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Changes and Hazards caused by Direct Human Interventions and Climate Change
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Effects of global change in the Czech Part of the River Elbe Basin

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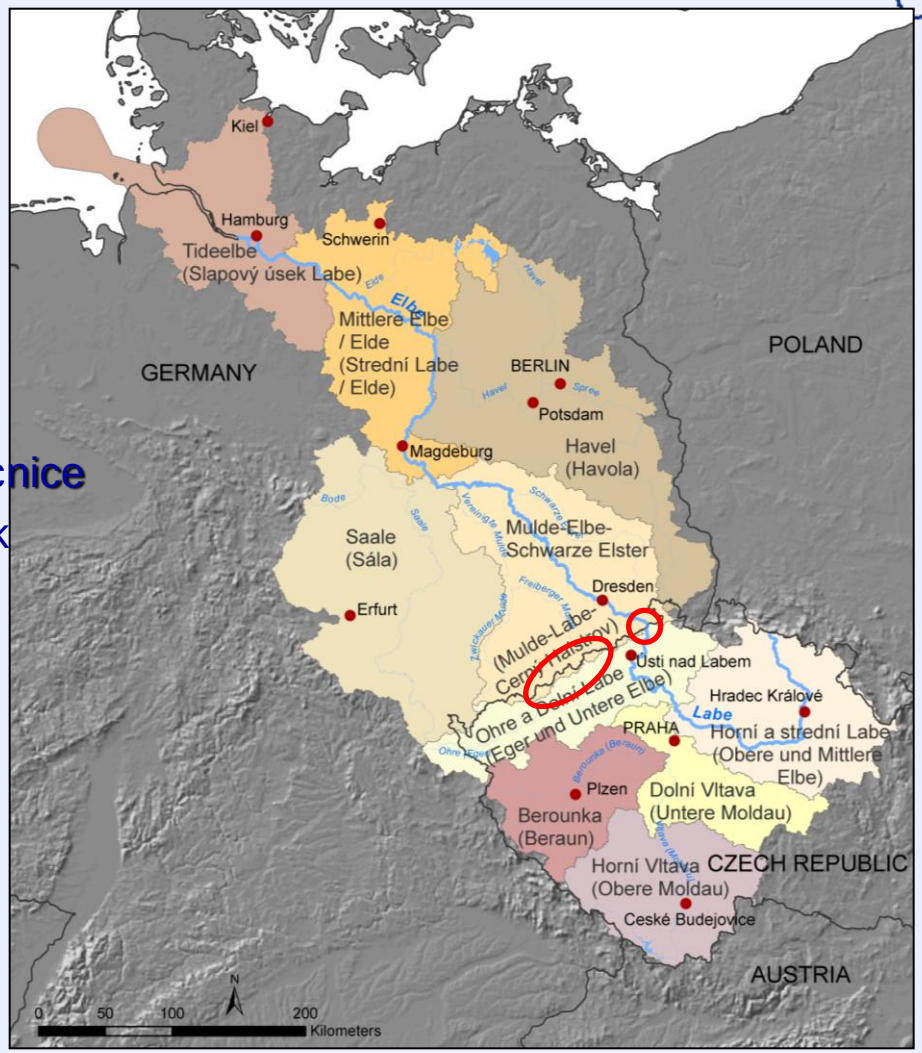
2. Project GLOWA-Elbe

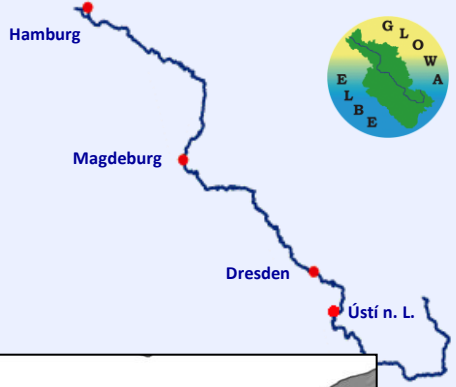
- GLOWA-ELBE: investigation of changes in the water availability in the whole Elbe River Basin under global change scenarios

- Czech Republic covers one third of the Elbe River Basin roughly

- Inflow to Germany at different locations:
  - Main stream of river Labe
    => Decin / Labe
  - Sub-basin of the river Mulde
    => downstream reservoir Prisecnice / Prisecnice
    => downstream reservoir Flaje / Flajsk potok

- Effects of climate change and reservoir management in the Czech Republic will in all probability have an influence on inflow to Germany





2. Project GLOWA-Elbe

Two frames of development analysed:

i) "**Globalisation**": fast global integration, higher economic growth rates and regional convergence

ii) "**Differentiation**": slow global integration, lower economic growth rates and regional differentiation

Both frames of development are combined with two environmental policies:

a) continuation of the present policy

b) higher standards for environmental regulation, e.g. higher reduction targets for CO2

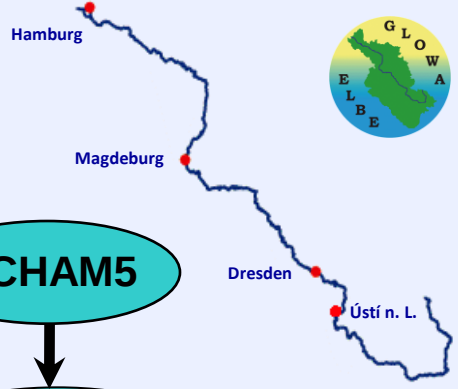
➔ 2 scenarios:

ia) "Globalisation without stronger environmental protection" (Globalisation w/o env. reg.),

iib) "Differentiation with stronger environmental protection" (Differentiation w env. reg.).

A climate warming of approximately 2°C (GCM: ECHAM5) by 2050 is assumed.

2. Project GLOWA-Elbe



Stochastic Simulation of Meteorological and Hydrological Processes

Simulation P, PET

Deterministic R-R-Model (100 realisations, SWIM)

Q(t)

ECHAM5

Stochastic generated climate series (100 realisations, STAR)

WBalMo

Deterministic Simulation of Water Use

Management Rules, Ranking Rules

Balancing of water yield and water demand within socio-economic context

Recording and Statistical Analysis of Systems States (Events)

e.g. certainty of water supply or minimum flow

3. Input Data and Information

Data and information delivered by Czech River Basin Authorities:

- reservoirs to be included in the model (name, location, controllable storage, active storage, water surface area, etc.) => reservoirs with capacity equal or larger than 1 mill. m^3
- water users, i.e. withdrawals and discharges (name, location, reference number of permit, monthly or yearly values for the last years, etc.) => quantity equal or larger than 0.01 m^3/s
- management of water resources facilities - e.g. water transfers between river reaches or reservoirs (name, location of intake and of orifice, capacity, etc.)

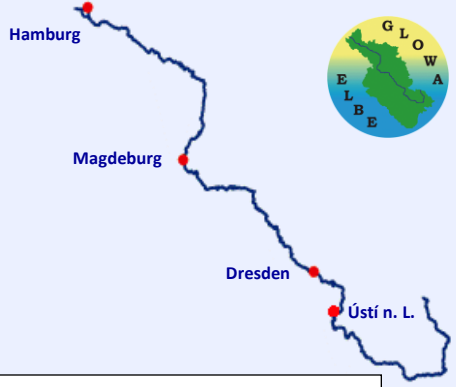
4. Development of Modules

Structure of the Modules

… is according to the river basin districts (Povodis) in the Czech Republic

- Upper Vltava,
- Lower Vltava,
- Berounka,
- Upper and Middle Labe,
- Ohre and Lower Labe.

4. Development of Modules



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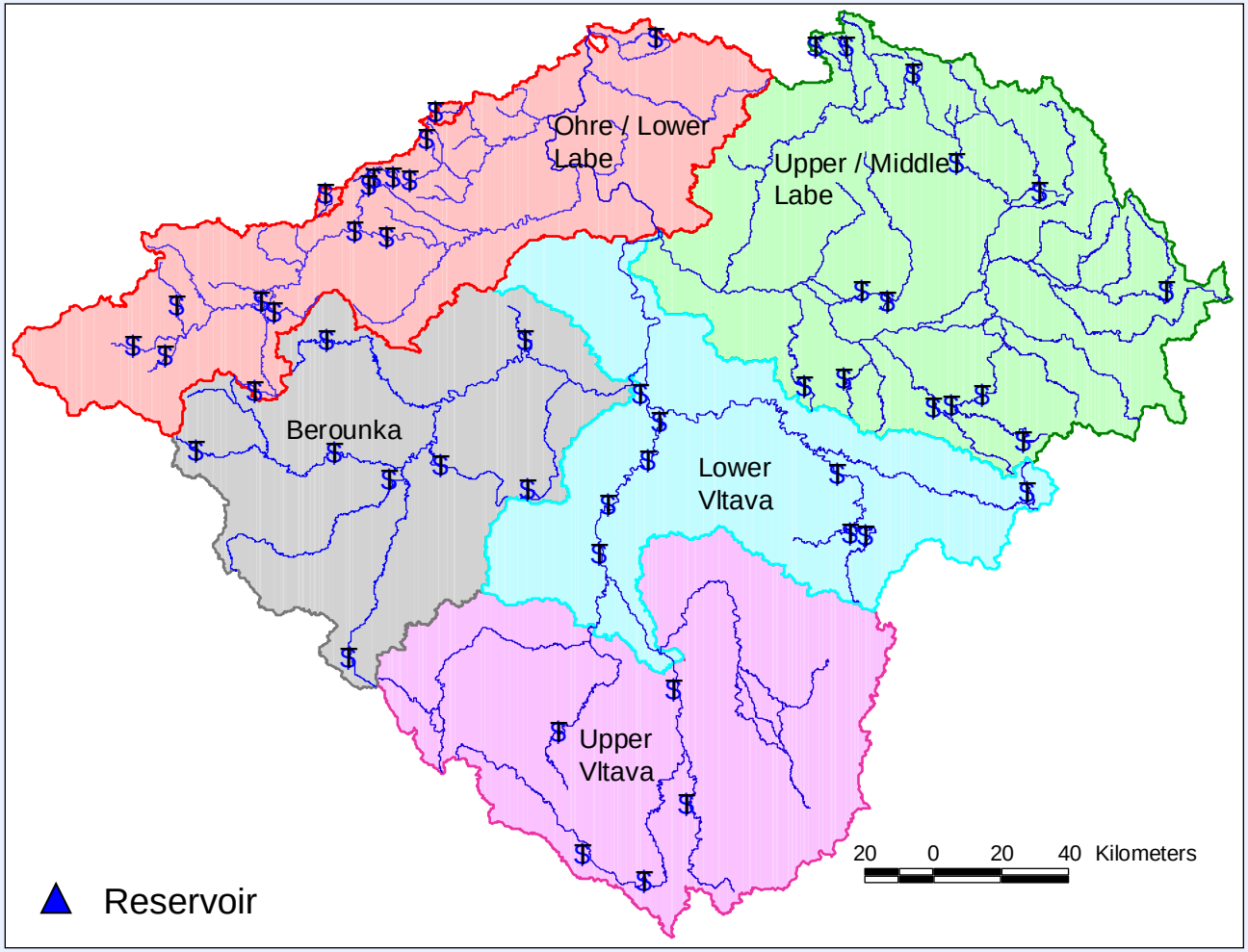

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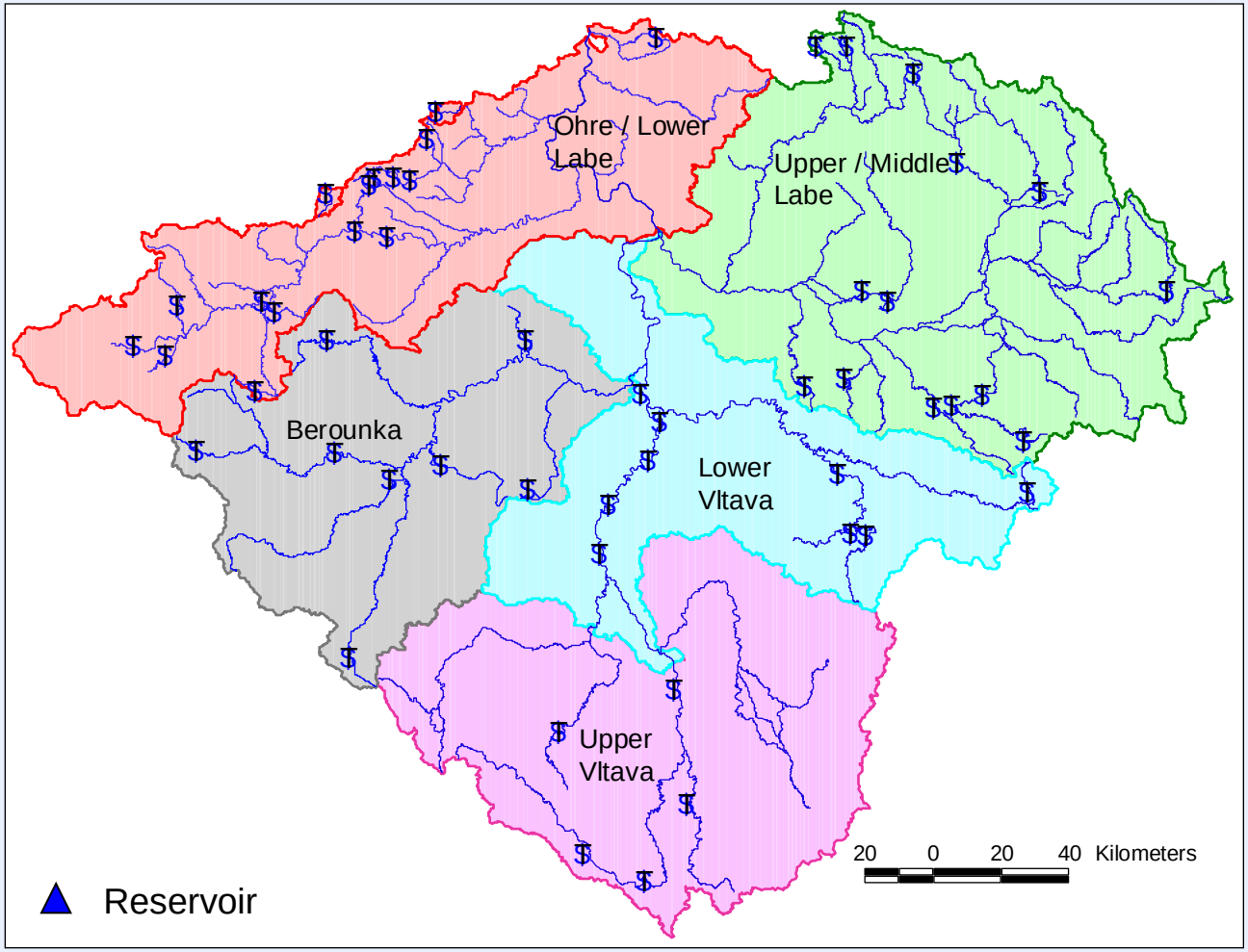

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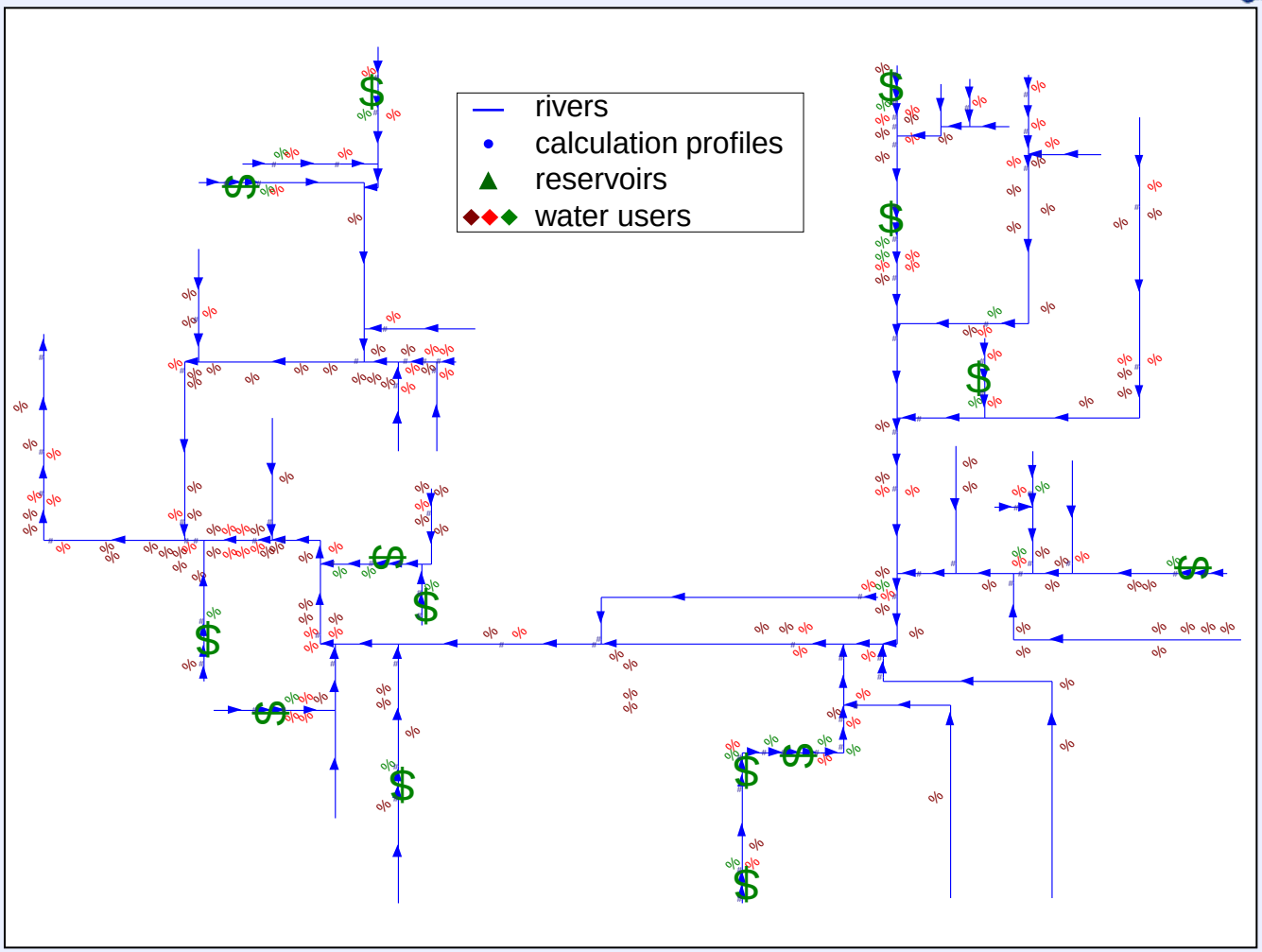
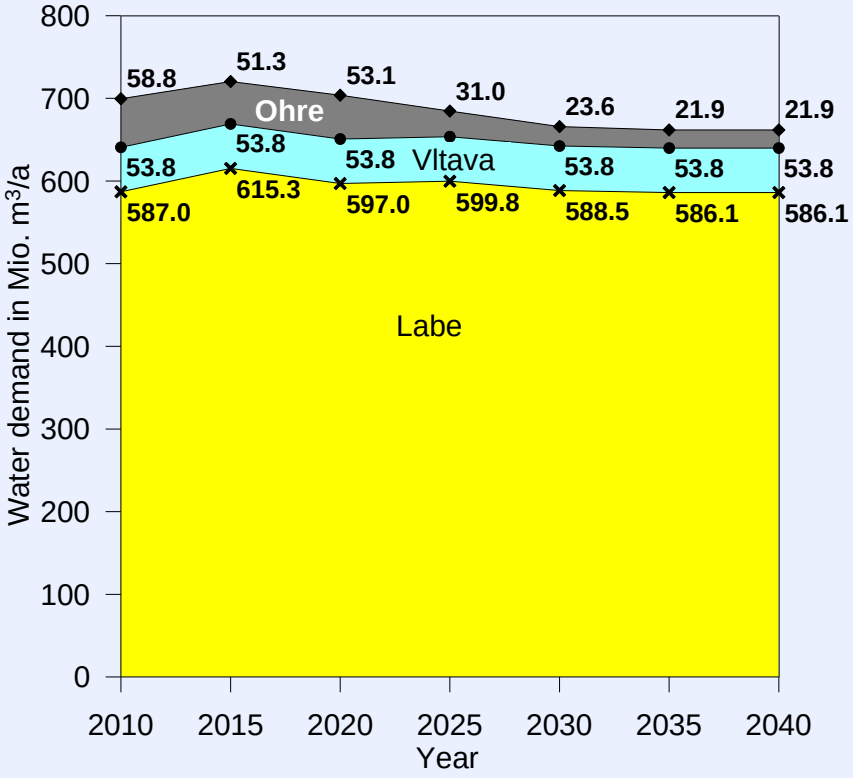
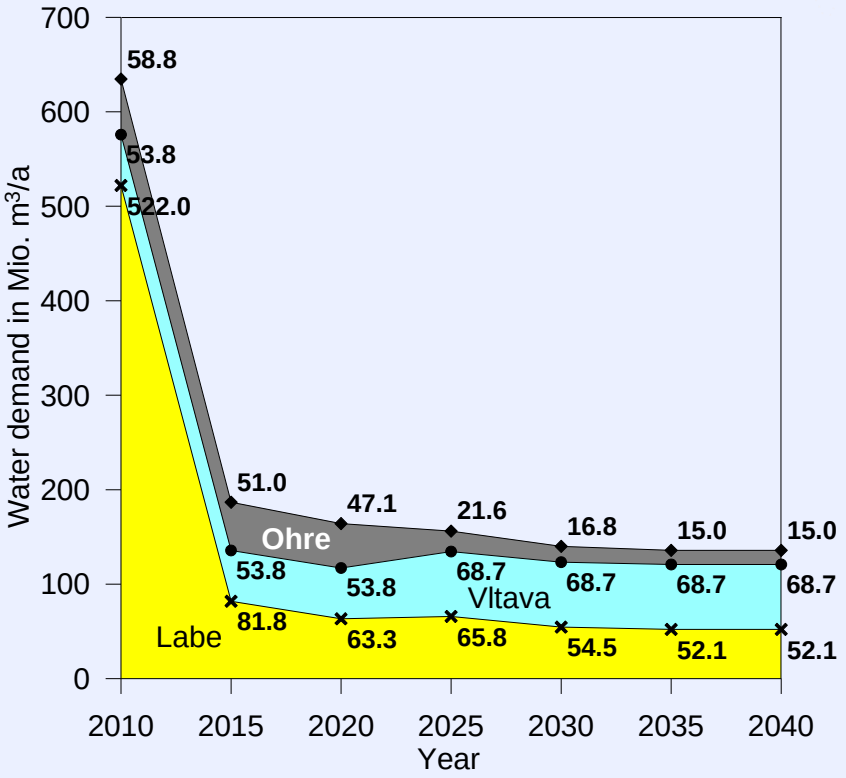


5. Results (socio-economic development) – Water demand and losses (withdrawal – return flow) of thermal power plants



Globalisation w/o env. reg.



Differentiation w env. reg.

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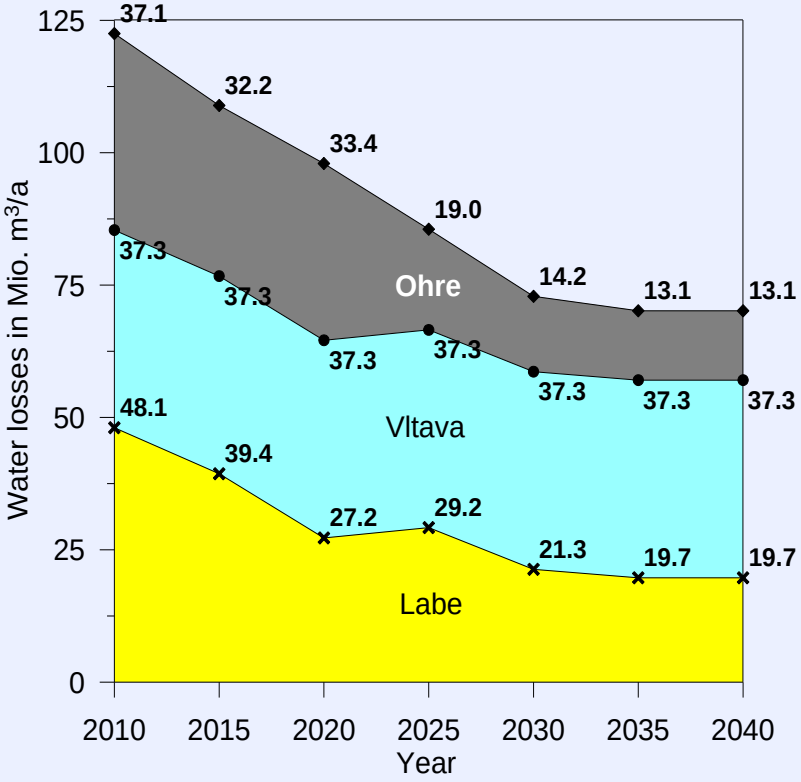

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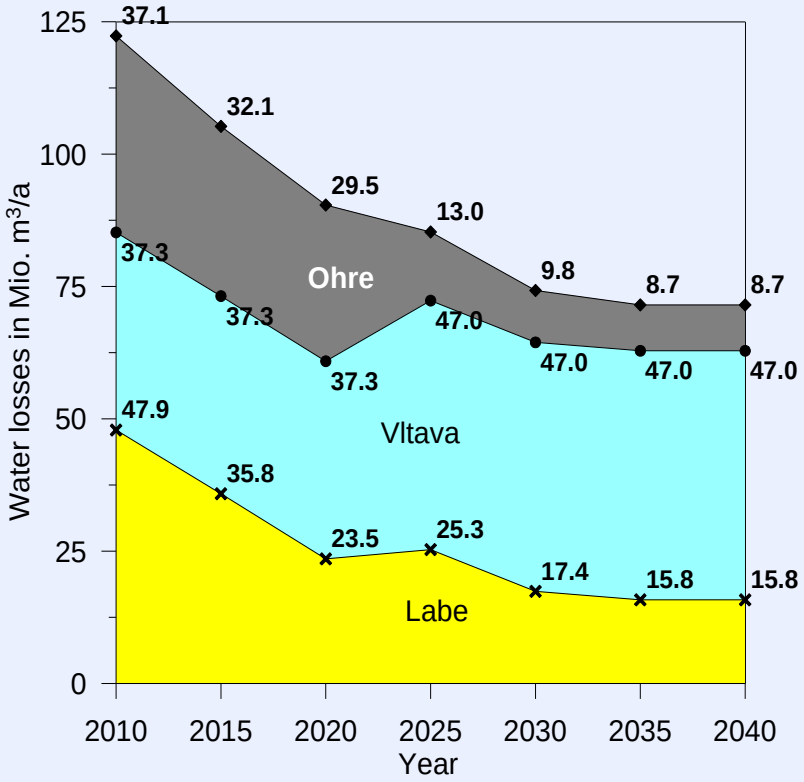
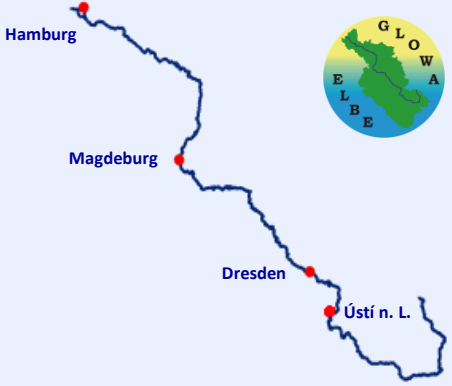
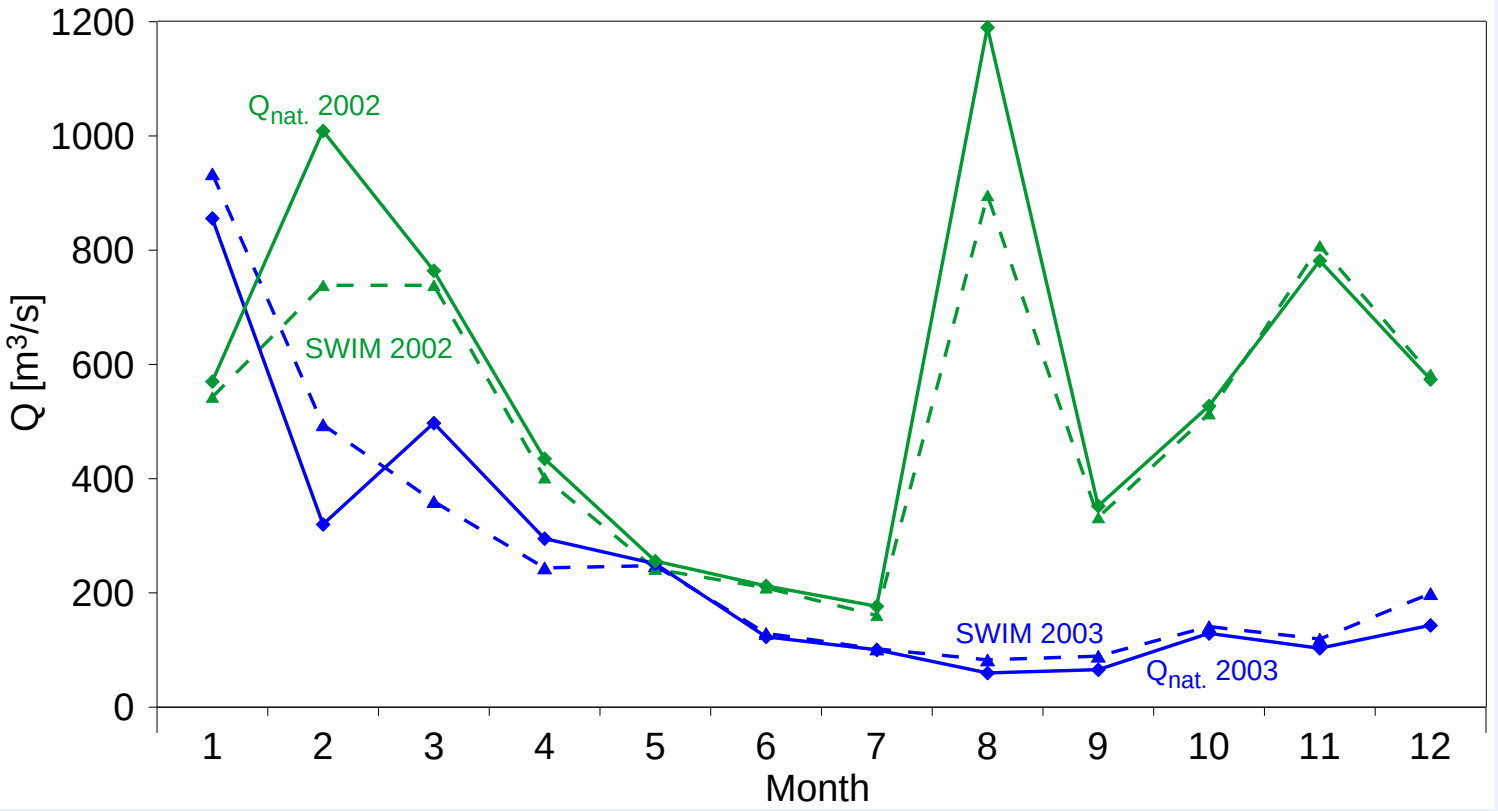


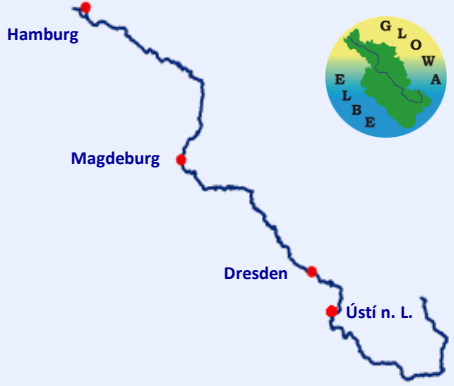
Differentiation w env. reg.

5. Results – Natural discharges: calibration of SWIM (72 gauges in the Czech Republic, years 2002 & 2003): Decin / Labe

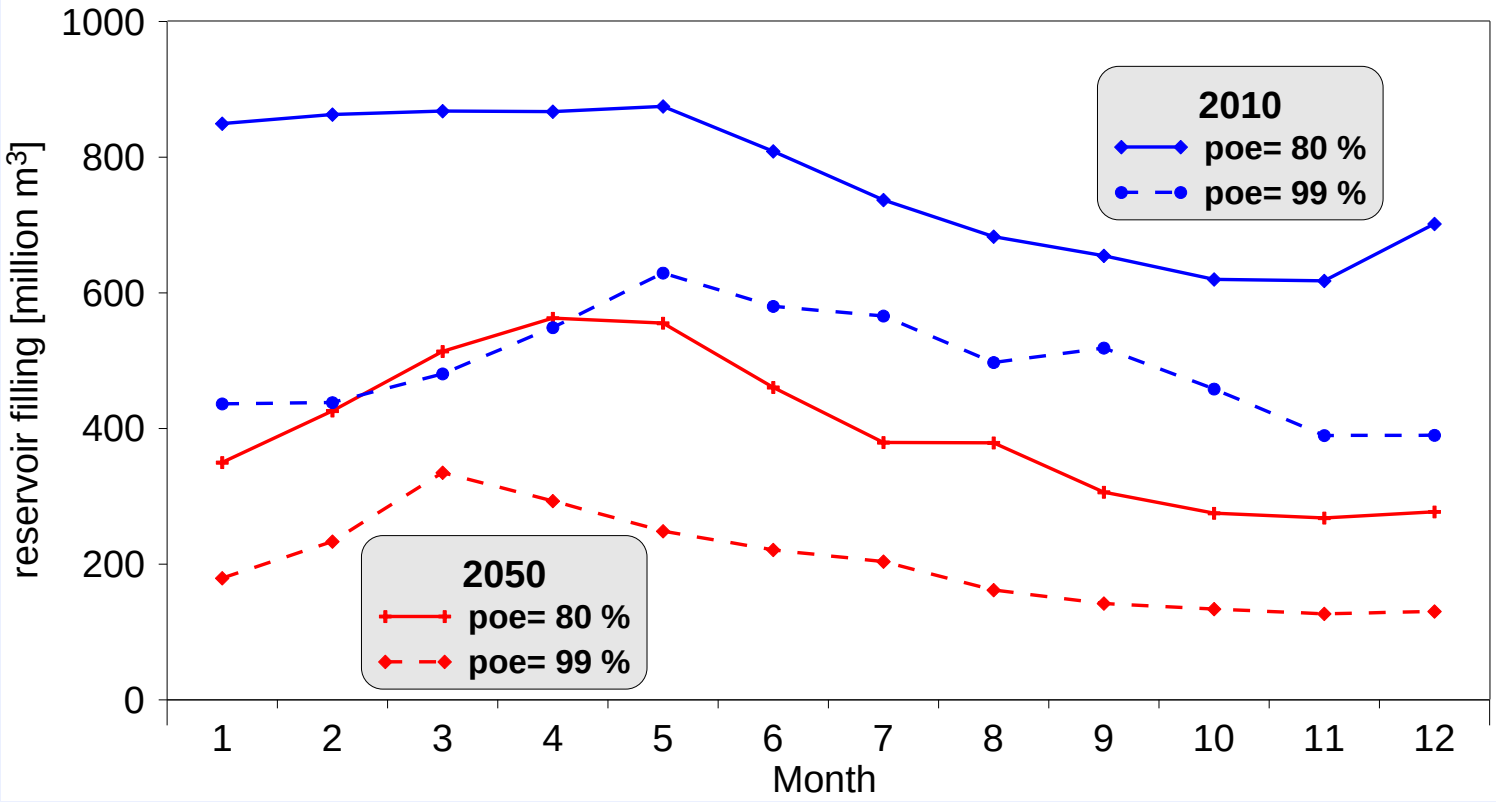




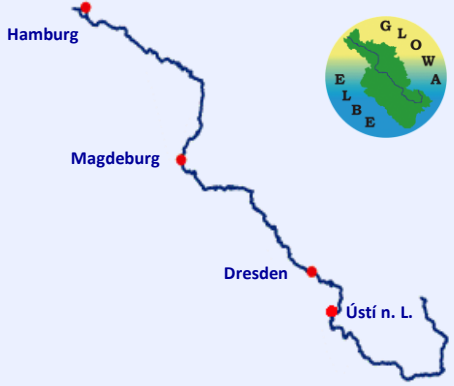
5. Results – Filling of Vltava-Cascade (Differentiation w env. reg.)



poe= probability of exceedance;
80%= moderate dry conditions, 99%= extreme dry conditions



5. Results - Streamflow Prague, gauge Mala Chuchle / Vltava



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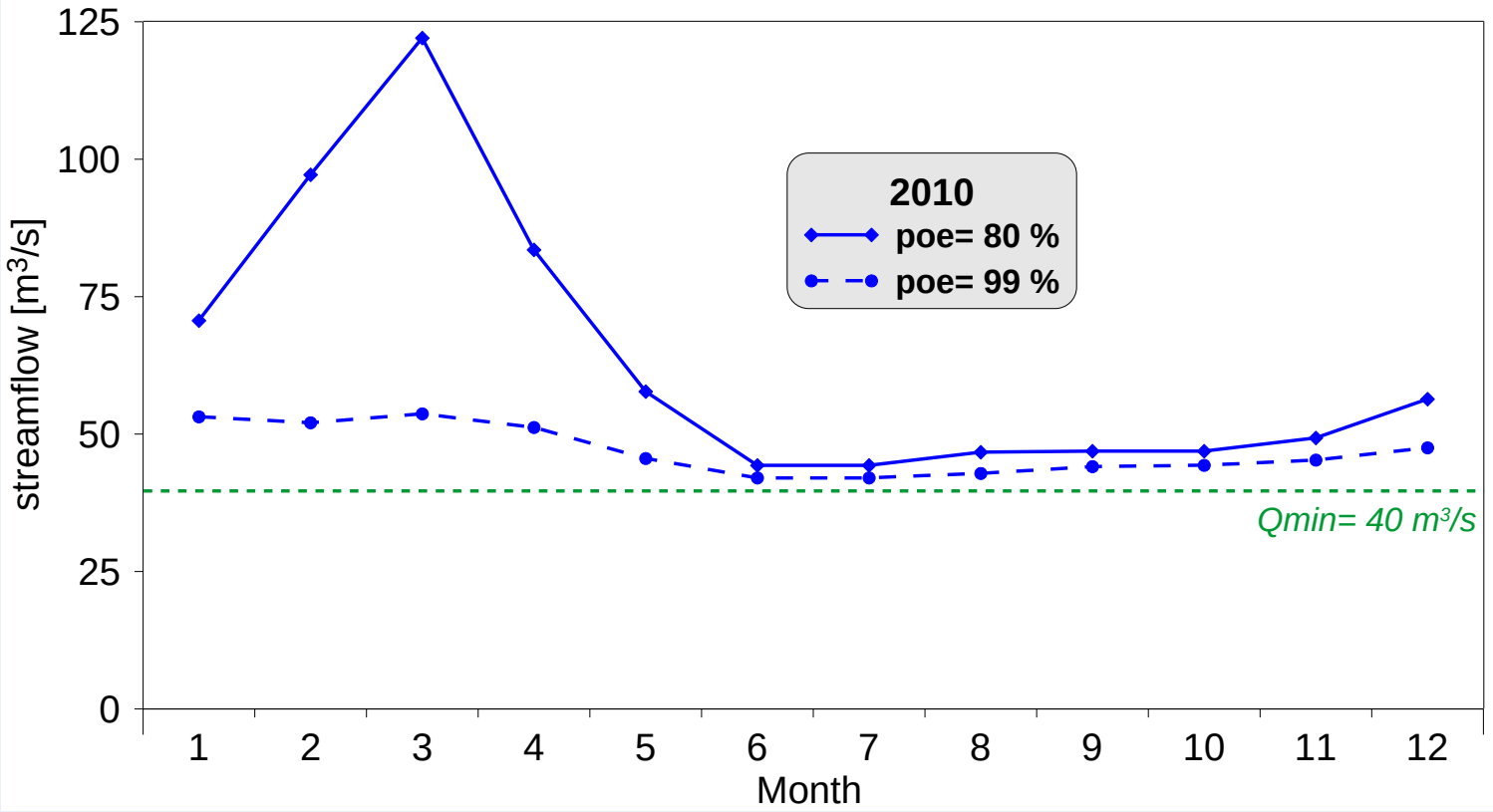

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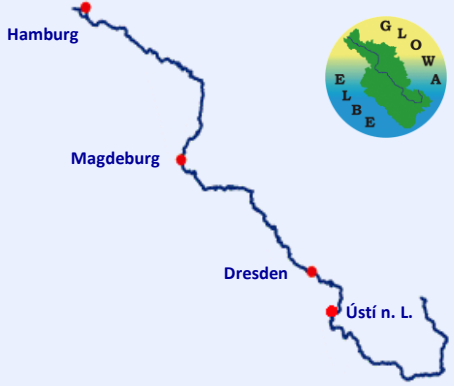

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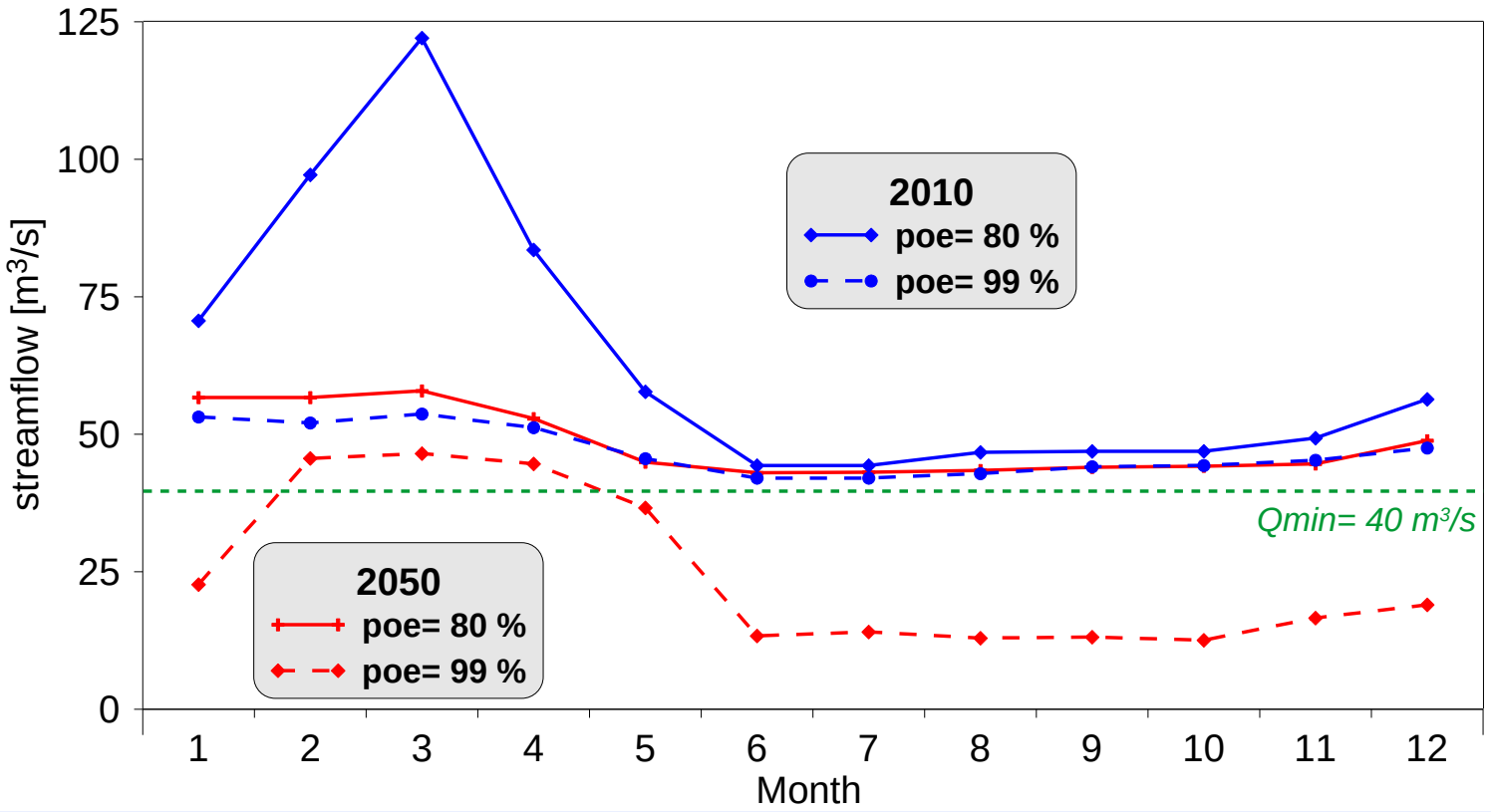
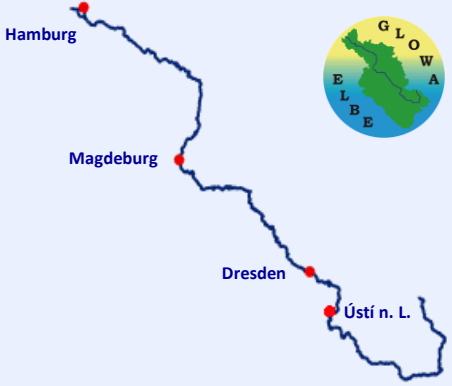
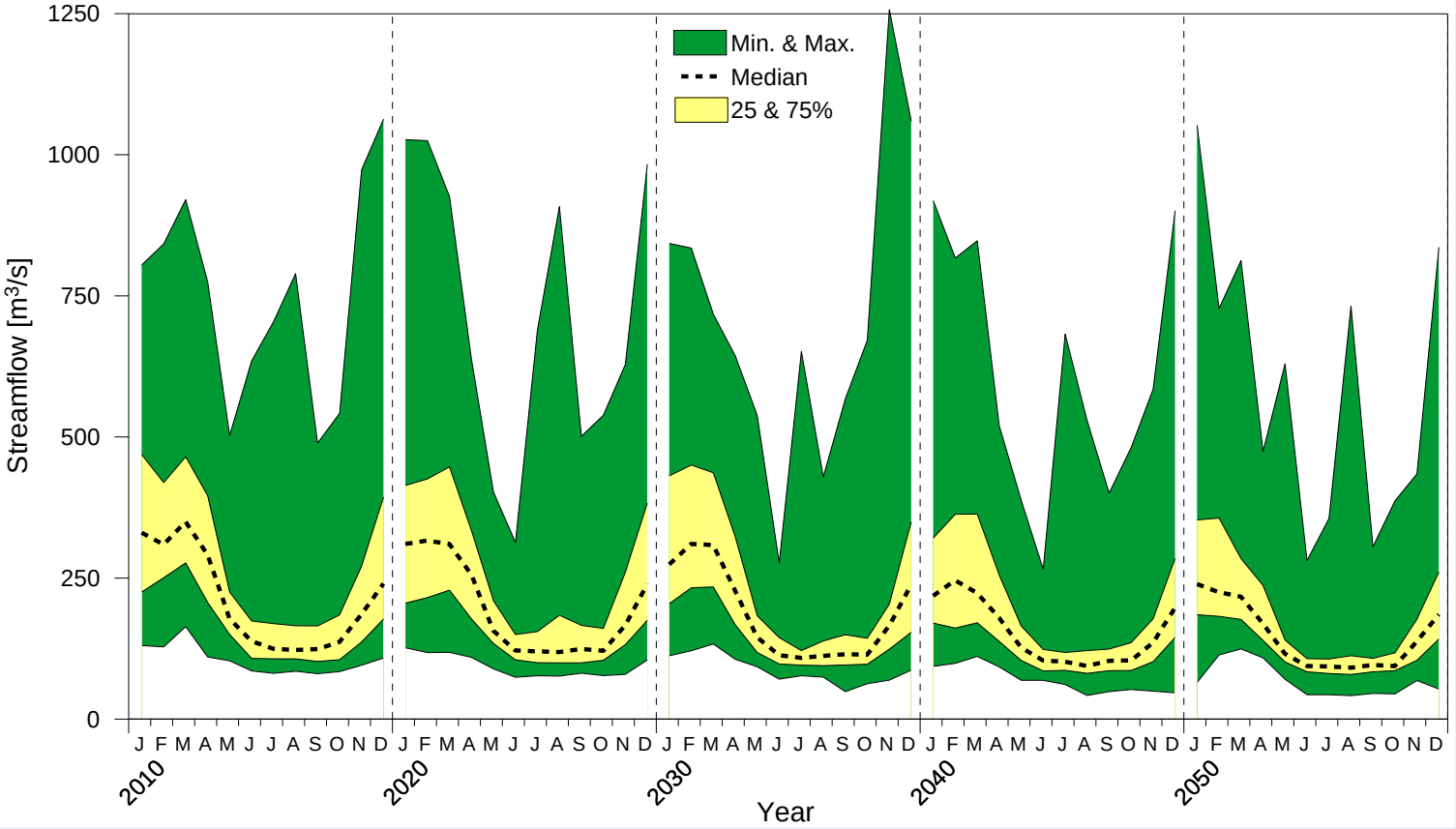


5. Results - Streamflow gauge Hřensko / Labe (Border Czech Republic / Germany)





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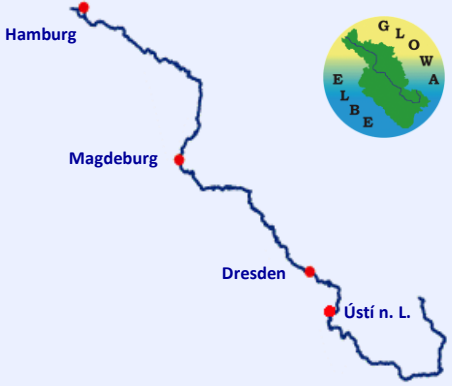

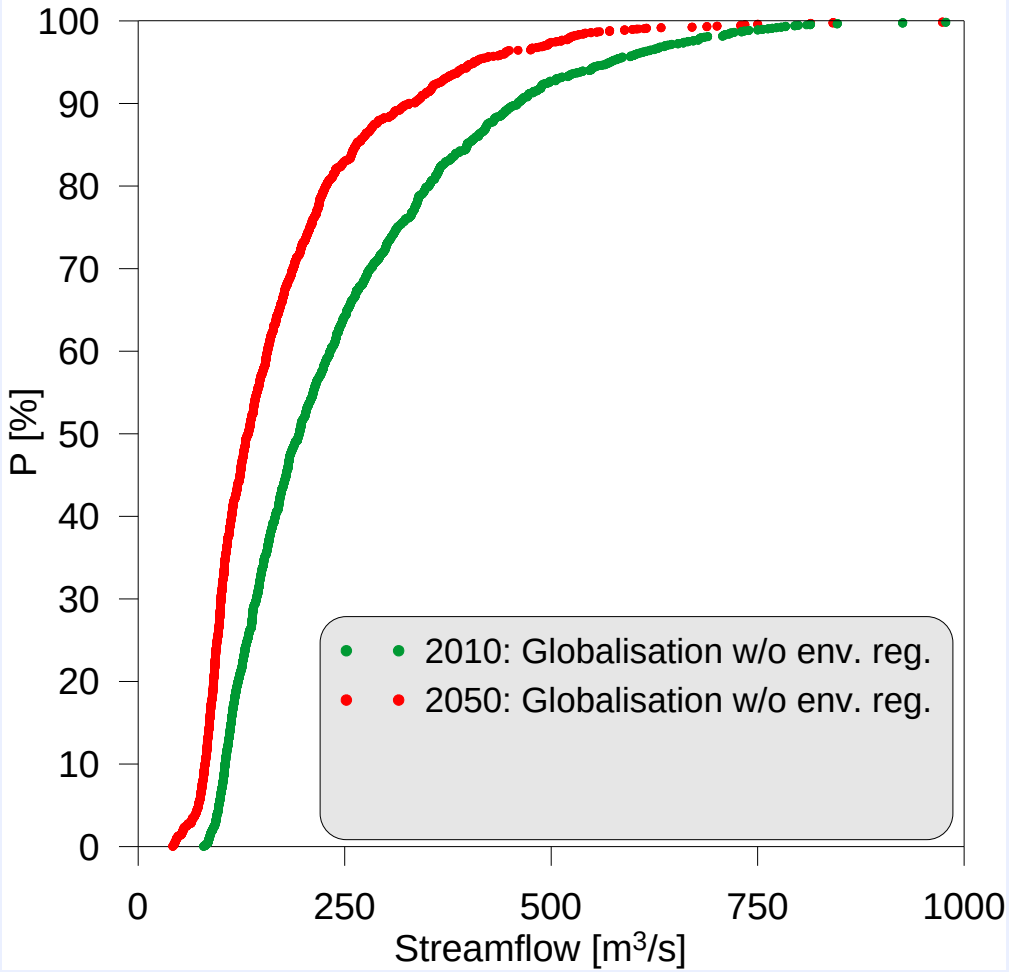

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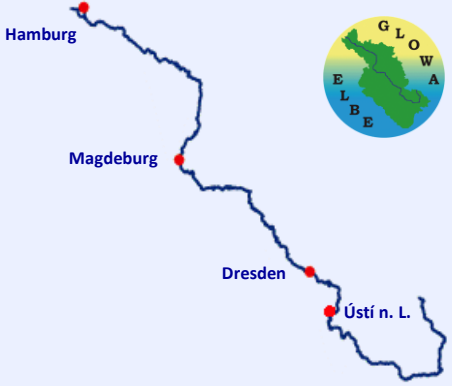
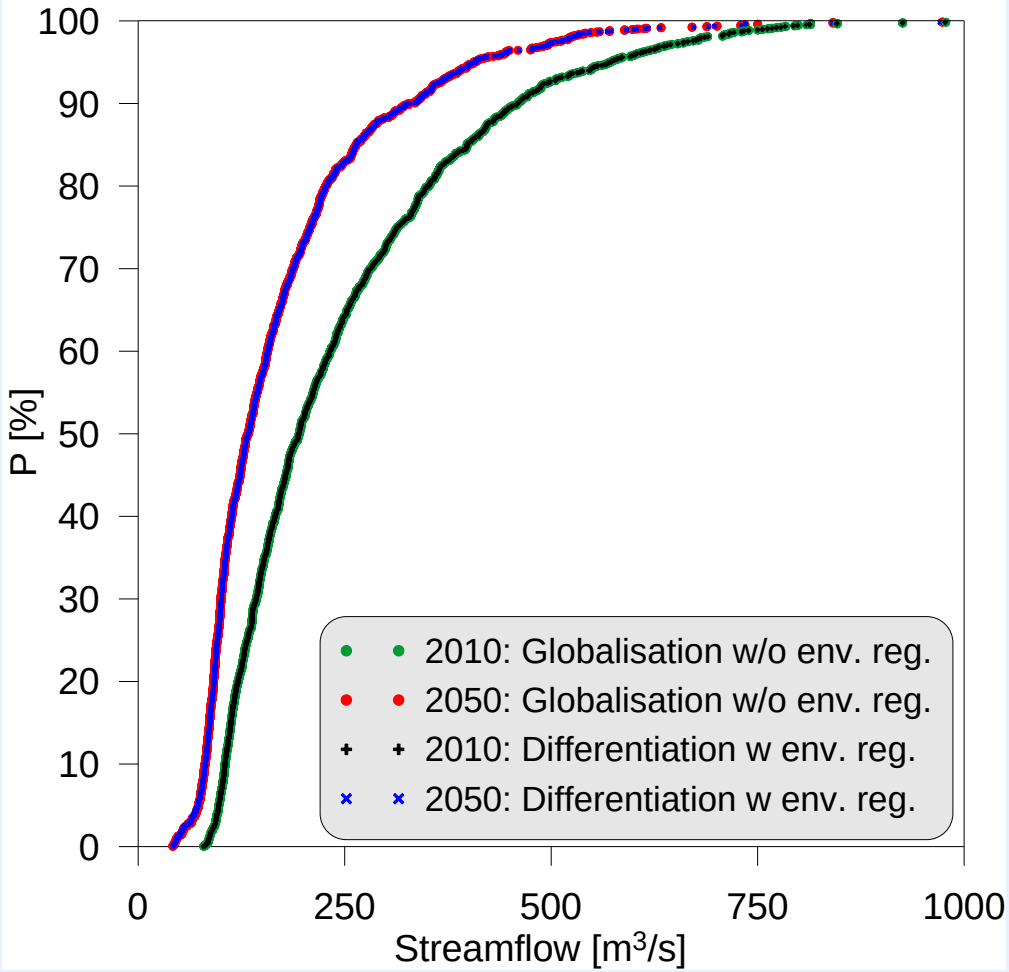
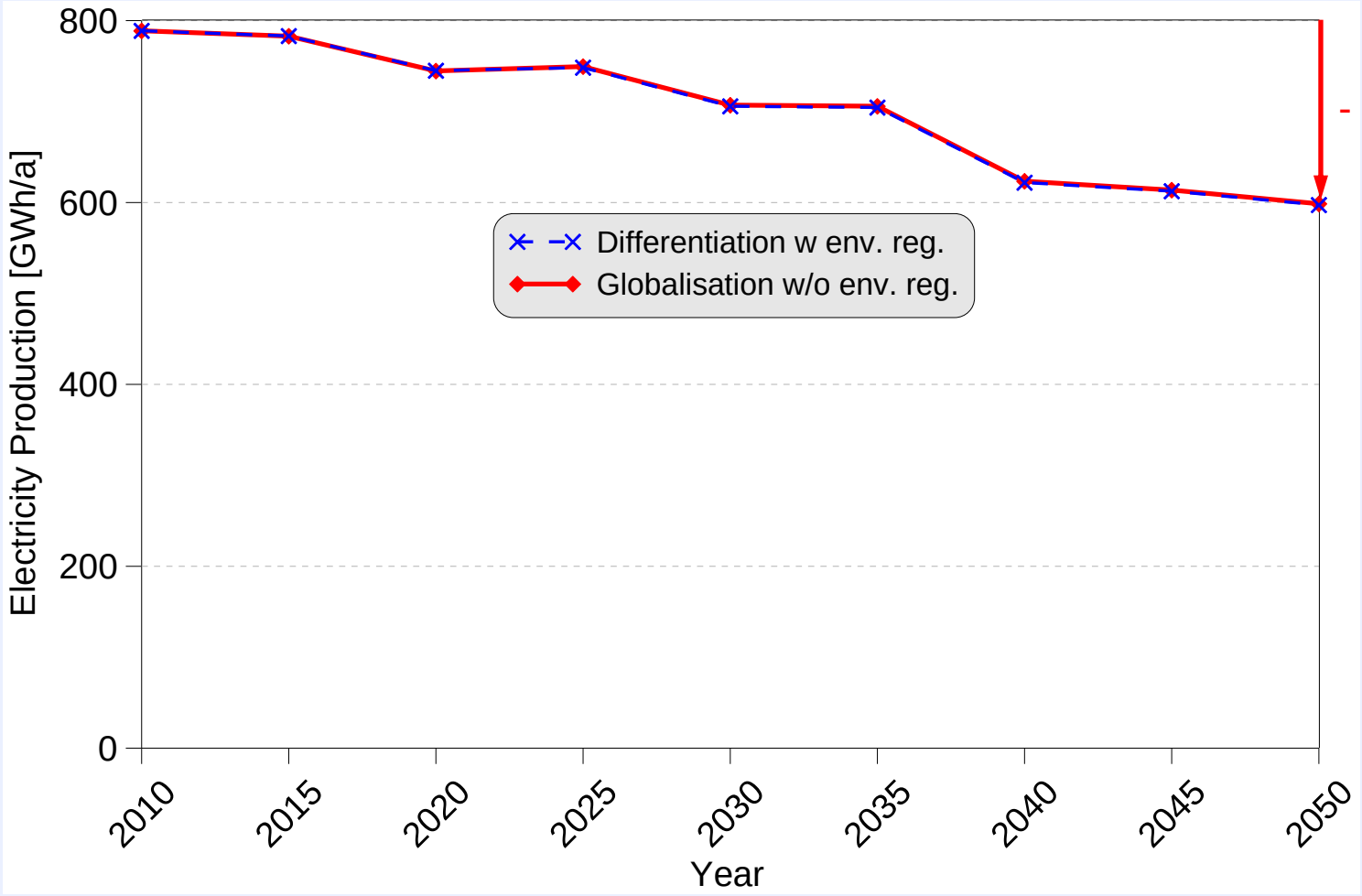




5. Results – Electricity production by Hydro Power Plants (no. HPP: 68, base load), sum of annual mean values



The water withdrawals for thermal power plants can be guaranteed!

6. Conclusion

- Climate change will affect water availability in the Czech part of the Elbe River Basin
- Affects will be different at different locations and within seasons (e.g. rising streamflows during winter and falling streamflows during summer and autumn)
- Streamflows during low flow episodes will fall generally
- Electricity production by HPP is sector most affected, for other water users water can be provided with high safety
- Under extreme dry conditions the water level in some reservoirs will fall significantly while other reservoirs are unaffected
- Adapted/changed management of reservoirs might compensate for some of the effects of climate change

- But: - only 70 climate stations for Czech part of River Elbe Basin (≈ 51.400 km^2)

  - other assumptions for climate warming would give different results

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

Thank You

for your attention!

Thanks: Povodi Labe, Povodi Ohre, Povodi Vltava

Contributors: Tobias Conradt, Frank Wechsung, Fred Hattermann, Stefan Vögele