

Použití katastrofických modelů podle Solvency II

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Why CAT risk working group was established

CAT risk model working group is a part of internal model working group team

- Solvency II requirements on internal models (sub-models)
- CAT sub-module has various specifics
 - Data specifics
 - Data with sparse observations, huge impact, expensive monitoring
 - Data from external sources (hydro-meteorological data, etc.)
 - Demanding model calculation
 - Usually outsourced as an external model
- Certain understanding from Company required
- To prepare guidance on market good practice
 - Aim to provide a checklist what needs to be done on the Company's level for smooth approval process
 - Aim to include also comments from supervisory authority

Workflow within the working group

Progress similar to Solvency II – we are not ready yet



- Initialization of the discussion – ABI market good practice document
- First one-by-one meetings with model vendors and supervisor
- Round table discussions on selected topics
 - Governance
 - Data
 - Model
 - Validation
- Czech good practice guideline writing

Agenda

Introduction

Governance

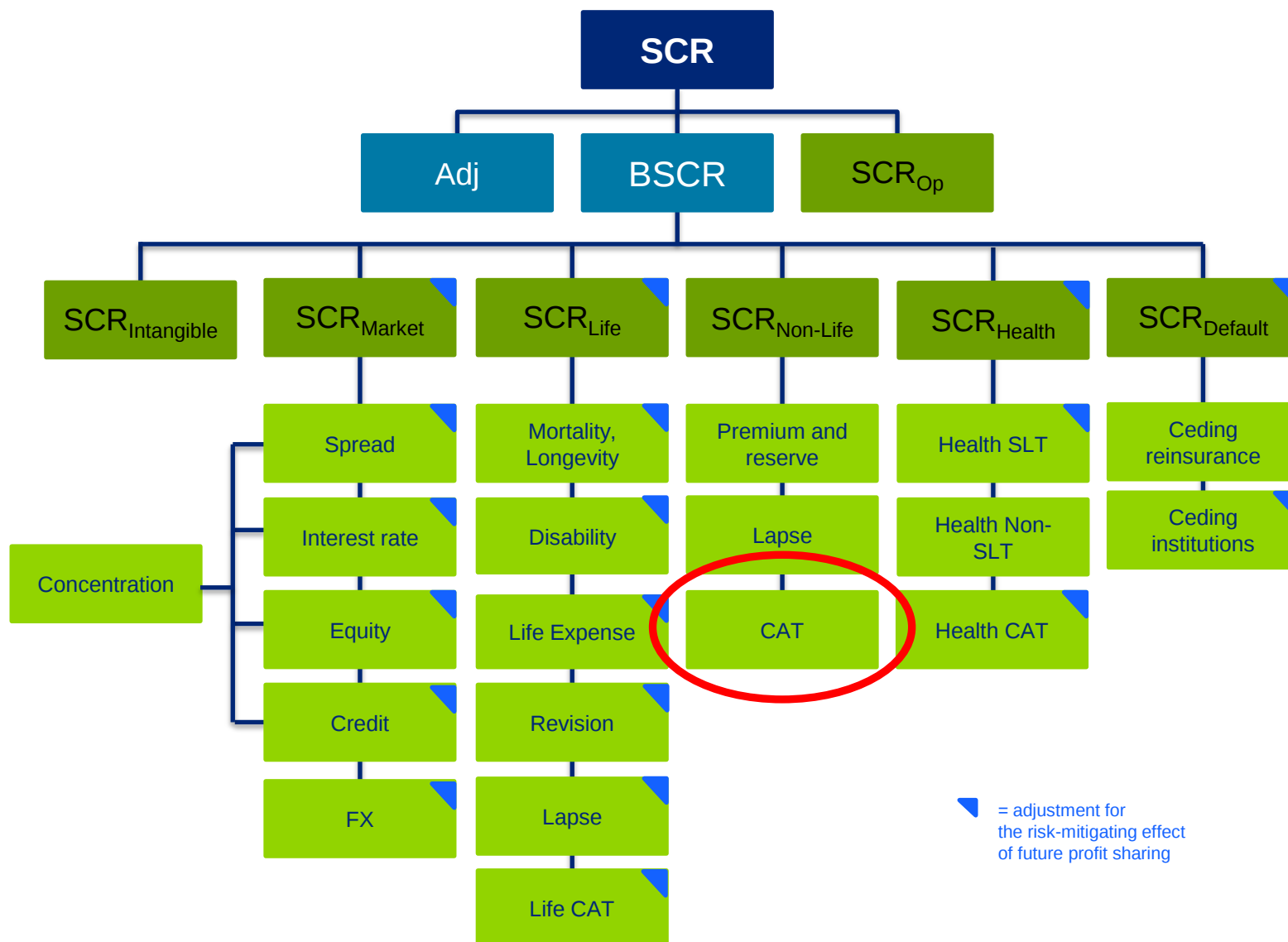
Data

Model

Validation

Solvency Capital Requirements

SCR structure standard formula – risks typology



SCR Non-Life Underwriting Risk - CAT

NL-CAT formula (Level 2)

Catastrophe risk is defined as: “the risk of loss, or of adverse change in the value of insurance liabilities, resulting from significant uncertainty of pricing and provisioning assumptions related to extreme or exceptional events.”

Directive 2009/139/EC point b) Art. 105(2)

$$SCR_{nlCAT} = \sqrt{(SCR_{natCAT} + SCR_{npproperty})^2 + SCR_{mmCAT}^2 + SCR_{CATother}^2}$$

- Nat CAT sub-module

- SCR_{natCAT} – natural perils
- $SCR_{npproperty}$ – non-proportional property reinsurance
- SCR_{mmCAT} – man made catastrophes
- $SCR_{CATother}$ – other NL catastrophes

- Natural perils modeled in CZ

- Flood
- Windstorm
- Earthquake

$$SCR_{natCAT} = \sqrt{\sum_i SCR_i^2}$$

SCR Non-Life Underwriting Risk – NatCAT

Nat CAT standard formula calculation (Level 2)

- Flood sub-module

$$SCR_{flood} = \sqrt{\left(\sum_{(r,s)} CorrFL_{(r,s)} \cdot SCR_{(flood,r)} \cdot SCR_{(flood,s)} \right) + SCR_{(flood,other)}^2}$$

- SCR_r bigger of scenarios

- Scenario A – two big events (65% and 45% of maximum Loss event)
- Scenario B – one major and one minor event (100% and 10% of maximum Loss event)
- Netting down is applied for each of events separately

- Notation

- $CorrFL$ – correlation of SCRs
- SCR_{other} – non CZ relevant
- L – maximum loss event
- Q – region factor
- WSI – Weighted Sum Insured
- W – flood zone factor
- SI – Sum Insured
- r – Region index
- i,j – flood zone index

$$L_{(flood,r)} = Q_{(flood,r)} \cdot \sqrt{\sum_{(i,j)} Corr_{(flood,r,i,j)} \cdot WSI_{(flood,r,i)} \cdot WSI_{(flood,r,j)}}$$

$$WSI_{(flood,r,i)} = W_{(flood,r,i)} \cdot SI_{(flood,r,i)}$$

$$SI_{(flood,r,i)} = SI_{(property,r,i)} + SI_{(onshore-property,r,i)} + 1.5 \cdot SI_{(motor,r,i)}$$

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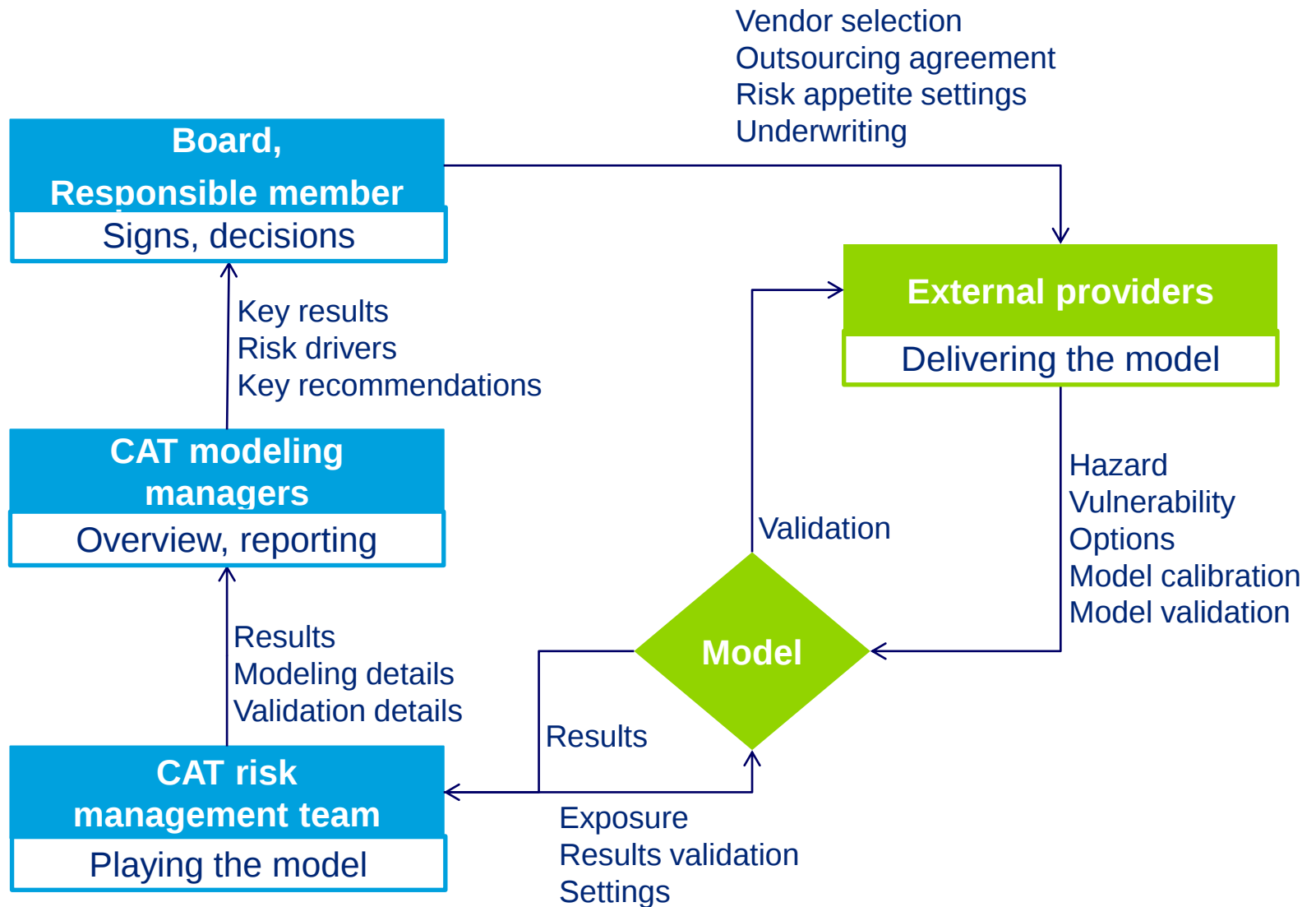
Data

Model

Validation

Key knowledge

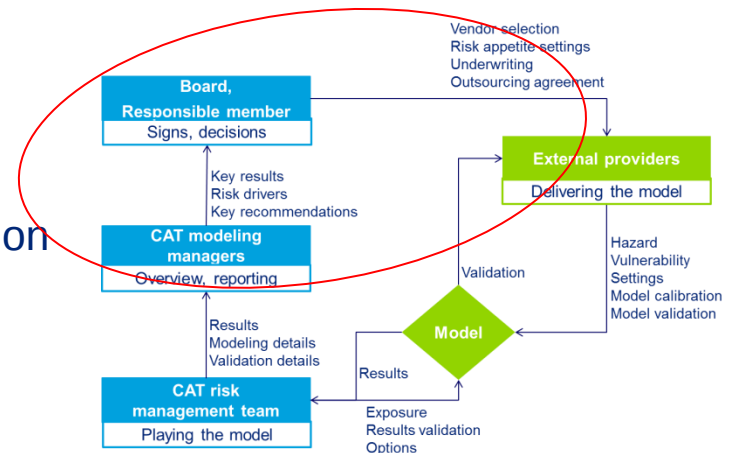
Who are the objects included in the CAT modeling process



Processes during CAT modeling (1/3)

Model selection

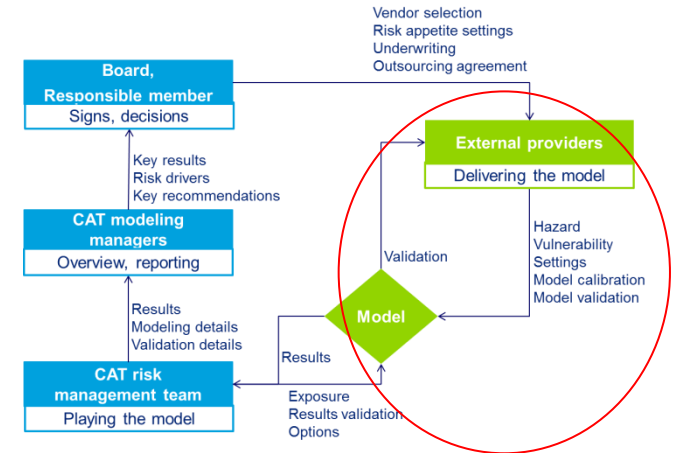
- Decisions about use of model
 - Board meeting minutes concerning CAT decision
- Analysis of market conditions
 - Regular status report of CAT model market
- Definition of selection criteria
 - Description for decision of model – reasoning why selected solution was chosen
- Regular analysis of suitability of model
 - Model validation report
- Model changes
 - Model selection report



Processes during CAT modeling (2/3)

Outsourced outputs

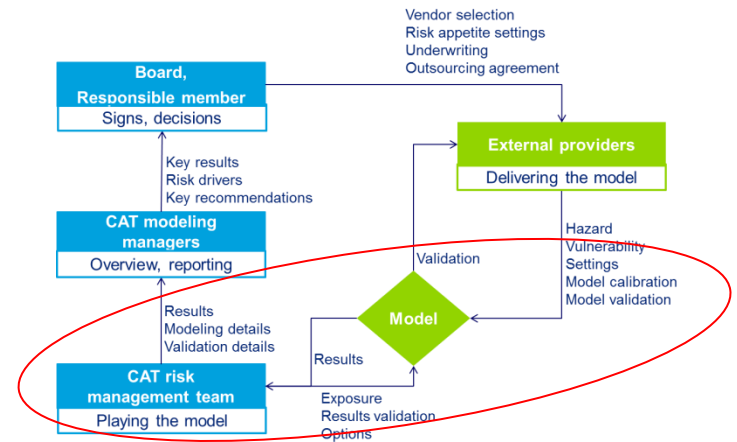
- Outsourcing
 - Outsourcing policy
 - Outsourcing agreement
- Modeling approach
 - Technical model documentation
(in more detail in model section)
- Model changes
 - Technical model documentation



Processes during CAT modeling (3/3)

Regular run

- Input data
 - Data handling report
(in detail section data)
- Run
 - Run report – documentation of options and settings, storage, dates etc.
- Result processing
 - Description of results analysis



Agenda

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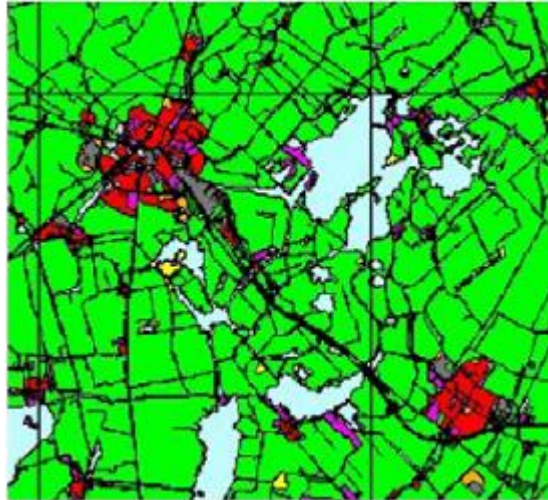
Validation

How the model works

Key modeling blocks

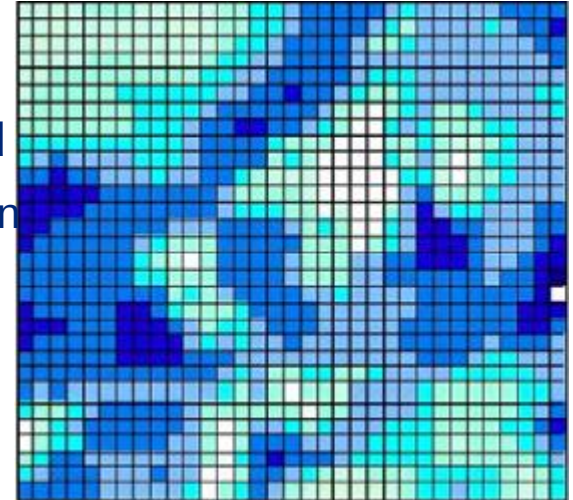
Exposure

- Location
- Characteristics industry/resident property/content etc.



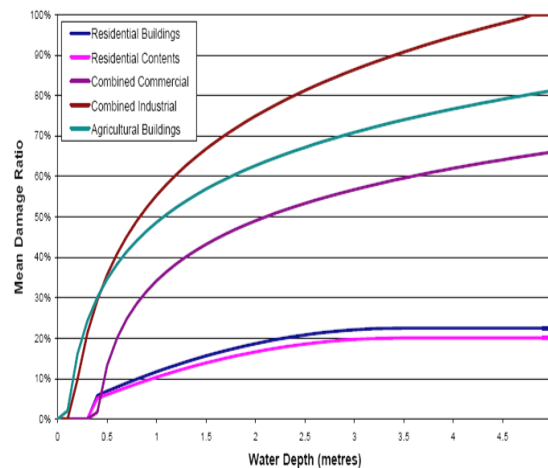
+ Hazard

- Inundation depth



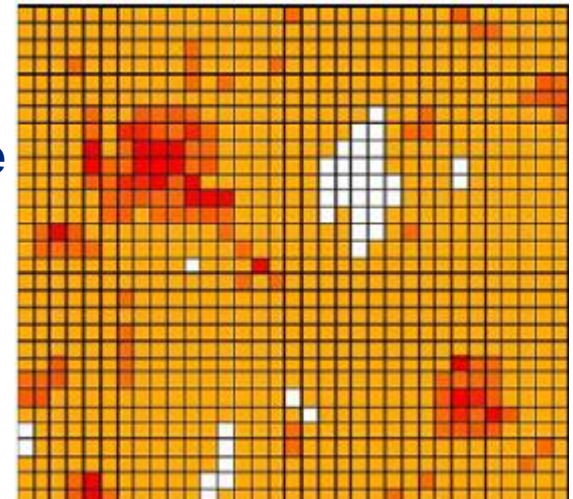
+ Vulnerability

- Mean damage ratio = claimed amount/insured property



= Damage

- Expected claimed amounts



Key considerations

Recommended documentation

Article 121 (paragraph 3) - Statistical quality standards

*Data used for the internal model shall be **accurate, complete** and **appropriate**. Insurance and reinsurance undertakings shall **update the data** sets used in the calculation of the probability distribution forecast **at least annually**.*

- Data must be accurate, complete and appropriate
- Regular updates
- Not necessary in-house, outsourcing expected
- Company has to demonstrate understanding of the processes
- Key questions to be clarified
 - Which perils and territories should be included in the catastrophe data?
 - Which data might be outsourced from model vendor?
 - What company input data are expected/available?
 - What is the frequency of updates required/possible?
 - Which correction approaches are reasonable?

Exposure data

Minimum exposure data set

- Frequent omissions non CZ markets
 - Property value = sum assured
 - Aggregations
 - Definition of limits and deductibles not unique (if applied aggregately or case by case)

Policy details	Granularity	Example	Purpose
PolicyID	per policy	AAAXXX001	Application of deductibles for multilocations
Line of Business (Segment)	per policy	Industry	Basic assessment of vulnerability
Replacement value - buildings	per policy	1 000 000	To evaluate total loss
Replacement value - contents	per policy	50 000 000	To evaluate total loss
R.Value - Business Interruption	per policy	5 000 000	To evaluate total loss
Policy Deductible	per policy	5 000 000	To evaluate claimed amount
Policy Limit	per policy	25 000 000	To evaluate claimed amount
Site Deductible	per location	500 000	To evaluate claimed amount
Site Limit	per location	5 000 000	To evaluate claimed amount
Building Deductible	per item	500 000	To evaluate claimed amount
Contents Deductible	per item	1 000	To evaluate claimed amount
Interruption Deductible	per item	1 000 000	To evaluate claimed amount

Exposure data

Ideal exposure data set

- Frequent omissions CZ
 - Line of business / segment (industry depends on sum assured)
 - Multi-locations
 - Unknown sums assured (old policies)

Location details	Granularity	Example	Purpose
Postcode	per location	1010	Location of risk
Street name	per location	Rockhgasse	Location of risk
Street number	per location	4	Location of risk
City	per location	Wien	Location of risk
Cresta	per location	10	Location of risk
Longitude (X)	per location	48	Precise location, esp. Flood
Latitude (Y)	per location	16	Precise location, esp. Flood

Property details	Granularity	Example	Purpose
Occupancy type	per location	Residential	General
Construction type	per location	Timber	Earthquake, wind
Roof type	per location	Flat	Wind
Number of stories	per location	6	Flood
Story on which is insured prope	per location	3	Flood
Basement	per location	Y	Flood
Raised ground flood	per location	yes	Flood
Floor type	per location	wood	Flood

Exposure data

Examples on recommended controls

- Company's responsibility
 - Collection of the data
 - Controls performed
- Test & corrections
 - Company
 - Completeness
 - Accuracy
 - Model provider (Appropriateness)
 - Split of multi-locations
 - Sum assured/limits

Accuracy checks:

- **Geo-browsers** - GPS coordinate vs. address
- **Sense checks** - industrial wooden house
- **Data champions** - enables to audit the data managements and data processes

Completeness checks:

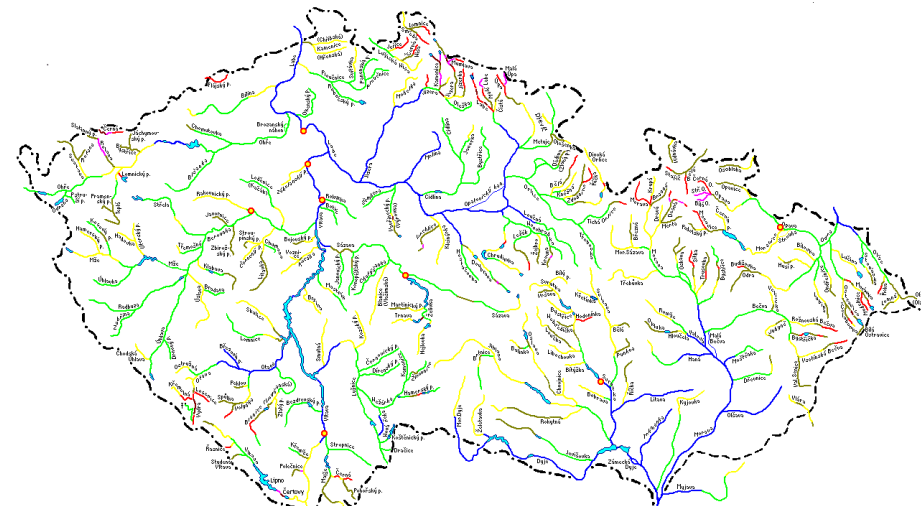
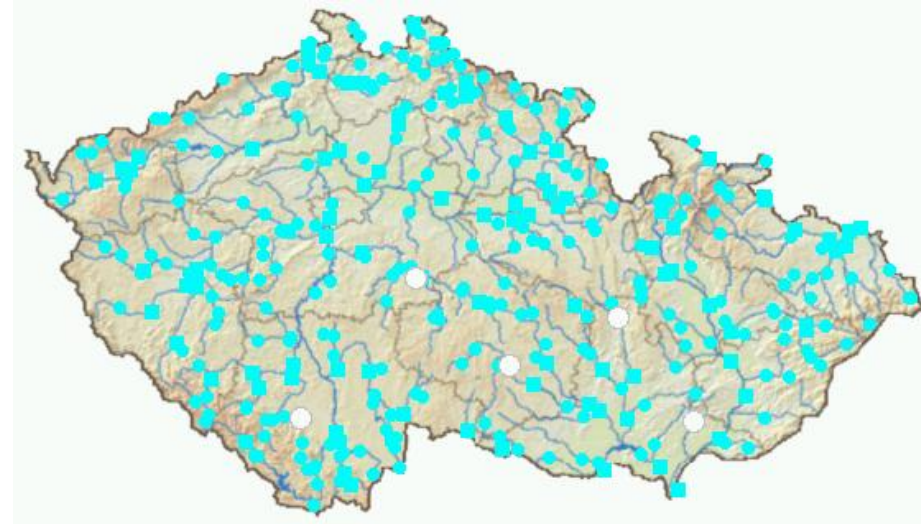
- **Share of missing data**
- **Actualization of the data**
- **Dependency of completeness on product characteristics**

Good communication between the company and model provider required

Hazard data

Modeling of how severe the natural peril could be

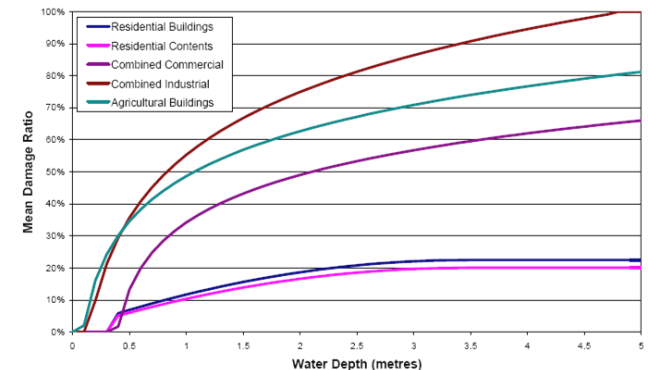
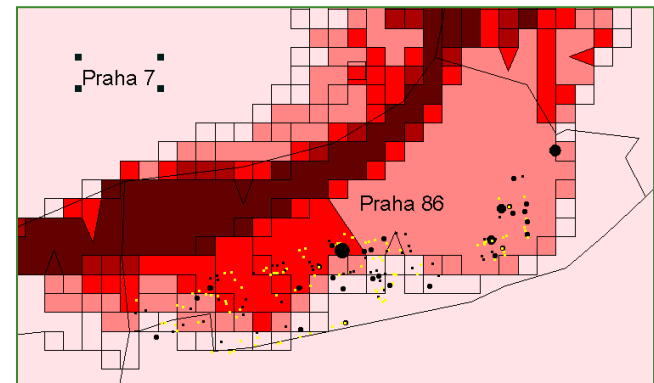
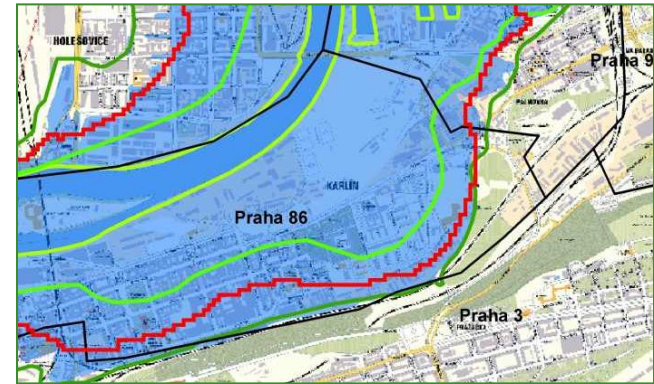
- Stochastic modelling of catastrophe events
 - Generating of water flow in the water gauges based on past experience
 - Flood event water level according to topological mapping
- Often provided by third party
 - ČHMÚ, other
- Data provided within the model
- Data testing and corrections
 - Responsibility of model vendor
 - To be set in outsourcing agreement
- The company has to prove understanding of the data handling process



Vulnerability data

Link between exposure and hazard - damage curves

- Loss data-set collection
 - Line of business, coverage or more detailed disaggregation where possible
 - (residential, industry, agriculture, ...)
- Reflects reality - reduce uncertainty
 - Sub-limits and deductibles
 - Flood defenses, development of terrain
- Provide a benchmark regional data-set
 - Comparison with other similar data-sets (e.g. Austria, Germany, Slovakia)
 - Company specific
- Provided within a model
 - To be clarified within the outsourcing contract



Key focus of supervision

Results of preliminary discussion

- Data sources, IT exchange of the data, external data used
- Definition of data sets, processes and responsibilities
 - Data collection, actualization
 - Data handling
 - Usage of the data within the model
 - Data quality measurement
- Results of performed controls
 - Accuracy (material discrepancies, time consistency of data)
 - Completeness (sufficient scope and granularity)
 - Appropriateness (suitability for modeling assumptions, reflects the risks reasonably)
- Data limitations & Impact assessment
 - Data adjustments
 - Expert judgment
- Correction and amendment processes

Break



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Model

CAT modeling management

- It is expected that model will be outsourced by the model provider
- Solvency II places no obligation on any model provider
- It is company's responsibility to ensure all requirements are placed in the outsourcing contract
- Any info from model provider can be supposed as part of documentation
 - **Comprehensive technical documentation**
 - Attending relevant conferences
 - Asking questions to model vendor
 - On site model run process review
 - Conducting and discussing standard valuation analysis

Comprehensive technical documentation (1/6)

Model development

- Model methodology
 - Basic components of the catastrophe model
 - Detailed theory and assumptions
 - Modelling and statistical approach taken
 - Mathematical and empirical bases underlying selected methods
- Model version and history
 - Info on version
 - Changes history including reasoning and date
 - Author

Comprehensive technical documentation (2/6)

Modeling approach

- Verification of approaches
 - List of validation approaches including explanation and results
 - Hazard validation
 - Vulnerability and loss validation
 - To explain independency of model development and model validation
- Limitations and weaknesses
 - In modelling particular exposures
 - In the financial calculations.
 - E.g. reinstatements or policy structures that cannot be modelled, and the means of accounting for this (if any)
 - Non-modelled perils or sub-perils
 - Missing river network
 - Model advantages
- Uncertainty
 - Nature, degree and sources of uncertainty

Comprehensive technical documentation (3/6)

Data inputs from Company and their verification

- Construction, occupancy, and LOB
 - List of exposure data requirements
 - Controls and amendments performed
 - Usage in the model
 - Potential impact -> results understanding
- Geographical information, including geo-coding
 - Indication of data source (external or vendor's internal data)
 - A list of areas covered / not covered by the model
 - Levels of geographical resolution
- Policy financial structure, and reinsurance
 - List of exposure data requirements
 - Controls and amendments performed
 - Usage in the model
 - Potential impact -> results understanding

Comprehensive technical documentation (4/6)

Other data inputs for model components

- Hazard information
 - How the peril is modelled including input data, controls and validation
 - Digital terrain model description and its preparation
 - River network generation
 - Hydrological data and its preparation
 - Preparation for flood extent modelling
 - Flood defences implementation
 - Probabilistic event set simulation
 - Cross country correlations (if applicable)
 - Validations performed (back test, stress test)
- Vulnerability information
 - Describe vulnerability curves types
 - Data sources
 - How they are developed, corrections, limitations
 - Validations - “As If” and “What If” events
 - Application of the vulnerability curves
 - Available occupancies and coverage

Comprehensive technical documentation (5/6)

Model options and settings

Option = a choice a company makes when deciding how best to approach the overall modeling of its exposure. For example, whether to use detailed or aggregate modeling

Setting = a choice provided by the model provider allows users to decide how a model is run. For example, ticking certain boxes in the analysis options at the time when the model is run

- Options and settings implementation
 - Options and settings available for respective territory
 - What kind of loss and risk this represents
 - Vendor recommendation including reasoning
 - How the recommendations reflect company's risk profile and data
- Solvency 2: Company is responsible for selected options and settings
 - Company may disagree with vendor's recommendation
 - Company is able to demonstrate rationality of their decision (even if recommended approaches applied)
 - Own validation assessment, own review of impacts
 - Additional questions/workshops/seminars expected

Comprehensive technical documentation (6/6)

Other details to be included in technical documentation

- System/software
 - System requirements
 - Installation guide
 - Database schemas
- Model change and future development
 - Highlight main drivers for future change and their impact
 - New scientific research
 - Learning from past events
 - Release of new data

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Validation policy

Policy is defined within governance of the processes

- Specification
 - Frequency of validation
 - List of tests to be performed
- Uncertainties to be covered
 - Data validation
 - Model validation
 - Wrong model (simplification, unexpected effects)
 - Wrong parameterization (lack of historical data, wrong detail, point estimates)
 - Results validation

Preliminary requirements of supervision

The first comments obtained from ČNB

- Who should validate?
 - Model provider validation - not sufficient
 - Company validation – in-house assessment of results required
 - Independent reviewer – ČNB: “at some stage independent reviewer will be required”
- Model change -> new validation?
 - Model change – new validation process required
 - Input data actualization – only data and results validation needed
 - Change of options – depends on previous validation process
 - Change of setting – only data and results validation needed

Example:

The company decides to apply own vulnerability curve.

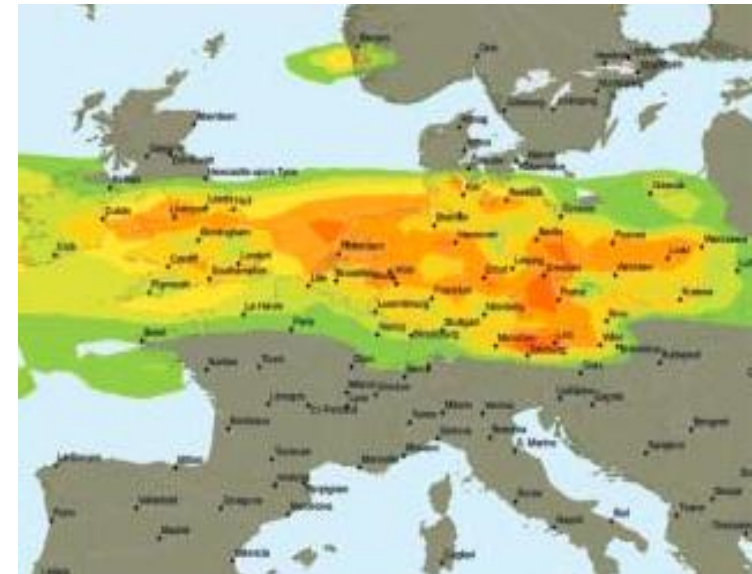
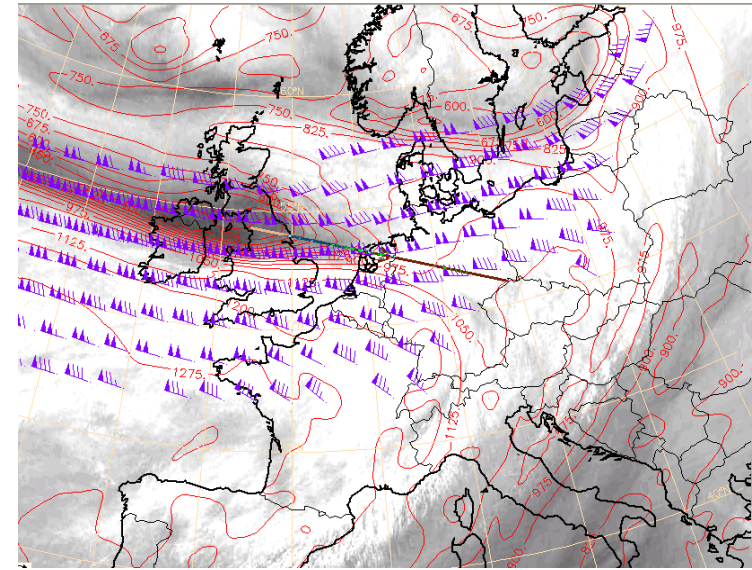
Do they need new validation process for whole model?

- Yes, if this setting was not validated at the first lap.
- No, if this setting was validated at the first lap.

Vendor model validation

Understanding of the model limitations and hazard data expected

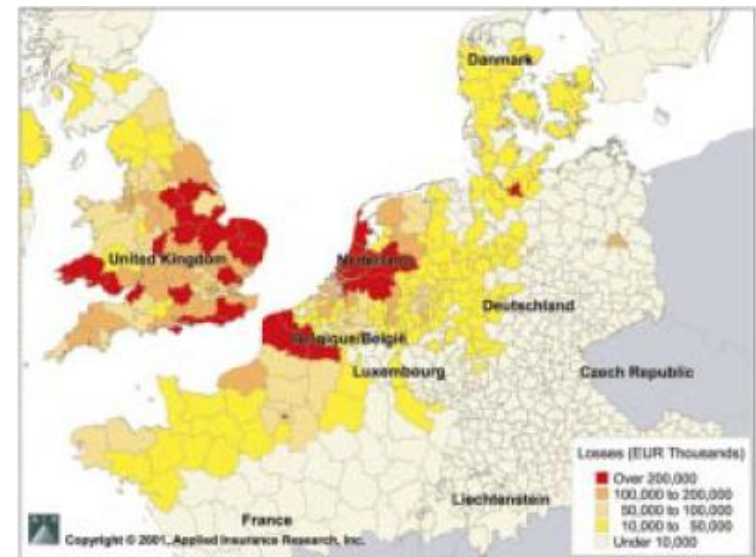
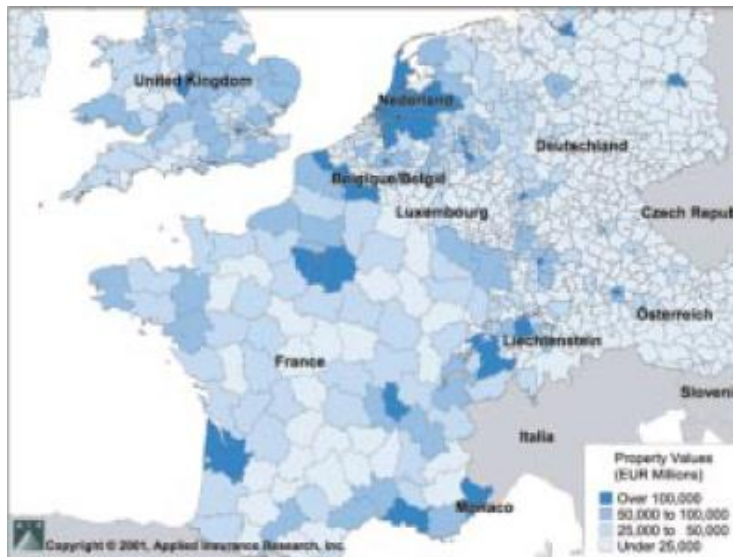
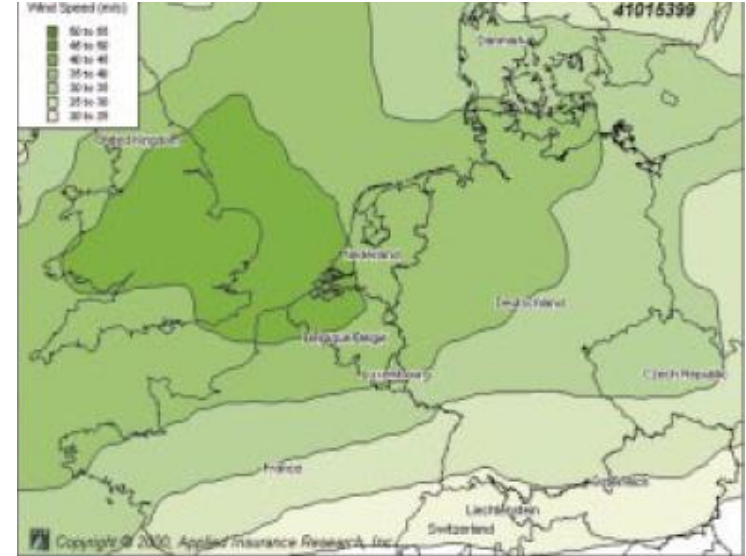
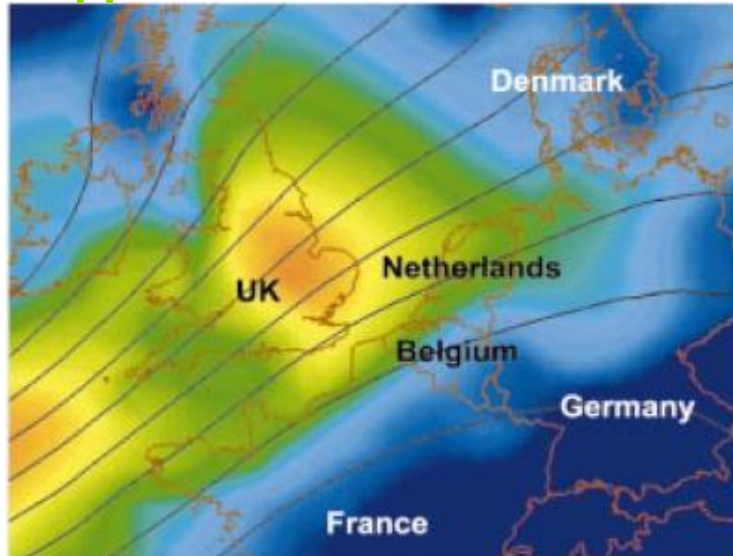
- Not need to be fully country-specific, but key local specifics to be tested
- Back testing
 - Test of the model outcomes vs. historical event
 - **Back test cannot be applied for the same past event as was calibrated**
- Single scenario testing (deterministic approaches)
 - As-If analysis
 - Refer back to historical loss event
 - Applies to current insured values
 - What-If analysis
 - Taking past catastrophe
 - Changing input parameters



What-If analysis example

Daria 1990, the most expensive weather event in UK ever.

What would happen if London was hit?



Company's model validation

Understanding of the exposure data expected

- Relying solely on model vendor validation does not fulfil Solvency requirements
- Data champions
 - Reasonability test for important / representative policies -> results validation
- Stress testing
 - Wrong model approach / options -> model validation
 - E.g. allow flood defences?
- Sensitivity testing
 - Testing impact of various settings -> parameterization validation
 - E.g. change of XY coordinates -> postcodes for industry
 - E.g. point estimates -> change of value to understand its impact
- Can be carried out by vendor, company must demonstrate understanding
 - Certain level of own assessment required

Independent reviewer model validation

Will be required by ČNB to some extent

- Brings independent insight into the processes
- Independent opinion might be signal for supervision
- Gains from the market knowledge and broader experience
- Gives additional questions and tests
- Helps to share knowledge across the practice

Questions & answers



Thank you for your attention

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