



Modelování povodňových škod & GIS

Martin Salaj
Aon | Impact Forecasting

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Agenda

1. Co je CAT modeling
2. Využití GIS při vývoji CAT modelů
3. Výstupy a použití CAT modelů
4. Ukázky z rekonstrukce povodní 2024



1

Co je CAT Modeling

Co je CAT Modeling



... tohle byla druhá
možnost z odpovědí
Google a není správná...

Catastrophe modeling

Catastrophe modeling ^[1] (also known as **cat modeling**) is the process of using [computer](#)-assisted calculations to estimate the losses that could be sustained due to a catastrophic event such as a flood, hurricane or earthquake. Cat modeling is especially applicable to analyzing risks in the [insurance](#) industry and is at the confluence of [actuarial science](#), [engineering](#), [meteorology](#), and [seismology](#).

From Wikipedia, the free encyclopedia



Impact Forecasting

Global catastrophe model development team



90 Countries



135+
Models



12 Perils



140+

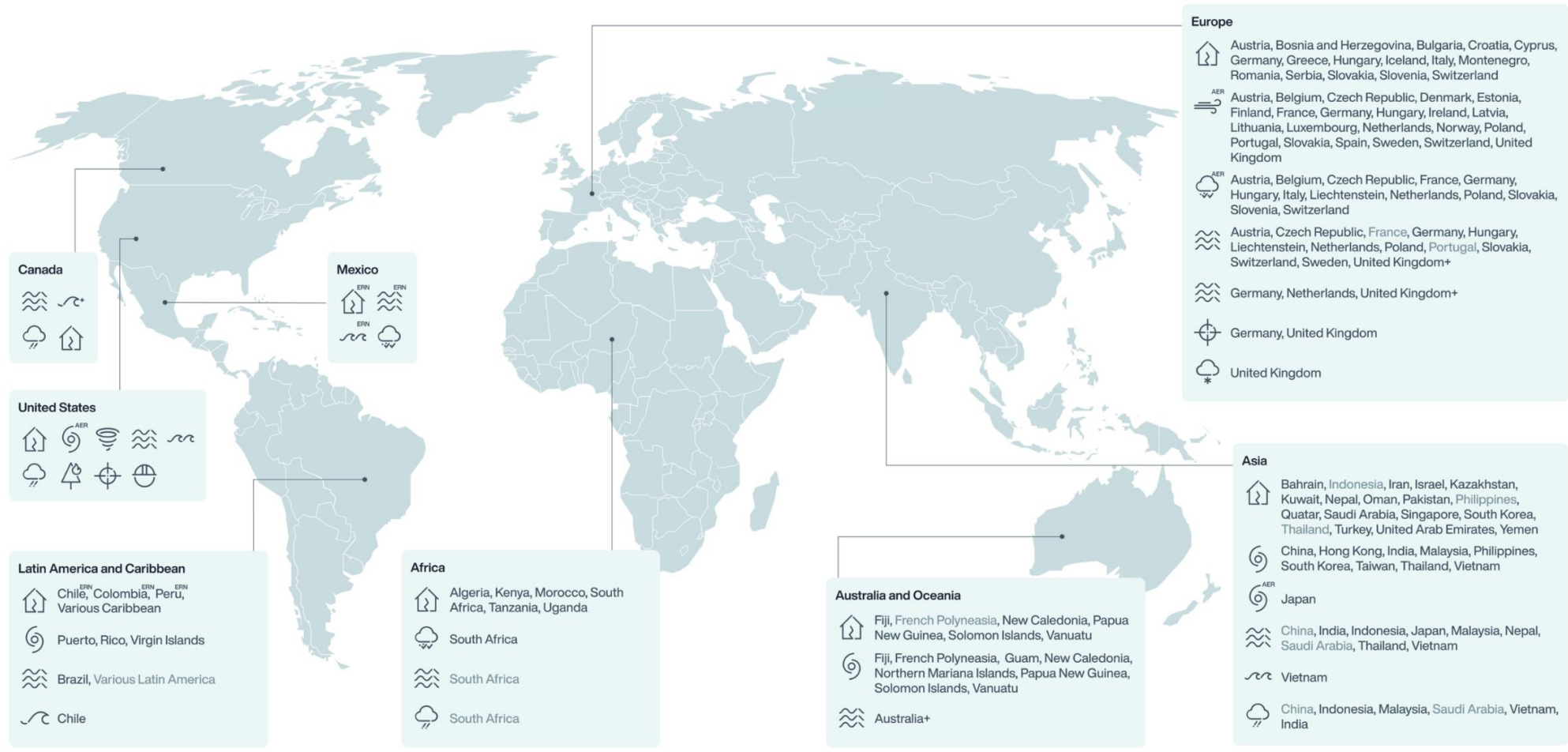
Modelling experts
over **5 time zones**



30,000

Events in Cat
Insight database

Model Coverage Map



AER Automated Event Response also available
 ERN Evaluación de Riesgos Naturales
 Country Scenario model only
 + Third party models



2

Využití GIS při vývoji CAT modelů

Příprava a práce s daty

CAT modelling řeší státy, kontinenty a to je velké množství a druhů dat

Modely terénu - DTM/DSM

Land Use a Land Cover

Půdy

Hustota obyvatelstva

Hydromorfologická data

topografické objekty

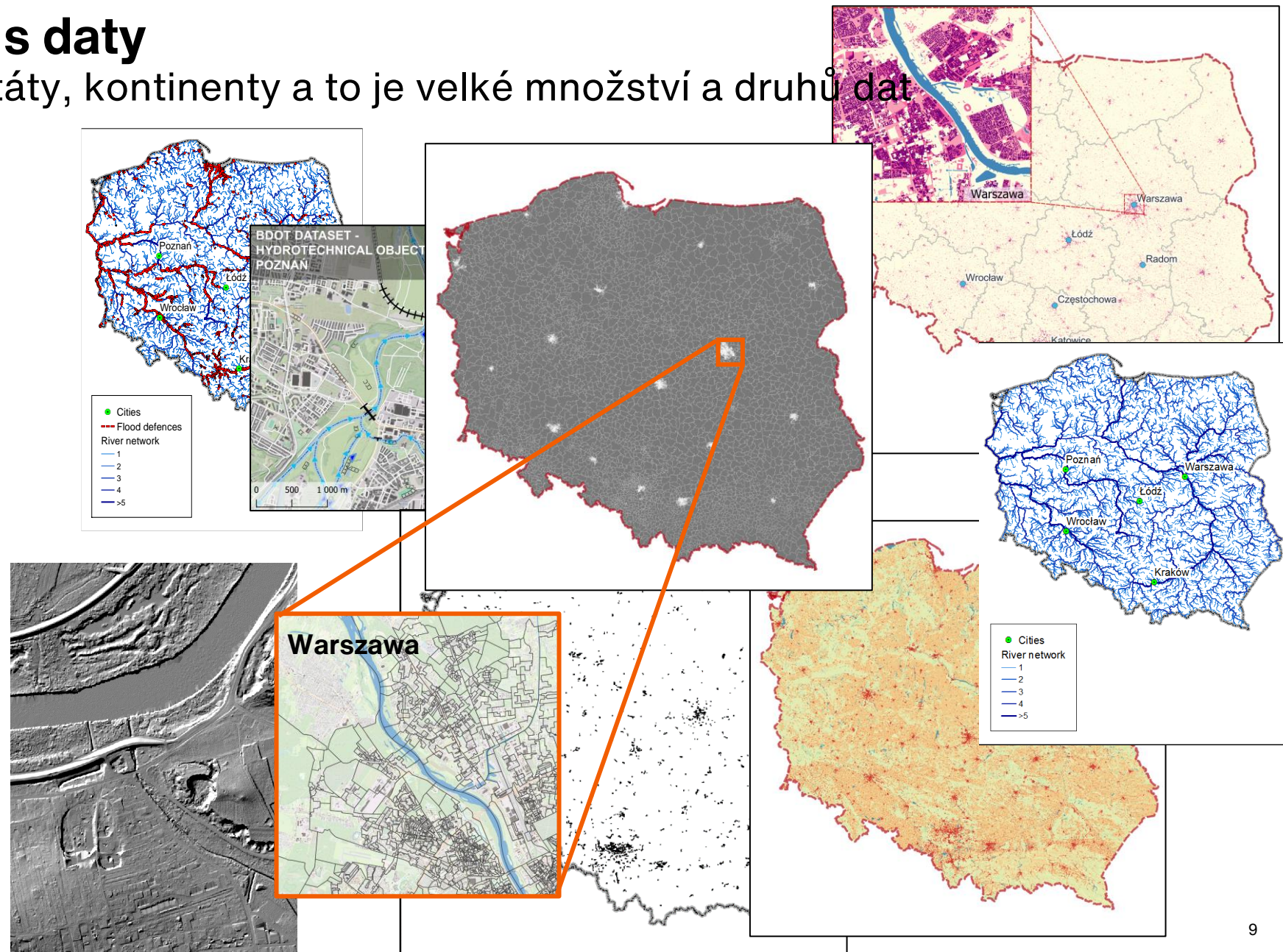
Silniční a železniční sítě

Administrativní jednotky

Budovy a jejich parametry

Klimatická data

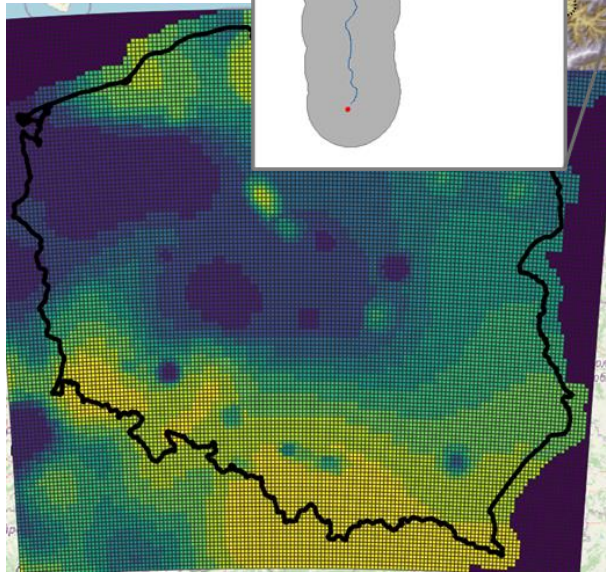
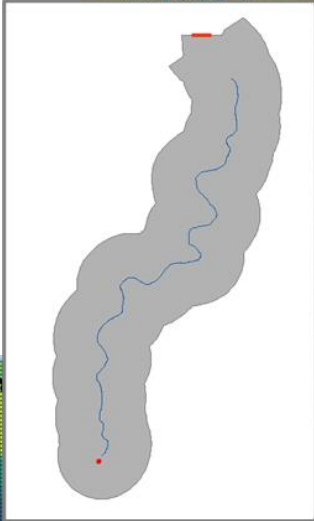
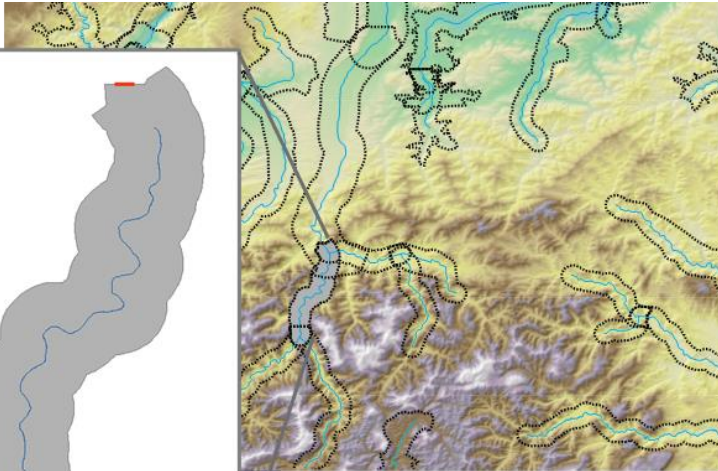
Hydrologická data



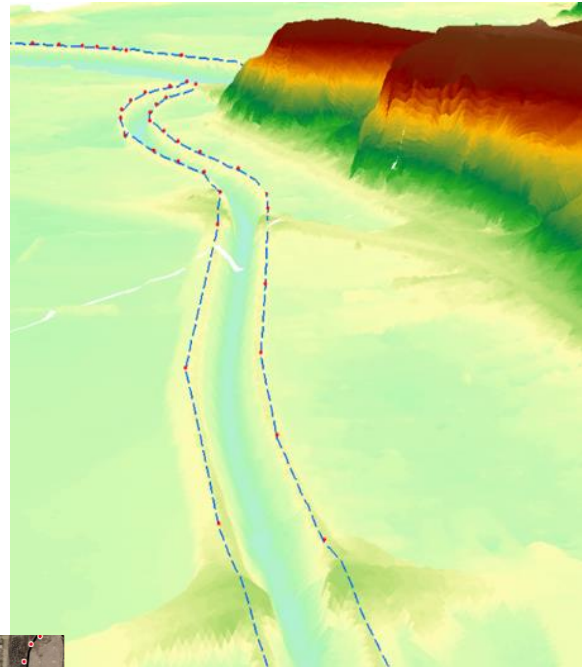
Analýzy

Široké použití analýz všech typů

...od jednoduchého „buffer“, přes ..



...Kriging...



...síťové analýzy...

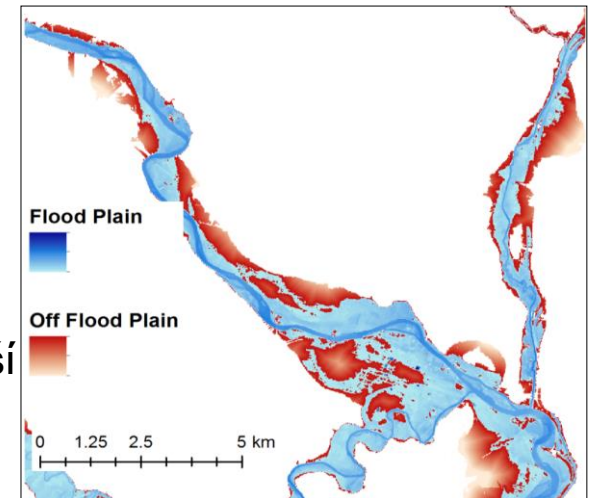
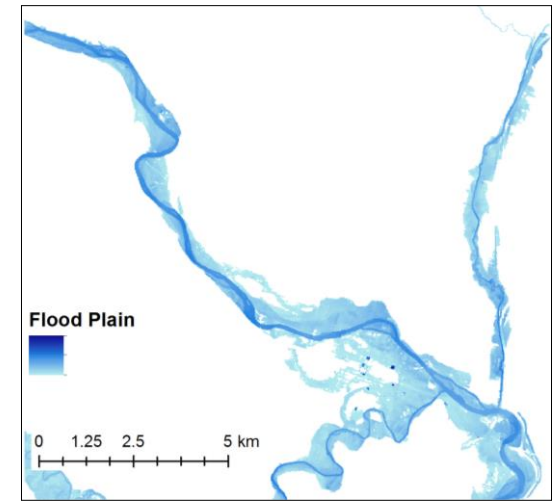
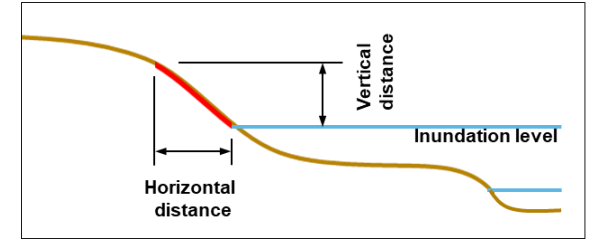
Legend

Virtual Pipes

- Inlets
- Outlets
- Roads
- Waterbodies

...extrakce z rastrů do vektorů...

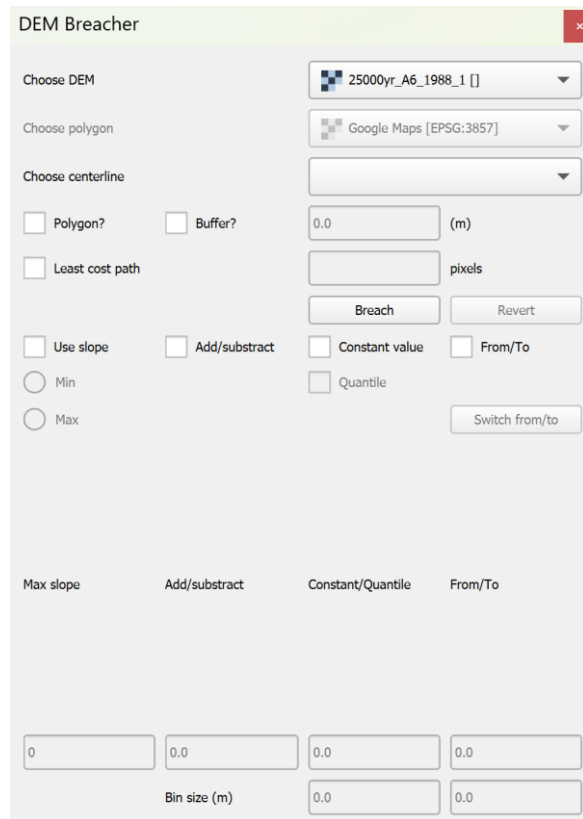
...prostorové analýzy a další



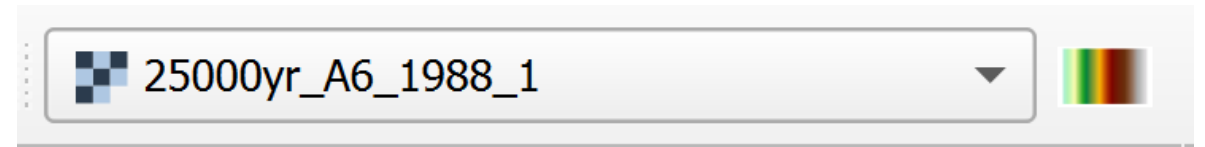
Nástroje

Interní a Externí

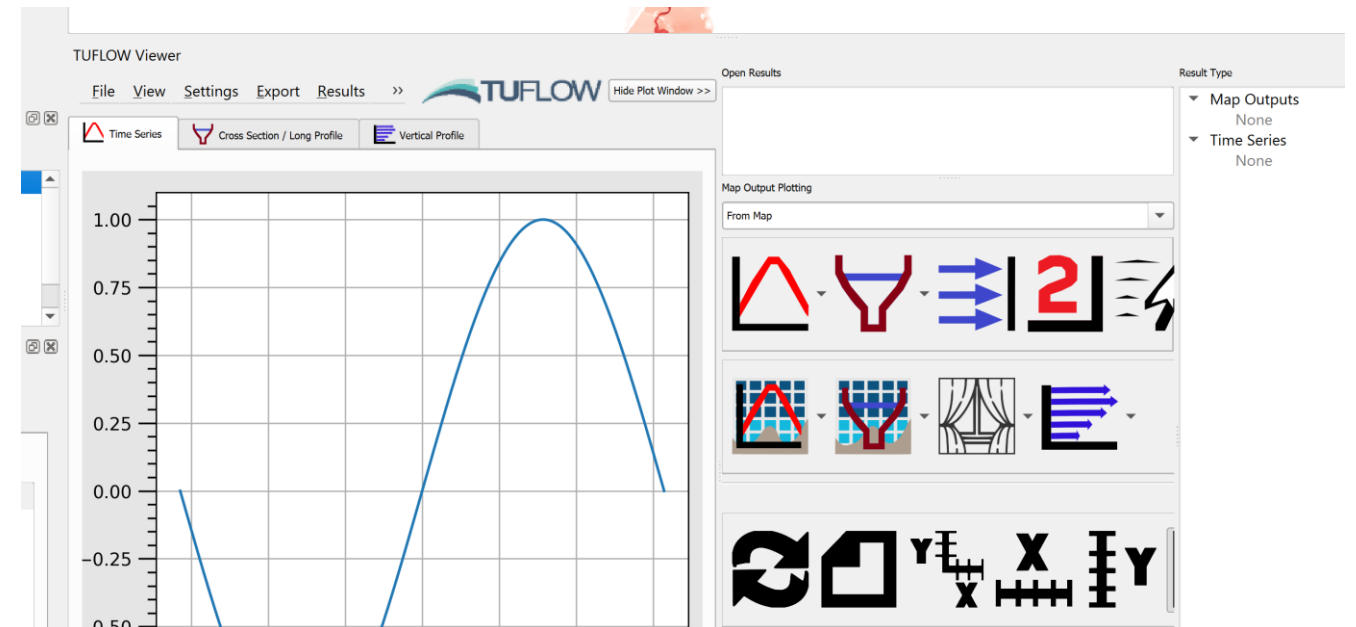
Nástroje pro editaci rastrů DTM/DSM



...symbologie vrstev...



...plugins pro používání
software 3tích stran ...



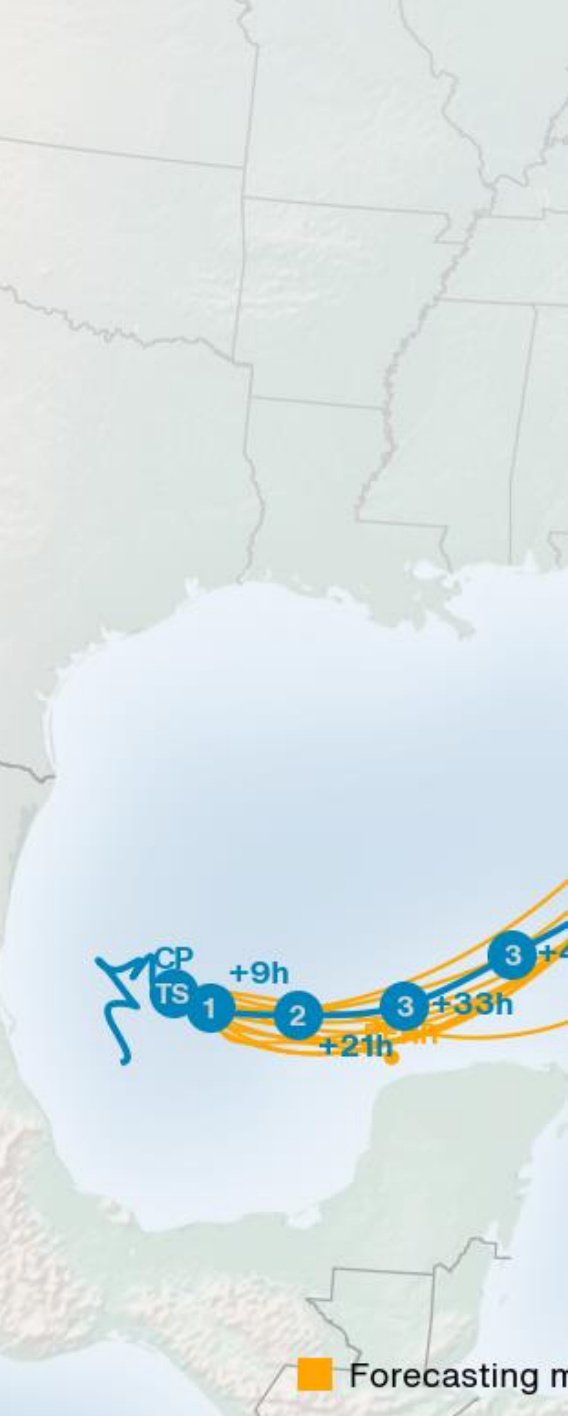
Scriptování

Denní chleba při práci s velkými daty a tisíci modely

```
4
5  ## be careful with this
6  import warnings
7  warnings.filterwarnings("ignore")
8
9  source = 'd'
10 threshold = 10
11 cellSize = '10'
12 area = 'A22'
13 epsg = 25832
14
15
16 dtmRootPath = ''
17 dtmPath = {
18     'A91_10': r'b:\01_Projects\145_Germany_Flood\01_MD\01_HAZARD\01_DTM\10m\A91\v05\A91_DGM',
19
20     'A21_10': r'b:\01_Projects\145_Germany_Flood\01_MD\01_HAZARD\01_DTM\10m\A21\v03\A21_DGM',
21     'A22_10': r'b:\01_Projects\145_Germany_Flood\01_MD\01_HAZARD\01_DTM\10m\A22\v05\A22_DGM',
22     'A23_10': r'',
23     'A24_10': r'b:\01_Projects\145_Germany_Flood\01_MD\01_HAZARD\01_DTM\10m\A24\v05\A24_DGM',
24
25     'C05_10': r'b:\01_Projects\145_Germany_Flood\01_MD\01_HAZARD\01_DTM\10m\C05\v05\C05_DGM',
26 }
27
28 ## location of domain's input files for area_cellsize
29 d_GeometryWorkspace = {
30     # 'A02_5': r'd:\temp\QGIS_proc\data\GIS\A02',
31     'A91_10': r'\eupraapp051\d$\01_Projects\145_Germany_Flood\
```

3

Výstupy a použití CAT modelů

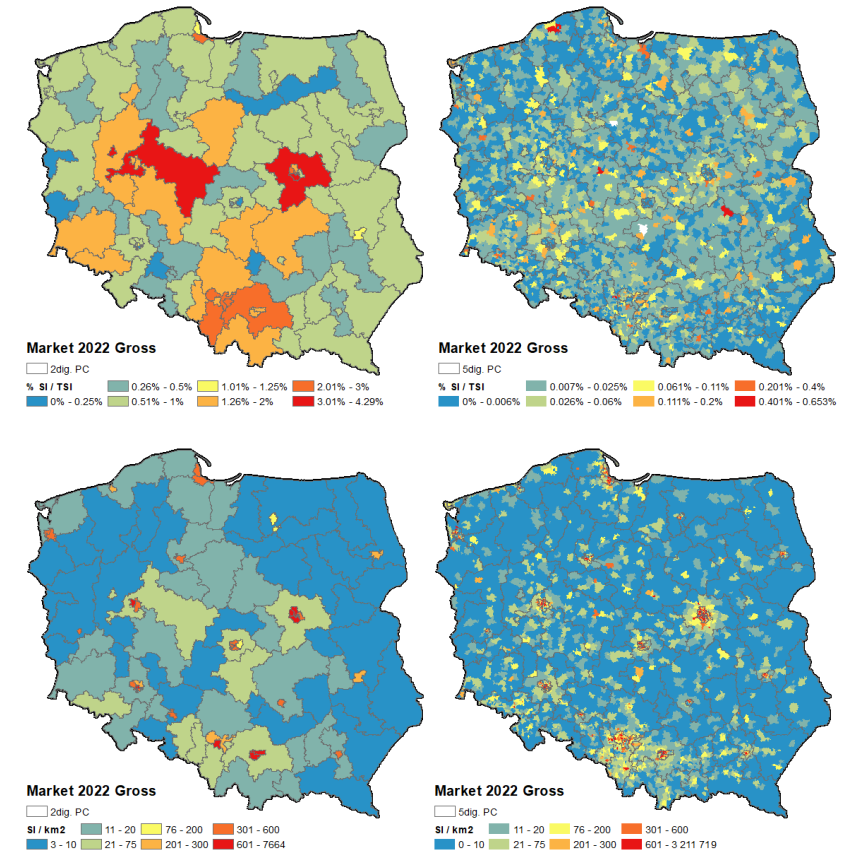
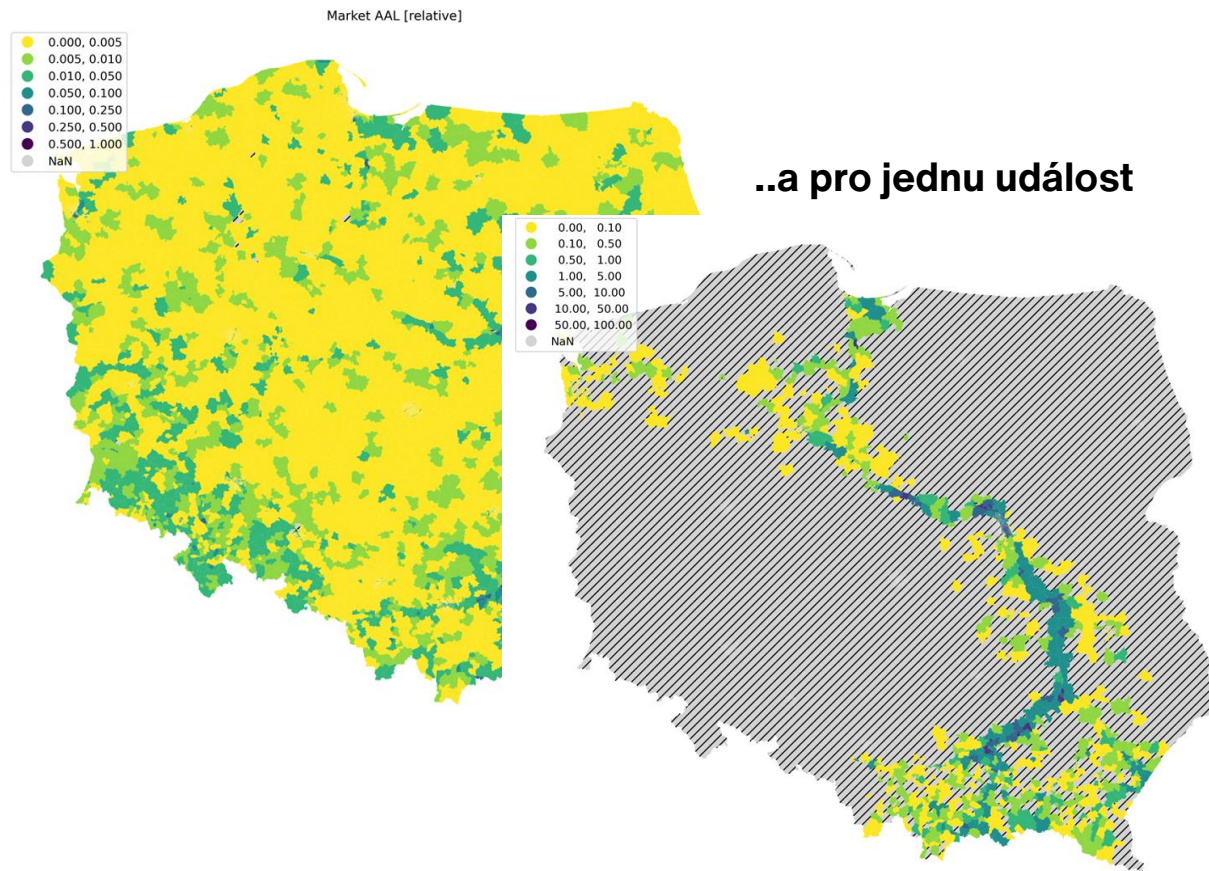


Odhady škod z CAT modelu

Základním produktem jsou PML či AAL škody pro portfolia pojišťoven

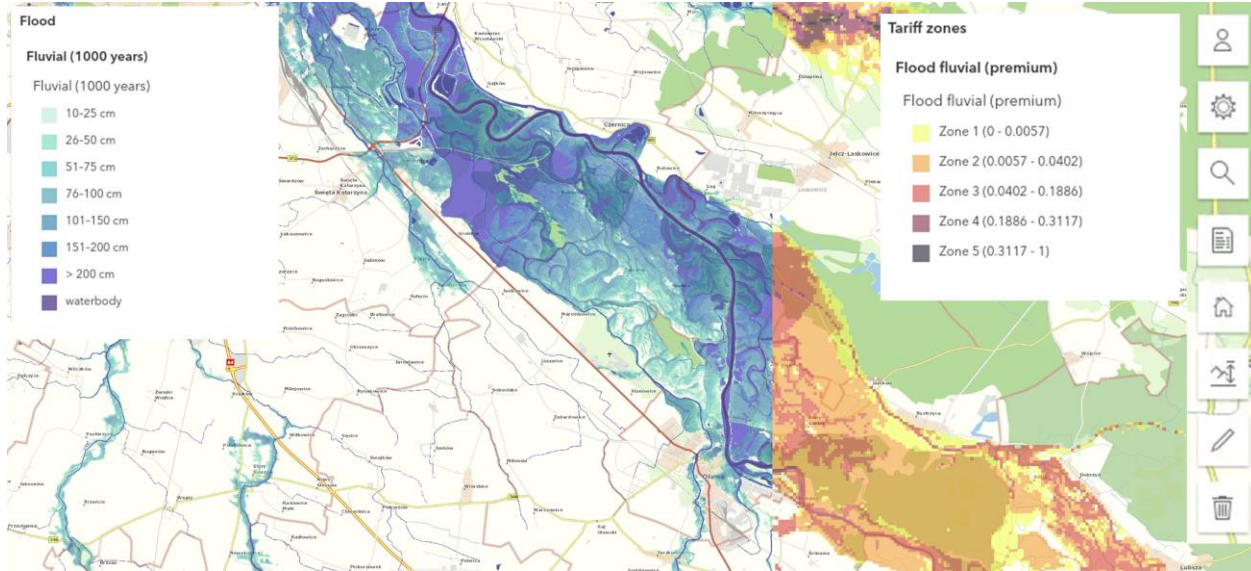
Škody pro celé portfolio po PSČ

Škody pro portfolio po 2 a 5ti místné PSČ

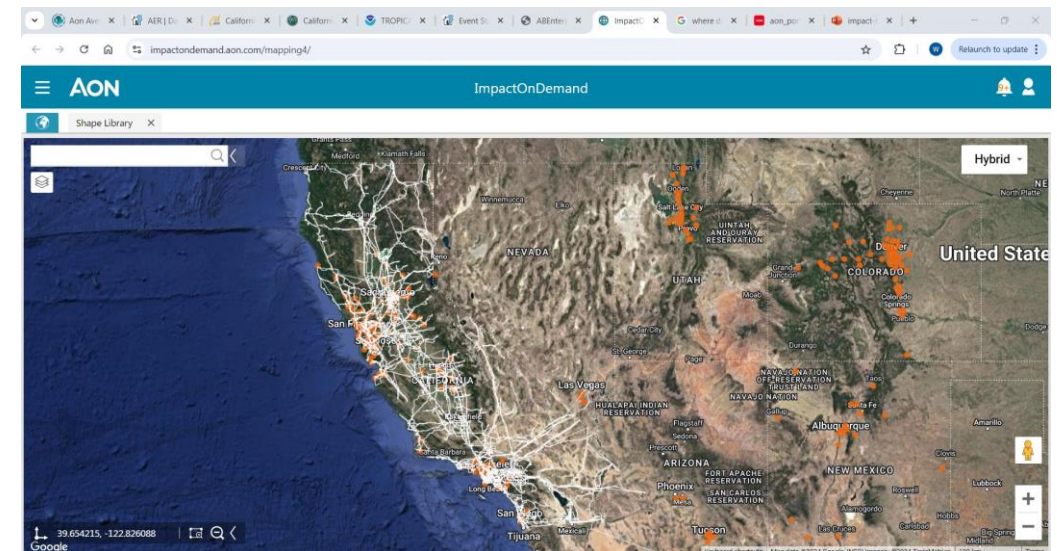


Aplikace a data pro primární upisování

Hazardová a risková data pro odhad rizik jednotlivých lokací



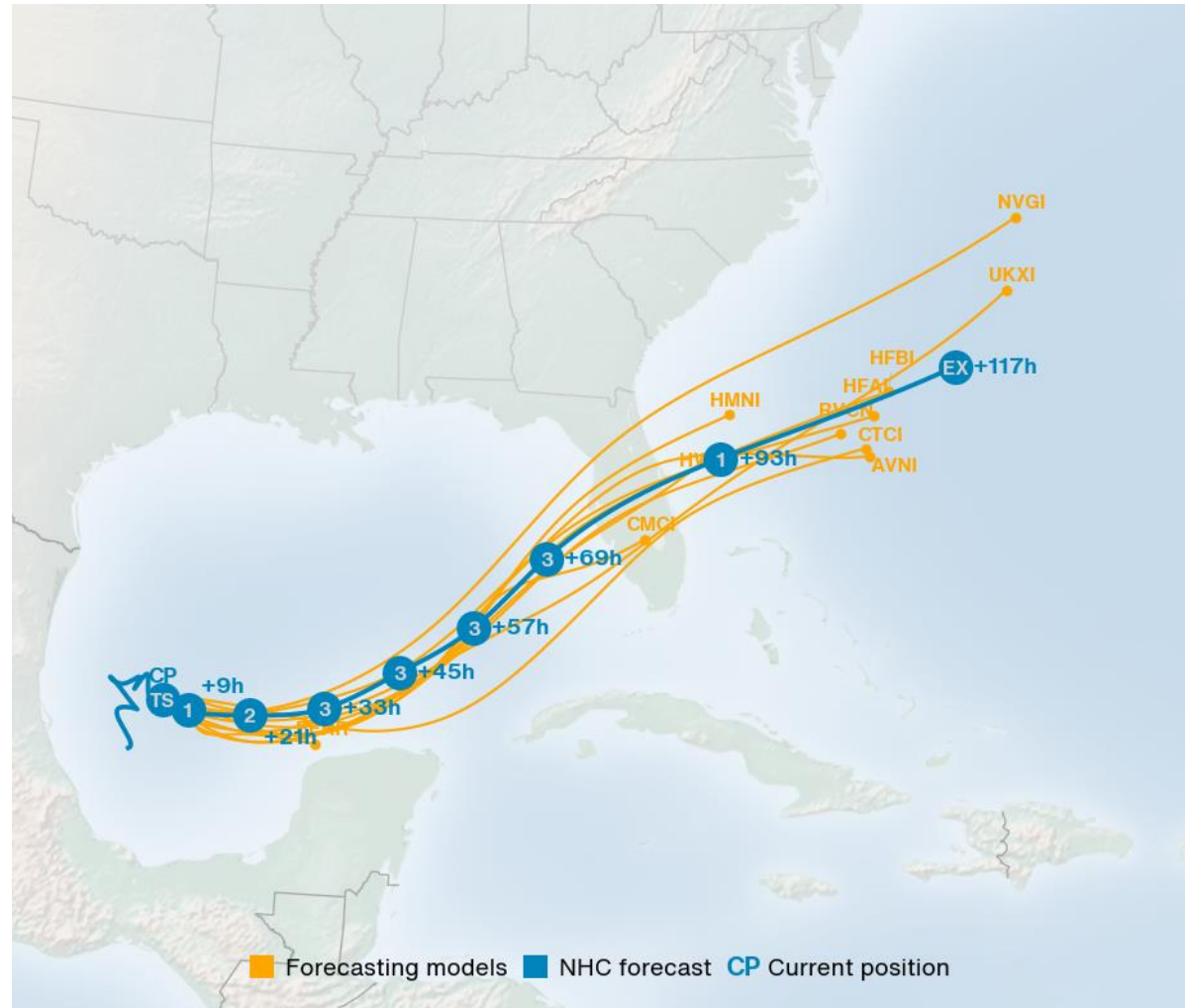
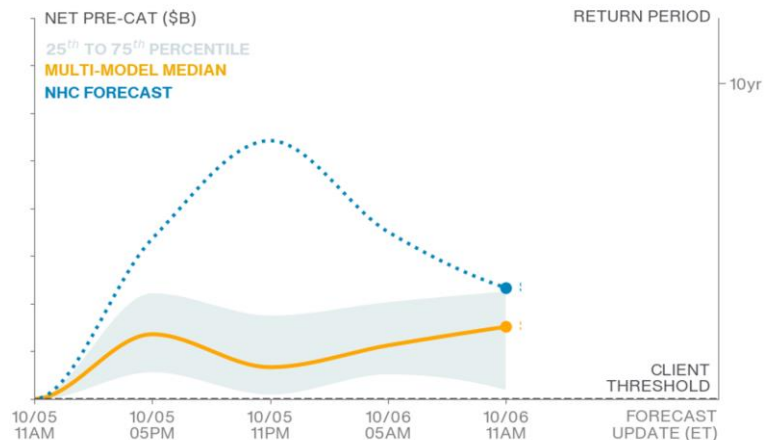
Peril	AAL	Rel. Margin	Cost of Capital	Total
Hurricane	366	0	0	366
Other Wind	3	0	0	3
Total:	369	0	0	369



Automatická reakce na přírodní událost

GIS má nezastupitelné místo při tvorbě automatických analýz a reportů

Automated Event Response: MILTON October 06, 11:00 AM (ET)



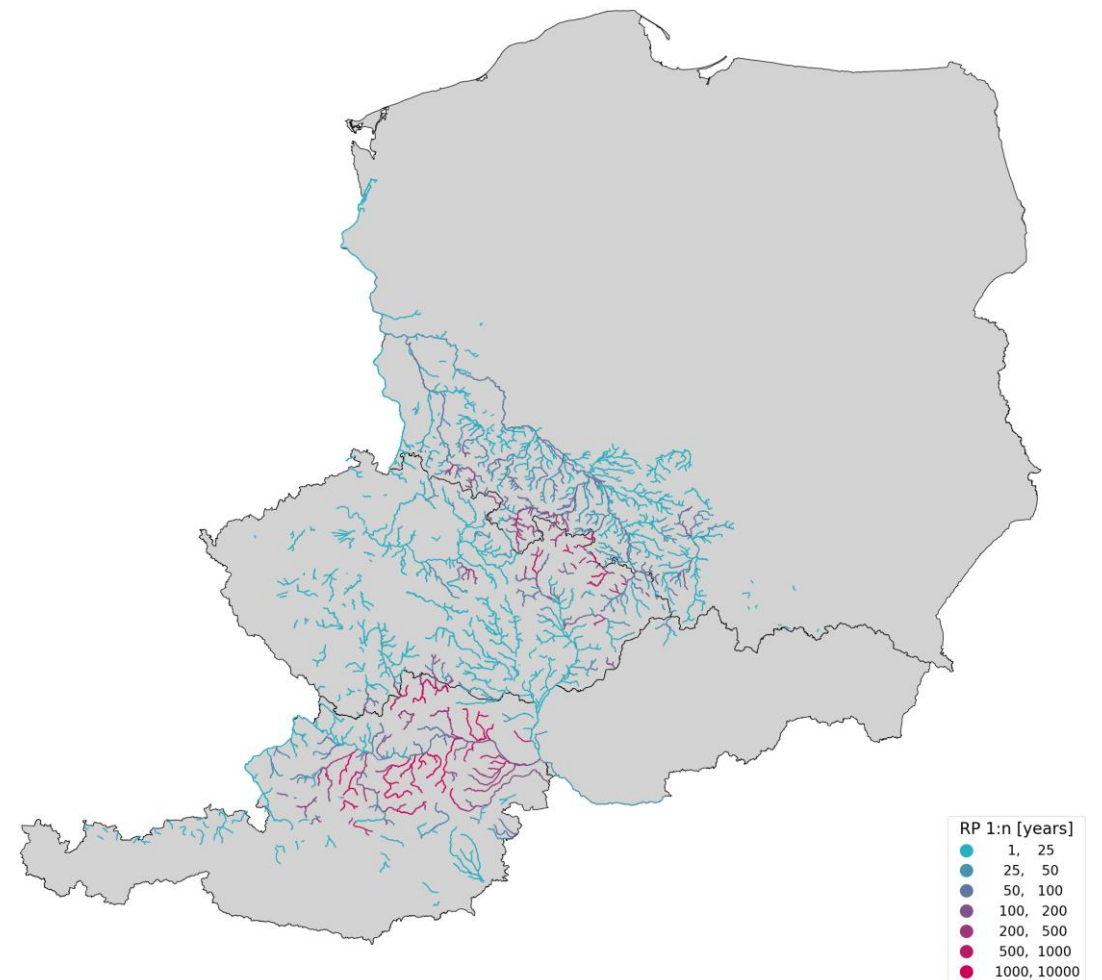
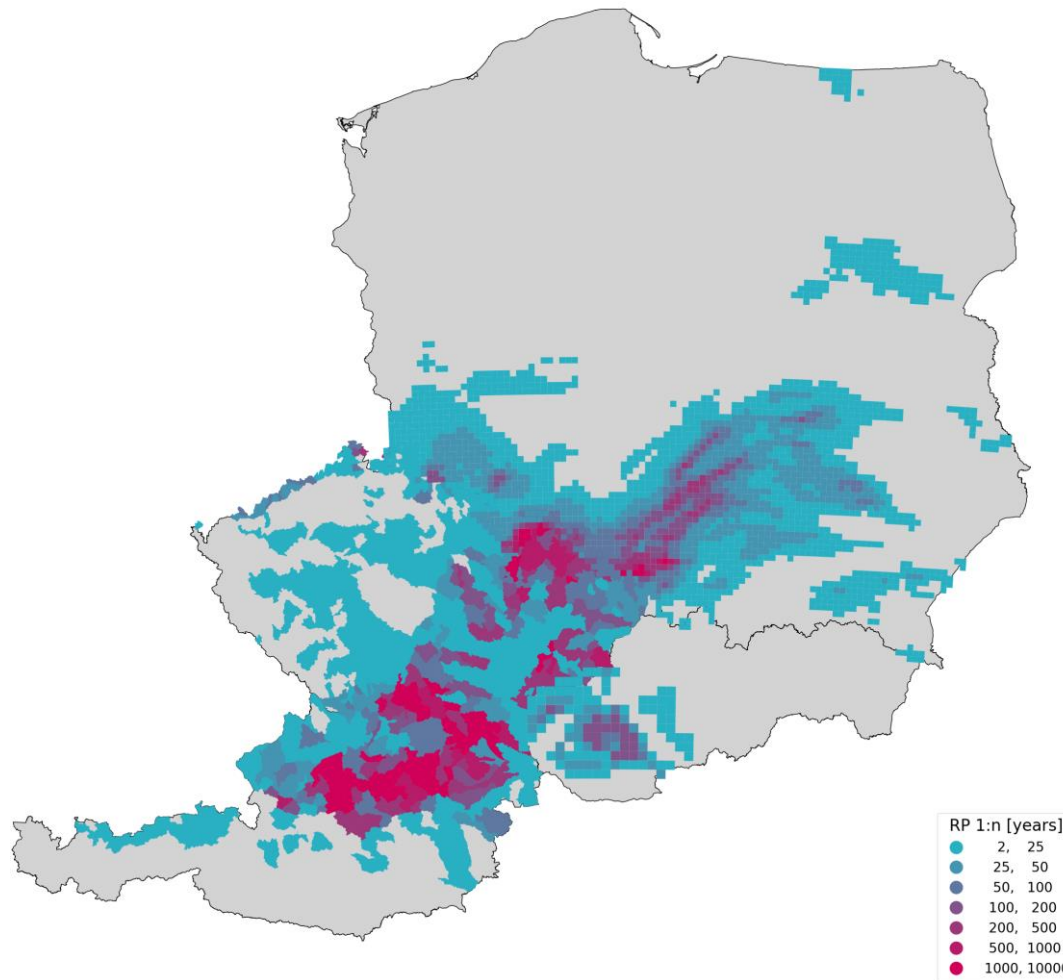


4

Ukázky z rekonstrukce povodní 2024

Rekonstrukce záplav v centrální Evropě v září 2024

Na základě Rainfall-Runoff modelu a měřených průtocích na řekách



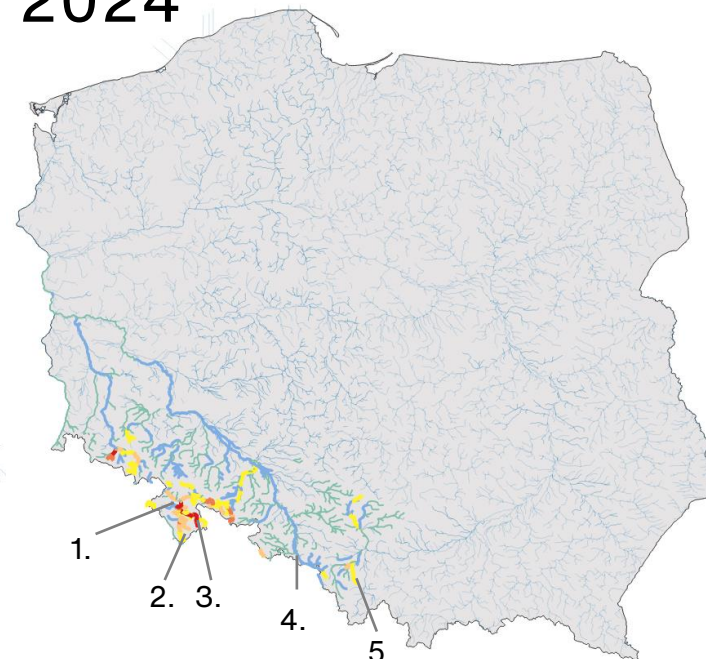
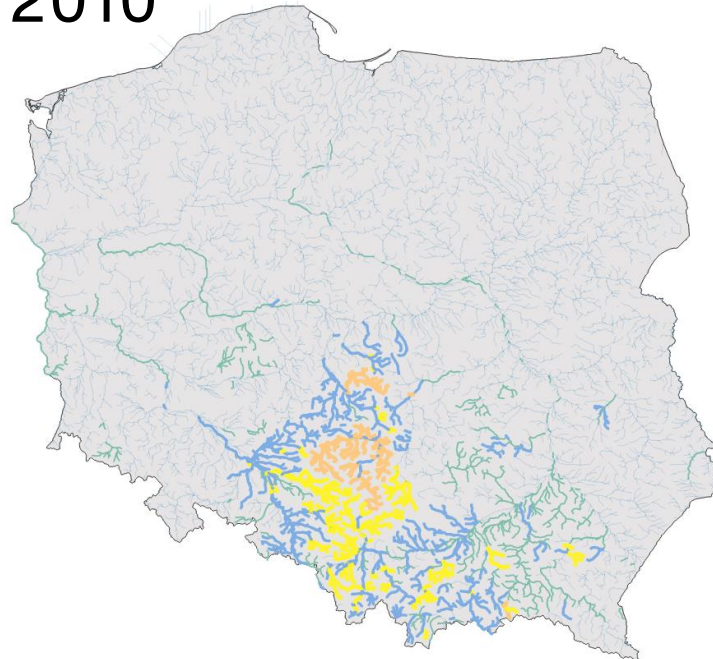
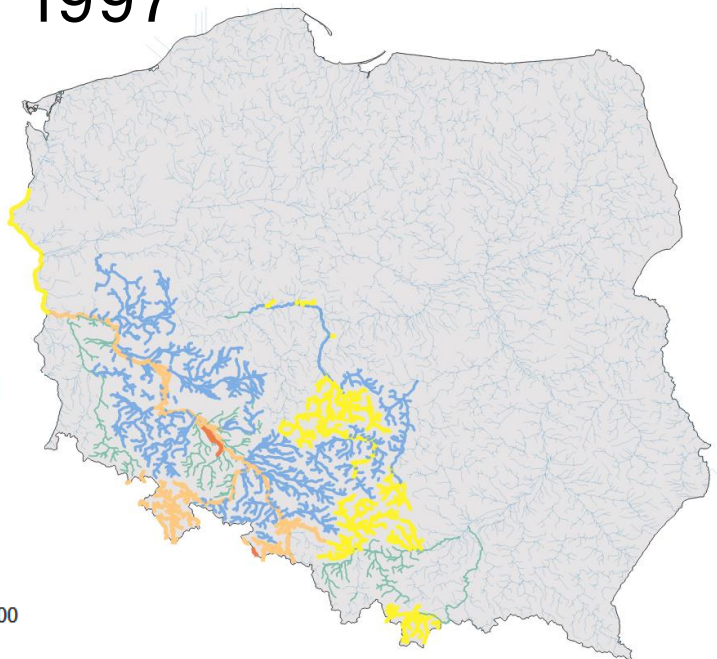
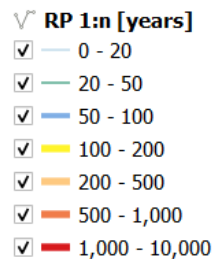
Porovnání velkých historických povodní v Polsku

1997, 2010 a 2024

1997

2010

2024



Hladiny vody při letošní povodni v 09/2024 na některých místech dosáhli nových rekordů

1. Řeka Nysie Kłodzkiej v Kladsku - 798 cm. To bylo o 1,5 m více než předchozí rekordní stav vody z roku 1997.
2. Řeka Wilczka, suchý poldr v Międzygórze - 2 718 cm. Bylo to 33 cm nad předchozím rekordním vodním stavem z roku 1997.
3. Řeka Morawka, suchý poldr v obci Stronie Śląskie - ??? . 14 září voda v poldru začala přetékat bezpečnostím přelivem, podobně jako suchý poldr v Międzygórze. Bohužel následující den před polednem došlo k protržení hráze tohoto poldru.
4. Odra v Krzyżanowicach (Slezské vojvodství), hranice s ČR - 914 cm. Tím byl vyrovnán rekord z roku 1997. Oproti roku 1997 byl průtok následně transformován novými poldry v u Ratiboře.
5. Řeka Biata v Mikuszowicach (okres Bielsko-Biała) - 260 cm . Je to o 3 cm více než rekord z července 1970, kdy to bylo 257 cm .

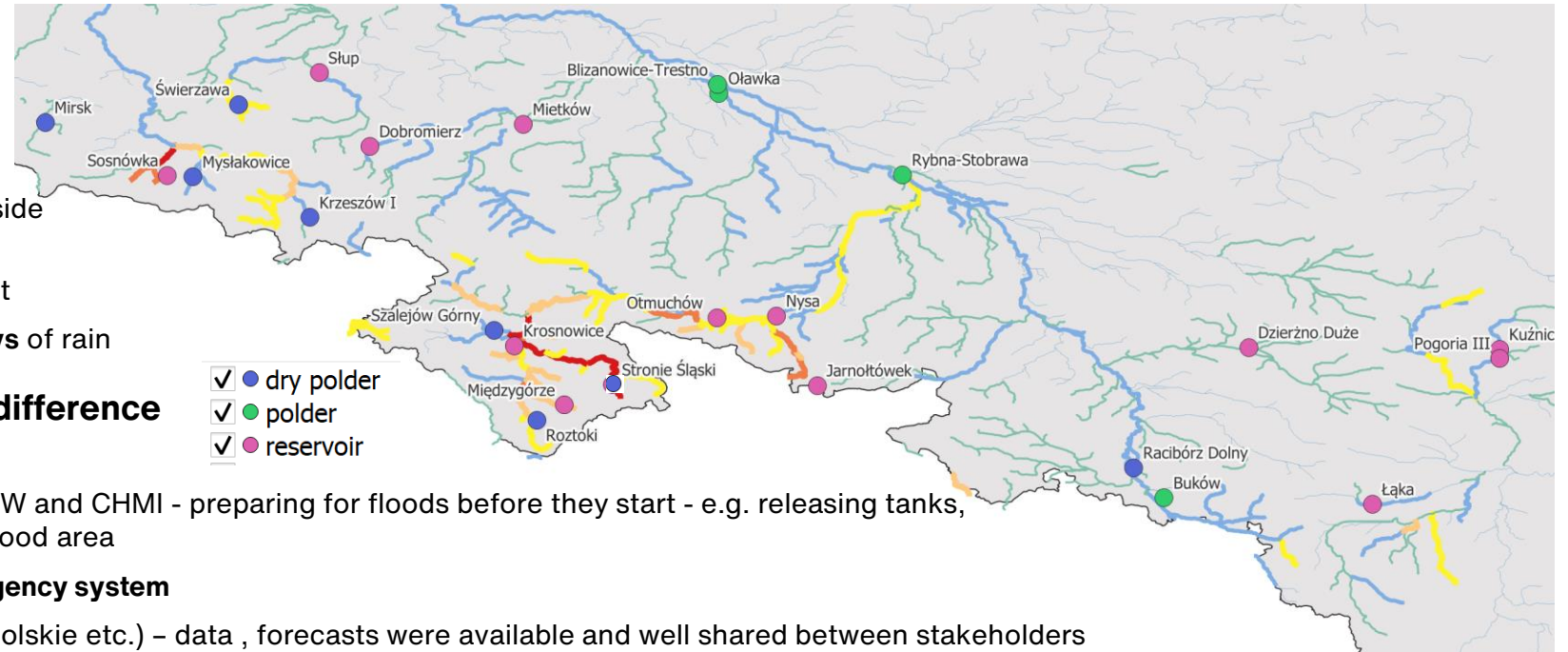
Povodeň 2024 vs 1997 v Polsku

Event 2024

- **smaller than 1997** – just south part of Odra river basin
- caused by **heavy rainfall**, mainly on both side of border with the Czech Republic
- the **land was unsaturated** before the event
- first **flood waves come hours-one-two days** of rain

Flood protection measures – main difference between 2024 and 1997

- **First alerts few days before rain** from IMGW and CHMI - preparing for floods before they start - e.g. releasing tanks, people started moving things out of the flood area
- **readiness** of all components of the **emergency system**
- **New information systems** (IMGW, Wody polskie etc.) – data , forecasts were available and well shared between stakeholders (e.g precipitations, flows, current situation and forecasts, status of individual flood protections etc.)
- Odra – New reservoirs, polders and dry polders – **Bukow and Ratiborz Dolny** significantly **transform flood wave** from Czech Republic at Odra river and protect several municipalities including Ratiborz, Opole and Wroclaw
- Nysa Kłodzka – Cascade of older and newer **reservoirs (Nysa, Otmuchow, Topola, Kozielno)** **transform** (despite levee failure of Topola) **flows from Kłodzko valley**
- **Dry polders and reservoirs in Kłodzko valley slow down** movement of **flood wave**, but their capacity was sometimes too small to extreme volume of flood wave. Failure of dry polder at Stronie Śląskie increase damage tens kilometers down the Biela Ladecka valley
- **Modernization of Wroclaw's flood protection measures** including more than 65km of levees, new bridges, Olawa bypass , Rybna polders etc. protect Wroclaw to flooding





5

Slova závěrem

Modelování povodňových škod & GIS

- **GIS je v CAT modelingu všude přítomný**
- **Umožňuje zpracovávat podrobnější a podrobnější data,**
- **Provádět více a více sofistikované analýzy,**
- **A pak vše zpět zjednodušit a**
- **Předat získanou informaci srozumitelně různým uživatelům k dalšímu použití na pár stránkách**

Děkuji za pozornost

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