Interreg Danube Region

Co-funded by the European Union

Tethys

Emission model(s) | Development and main outcomes - National Models

Oliver Gabriel

oliver.gabriel@umweltbundesamt.at

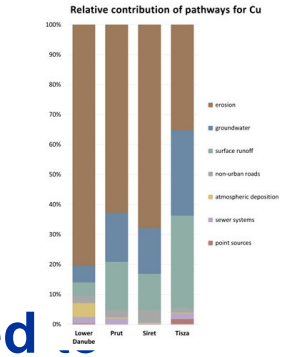
Environment Agency Austria

Tethys Final Conference

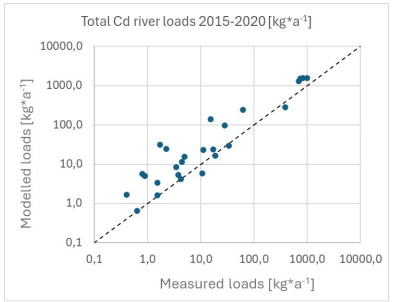
Vienna - BOKU River Lab, 02.06.2026

ENVIRONMENT AGENCY AUSTRIA

Hazardous Substances Modelling in the Danube Basin in a nutshell



- Fragmented knowledge and experience
- In **ICPDR PM EG** the country representatives **expressed a strong need** to further **develop management and modelling approaches to tackle Hazardous Substances (HS)** in surface waters



- National Emission modelling should support/improve:
  - **Knowledge** of **data gaps**
  - **Pressures & Impact assessment of HS** on base of pathway and source analyses
  - **Establishment** of **efficient mitigation measures** (by Scenario Analyses)
  - **Provide a** clear **plan** how to **use Models and Databases** to **further advance the national modelling and management of HS**

National Emission Modeling - Objectives

- **Improve understanding** of emission modeling in 9+1 Danube countries
- **Building capacity and expertise** in emissions modeling: more than 40 national experts involved – (technical experts on modelling, data and GIS)
- **9+1 national emission model instances installed on national servers** (provided in Tethys)
- **Setup of fully functional national emission models** in 9+1 countries
- Highlight **information/data gaps**
- Identify **specific country-relevant needs** in the model setup
- **Support risk assessment** and evaluation of mitigation measures **(scenarios)**
- Develop a **communication strategy** between PP and RBMP responsible authorities (if not the same)

National models - Challenges and Procedure

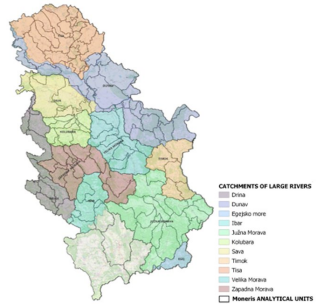
- **Significant heterogeneity among the participating partners and countries:**
  - EU Countries/ Non - EU Countries
  - Modeling experience/ experience with MoRE
  - Data availability
  - Capacities for follow up activities

- **Capacity Building Activities**
  - **Webinar series** - around 20 recorded Seminars on input data & model structure
  - 1,5 day hands-on MoRE workshop in Vienna
  - **Permanent MoRE Helpdesk** by EAA and **technical support** by a software

National models – Input data & Model setup

- Finer **delineation of AUs** in five countries (UA, (BA), HU, SK, AT), five countries use the Danube-wide AU delineation (MN, RO, BG, HR,
- All **basic input data** were **implemented** for all AUs by partners
- All model instances **implemented** the **land use and water balance**
- **Lack of basic input data** on national scale were addressed:
  - **Industrial dischargers**
  - **Septic tanks** and specific information on **sewer systems**
  - **Drained areas** and **soil loss calculations**
- **Lack of substance specific data** – only data on Heavy Metals in different compartments (all partners will report in detail)

  HM: lack of substance specific data of abandoned mines



Actual input data code	Name	Description
Analitical Unit (AU)	Topography	
BI_A		Area of analytical units
Topography	Digital Elevation model	
BI_ELEVA		Mean hights of subcatchments
Landuse	Landuse data set	Landuse categories in actual version
BI_A_AL_slope_0-1	Arable land	5 slope classes: 0-1, 1-2, 2-4, 4-8, >8
BI_A_PST	Pastures	
BI_A_WS_mr	Water surface	Main river (also lakes, reservoirs)
BI_A_WS_trib	Water surface	Tributaries (also lakes, reservoirs)
BI_A_FOR	Naturally covered areas	Woods, scrubland
BI_A_O	Open areas	Mountainous area without vegetati
BI_A_OPM	Surface mining	Mining areas
BI_A_URB	Settlements	Total urban areas
BI_A_IMP	Impervious urban area	Paved areas inside urban areas: set car parks, ...
BI_A_WL	Wetlands	Area of Bog, swamp, floodplains
BI_A_OR	Country roads	Paved road area; not included in se
BI_A_REM	Other remaining areas	Other areas not listed above
Drainages	Melioration cadastre	
TD_SHR_a_SD_agri	Tile drained areas	From arable land and pastures
Meteorological Data	Climatic data	
AQ_EVAPO_cl	Evapotranspiration	Long term mean annual evapotransp
BI_PREC_mpr	Precipitation	Monthly values
Hydrological data	River Discharges	
BI_Q_net	Net runoff	Modelling period; annual data
Erosion	Soil loss	
ER_agri_SL_spec_it_AL	Soil loss	Soil loss from arable land (optional
ER_agri_SL_spec_it_PST	Soil loss	Soil loss from pastures
Sewer system	Statistical Data about inhabitants and waste water system (partly fr	
BI_INH	Number of inhabitants	
US_ss_VOL_SST	Sedimentation tanks	Storage volume of storm water sedi sewer systems
US_cso_VOL_SOT	Storm water overflow	Storage volume of storm water o sewer systems
US_cso_VOL_spec_SOT	Storm water overflow	Storage volume of storm water o sewer systems, area-specific
US_L_CS	Combined sewers	Length of combined sewers
US_L_SS	Storm water sewers	Length of storm water sewers
US_L_WWS	Sewage sewers	length of sewage sewers
US_SHR_inh_con_tot	Connection rate	Percentage of inhabitants that are c
US_SHR_inh_conWWTP_tot	Connection rate	Percentage of inhabitants that are and waste water treatment plants
US_SHR_inh_nss_tot	Connection rate	Percentage of inhabitants that ar systems
US_INHC_H2O	Water consumption	Inhabitant specific water consum pt
US_nss_SHR_inhl_towwtp_sept		Percentage of inhabitant load that tanks to waste water treatment pla

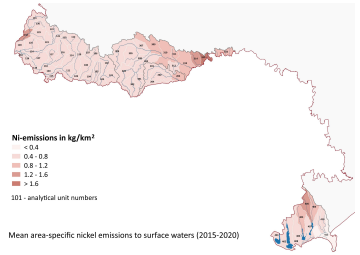
National models – Status and Model setup

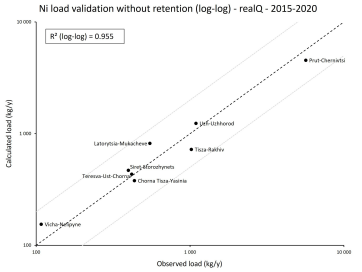
- In model instances status varies: from already **implemented scenarios** (Proof of Concept) to **model runs on single substances**
- In most model instances, **at least Heavy Metals are implemented, partly validated** and running without model errors

Country	UA	RO	BG	ME	BiH	HR	RS	HU	SK	AT
Implementation on "national" server	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Implement results in N-RBMPs	Yes	Yes	Open	Open	Open	Via other existing model	Open	Yes	Open	Yes (continued)
Other Recommen-dations	Extend to other Ukrainian catchments	Further development needed	Mid of June results are presented to all Water Directorates	National modelling recommended-necessary to win over other institutions	Support national modelling – starting point	Use best practise results and approaches from MoRE	Recom-mended; Discussion with responsible institutions	Further Model extensions planned	Further develop ment needed	Discussion on substances of "new" relevance

National models – Final Results

- More than 20 national MoRE model experts with sound theoretical and practical background in 10 Danube - countries
- Operational national model instances on national servers
- First examples and model results of the whole process of emission modelling
- In-depth knowledge of the data types and data preparation required for emissions modelling
- A clear vision for the steps required to maintain sustainable implementation and further development of the national model instances





Oliver Gabriel

oliver.gabriel@umweltbundesamt.at

Telephone +43-664-78055588

ENVIRONMENT AGENCY AUSTRIA

Interreg Danube Region

Co-funded by the European Union

Tethys