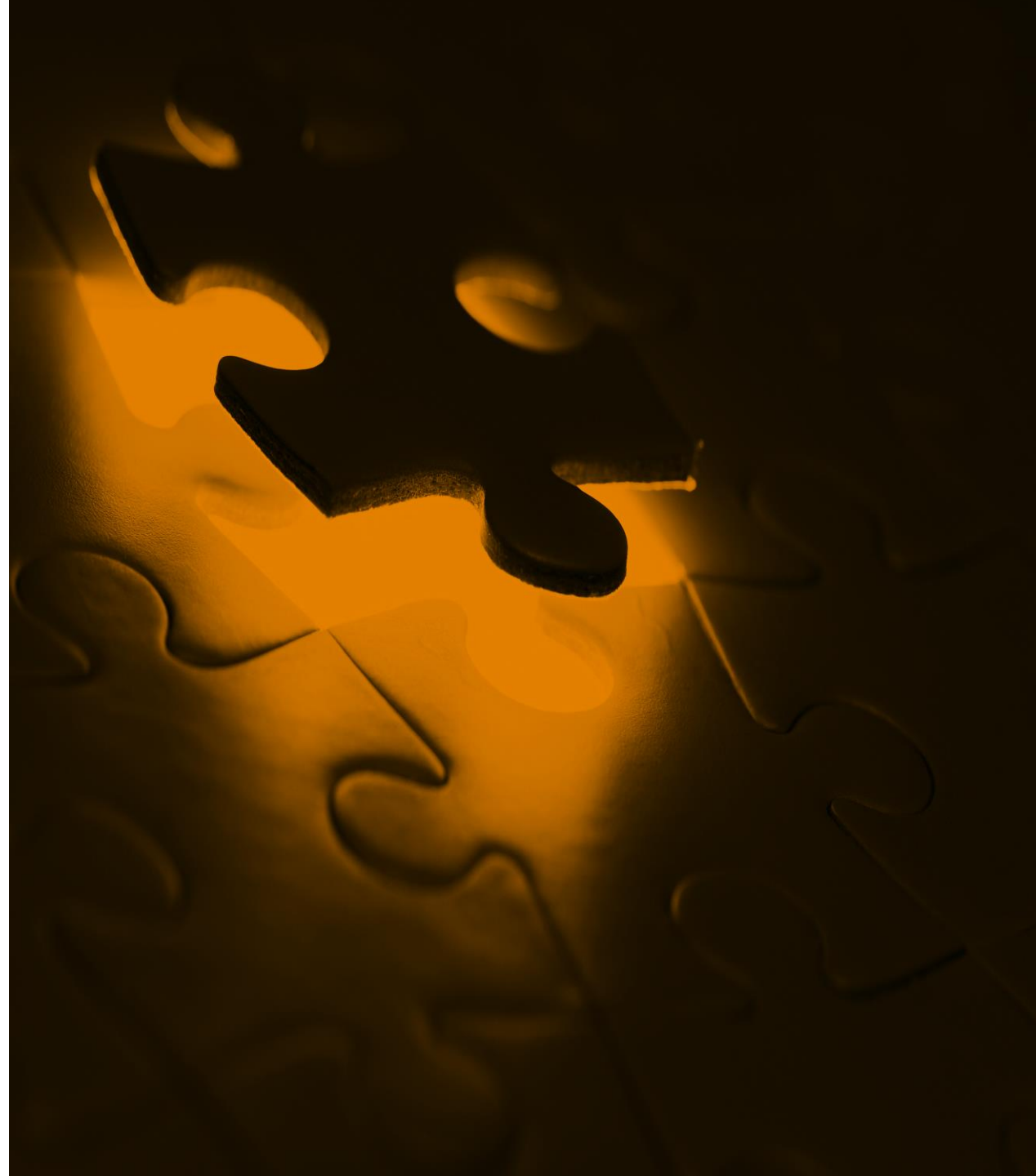
Rule-based Acceptance and Pricing



Flood Policy

Implications

- From point-based to property-based lookups
- Need for up-to date building & defences datasets
- Aggregation and disaggregation per building
- Re-calculation of risk for new urban developments



REOR²⁰

Thank you!

David

Head of Product

david@reor20.com

Zurich, 11.09.2023



REOR20 All rights Reserved

Handling Complexity in Flood Models: A Close Look at Hazard and Exposure Data



Oliver Wing

*Chief Research
Officer, Fathom*



Petr Puncochar

*Global Head of Flood
Model Development,
Impact Forecasting*



Jane Toothill

*Managing Director
JBA Risk
Management*

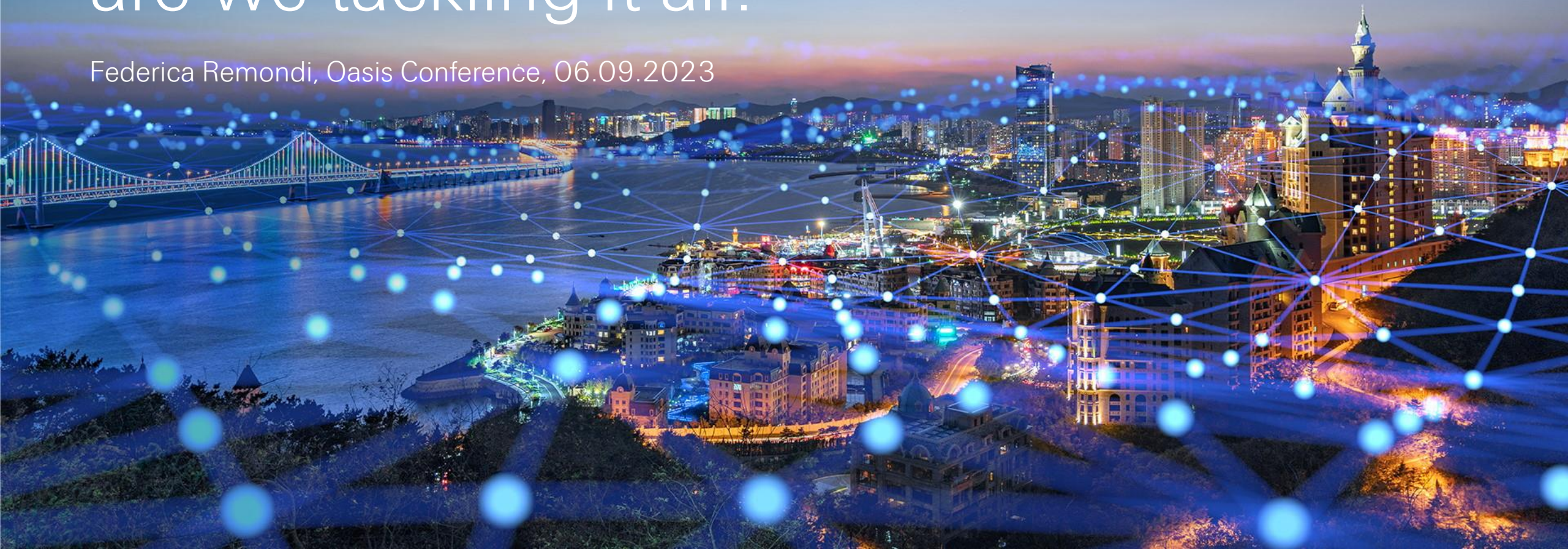


Federica Remondi

*Flood Lead,
Swiss Re*

Handling Complexity in Flood Models: are we tackling it all?

Federica Remondi, Oasis Conference, 06.09.2023



Current and future flood models face challenges that require a robust while flexible approach

Robust, granular and continental-scale hydrodynamic model

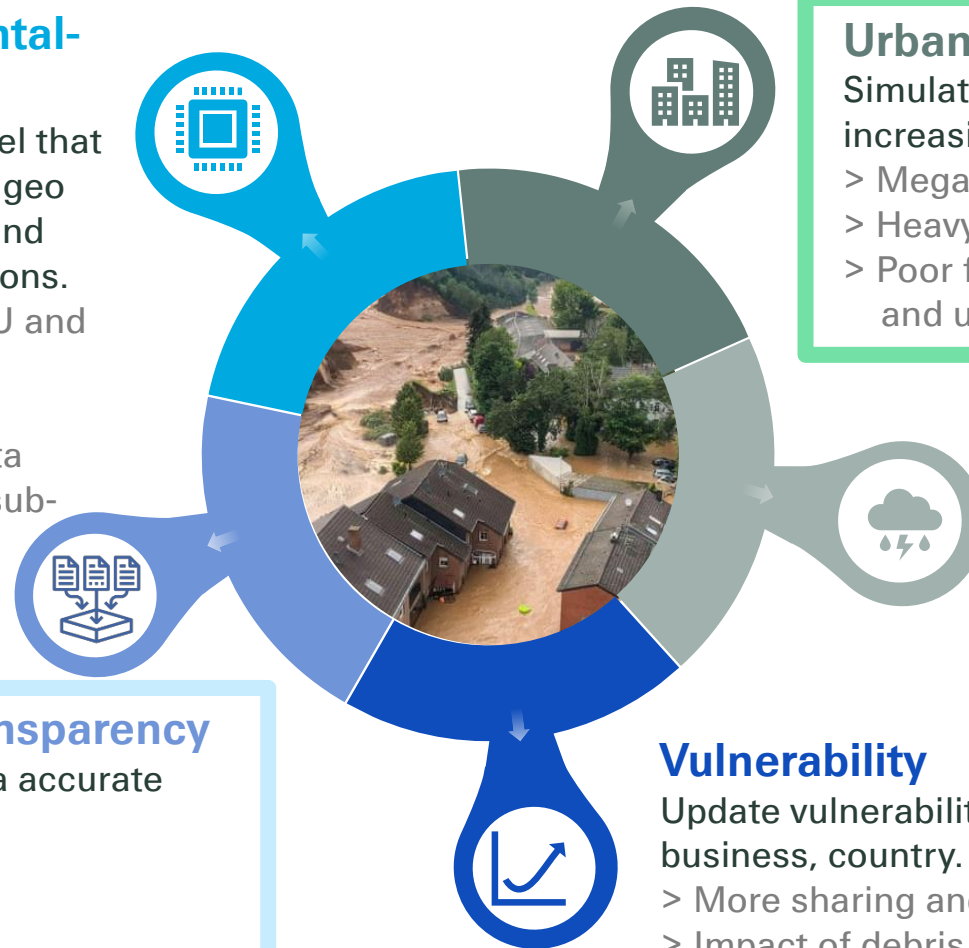
High-performance hydrodynamic model that can take advantage of high-resolution geo datasets, while being process-based and representative also in data scarce regions.

- > Speed-efficient model codes for GPU and cloud computing
- > Lidar DTM, building footprints
- > Hydrography and flood defences data
- > Compound events: Combination of sub-perils and consequent events

Exposure data quality and transparency

Collect and include in submission data accurate exposure, claims, policy information

- > Disaggregation assumptions
- > Uncertainty handling



Urbanization

Simulate urban flash flooding in light of increasing population densities and built-up areas

- > Megacities in South(east) Asia
- > Heavy rainfall patterns
- > Poor flood defense infrastructure maintenance and upgrade

Climate change

Make sure our models are de-biased and represent current risk view. Include climate change scenarios and achieve stochastic simulations.

- > Impact of higher rainfall intensities
- > Impact of sea level rise
- > Assess future exposure

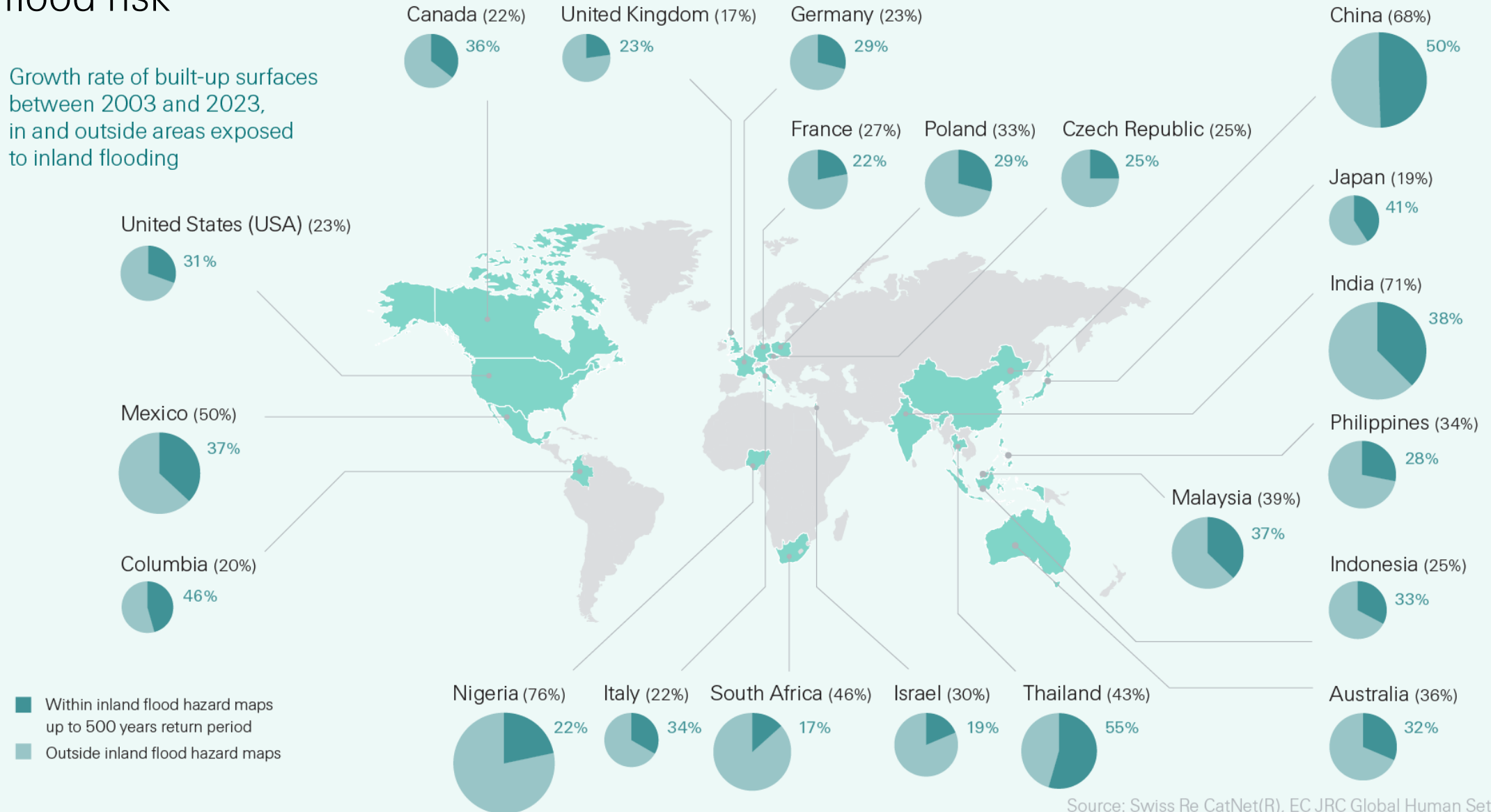
Vulnerability

Update vulnerability functions per occupancy, line of business, country.

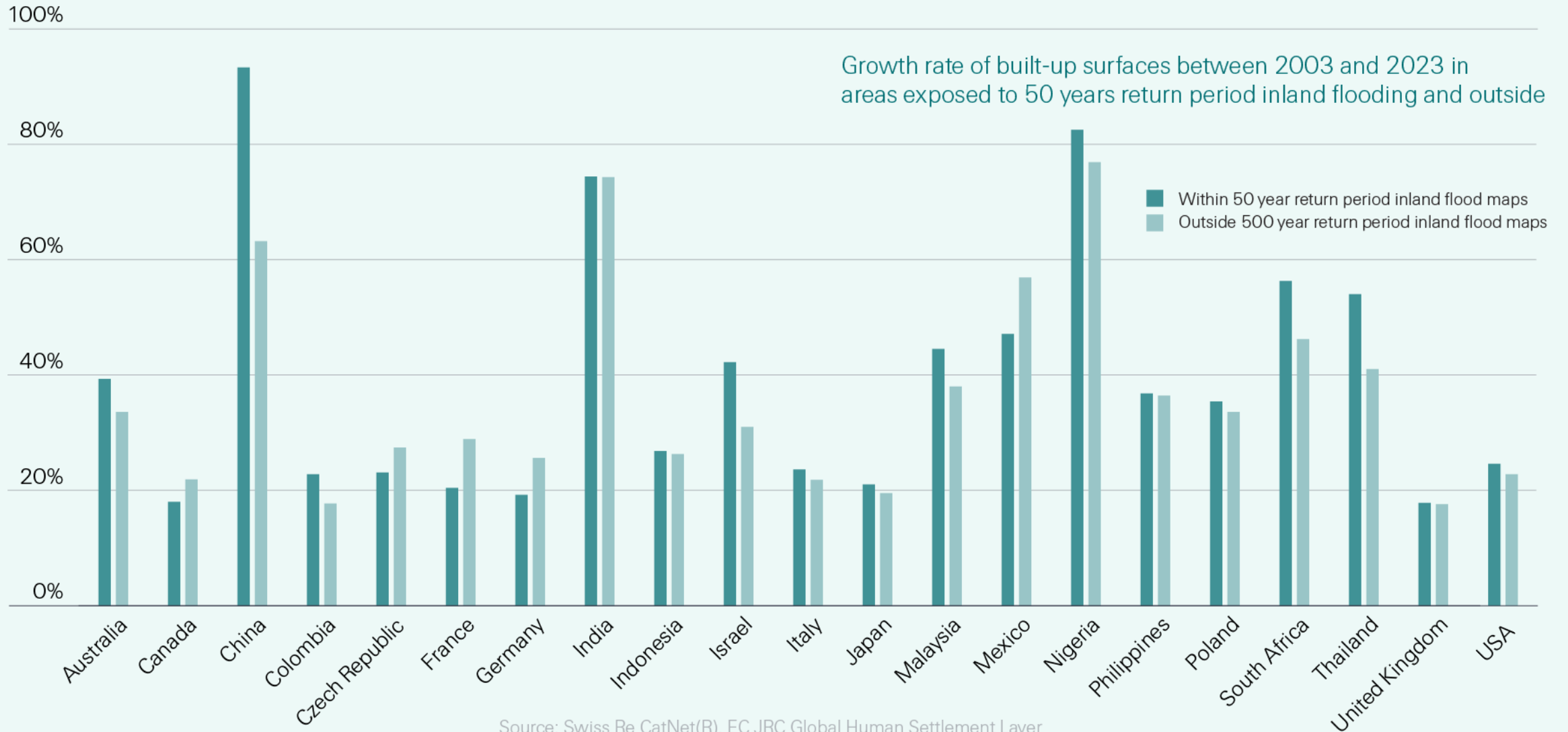
- > More sharing and use of claims data
- > Impact of debris, social inflation

The increase in built-up areas is a global phenomena also seen in regions exposed to flood risk

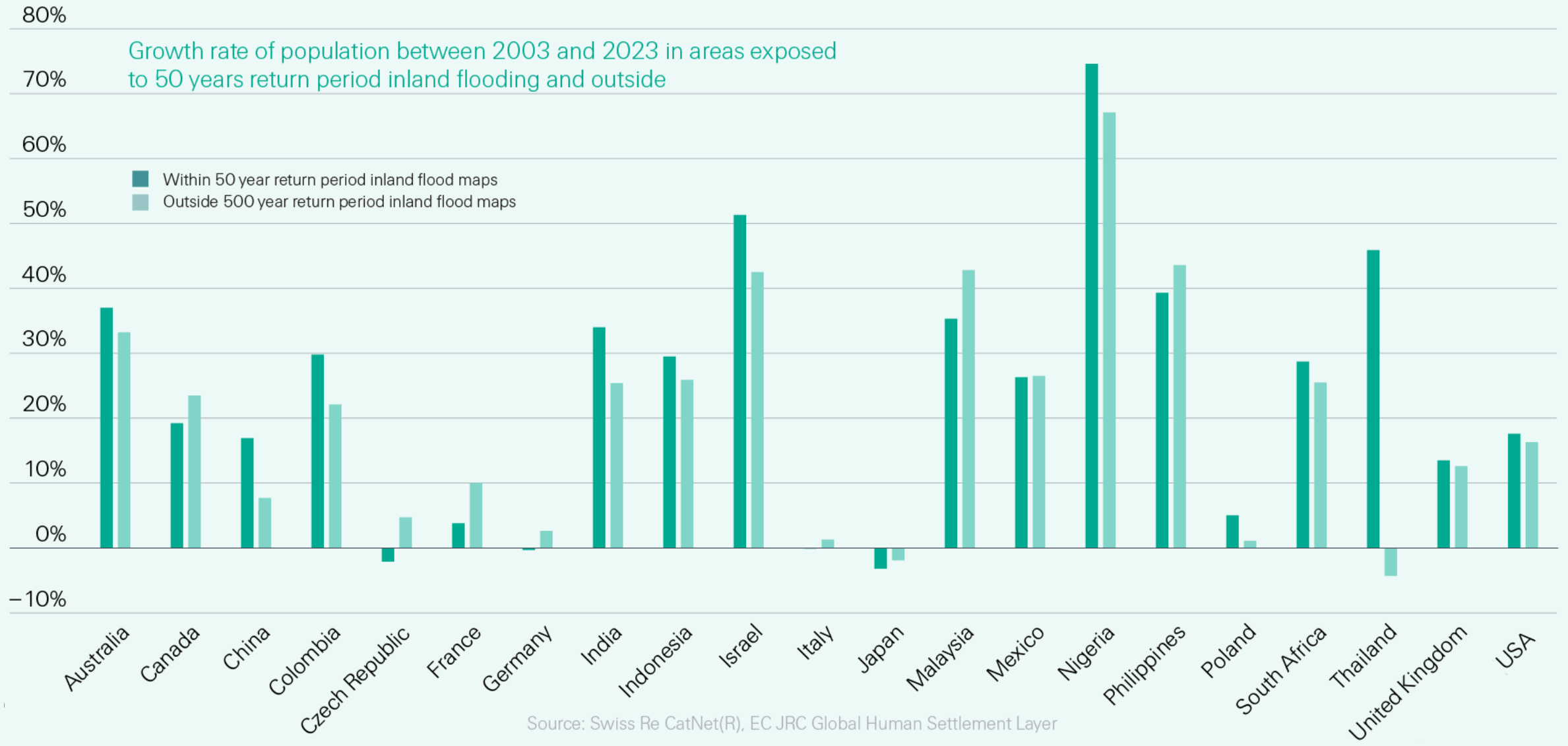
Growth rate of built-up surfaces between 2003 and 2023, in and outside areas exposed to inland flooding



The growth rate of built-up areas in regions highly exposed to flooding is rarely lower than the one in the least exposed regions



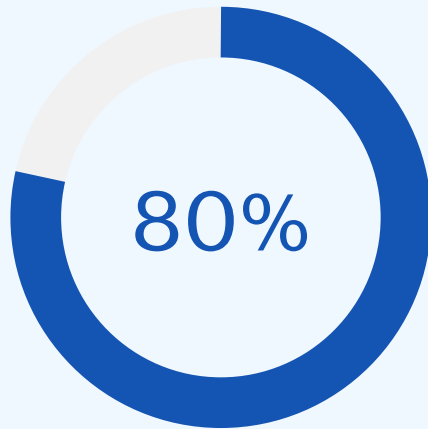
Population growth is similarly reflecting built-up trends, showing no major correlation to flooding risk



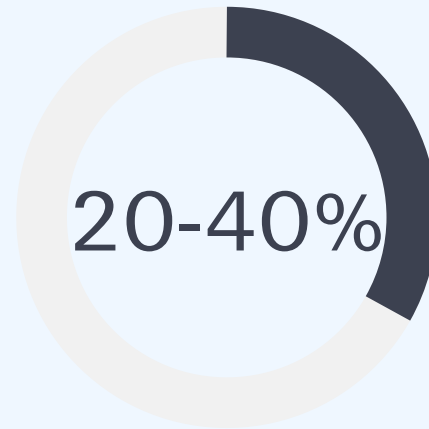
Source: Swiss Re CatNet(R), EC JRC Global Human Settlement Layer

Sharing flood exposure data at high resolution is not a yet the norm also in the re/insurance key markets, increasing uncertainty in the model outcomes

% TIV received in treaty submissions at address/exact level*



USA, Germany & Australia
In few key markets sharing exposure at lat/lon level is becoming a standard



China & India
In large markets we still see a lack of transparency

Which assumptions do we take?
How can we reduce uncertainty?

*Source: Swiss Re. Confidential and indicative data.

A photograph of a flooded road. The road is asphalt with a yellow center line. The water is murky and reflects the sky. There are utility poles and trees in the background. The sky is overcast with grey clouds.

Can flood models be
used equally from
portfolio accumulation
down to tariffs analysis ?

Model Validation: Are There Opportunities to Improve How This is Done and the Data



Dickie Whitaker

*Chief Executive,
Oasis LMF*



Malcolm Haylock

*Head of Catastrophe
Modelling, Fathom*



Nigel Winspear

*Head of Natural Catastrophe
Analytics Research, Sompo
International*



Oriol Gaspa Rebull

*Head of UK Property
Analytics, Aon
Reinsurance*



Guido Felder

*Lead Catastrophe Researcher,
Zurich Insurance*



Dr. Nigel Winspear

*Head of Natural Catastrophe Analytics
Research, Sompo International*



SOMPO INTERNATIONAL

Promise. Trust. Protect. At the center of everything we do.

Catastrophe Model Validation

What and How?



Sept 6, 2023
Oasis Zurich
Dr. N. Winspear
V1.1

Agenda



SOMPO INTERNATIONAL

Promise. Trust. Protect. At the center of everything we do.

1. Core questions to be addressed
2. Emphasis on both questions
3. Tailor effort to match [the materiality of the peril]
4. Designing the content in advance
5. Remember what it is not

Model validation – resolves to 2 core questions

Validation is ... **the process by which you determine whether the external catastrophe model provides a valid representation of the catastrophe risk for your portfolio** [LMA (2012) - Validating external catastrophe models under Solvency II]

This resolves to two core questions:

1. Does the model adequately represent the system being modelled?

'Good fit' of the model and its components against historic data likely to have been used to build and calibrate it. Says little to nothing about the suitability of the model for use with a specific portfolio.

2. How well does it predict using unrelated data not used to build/ calibrate the model?

Focuses on the predictive skill of the model with respect to portfolios that were not used to build or calibrate it.

Model validation should ideally be designed to answer both questions, in a way that reflects the relative materiality of the peril.

Tailor effort to match

Tailor the work to the materiality of the peril

Materiality can be assessed at a high level and then mapped to different categories of model validation study

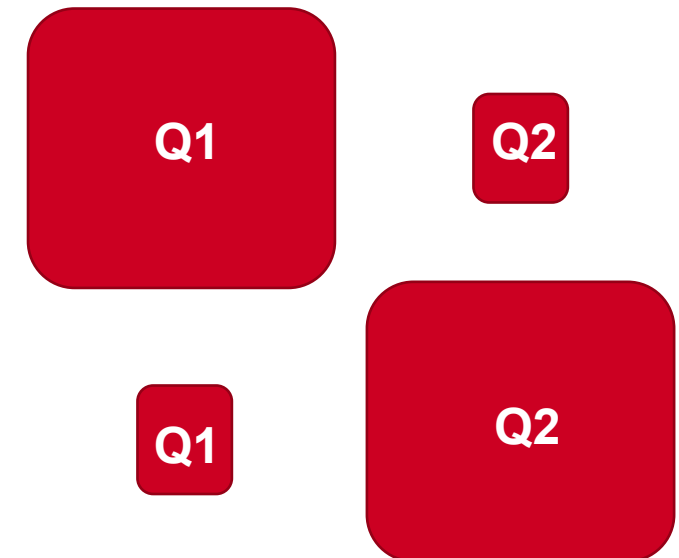
OEP 1:100 VaR (USD Millions) - example	% of Gross Written Premium (GWP) - example	Materiality Category	Validation Category	Questions Addressed
>500	>20%	High	Comprehensive	Q1, Q2
100-500	>5<=20%	Medium	Intermediate	Q1, Q2
50-100	>2<=5%	Low	Basic	Q1, Q2
<50	<=2%	Immaterial	Light touch	Q1

Place equal emphasis on answering both questions

In practice we often see excess focus on Q1 but little on Q2, or *vice versa*.

Imbalance leads to the risk of improper risk assessment due to subsequent use of the model ...

- without knowing if it is a good fit to the peril **[Q1]**
- for portfolios for which it is not well calibrated **[Q2]**



Plan the content in advance

Validation Category	Validation Module	Questions Addressed	Example of Content
Comprehensive/intermediate	Loss validation	Q1, Q2	<ul style="list-style-type: none"> - Industry back-testing, scenario testing, historic loss comparison (modelled vs. actual). - Own portfolio back-testing, scenario testing, historic loss comparison (modelled vs. actual). - Model parameter sensitivity testing (choice of event catalogue, demand surge, sub-perils ...)
	Hazard validation	Q1	<ul style="list-style-type: none"> - Overview of peril hazard implementation in the model. - Event rate benchmarking by sub-peril, by region. - Event footprint intensity benchmarking by sub-peril, for selected events/ event sources.
	Vulnerability validation	Q1, Q2	<ul style="list-style-type: none"> - Portfolio sensitivity to changes in primary & secondary exposure attributes. - Location level reconstruction of damage curves. - Testing for regionalization in vulnerability modelling.
	Geocoding	Q2	<ul style="list-style-type: none"> - Portfolio impact of disaggregation of aggregate exposures. - Portfolio impact of geocoding at different spatial resolutions.
Basic	Loss validation	Q1, Q2	<ul style="list-style-type: none"> - Reuse existing vendor industry loss validation work and add back-testing of industry loss experience from own testing. Consider adding back-testing of own portfolio loss experience.
Light touch	Loss validation	Q1	<ul style="list-style-type: none"> - Simply reuse existing vendor industry loss validation work.

1.

1. Often assumed that model validation will result in a view of risk
2. Model validation lays the foundation for subsequent development of a view of risk
3. View of risk development needs input from a much wider panel of experts – actuaries, exposure managers, underwriters – and will need to be revised much more regularly than the model validation exercise – hence **flows from** the validation exercise

2. Functional verification

1. We assume in good faith that the model works as intended on receipt
 1. Functions correctly – policy conditions, hours clauses, inuring order of layers, etc.
 2. Financial calculations are implemented in a way that is generally accepted
 3. All vulnerability sensitivity combinations make sense
2. We do not spend time verifying these things work – this could easily consume the entire validation project duration, without addressing either of the 2 core questions
3. This is a very important topic – but very few perform exhaustive verification testing. Potentially a systemic risk to the industry. This risk could be largely eliminated by creating an independent industry body to assume this important role on our behalf.



LOSS MODELLING
FRAMEWORK



Swiss Re
Institute



Oriol Gaspa Rebull

*Head of UK Property Analytics, Aon
Reinsurance*

AON

Oasis Event

Oriol Gaspa Introduction

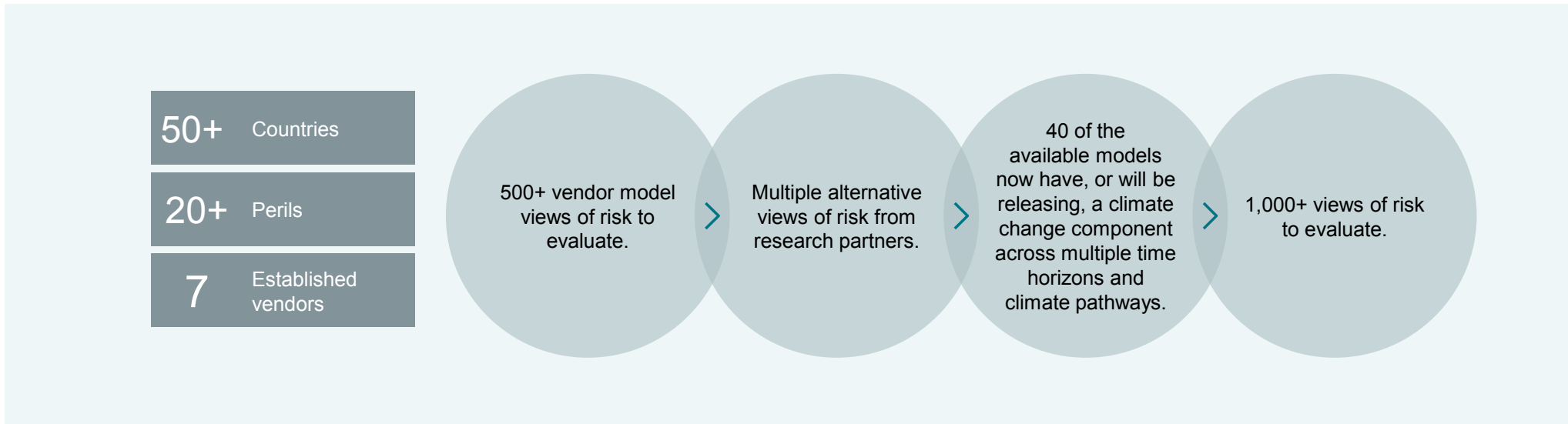
September 2023

Proprietary & Confidential



Aon continually evaluates a large range of models on behalf or for clients

The risk landscape has become increasingly complex and has led to a proliferation of models; by peril and country globally. Climate change is creating further uncertainty and is a key driver of the hardening market.



Large global	Super regionals & Regionals	Global Re Specialty	Casualty, Cyber & Motor
Validation of model changes			
Evaluation and opinion of underlying methodologies			
Analysis on portfolio model accuracy			
			Validation of actuarial profiling
Benchmarking of underlying exposures, modelling assumptions and loading factors			
Advise on the model of choice			
Suitability of climate models			
Design of a bespoke View of Risk			
Model comparison			



Guido Felder

*Lead Catastrophe Researcher, Zurich
Insurance*

Simplifying model validation through transparency and standardization

Oasis Conference 2023, 6 September 2023

Guido Felder
Lead Cat Researcher
guido.felder@zurich.com

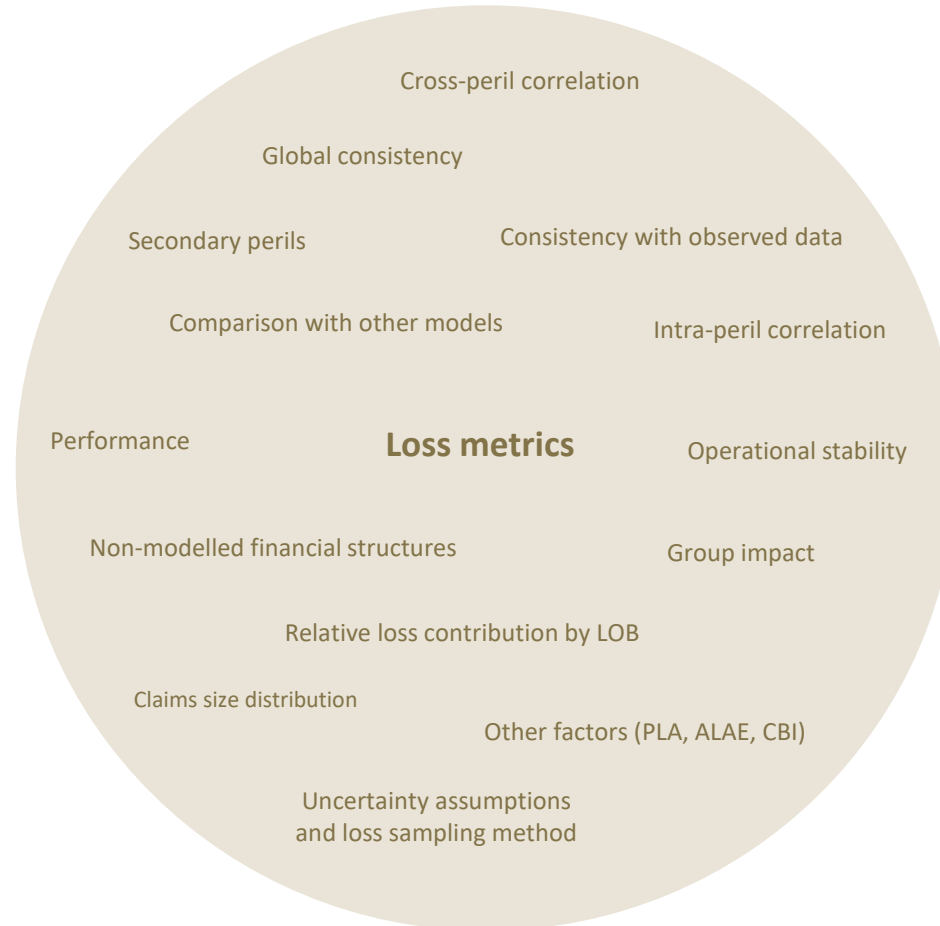
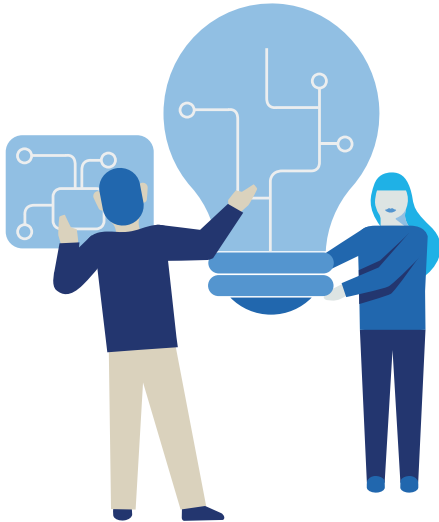


Two perspectives on model validation

Scientific perspective

Does the model reflect scientific state of the art?

- Publications
- Open data
- Emerging tools and methods (AI)
- Academic network



Business perspective

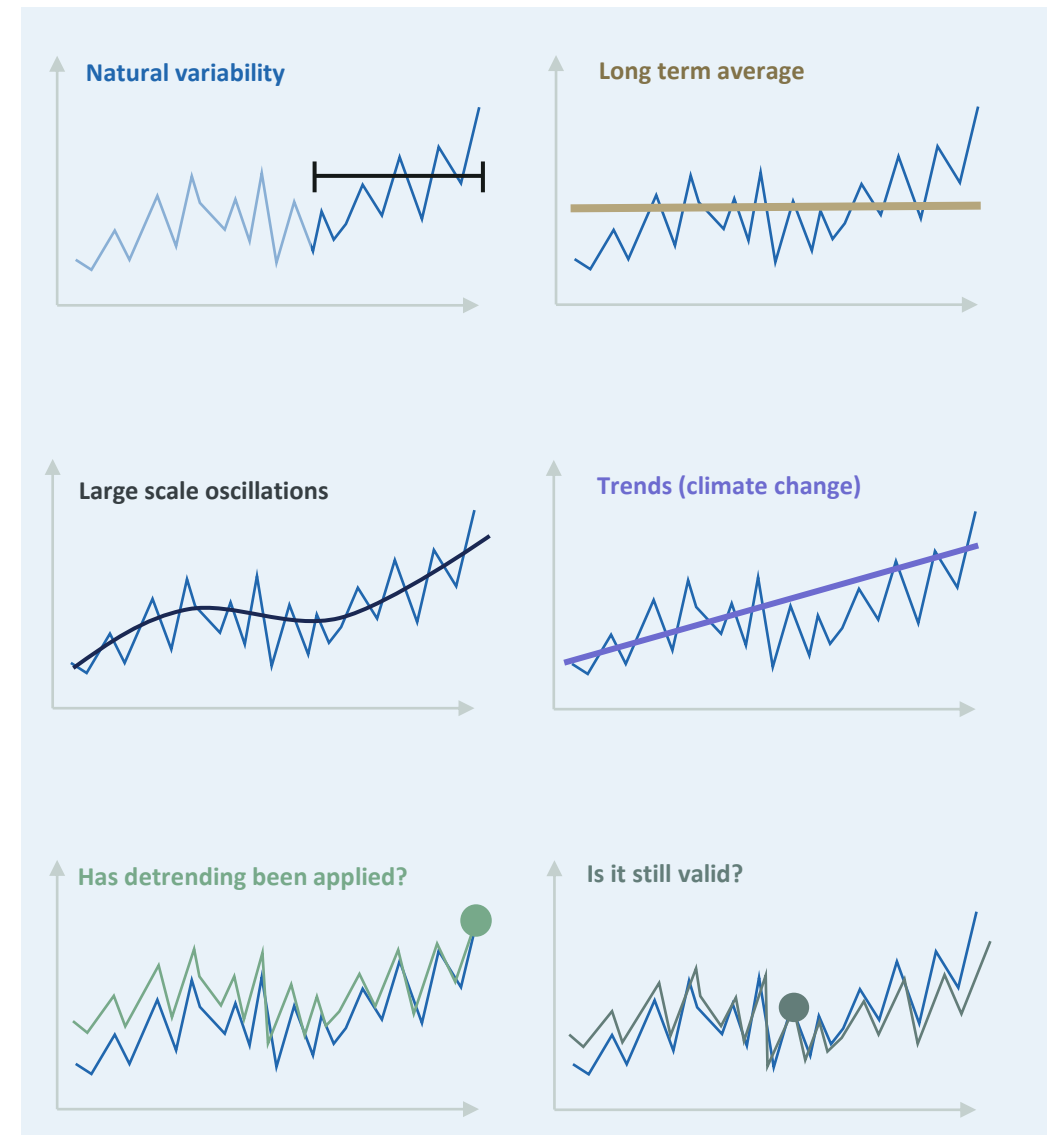
Is the model appropriate for the business needs?

- Claims history
- Portfolio structure
- Exposure data standards
- Local expertise



Example for the need for transparency

Question	Does the hazard module reflect current conditions?
Points to consider	<p>Vintage of data set(s) used for event set generation</p> <ul style="list-style-type: none">- Varying input time series- Irregular update cycles- On-levelling to current conditions <p>Underlying assumptions</p> <ul style="list-style-type: none">- Short vs. long time series- Extremes vs. outliers- Climate change vs. natural variability- Other dynamic components (e.g. poleward shift of TC tracks)
Consequences	<ul style="list-style-type: none">- Need to get in touch with developers- Take actions (or not)- Ensure consistency across different models and vendors



Simplifying model validation through transparency and standardization



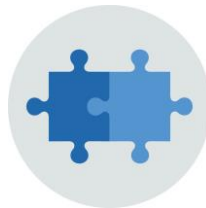
Insurer view

- Internal validation will remain
- Need for transparency on models (incl. limitations)
- Limited data sharing capabilities due to legal restrictions
- One (!) industry standard for technical documentations and validation reports would reduce non-value adding workload



Model provider view

- Exposed to market conditions
- Low motivation for transparency around limitations and deficiencies
- IP considerations
- Increasing demand for transparency



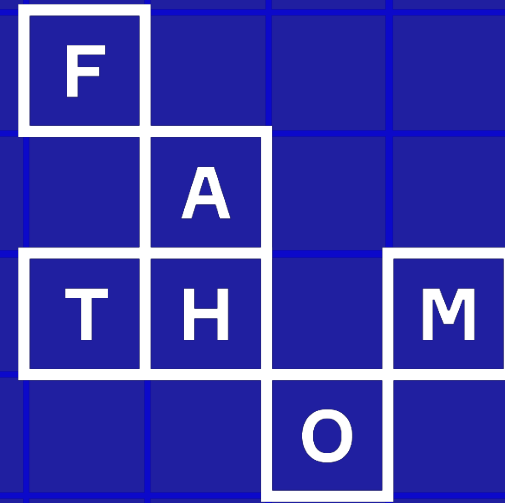
Opportunities for industry collaborations

- More **transparency** could help both sides Insurers benefit from facilitated
- Standardization of **validation reports** and skill scores
- Further standardization of **formats**
-



Malcolm Haylock

*Insurance Head of Catastrophe Modelling,
Fathom*

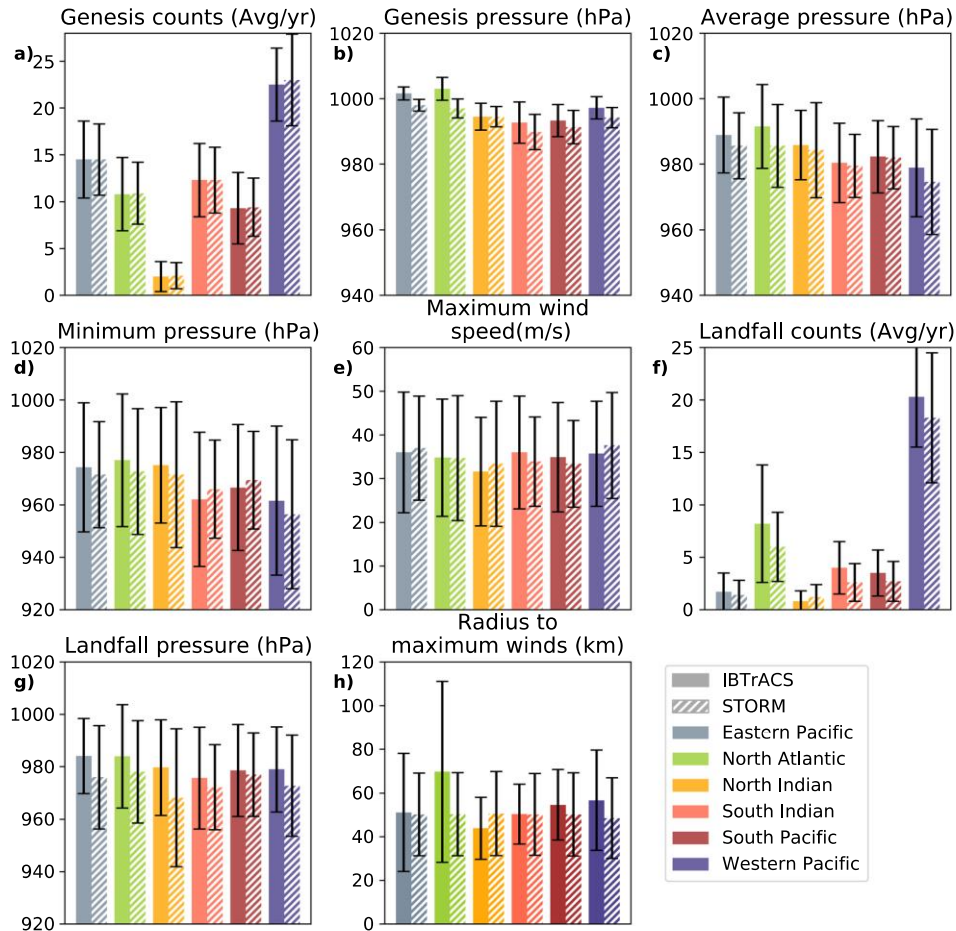


Model Validation - Meeting in the Middle

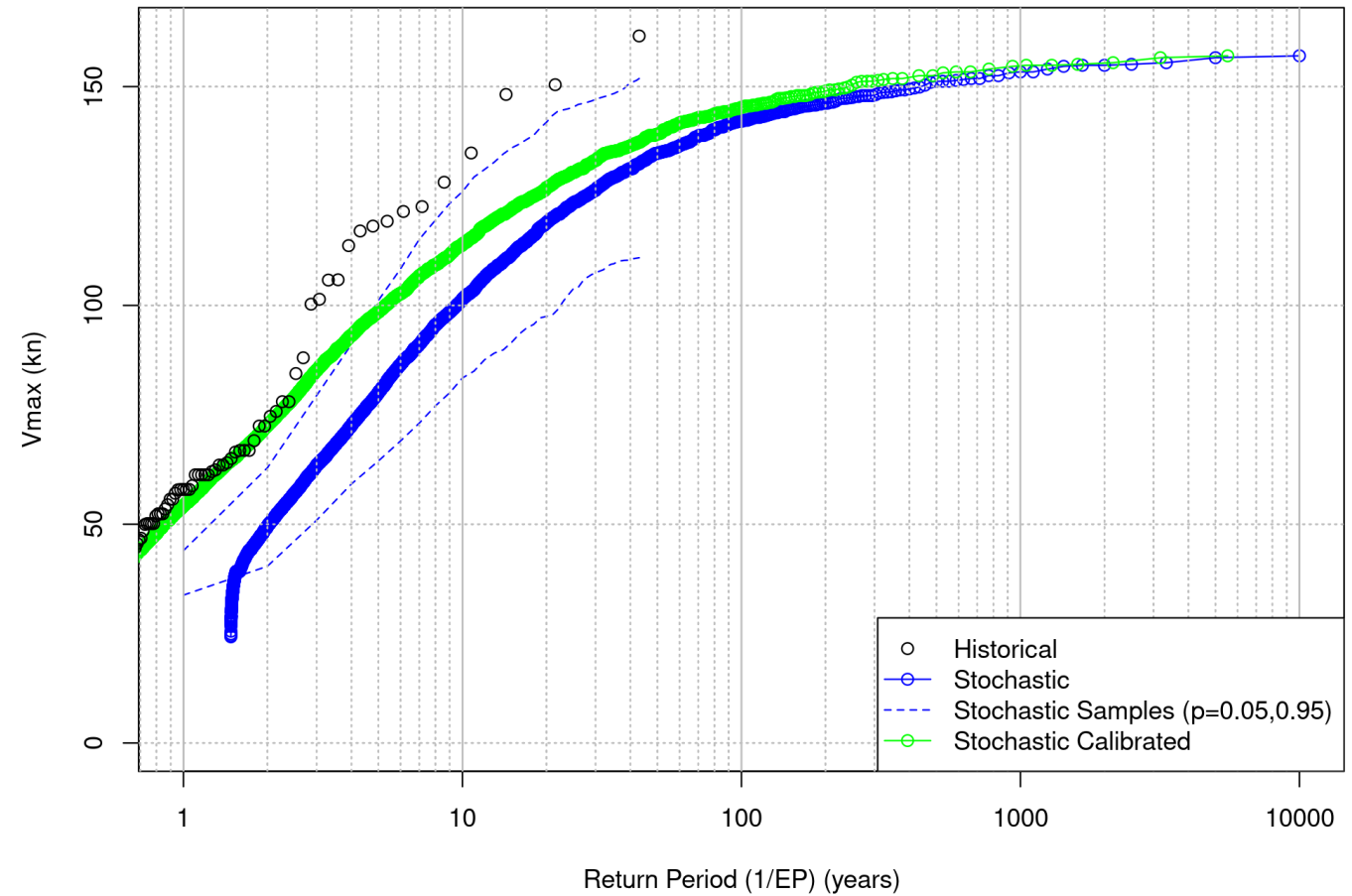


Is there a common understanding of what matters?

North Atlantic Basin TC Statistics

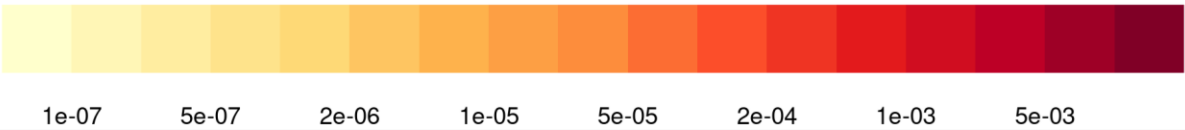
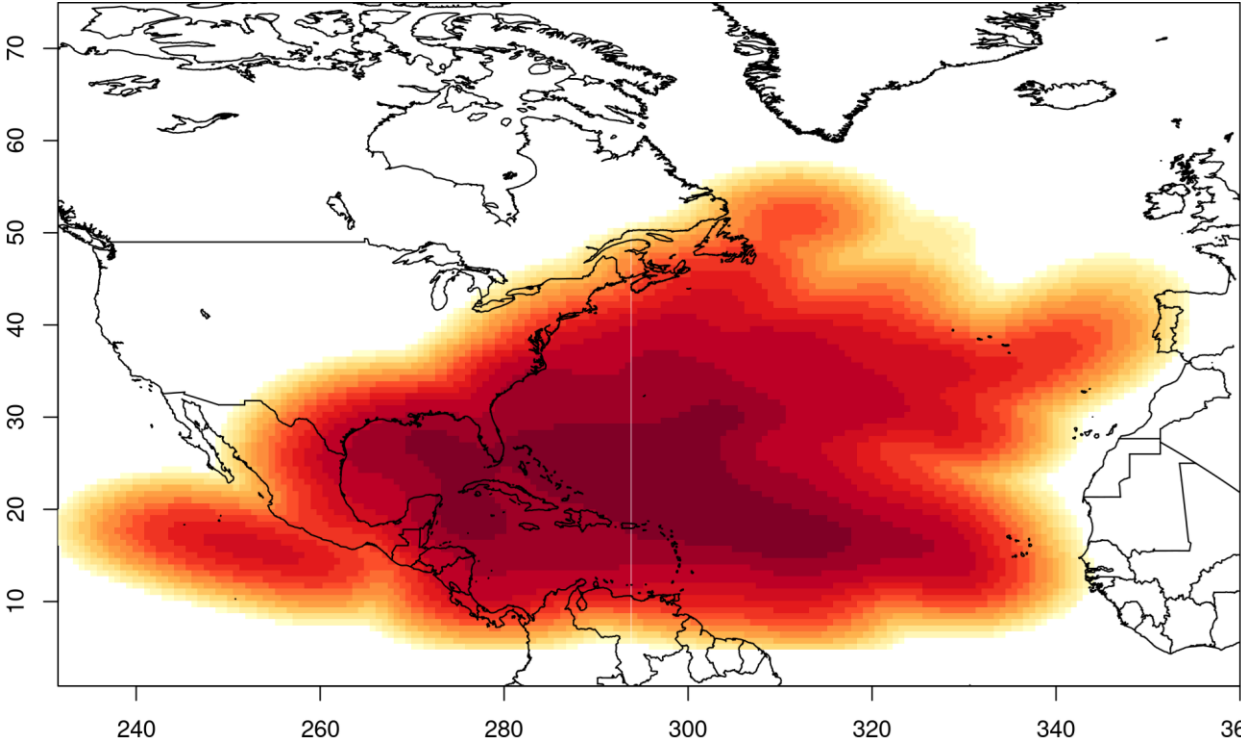


TC Box cover for Florida (50km radius)

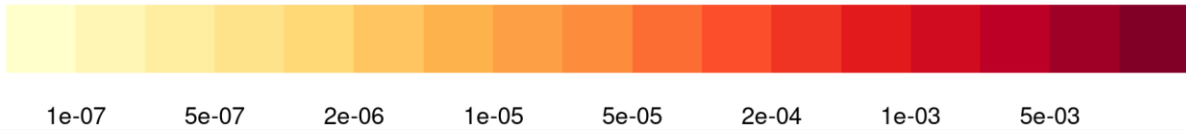
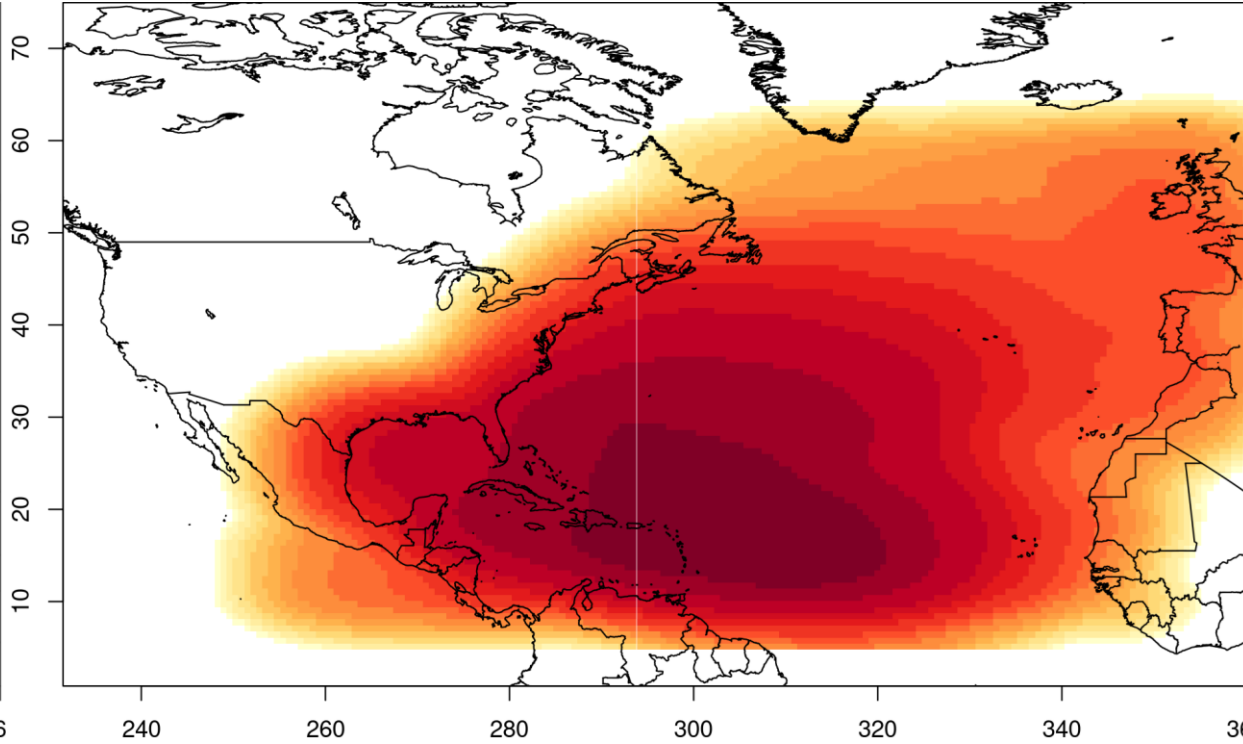


Why the difference?

Historical

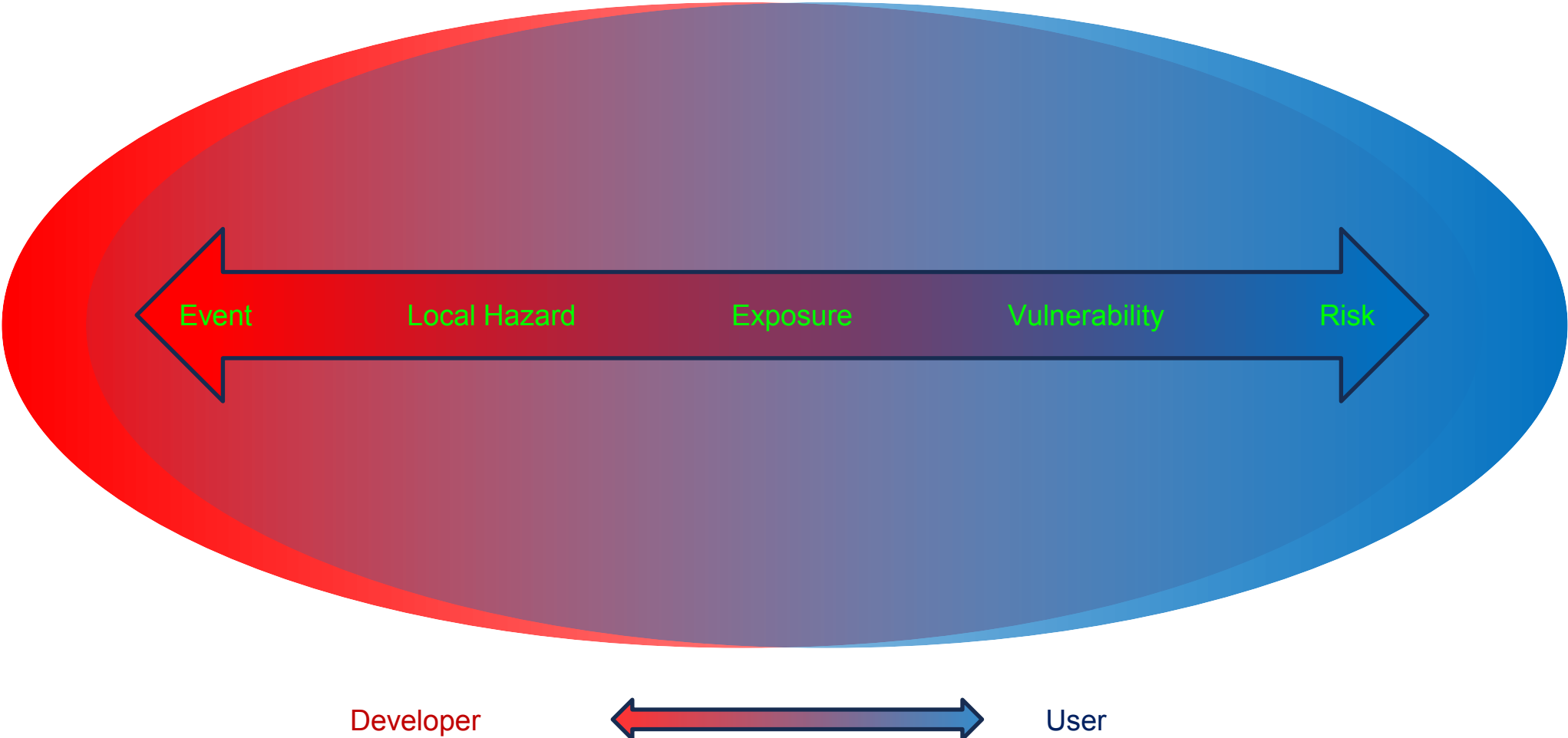


Stochastic



Kernel density exceedance for cat-2 and higher (obs/yr/deg²/kn)

Developers and users need to validate models, but can we do this more efficiently?



How Do We Get There?

- What users need from developers
 - Open channels of communication.
 - Model documentation that is
 - Scientific clear, concise, objective and reproducible.
 - Covers key uncertainties and sensitivities.
 - Key data exhibits in order to interrogate the risk drivers in a model.
 - Users should not need to reverse-engineer models to understand them.
- What developers need from users
 - Open channels of communication.
 - Guidelines on what diagnostics are necessary for a user to understand a model.
 - Feedback on the diagnostics to improve the model.



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