Magdalena Mrkvičková

Adaptation strategy for water resources of a pilot river basin in the Czech Republic
Background of the project

“Research on Adaptation Measures to Minimize Impact of Climate Change in Regions of the Czech Republic“ – funded by the Ministry of Agriculture

The aim of the project:
– to develop guidance on climate change impact assessment and proposal of adaptation measures on water resources with the focus on the technical efficiency of the identified measures
– to verify the guidance on three pilot basins

Background documents: WFD CIS Guidance No. 24 – River basin management in changing climate, UNECE Guidance on Water and Climate Change
First pilot river basin

The Orlice river basin, (2038 km²)
- One of the main groundwater resource zones of the regional drinking water supply system
- A NATURA 2000 site - conflicts of interests among water users and water authority currently occur
Vulnerability assessment

Analysis of statistical significance of trends in the observed air temperature, precipitation, runoff, groundwater head.

Use of water across the river basin (abstractions, treated waste water disposal…)

Test of trend appearance – annual air temperature 1960-2009 (1980), gradient 0.6°C per 10 years

Test of trend existence – groundwater head, gradient -5 cm per 10 years
## CC impact assessment

Climate change impact assessment based on the RCM projections of future climate, SRES A1B, (the ENSEMBLES project, project Refining of Current Estimates of CC Impact... Pretel et. al., 2010)

<table>
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<tr>
<th>Acronym</th>
<th>RCM-model</th>
<th>GCM model</th>
<th>Institute</th>
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<td>ARPAGE 5.1</td>
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<td>RegCM3</td>
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<td>Abdus Salam Int. Centre for Theoretical Physics, Italy</td>
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Projected CC impacts
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Preliminary hazard analysis

- identification of hazards and subsequent hazardous events (hazards related to natural processes and to the climate and social response)
- qualitative assessment of the likelihood of the occurrence and consequences, decision about the level of acceptable risk
Risks assessed as very high

- High temperature of water in the Orlice river disabling the treatment process
- Overexploitation of groundwater resources in the main resource zone
- Low security of water quantity in the Orlice river during periods of drought
- Irreversible impact on biodiversity within the environmentally protected areas

– Wetlands in the resource zone, Natura 2000 site
Identified adaptation options

- Optimization of operational rules of the existing water reservoir
- Additional water abstraction from the reservoir

1 – surface water abstraction (back up water source)
2 – groundwater resource area (environmental protection)
3 – Pastviny Reservoir
Identified adaptation options

- New water reservoir in a locality preserved for future surface water accumulation – new source of water for drinking purposes
Identified adaptation options

- New multipurpose water reservoir instead of the planned flood protection facility (polder) – source of water for recharging aquifer
- Area for abstraction of water from riparian zone of the Orlice river

1 – surface water abstraction (back up water source)
2 – groundwater resource area (environmental protection)
5 – planned detention pond or multipurpose reservoir
6 – area delimited for water abstraction from the riparian zone
Technical efficiency simulation

- Efficiency of the adaptation measures checked by simulation using the HEC-ResSim model
- Security of water abstraction was estimated for the current set of operational rules and for optimized operational rules
- Series of water level in reservoirs obtained for each RCM simulation were then averaged
Difficulties encountered

- Average of all projections – at least 50 % probability of underestimated climate change impact
- The most “pessimistic“ projection – unreasonably high costs of the measure

Water level in the Pastviny reservoir with the probability of exceeding 98.5 % (period 2070-2099). Red line represents the average of the 8 RCM simulations, grey area shows the variance of the 8 RCM simulations.
Difficulties encountered

- Any subset of RCM projections – part of available information about uncertainty of the whole multi-model ensemble is lost
- Difficulties to interpret the results obtained as an average of subset of available climate change projections
- Baseline period 1961-1990 used for the climate change impact assessment is not long enough for running simulations on water reservoirs, a weather generator for simulation longer runoff time series might be used
Conclusions

Simulation modeling enables us to estimate:

- Expected technical efficiency of a structural adaptation measure for a particular climate change projection
- Range of uncertainty associated with the RCM projections

Desired additional amount of water can be achieved by optimization of the existing reservoir (mean of 8 projections).

Evaluation of uncertainty might be a part of the result when it is used for decision making.

Common agreement is needed on the acceptable level of risk related to underestimated impact of climate change.

Final decision about the best adaptation measure should be made based on discussion among experts, stakeholders and water authorities.
Thank you for your attention
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