

The Québec-Bavarian Collaboration on Climate Change

Adapting Regional Watershed Management to Climate Change – The Québec-Bavarian Collaboration Project Q-BIC³

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& the team of Q-BIC³





Outline of the presentation:

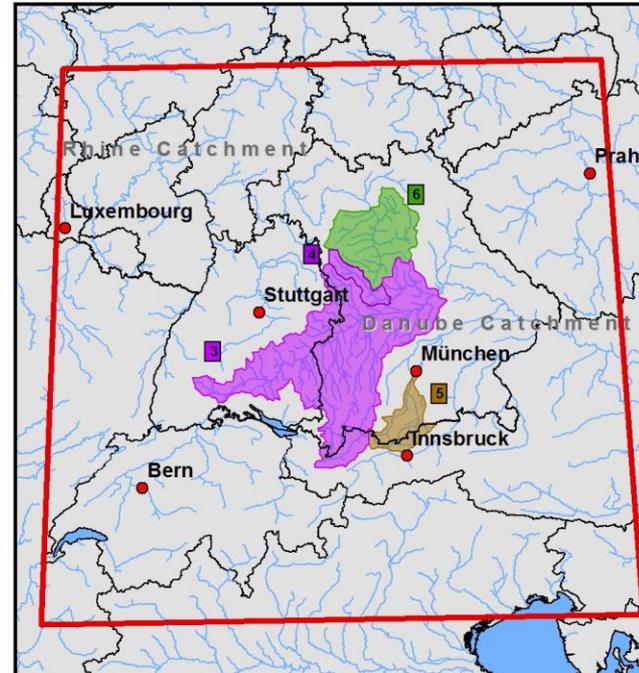
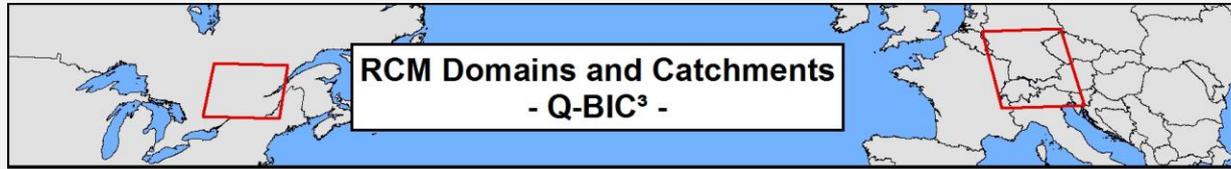
- Key issues of Q-BIC³
- The Ensemble of Climate Inputs & Hydrological Models
- Challenges for Water Management of the Danube-Main Transfer System
- Approaches to simulate adaptation of water management to Climate Change





- 1. Identify impacts & adaptation options** for water resource management in Q&B
- 2. Quantify & reduce projection uncertainties** of the model chain
- 3. Investigate the required complexity** of hydrological models to estimate CC impacts
- 4. Develop a regionally transferable and modular modeling system** for integrated watershed management under CC

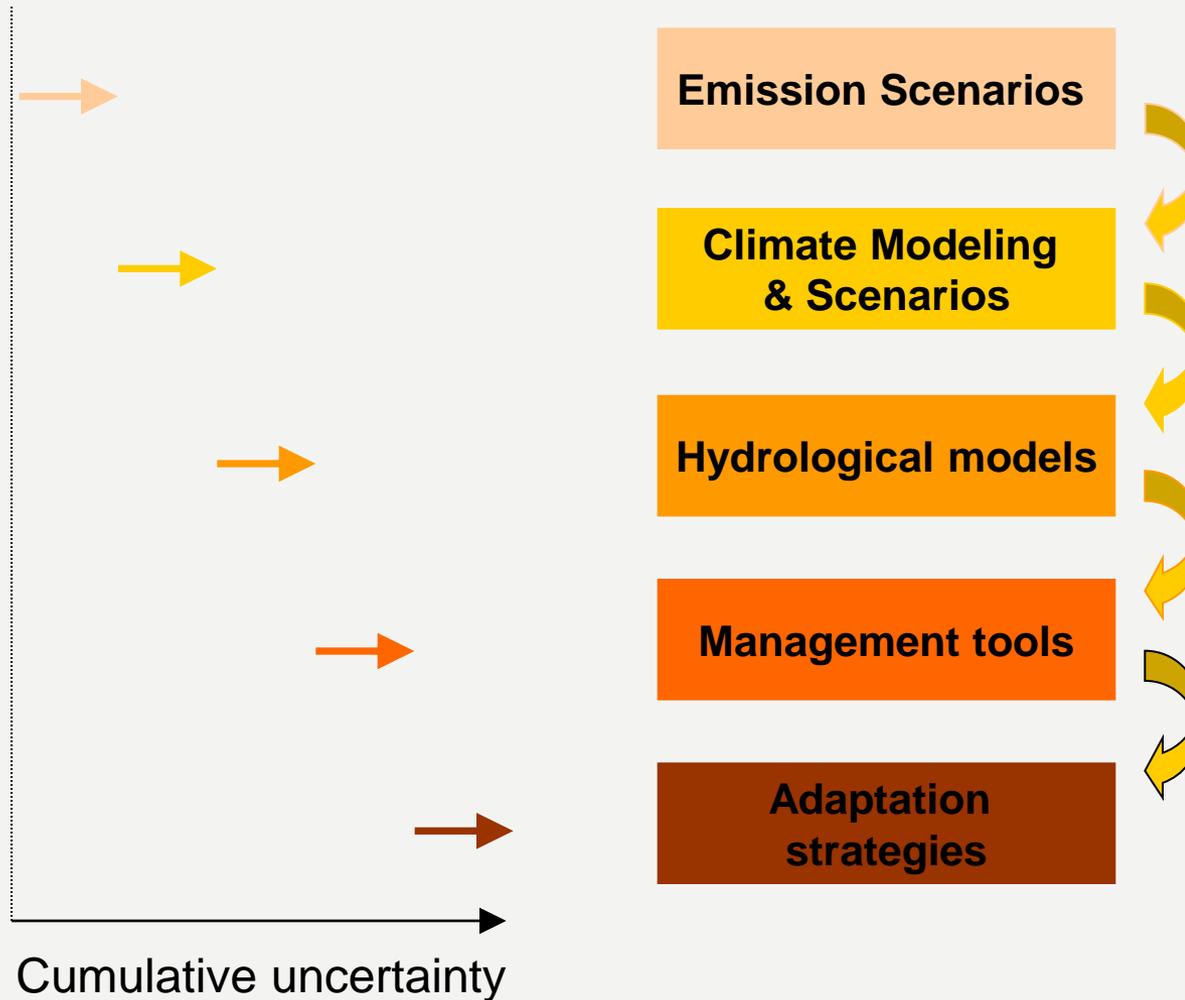


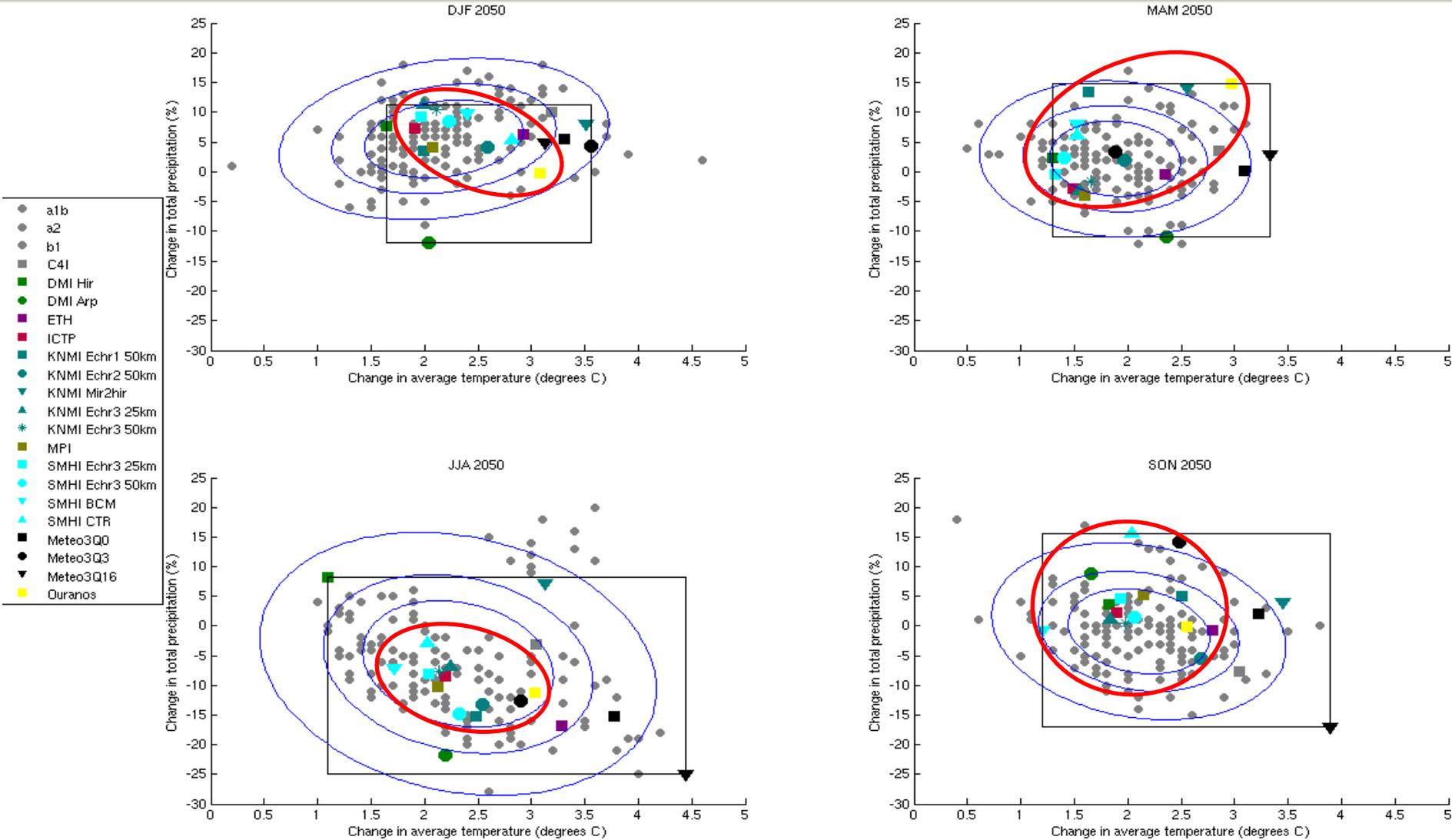


- [1] Gatineau (Rapides-Farmers; 23981 km²), [2] Saint Francois (Weedon; 2922 km²), [3] Danube (Kehlheimwinzer; 26284 km²), [4] Altmuehl (Eichstaett; 1396 km²), [5] Isar (Munich; 2814 km²), [6] Regnitz (Pettstadt; 6991 km²)

Centre d'expertise hydrique Québec





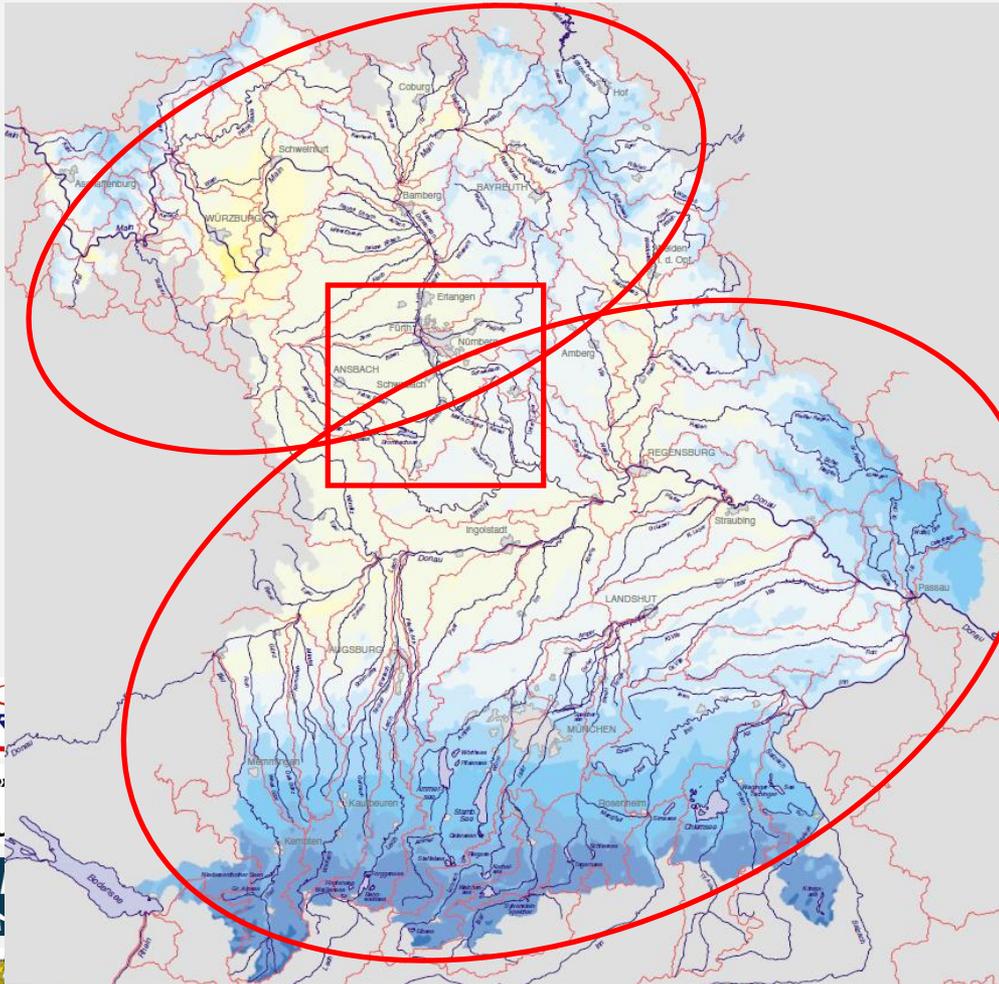




4 watersheds & 4 hydromodels (plus side projects)

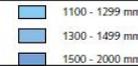
Watershed	Quebec		Bavaria	
	Gatineau	Haut-Saint-Francois	Upper Isar	Altmuehl-Regnitz Transfer
HSAMI	HQ	HQ	HQ	HQ
Hydrotel	CEHQ	CEHQ	CEHQ	X
PROMET	LMU	LMU	LMU	LMU
WaSim-ETH	X	LfU/LMU	LfU/LMU	LfU/LMU
Others	From McGill, UL (upon additional funding...)			





Regnitz river:

- Tributary of the Main river
- winter precipitation regime
- little ground water storage
- **problem of low flows in summer**



Climate Change impacts?

- dP may further **reduce low flows**
- dT may increase water demand for **irrigation**

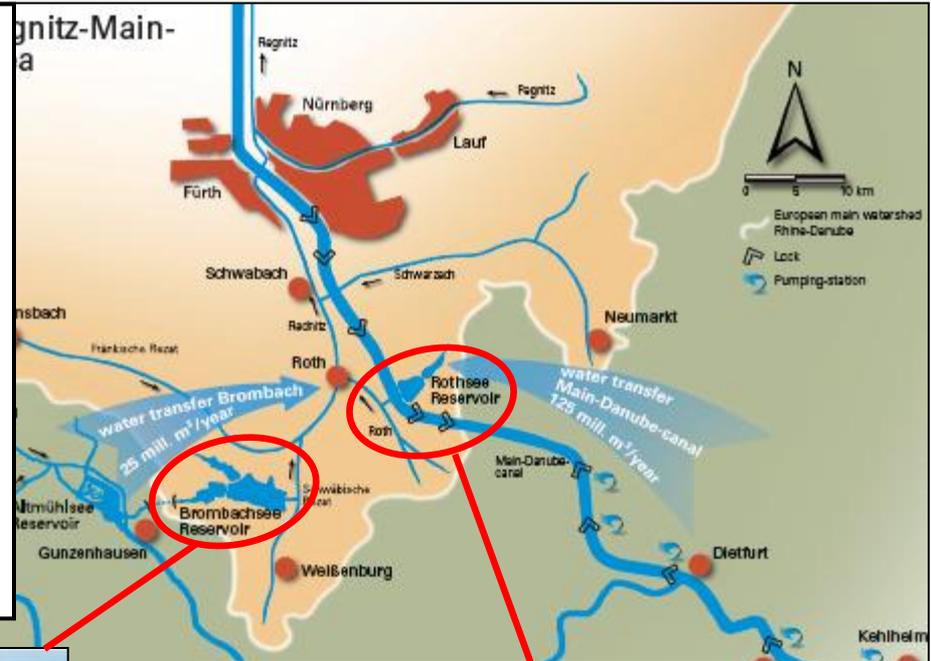
Karten zur
Wasserwirtschaft





Danube-Main water transfer:

- transfers about about 150 mill. m³/yr
- Brombach and Roth reservoirs built for that purpose
- Even today **competition** between recreation & water management
- **Adjustment of rules and structures to Climate Change needed?**

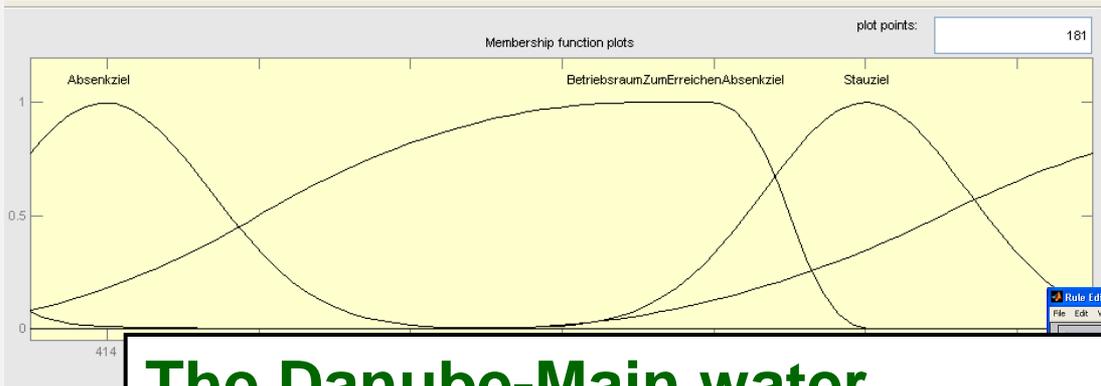




Altmühlsee reservoir:

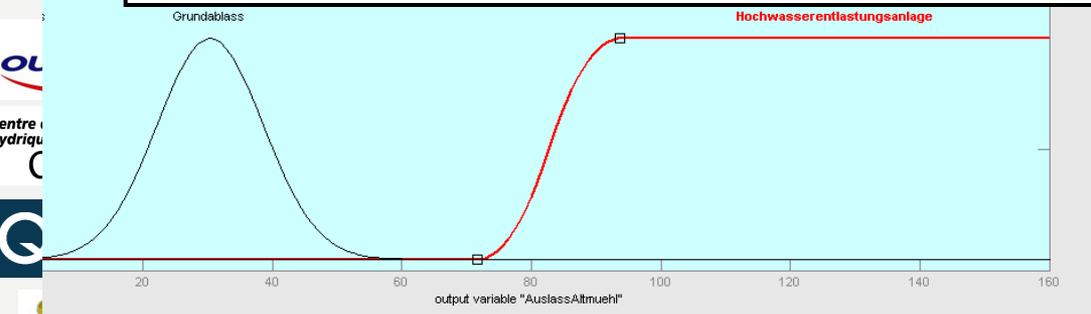
- Flood protection for Altmühl
- Water transfer to Regnitz via Brombach reservoir
- **Eutrophication!** - floods transport suspended sediments from agricultural area, but no constant inflow (Climate Change!)





The Danube-Main water transfer system is managed by human decisions based on reservoir and gauge levels

Fuzzy model of water transfer set up with knowledge-based fuzzification and de-fuzzification rules of management decision





Conclusions

- Bias correction of RCM data is (still desperately) needed for hydromodel simulation
- Hydromodels produce different runoff curves even if calibrated on same gauge time series
- Reproduction of the annual cycle of runoff and the frequencies of high and low flows (or indicators!) are more important than R^2 etc.
- Because water management often uses thresholds, fuzzy logic seems to increase robustness and adjustability to uncertainties in simulated runoff





Thank you very much for your attention!!!