



Interreg



Danube Transnational Programme

Danube Hazard m³c

Interreg
Danube Region



Co-funded by
the European Union



EMISSION MODELLING IN THE DANUBE BASIN

From pilot action to capacity building

Martine Broer, Karlsruhe 12.06.2026

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Outline

Background

Pilot action – Danube Hazard m³c

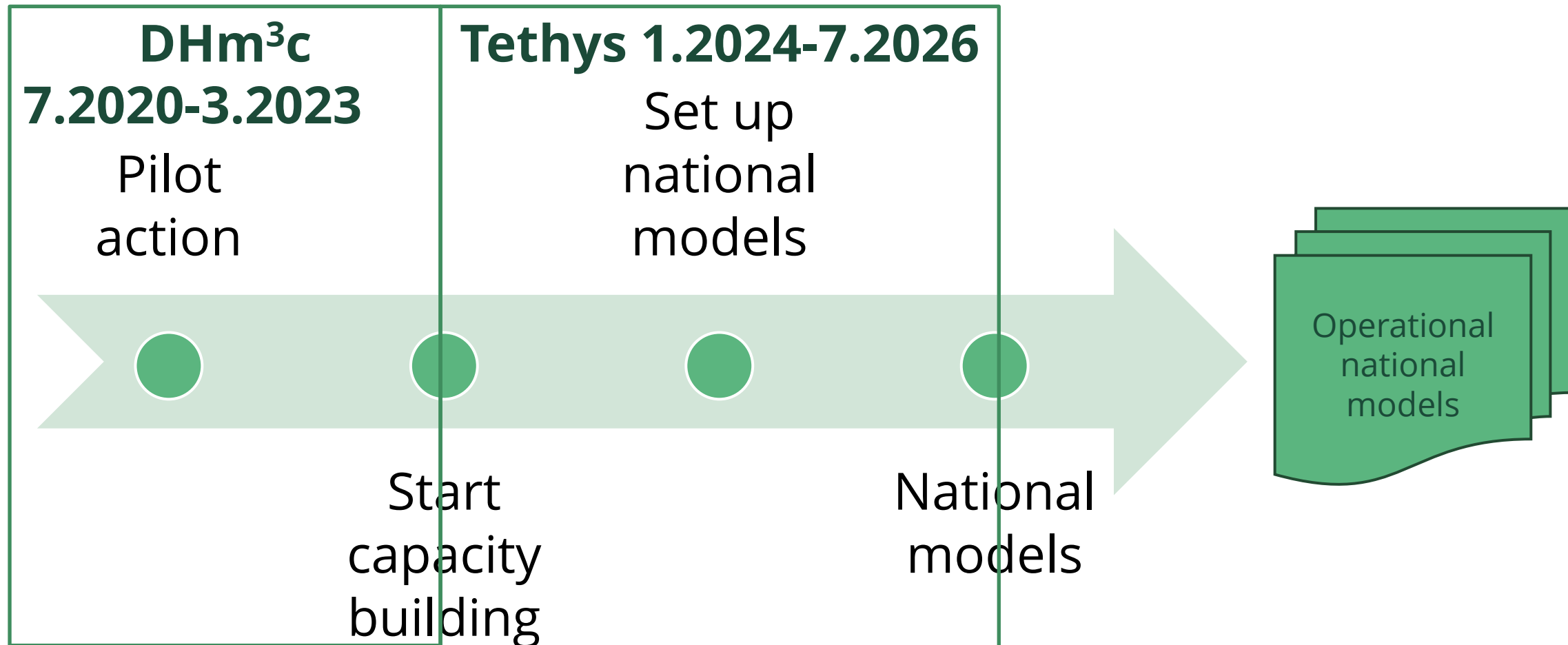
- Pilot areas
- Modelling concept
- Results

National models –Tethys

- Objectives and challenges
- Capacity building
- Preliminary Results – focus on learning process
- Summary

Outlook & recommendations

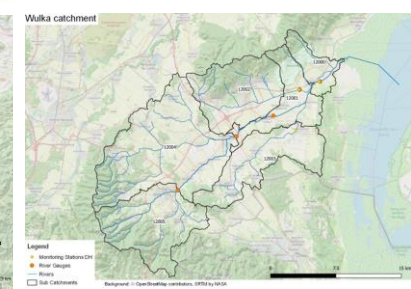
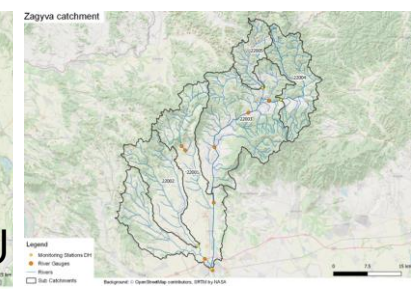
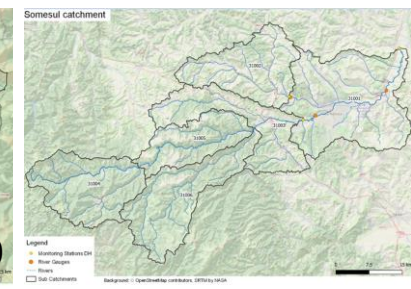
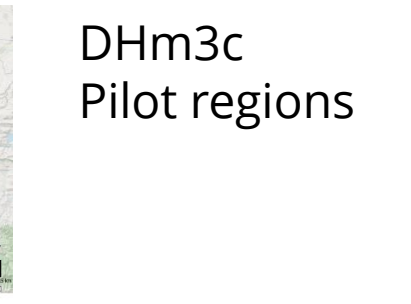
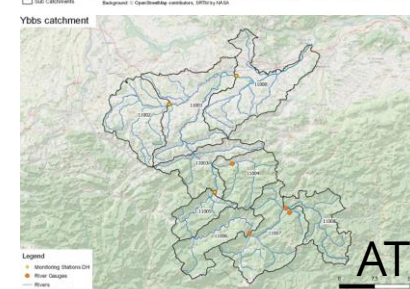
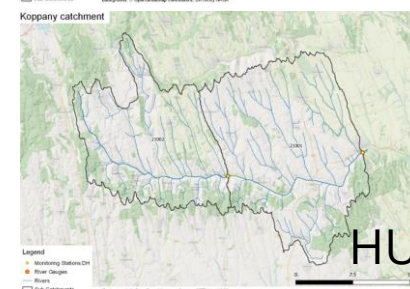
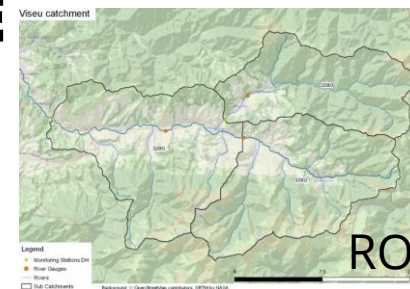
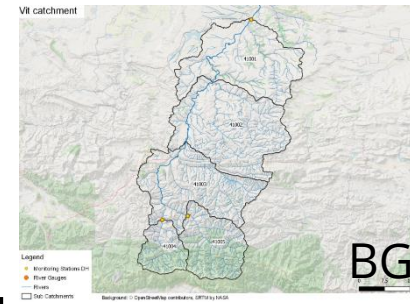
Background



Pilot action - DHm³c

Emission modelling in seven pilot areas in four countries with the MoRE model

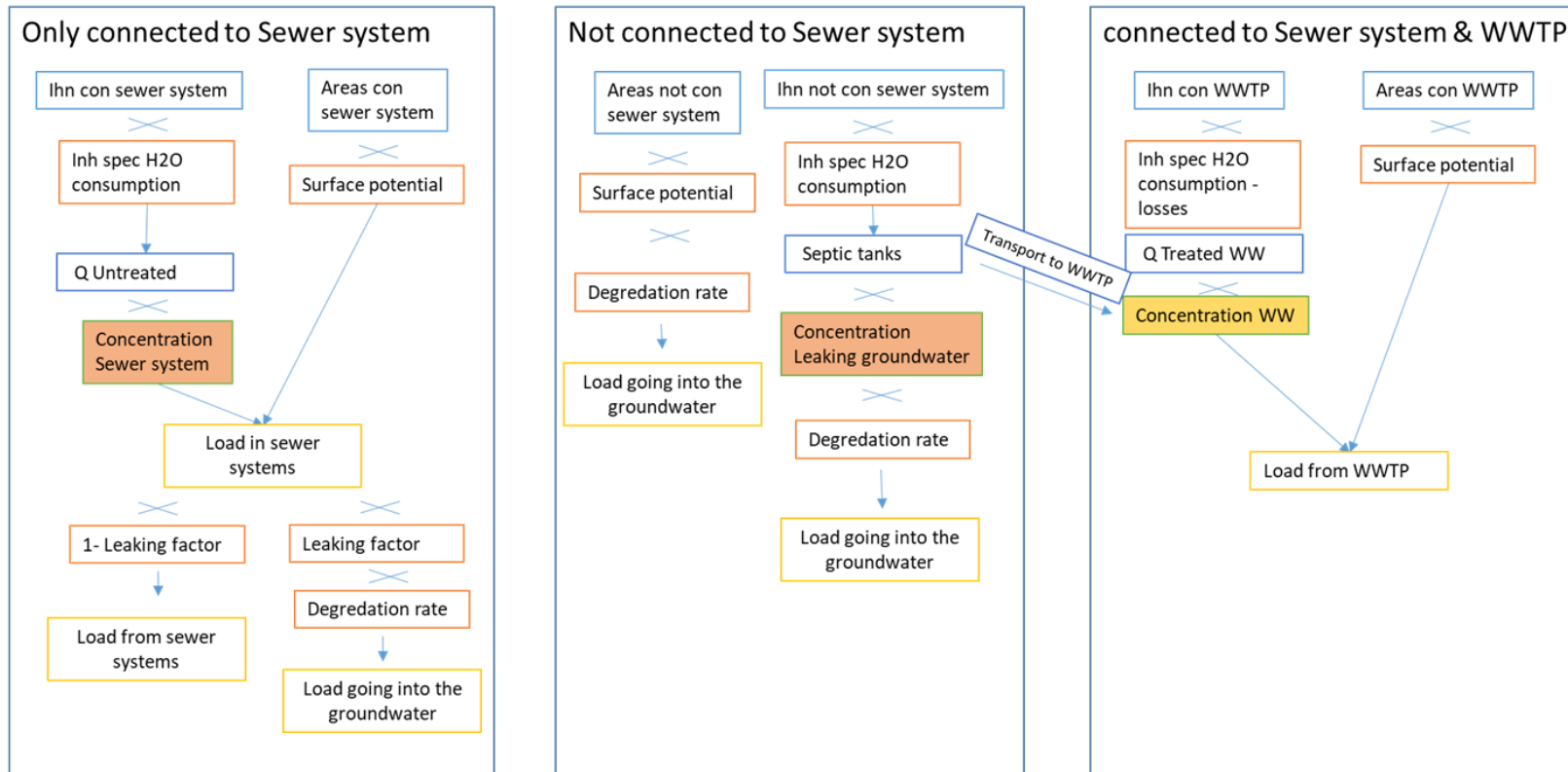
- Large heterogeneity between the pilot areas
 - Availability of basic input data
 - Erosion data
 - Availability of substance specific data
 - DHm³c monitoring campaign
 - Differences in urban systems/WWTPs
 - Abandoned mining in some pilot areas



DHm³c
Pilot regions

Pilot action - modelling concept

New approach urban systems – based on Bulgaria Abandoned mining



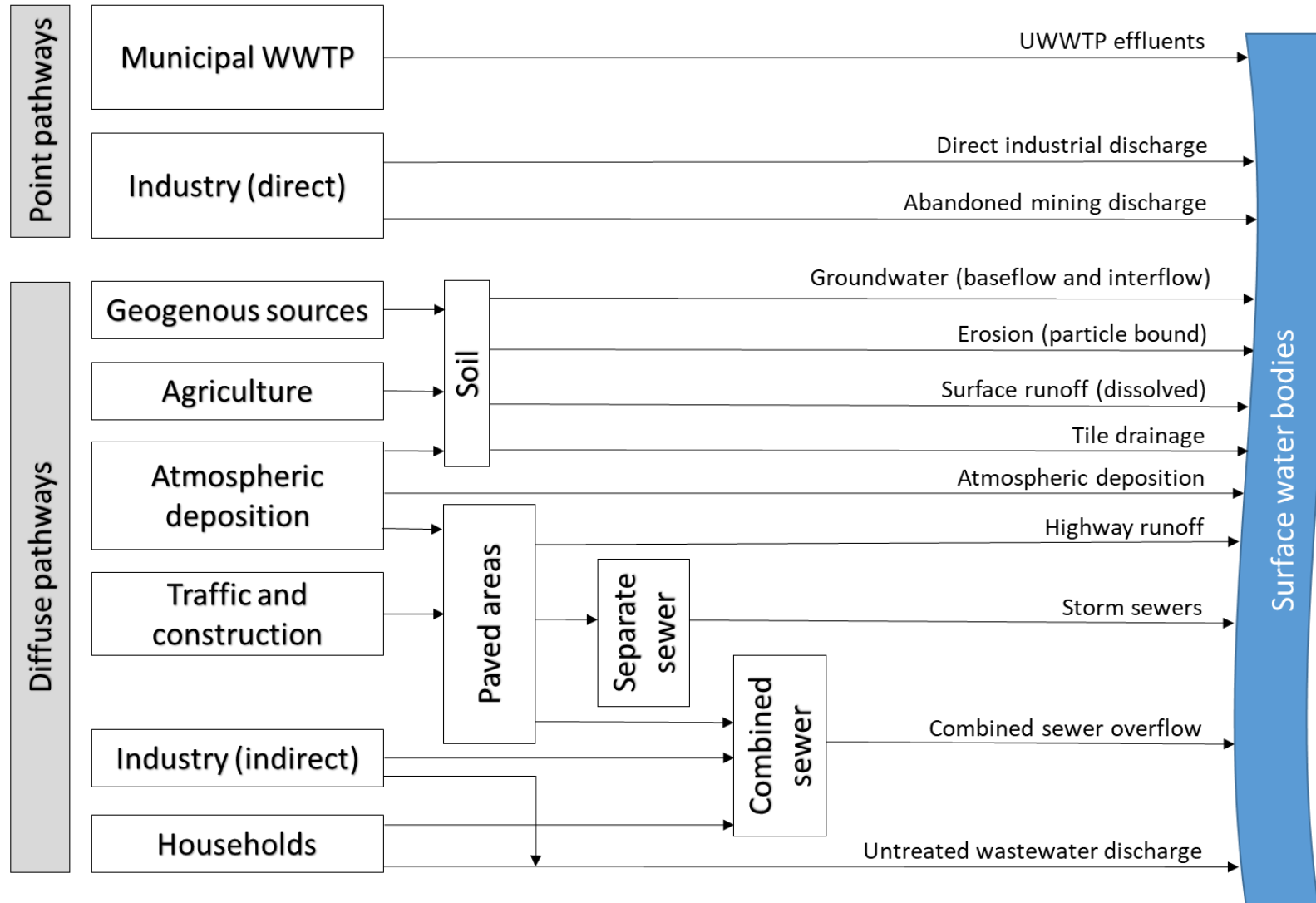
Implemented as point sources

Simple $E = Q \cdot c$ approach

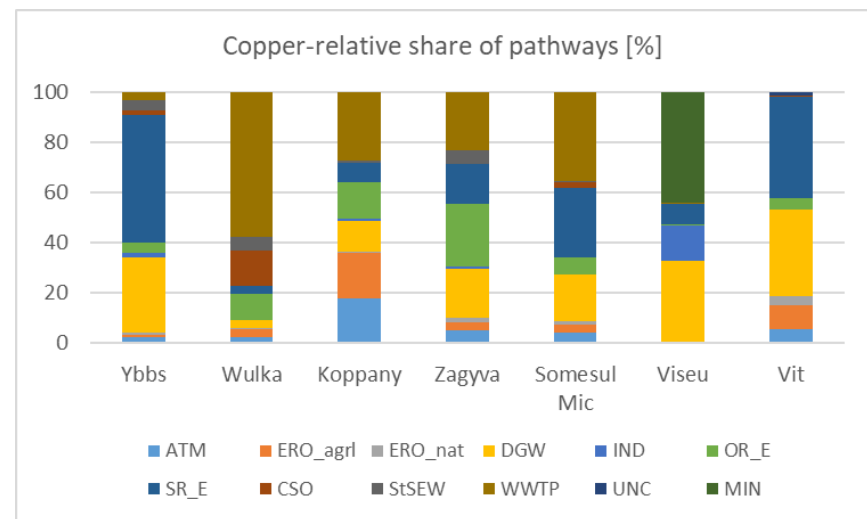
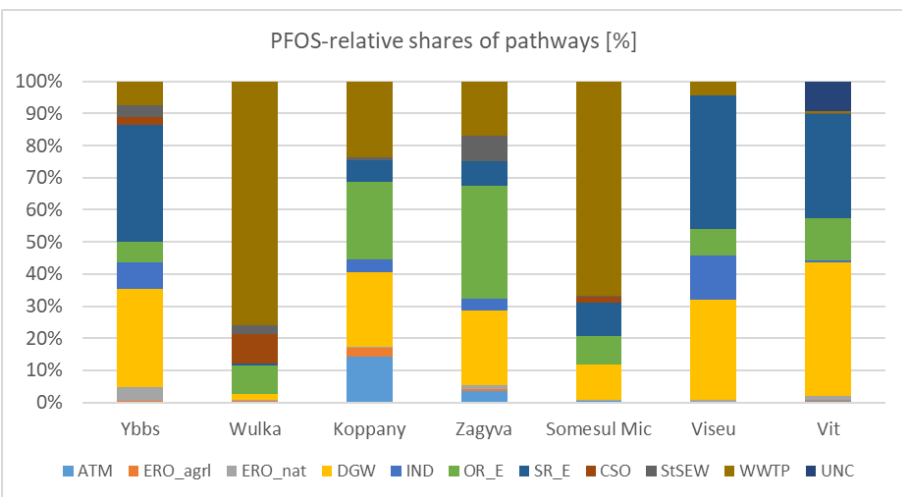
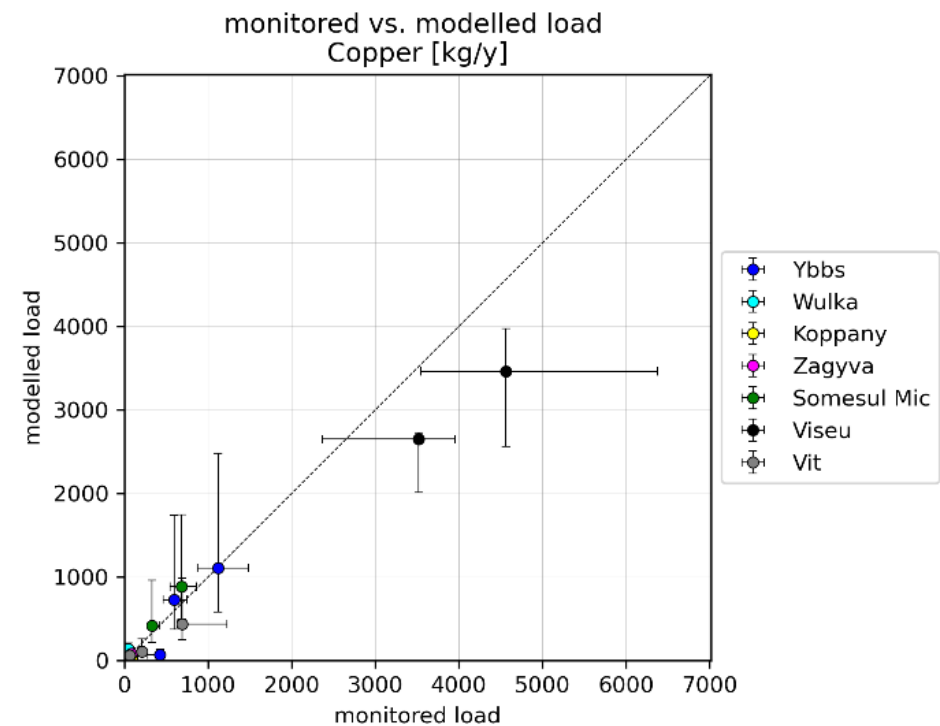
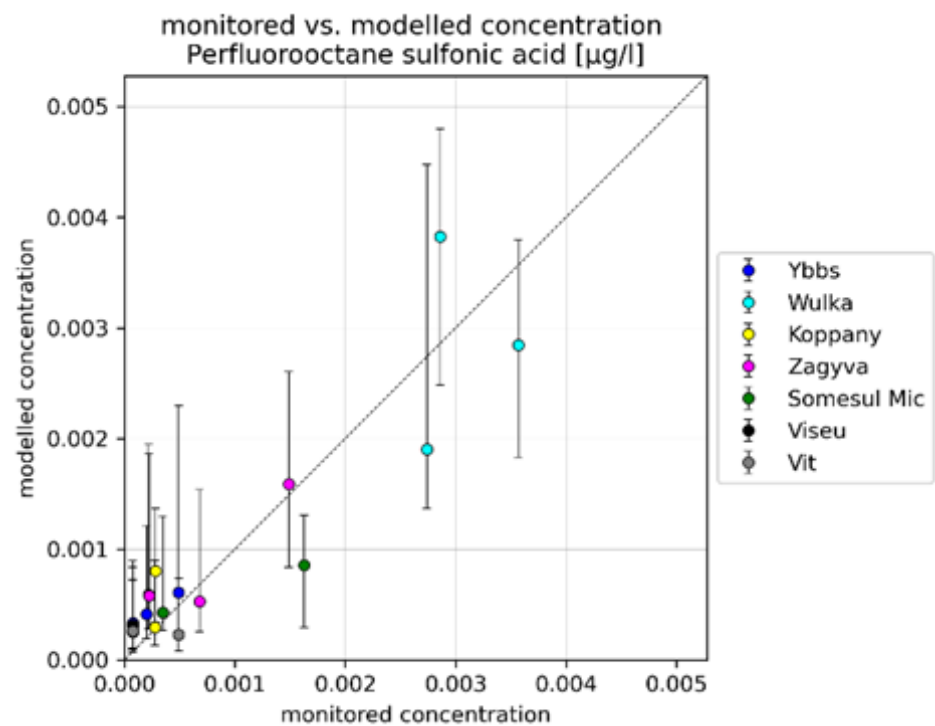
Concentration data from DHm^3c

A lot of improvement is possible!

Pilot action - modelling concept MoRE



Pilot action - modelling results



National models - Objectives

- Improve understanding of emission modelling in 9+1 Danube countries:
- **Ukraine, Romania, Bulgaria, Serbia, Montenegro, Croatia, Hungary, Slovakia, Austria & Bosnia & Herzegovina**
- Building capacity and expertise in emissions modelling: (more than 40 national experts involved – technical experts on modelling, data analyses and GIS)
- 9+1 national emission model applications installed on national servers (most of them provided in Tethys)
- Highlight information/data gaps
- Identify specific country-relevant needs in the model setup
- Support risk assessment and mitigation evaluation
- Develop a communication strategy between PP and RBMP responsible authority (if not the same)

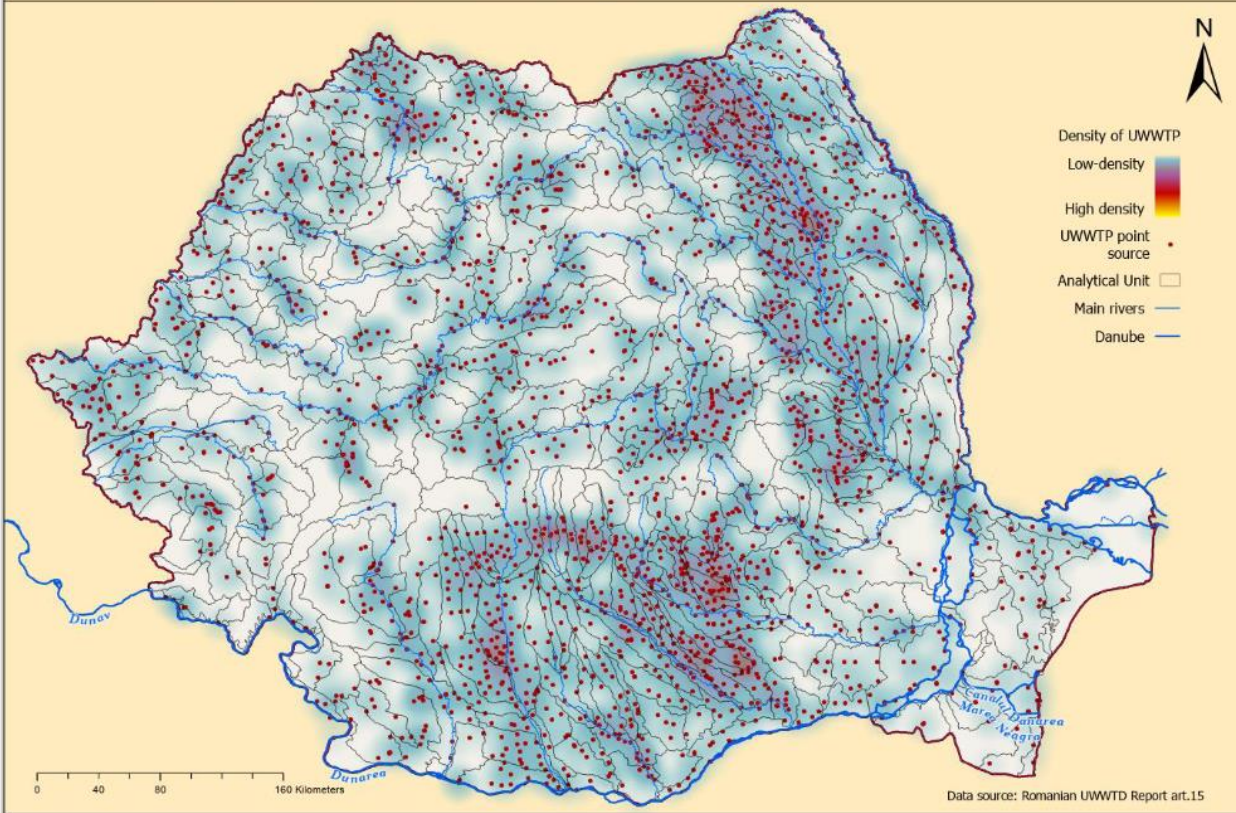
National models - challenges

Significant heterogeneity among the participating partners and countries:

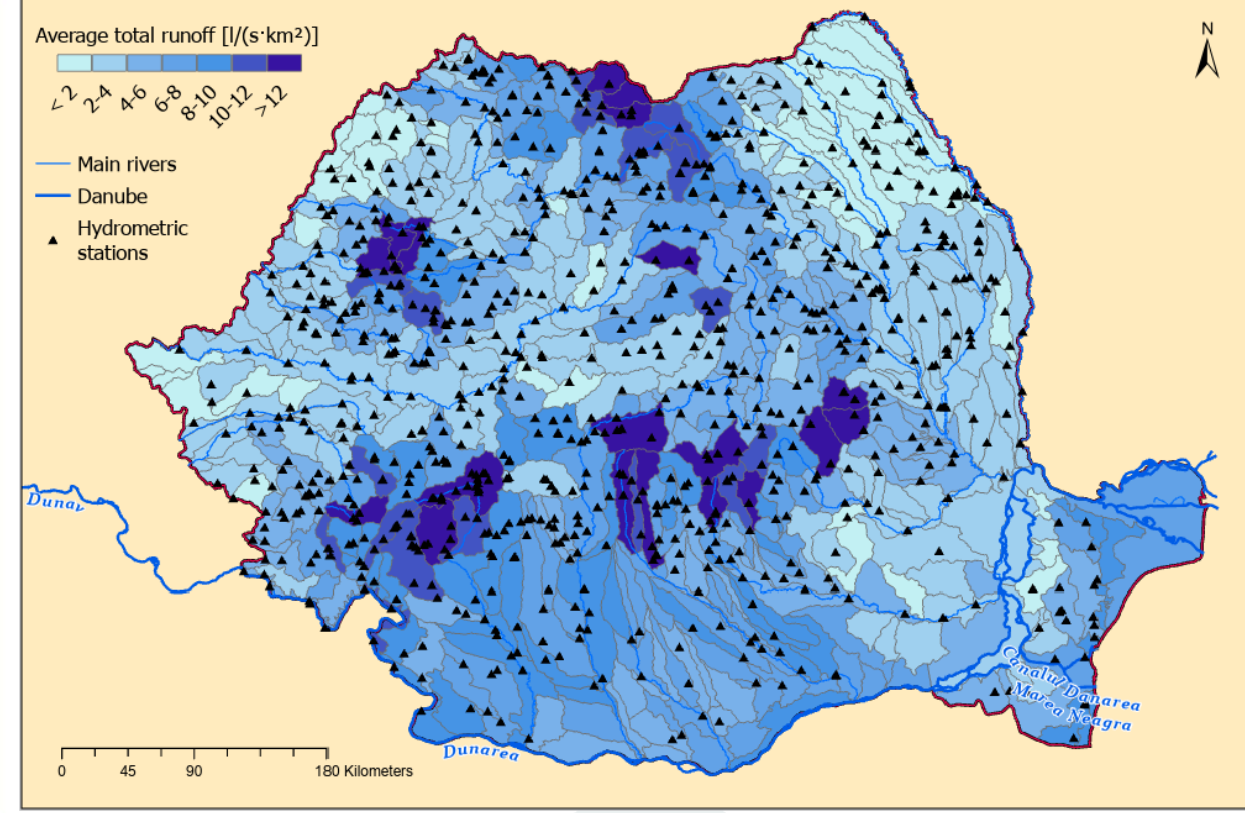
- EU Countries/ Non - EU Countries
- Modelling experience/ experience with MoRE
- Data availability
- Capacities for follow up activities

National models – data availability -RO

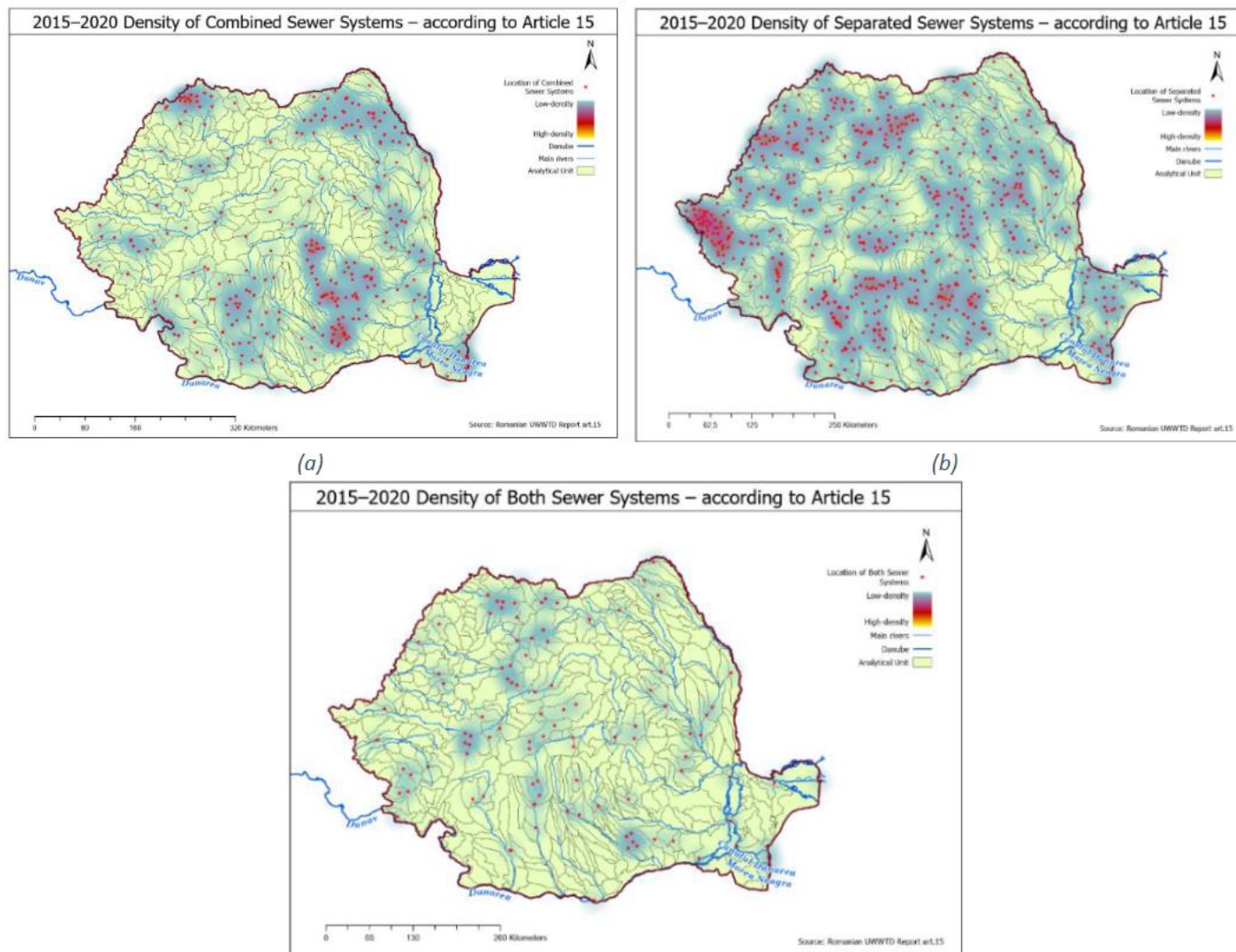
2015-2020 UWWTP location and density



2015-2020 Average Total runoff in [$\text{l}/(\text{s}\cdot\text{km}^2)$]

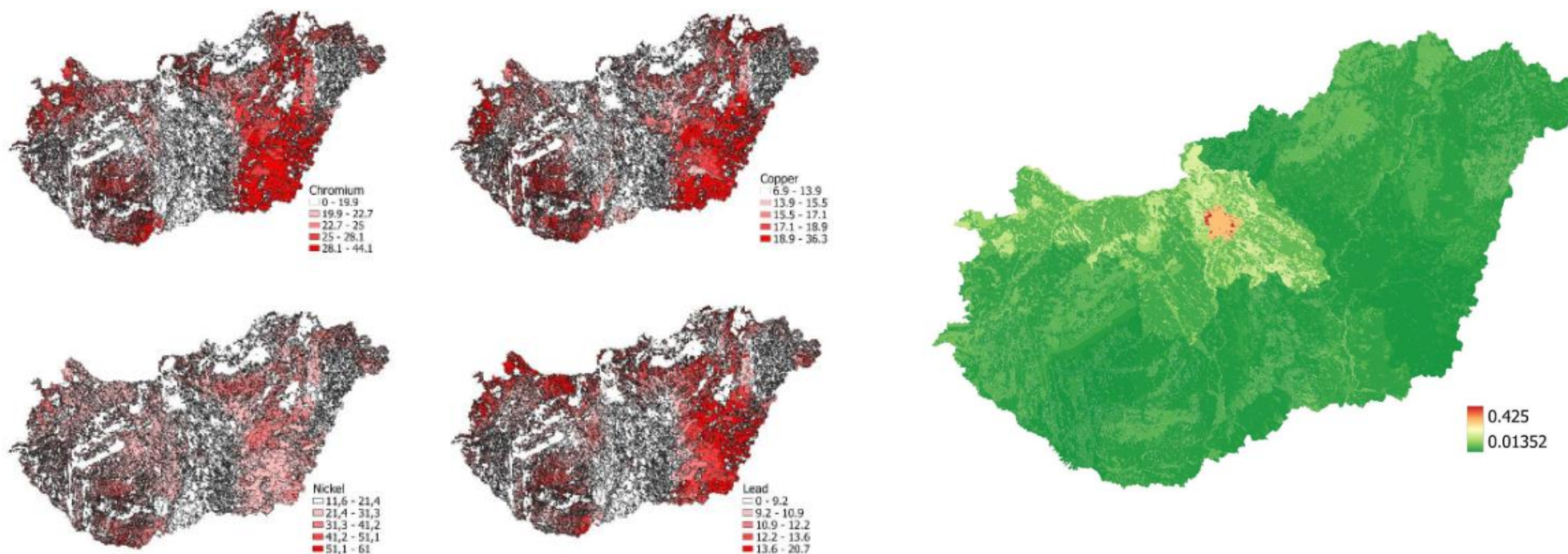


National models – data availability -RO



National models – data availability - HU

Soil concentrations for heavy metals & PFOS



National models – data availability

- Basic input data is available in most countries!
 - Water balance data is not easily available in some countries

Missing data

- National Soil loss data
- Data on drained areas
- Septic tanks and specific information on sewer systems
- Data on industrial dischargers for non-EU countries
- Substance specific data except for heavy metals

Capacity building

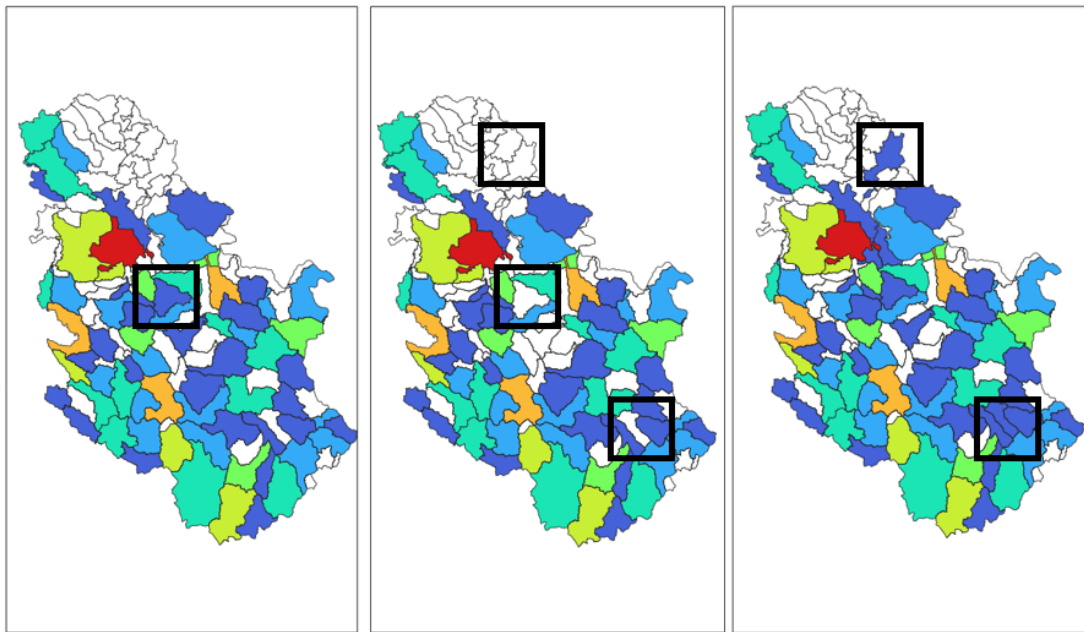
- 20 recorded Webinars focusing on:
 - Input data
 - Model structure
 - Calculation approaches
 - Adapting the MoRE Model to specific needs
- 1,5 day hands-on MoRE workshop in Vienna after 1,5 years
- Bilateral meetings/status updates when needed
- Projects partners supporting each other
- Permanent MoRE Helpdesk by EAA and technical support by a software Company



modelling results - Serbia

Modelling of heavy metals is finished, validation is still needed

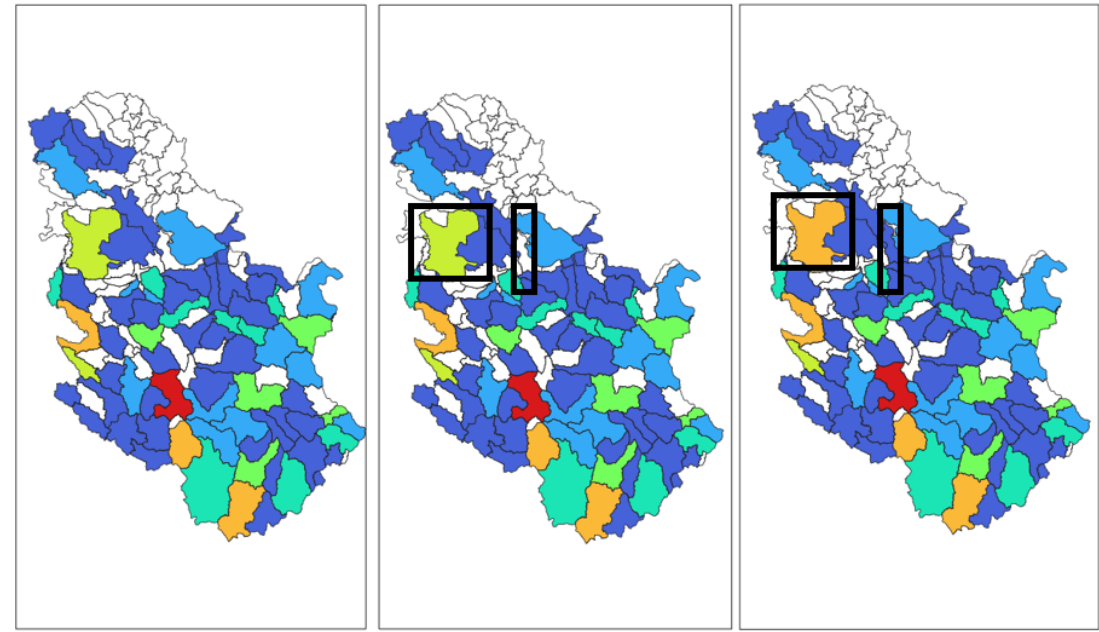
3 scenarios: Scenario 1: Current state, Scenario 2: Power cut and no WWTP plants operating Scenario 3: All analytical units have a functioning municipal WWTP.



SCENARIO 1

SCENARIO 2
Zinc

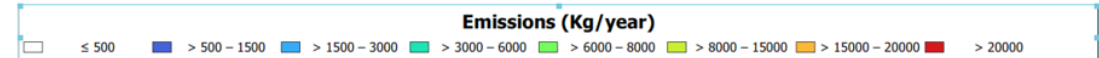
SCENARIO 3



SCENARIO 1

SCENARIO 2
Mercury

SCENARIO 3



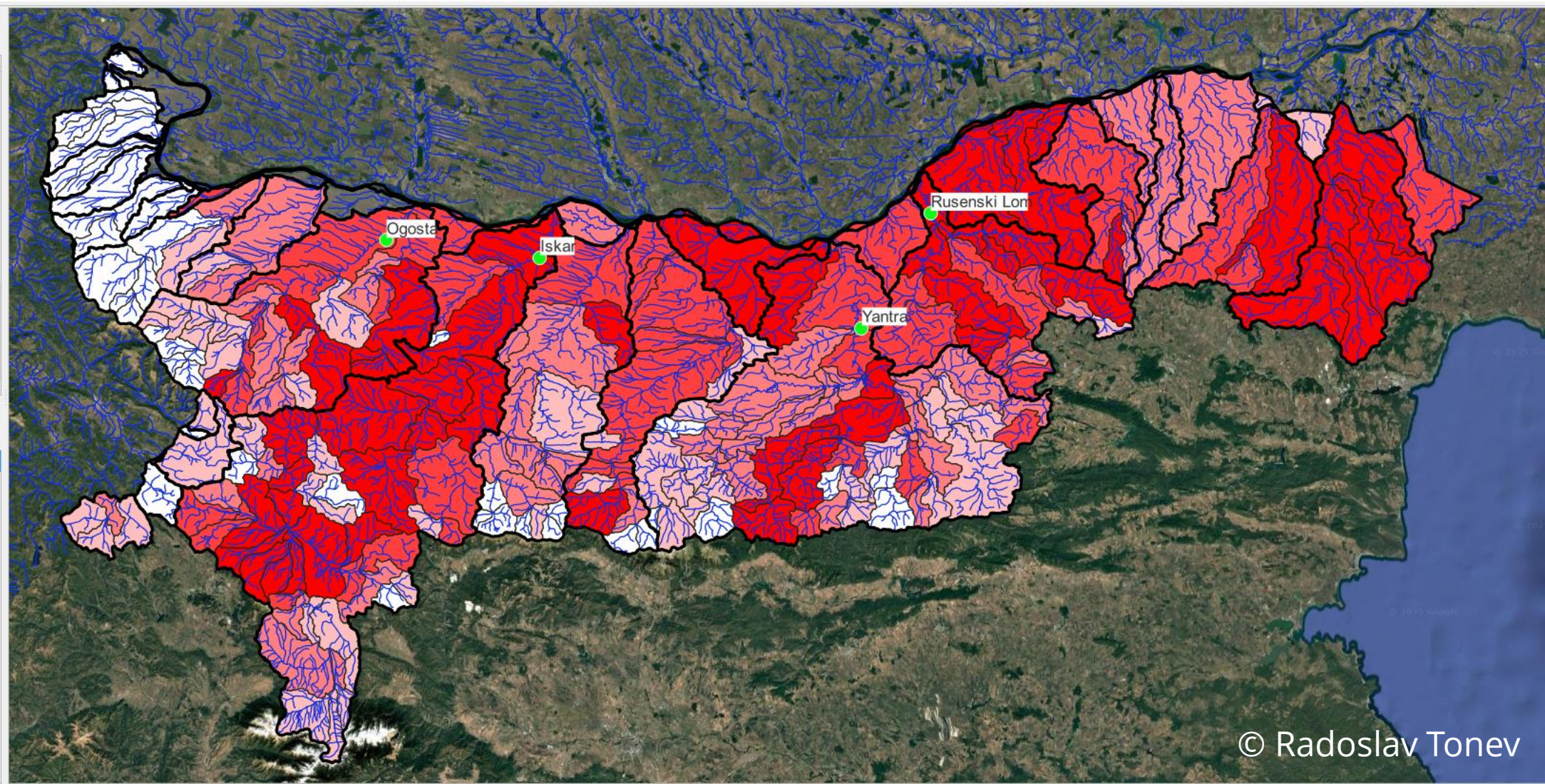
Modelling results – Bulgaria - PFOS

Browser

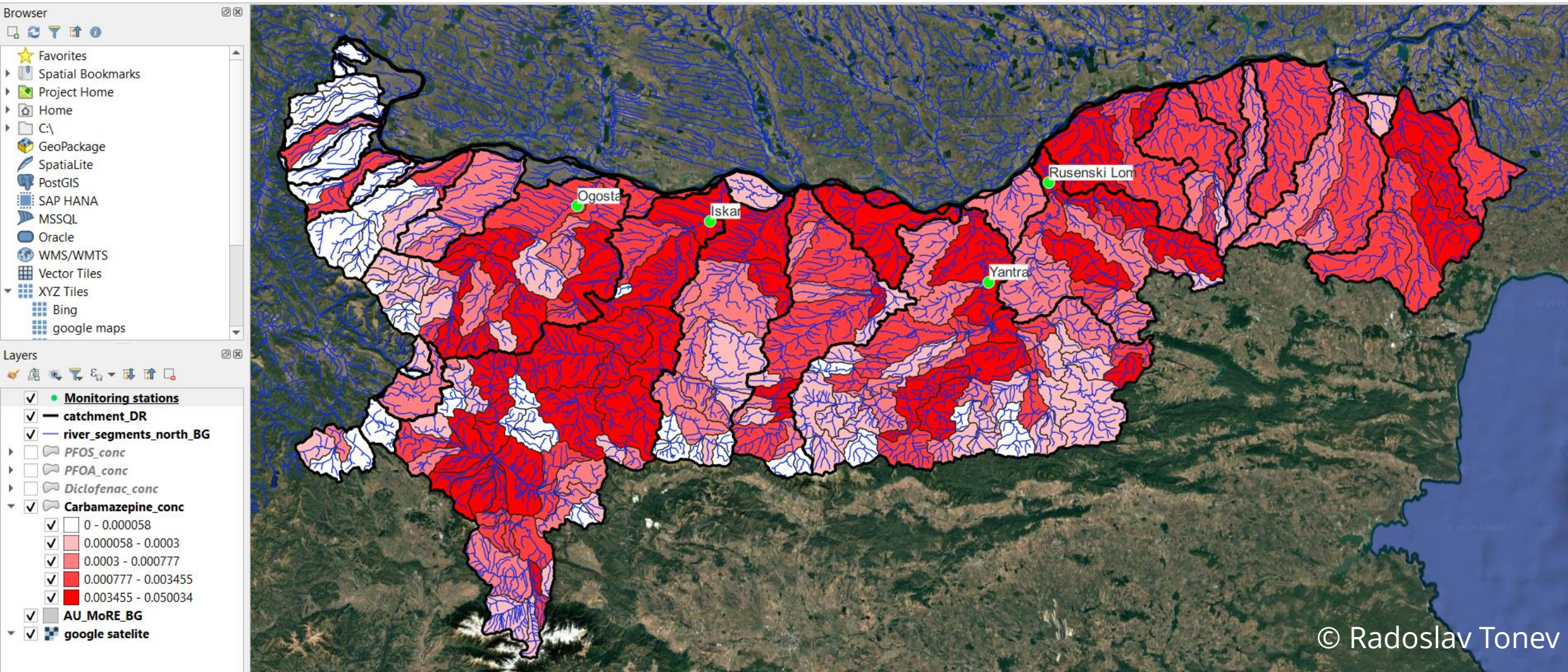
- ★ Favorites
- Spatial Bookmarks
- Project Home
- Home
- C:\
- GeoPackage
- Spatialite
- PostGIS
- SAP HANA
- MSSQL
- Oracle
- WMS/WMTS
- Vector Tiles
- ▾ XYZ Tiles
 - Bing
 - google maps

Layers

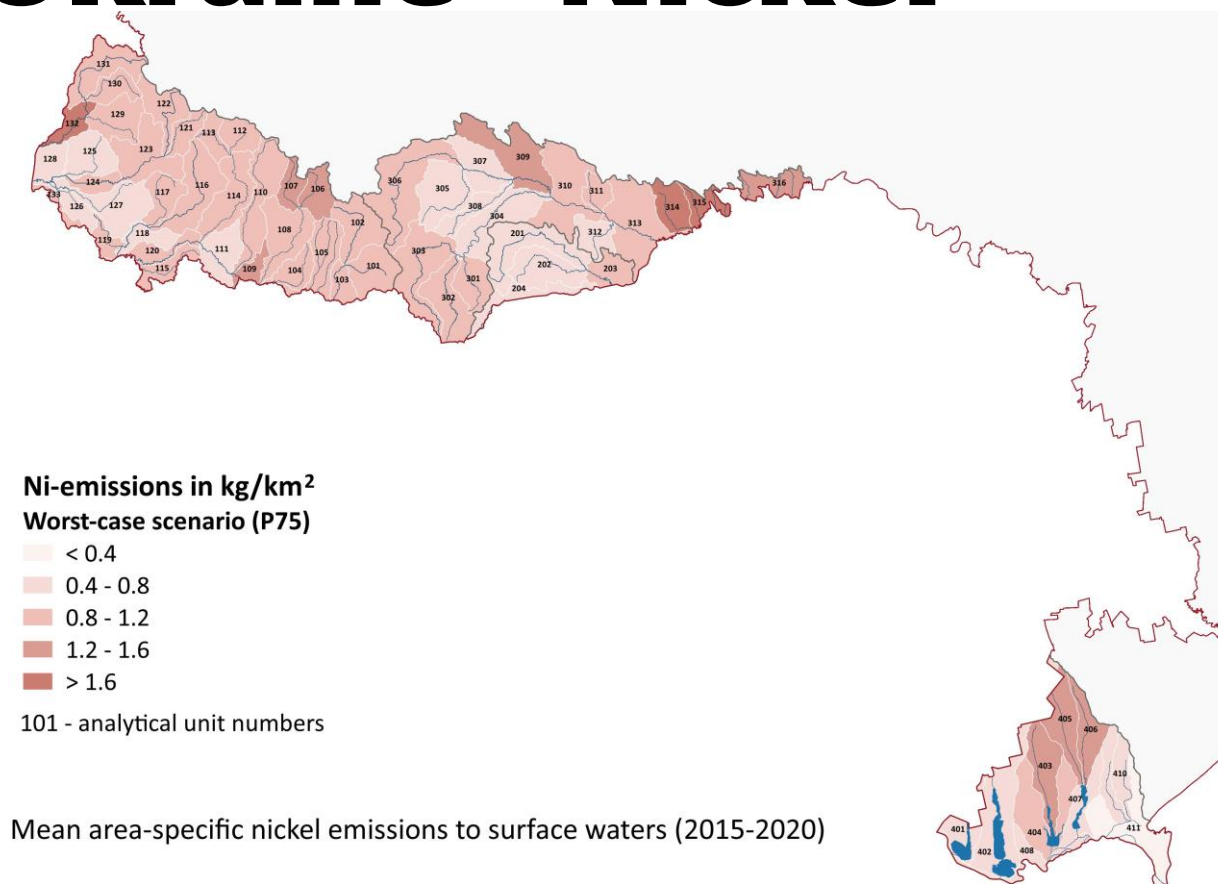
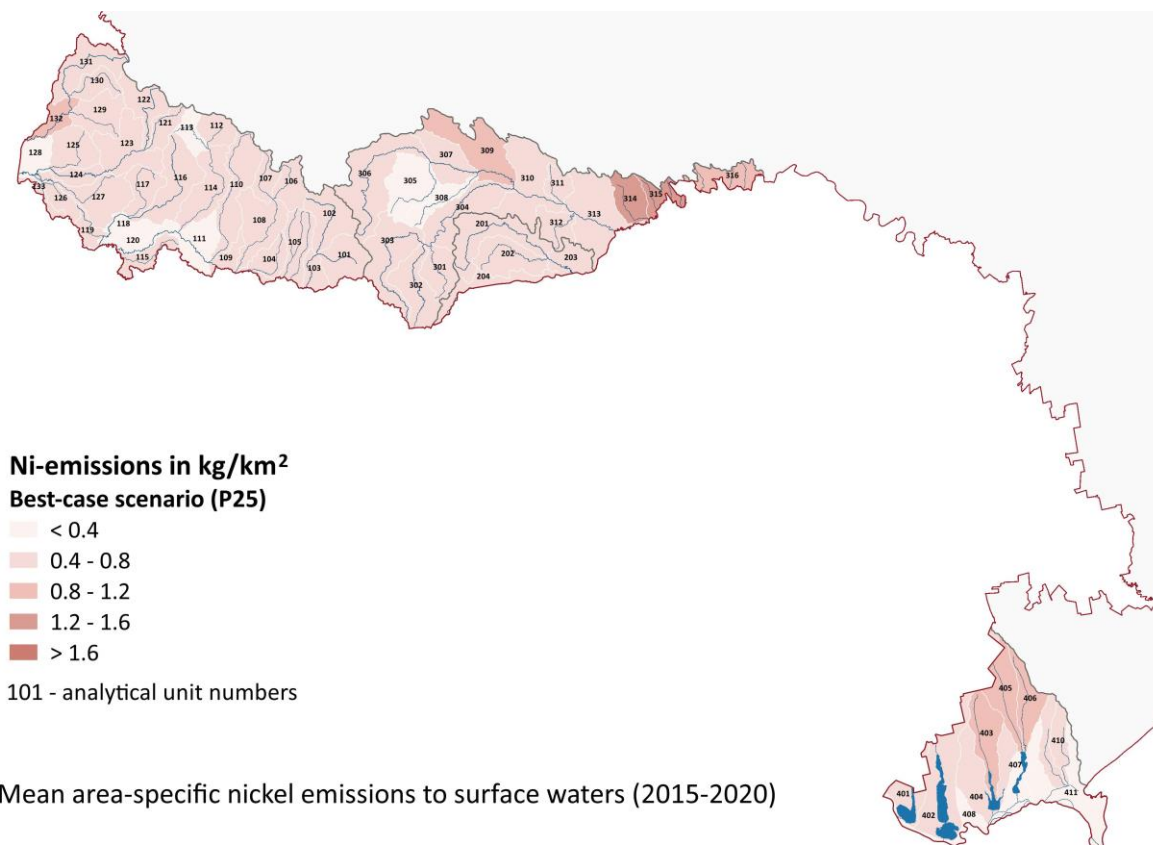
- ☒ ● Monitoring stations
- ☒ — catchment_DR
- ☒ — river_segments_north_BG
- ☒ PFOS_conc
 - ☒ 0 - 0.044
 - ☒ 0.044 - 0.187
 - ☒ 0.187 - 0.347
 - ☒ 0.347 - 0.587
 - ☒ 0.587 - 40.947
- ☐ PFOA_conc
- ☐ Diclofenac_conc
- ☐ Carbamazepine_conc
- ☒ AU_MoRE_BG
- ☒ google satellite



Modelling results – Bulgaria - Carbamazepine



Modelling results – Ukraine - Nickel



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Summary

- Successfully setting up 9 national models on hazardous substances
- Main focus on modelling of heavy metals
- First results from national models from Bulgaria, Serbia & Ukraine
- Around 30 experts participated in the capacity building activities

Recommendations & Outlook

Capacity building

- Learning in person works best!
- Seminars should line up with ongoing work
- Easily accessible help is very important

Identifying data gaps and monitoring needs

- National soil loss data
- Validation points in rivers
- Industrial dischargers in non-EU-Countries
- Data on sewer systems
- Substance specific data

THANK YOU.

-  umweltbundesamt.at
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-  bsky.app/profile/umweltbundesamt-at.bsky.social
-  [linkedin.com/company/umweltbundesamt](https://www.linkedin.com/company/umweltbundesamt)

Emission modelling in the danube
region

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