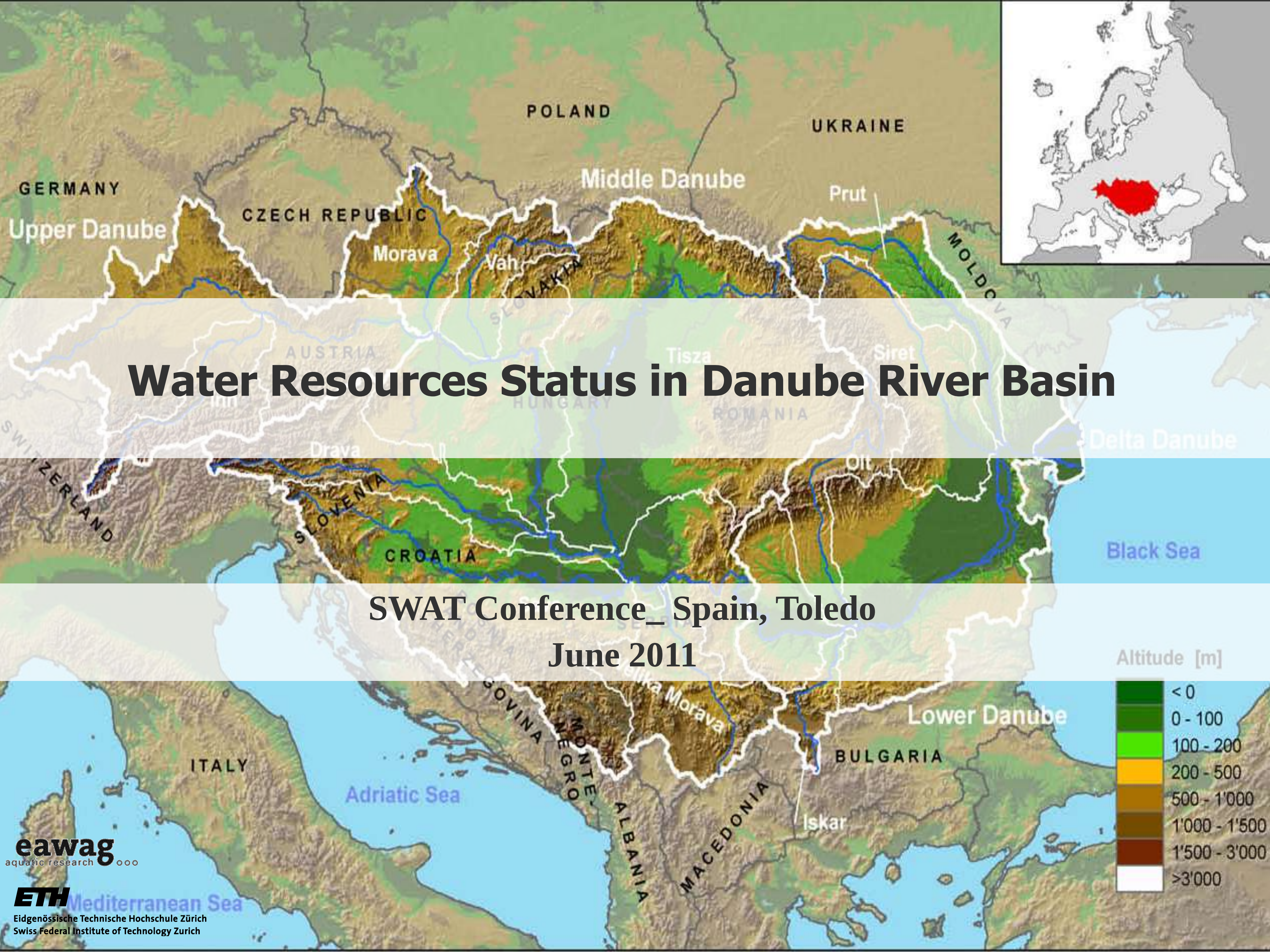
Water Resources Status in Danube River Basin

SWAT Conference_ Spain, Toledo
June 2011



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aquatic research

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

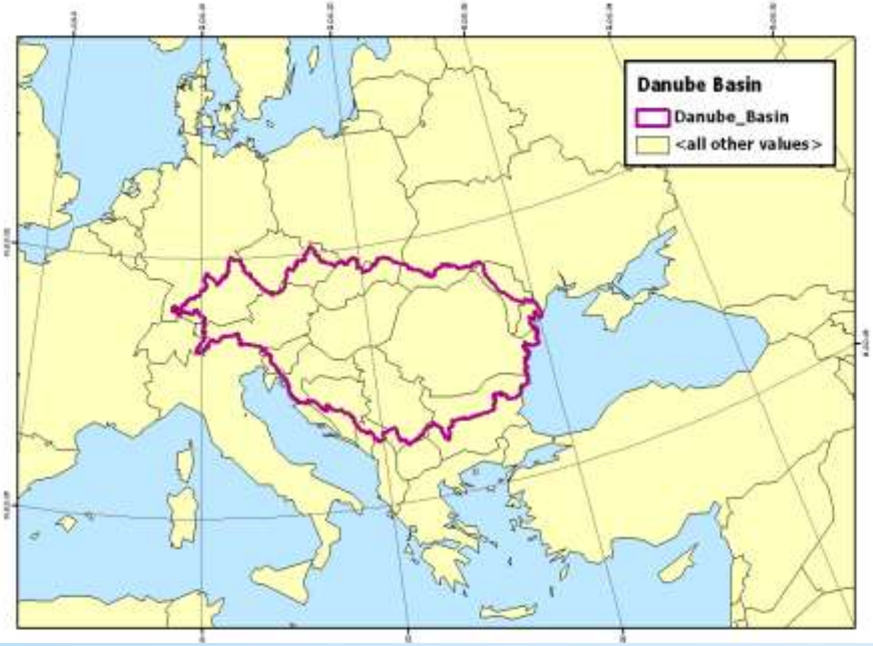
Content:

Objectives

- Introduction
  - EnviroGRIDS
  - BSC
  - Danube
- Methodology
  - Model Inputs
  - Model Set up
- Results
- Conclusion

Objectives

- Building and calibratîng a hydrologic model of Danube Basin Using SWAT and SWAT CUP
- Quantifying the water resources availablity in Danube river Basin
- Modeling the major crops yield



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Content:

Danube as a part of Black sea, EnviroGrids project:

Coordination team : UNIGE and UNEP/GRID
Coordinator: Dr. Anthony Lehmann
Duration : April 2009- March 2013

Consortium: 27 partners, 15 countries

Total budget: 7.9M€

ww.envirogrids.net

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enviroGRIDS main objectives

Content:

1. Management (UNIGE)
2. Spatial Data Infrastructure (UNIGE)
3. Scenarios of change (UAB)
4. ***Hydrological basin models (EAWAG)***
5. Impacts on selected Societal Benefits Areas (IISD)
6. Black Sea Basin Observation System development (UTCN)
7. Dissemination and training (SORESMA)

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Our contribution to EnviroGRIDS project

- **Data collection for SWAT to model water resources in the BSC**
- **Build, calibrate and validate a hydrologic model of BSC**
- **Quantify the impact of land use and climate change on water quantity**

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Danube River basin within Black Sea Catchment

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✓ General information

- Area: 800,000 km2
- coverage: parts of 19 countries
- Poulation_ 83 millions

✓ Climate and Hydrology

- Precipitation Range: 500 to 2000 mm
- Averrage annual precipitation peaks: 3200 to 350 mm
- Altitude: -23 to 3894 m
- Highest average annual temperature: 11 to 12 C
- Highest seasonal change in Temperature: 74 C

✓ Human Impacts and Management

✓ Agricultural Status

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Content:

Materials and Method

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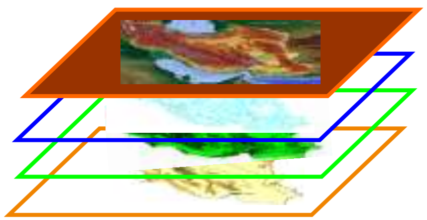
SWAT

Content:

Input

Digital maps



Climate data:
- Daily precipitation
- Daily temperature

Reservoir/dam data:
- Daily inflow-outflow
- Parameters related to reservoi

Crop related data:
- Agricultural practice & Management data

Other inputs:
- Water use data
- Water transfer

SWAT →

Output

- **Hydrological components:**
  - River discharge
  - Actual evapotranspiration
  - Ground water recharge
  - Soil water
- **Crop yield**
- **Other outputs related to:**
  - Water quality
  - Sediment and …

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Model Inputs

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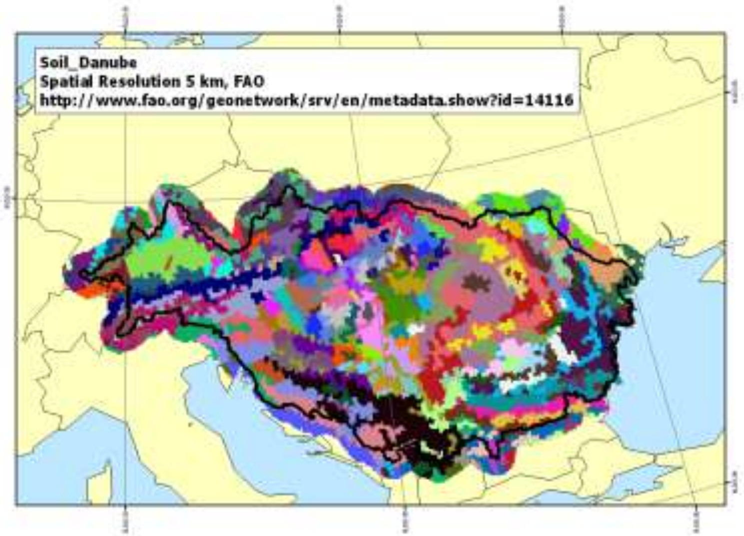

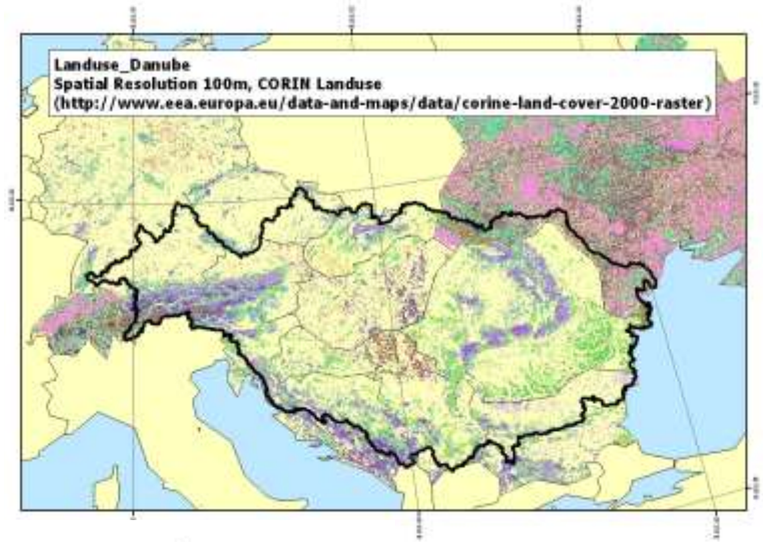

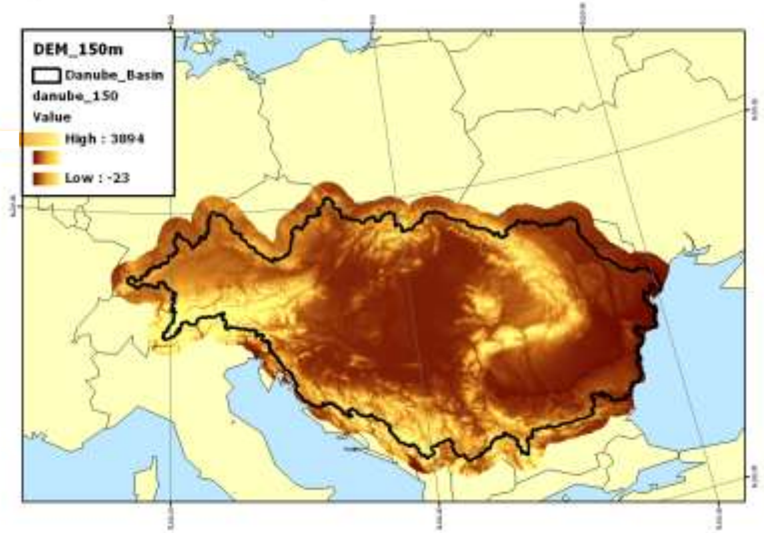

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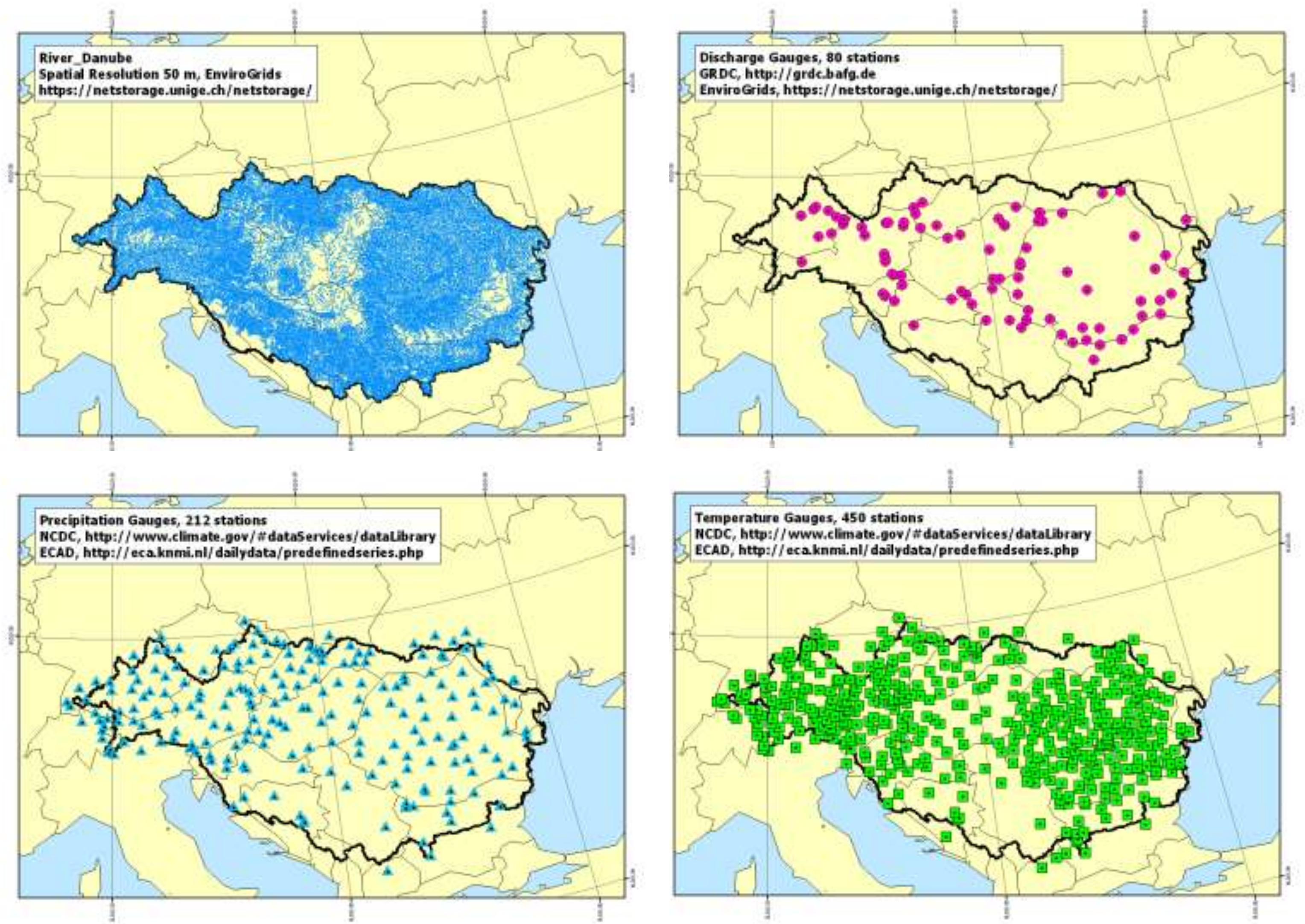
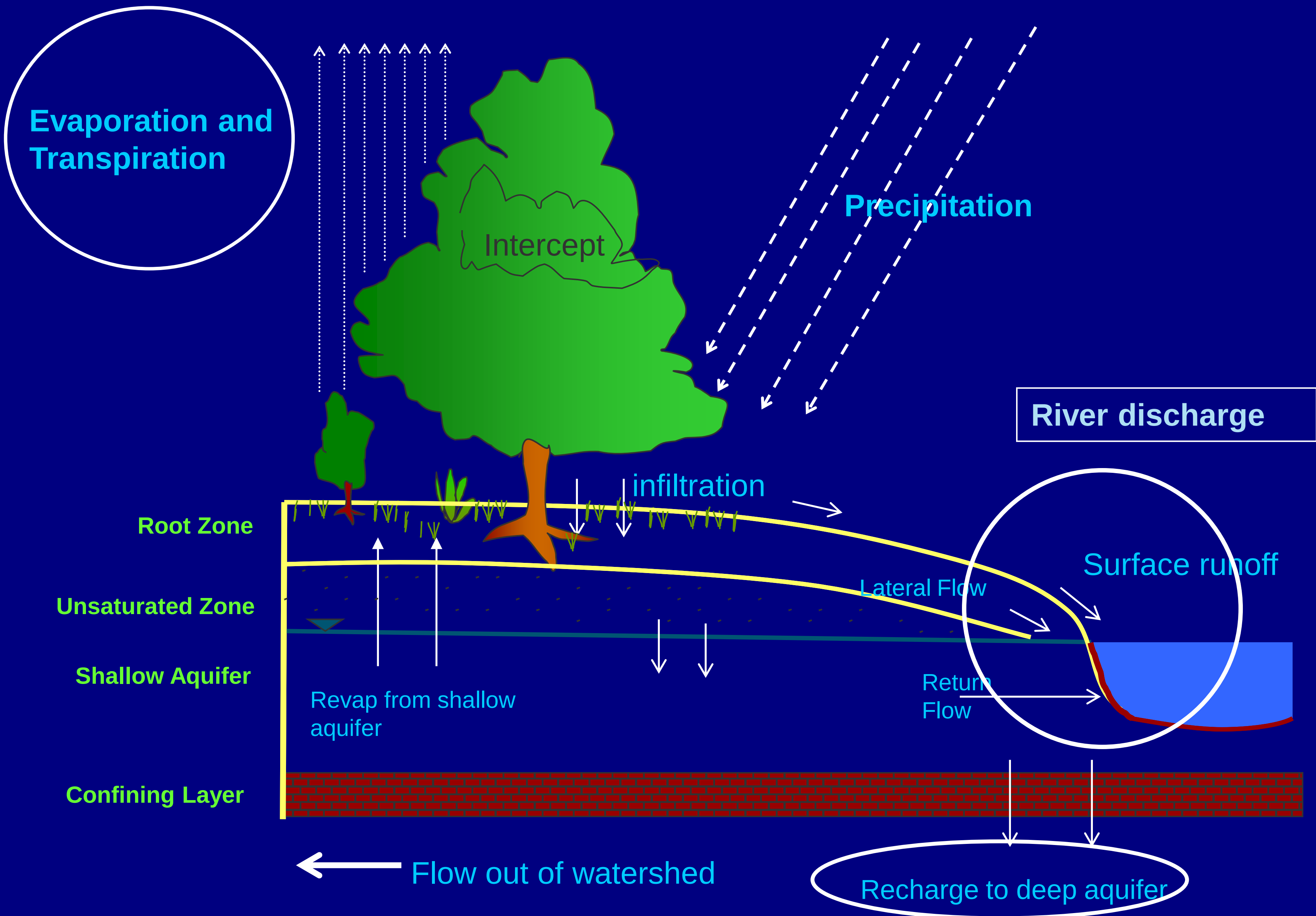
Model Inputs

Content:



Conceptual model of Hydrology in SWAT



Model Inputs
Wheat and Maize Yield

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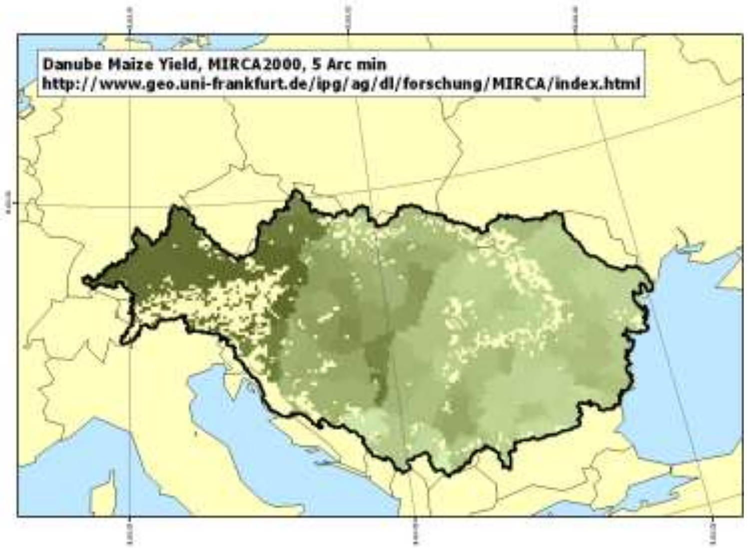

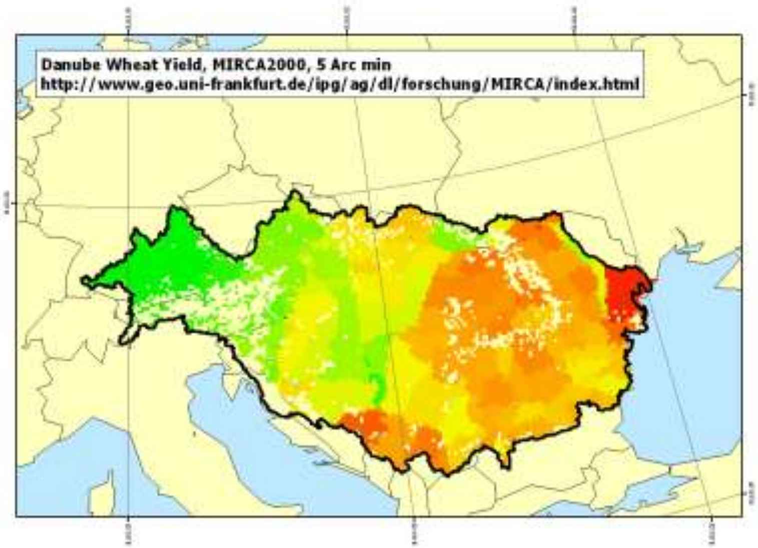

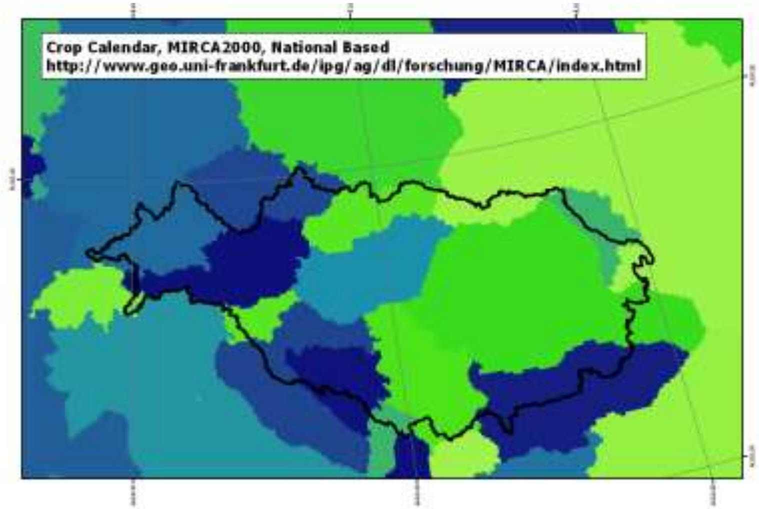

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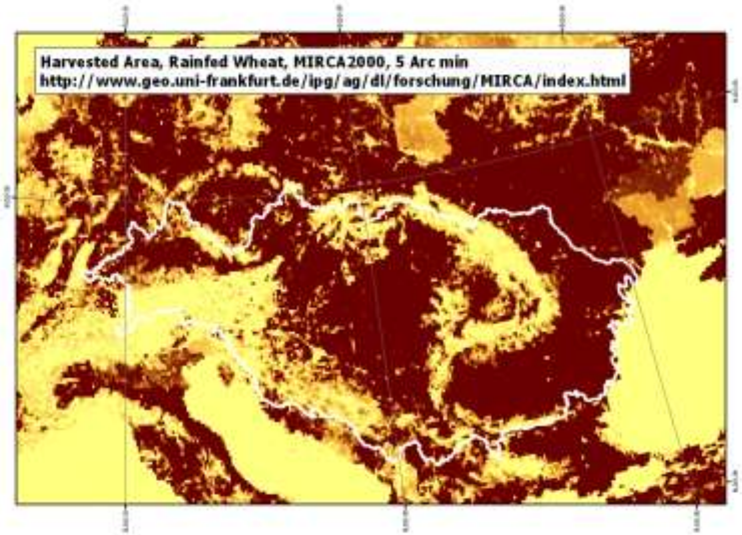
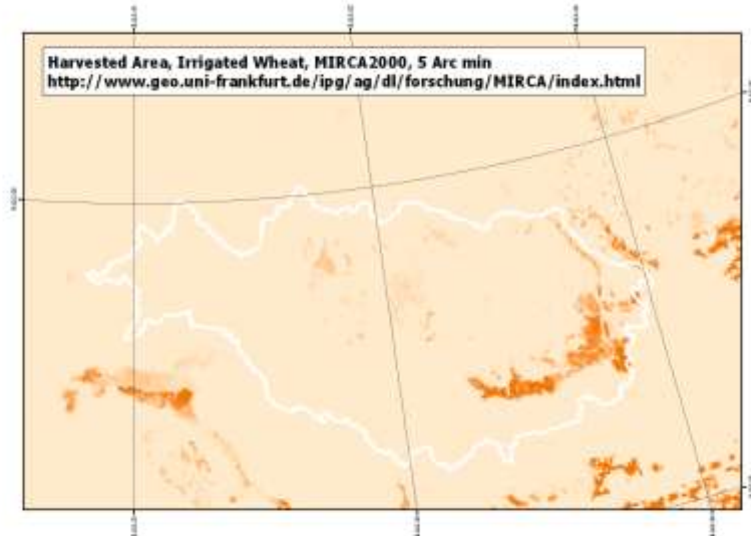
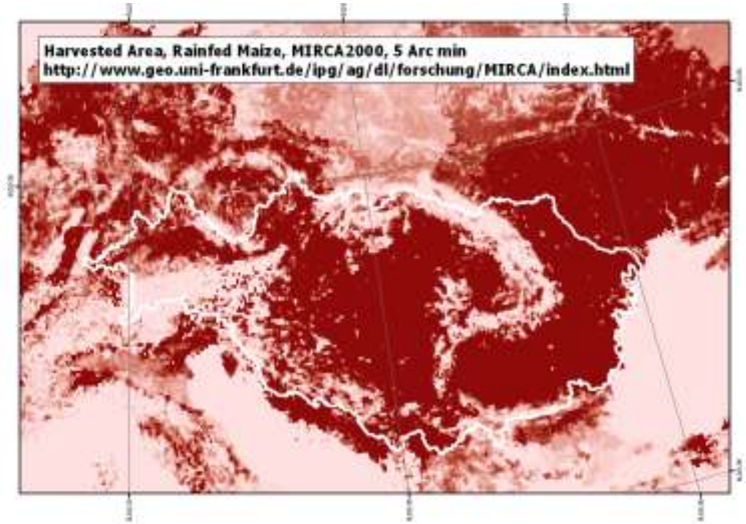
Model Inputs

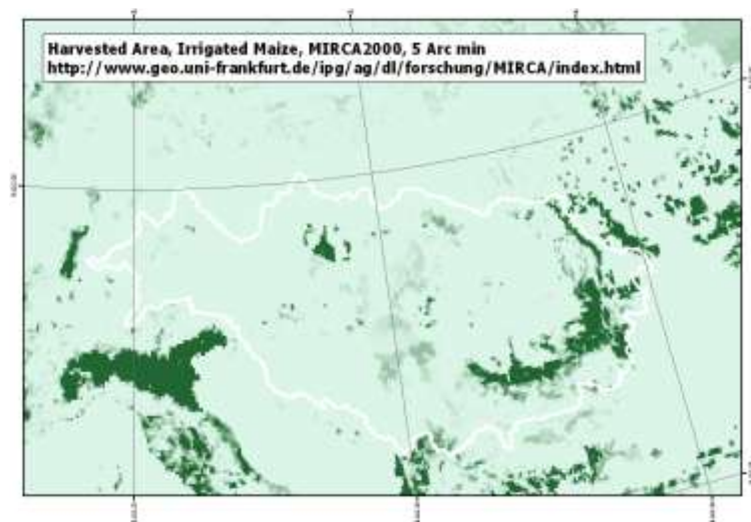
Harvested area

Content:









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Content:

Model Setup

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Model Setup

Content:

- Arc SWAT 2009.93.7 was used to parametraize the whole area
- Based on DEM and stream network the area of 800,000 km2 was devided into 1363 Subbasins (Threshold area was set to 300 km2)
- Multiple Soil, Landuse and Slop combination was chosen (Multiple HRUs, 44,000 HRUs)
- SWAT weather generator was used to fill in gaps in measured data
- ET Calculation based on Hargreavs Method
- Daily Steps Swat Run and Monthly Outputs
- 39 yr simulation period, 3 yr warm up period (1970 to 2009)

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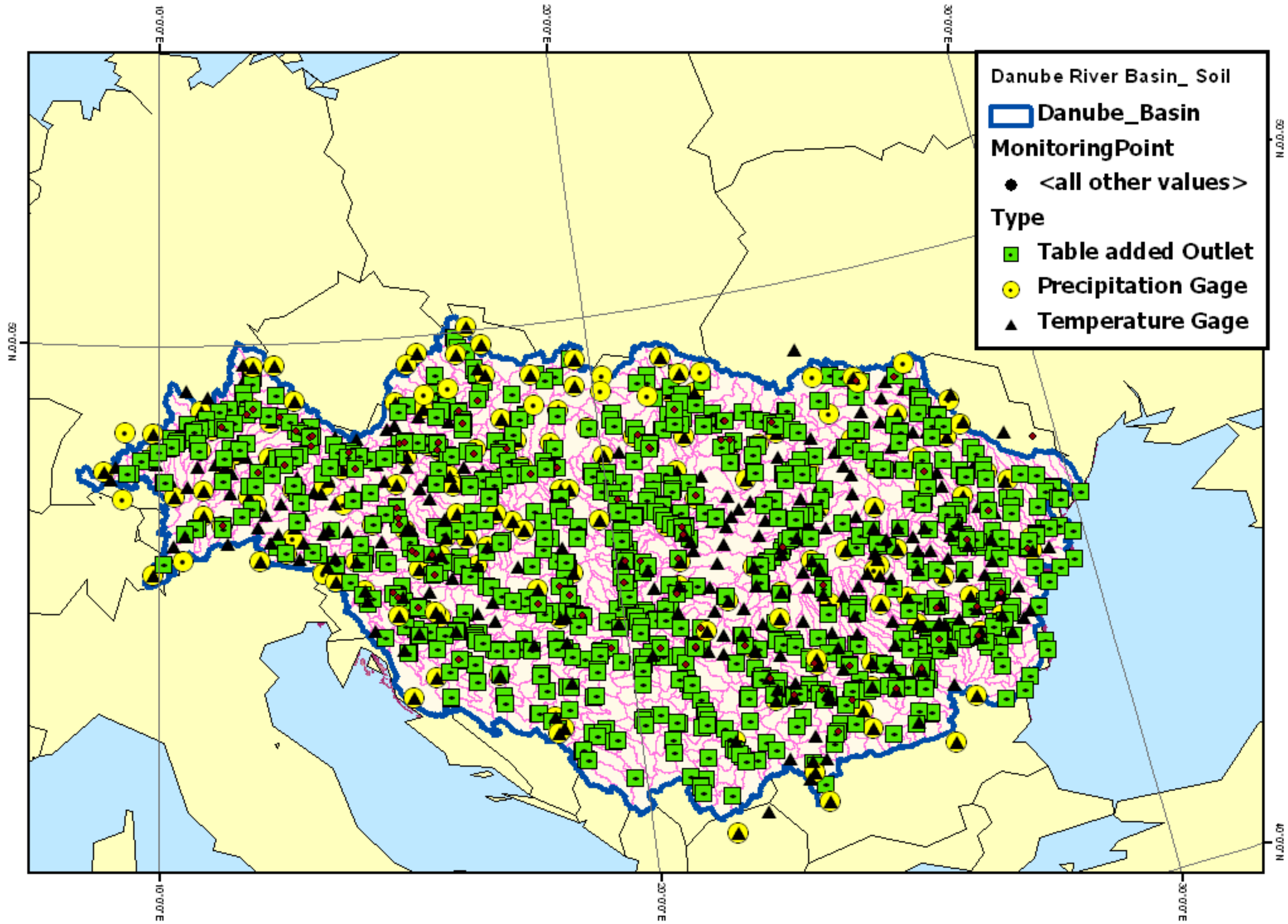

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Content:

Results

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SWAT CUP

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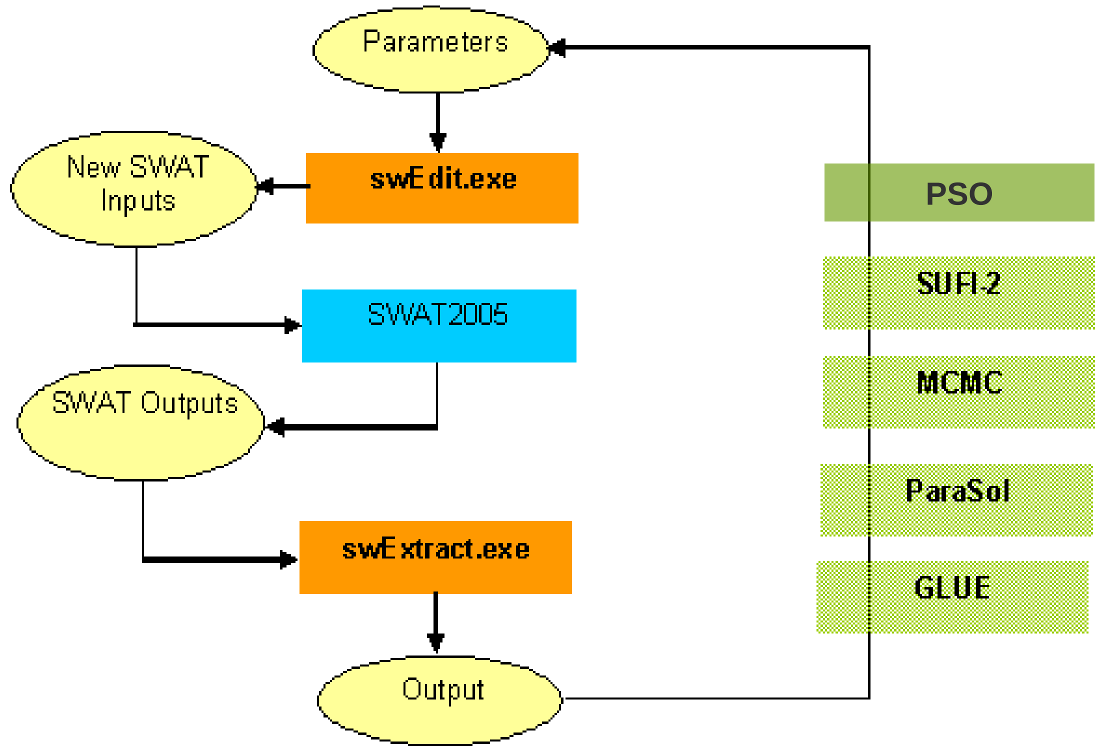
- Welcome
- Organisation
- Research
- Publications
- Teaching
- Software
  - AQUASIM
  - SIMBOX
  - IRRM
  - SWAT-CUP
  - STOICHCALC
  - UNCSIM
  - IDENT

Department System Analysis, Integrated Assessment and Modelling

SWAT-CUP

SWAT-CUP is a computer program for calibration of SWAT models. SWAT-CUP is a public domain program, and as such may be used and copied freely. The program links GLUE, ParaSol, SUFI2, and MCMC procedures to SWAT. It enables sensitivity analysis, calibration and uncertainty analysis of a SWAT model. The overall program structure is as shown in the Figure below.



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Results_examples

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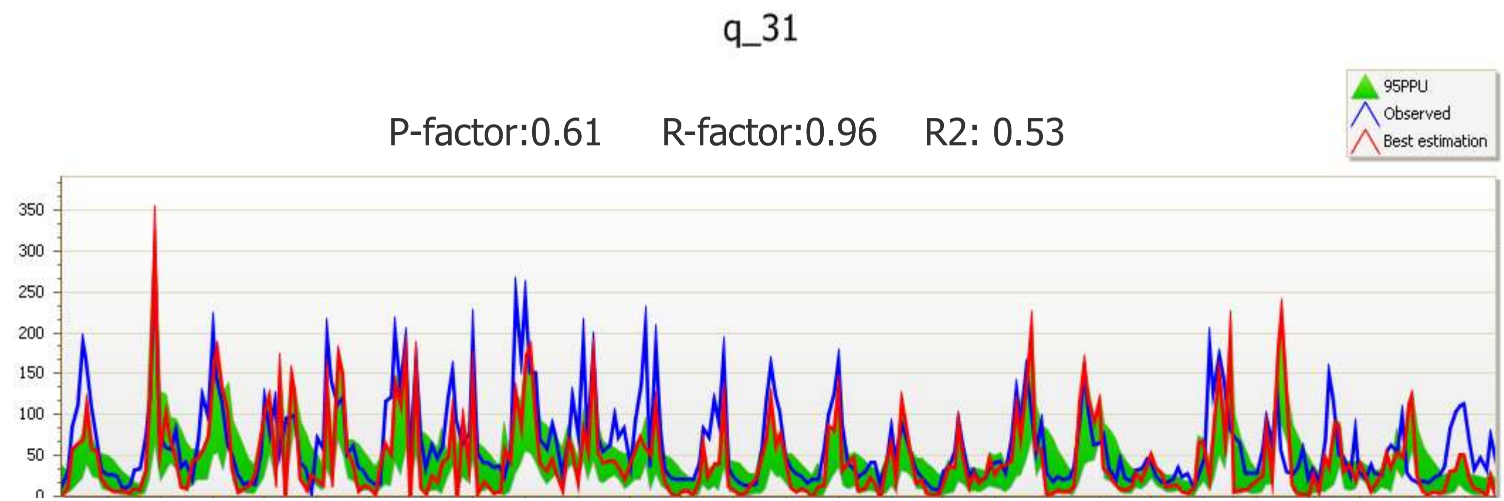
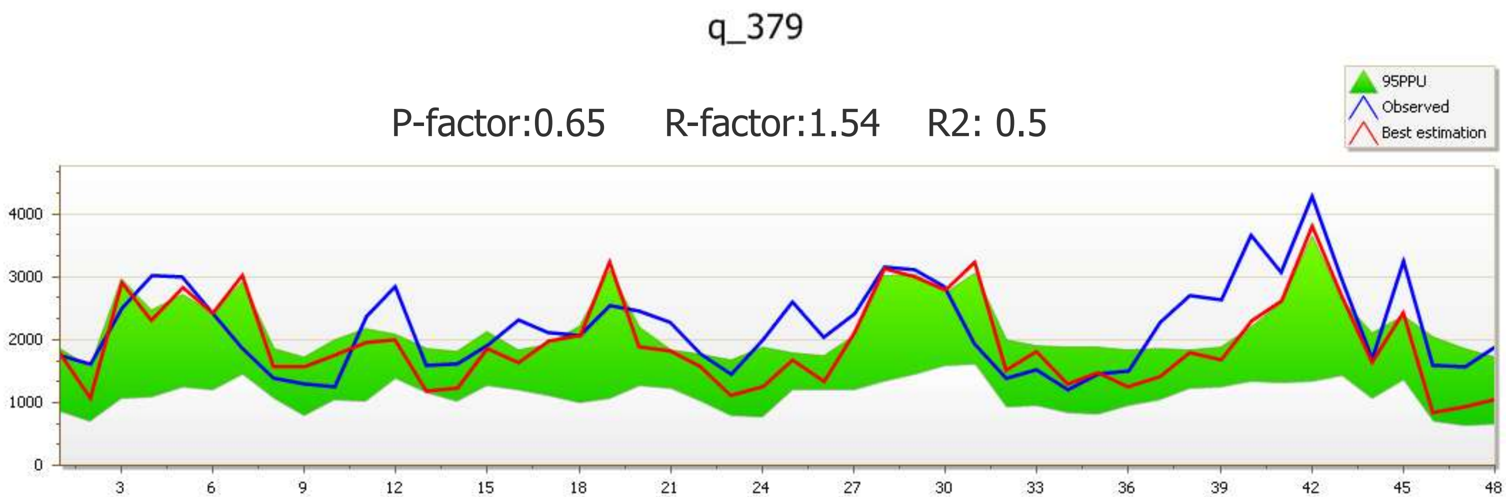


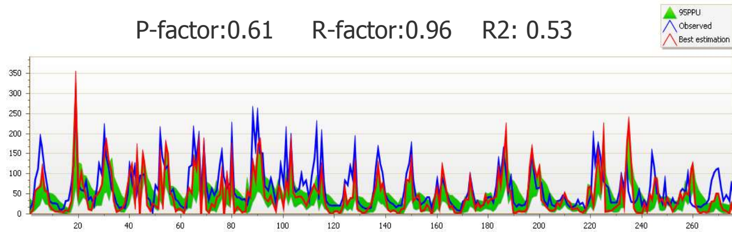


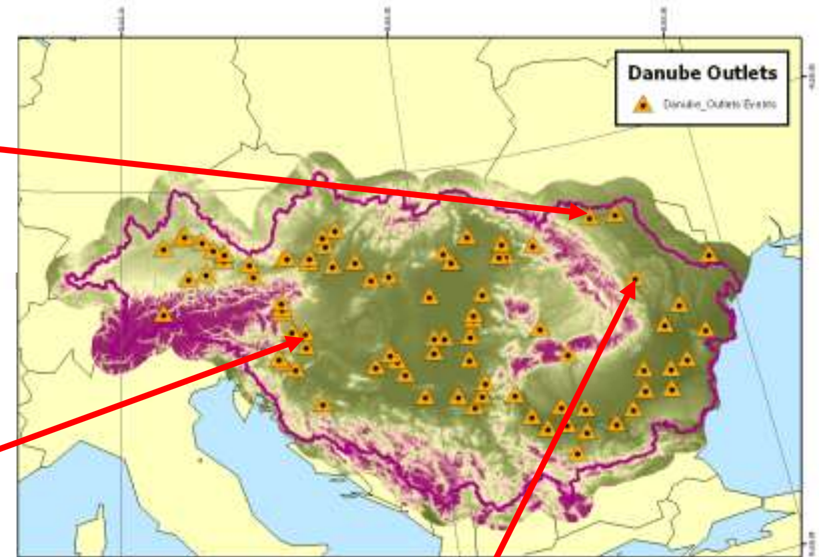
Results

Content:

q_31

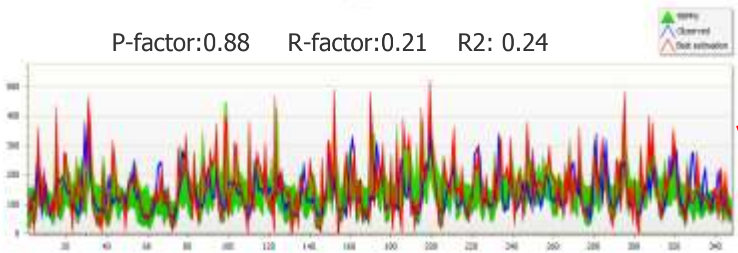
P-factor:0.61 R-factor:0.96 R2: 0.53





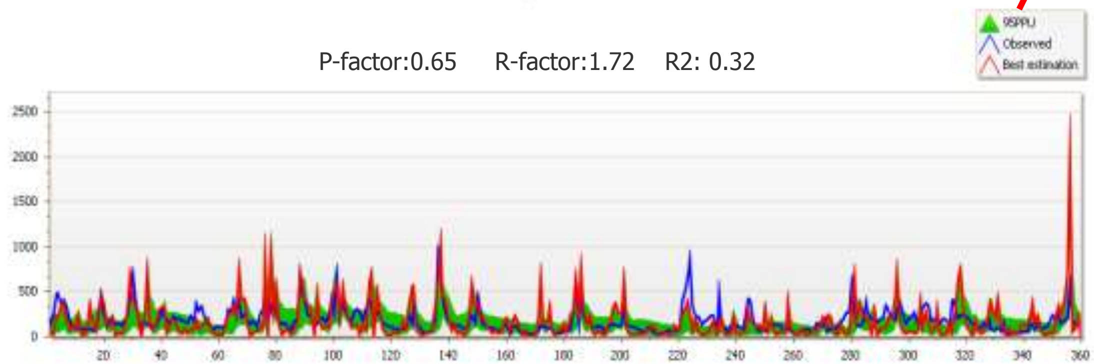
q_719

P-factor:0.88 R-factor:0.21 R2: 0.24



q_660

P-factor:0.65 R-factor:1.72 R2: 0.32



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Results

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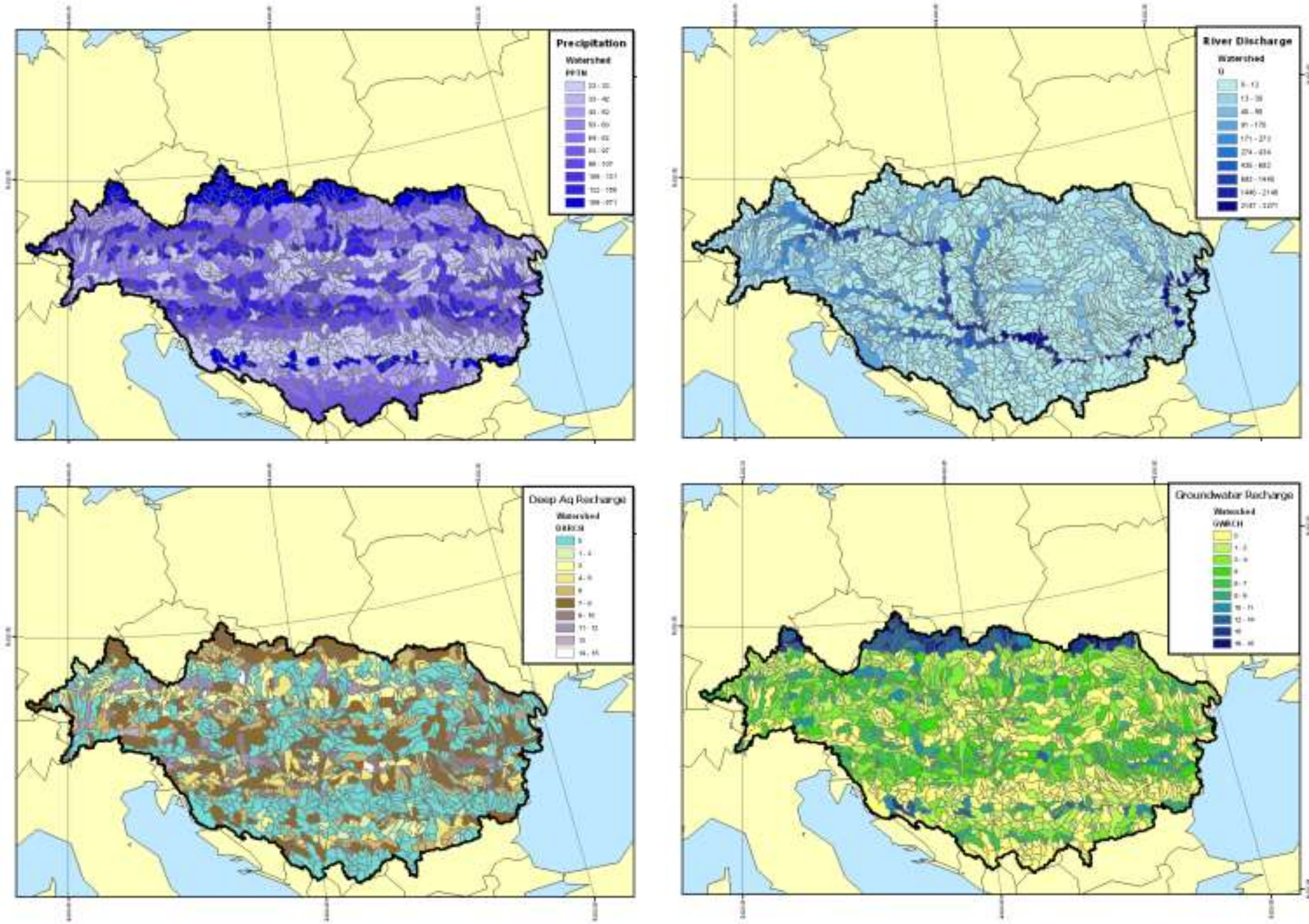

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Results

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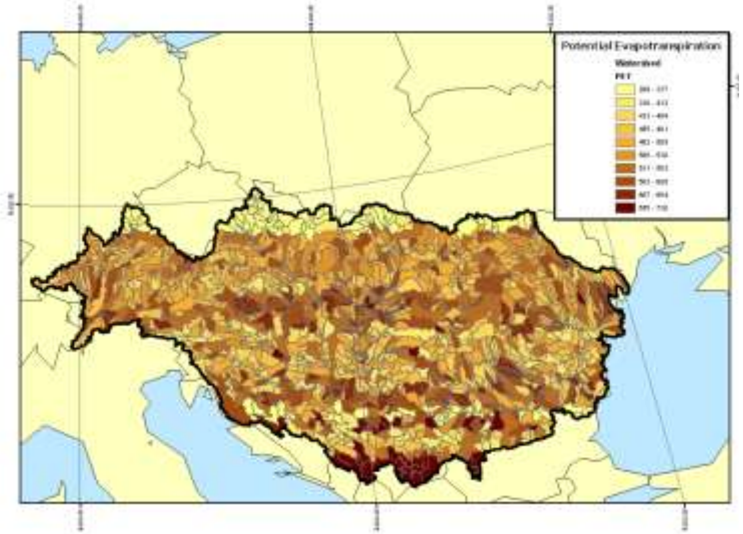

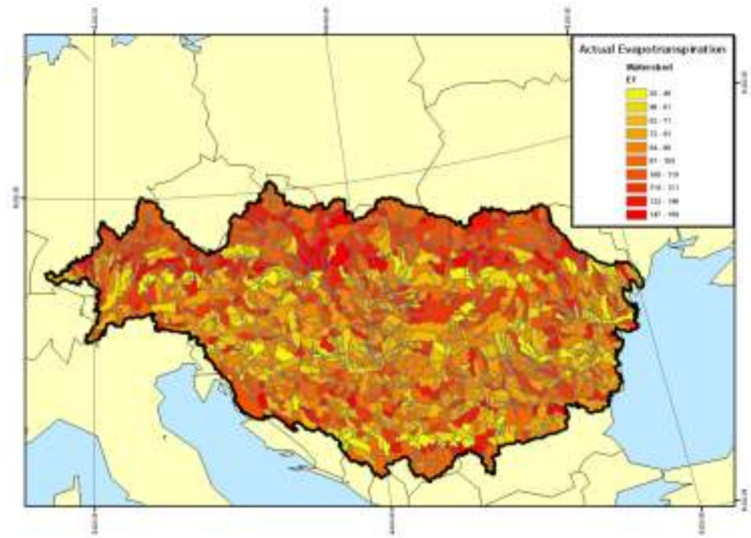

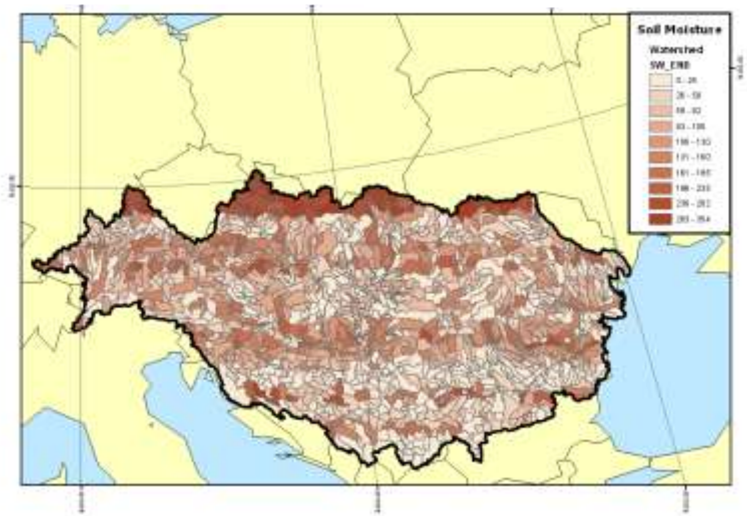

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Content:

Conclusion

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Content:

- Knowledge of the internal renewable water resouses is strategic information which is needed for long term planning and food security.

- The resulting tools and data will allow for the analysis of river basin pressures and their impacts on human and ecosystem well-being by local stakeholders and decision makers.

- Assessing the impact of climate change and landuse change will also help to provide early warning to vulnerable populations and identify the efforts needed to adapt and to limit negative social, economical and environmental impacts in the future.

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Thanks for your attention

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