Possibilities to transfer model parameters

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Problem

- Non unique parameters for models
  - Incomplete information
    - Rainfall – spatial variability
    - Soil – spatial variability
- How to transfer a parameter set ?
- How to assess the quality of the transferred dataset ?

Parametric solution

$$\theta = f(C, \beta)$$

θ Model parameters

C Catchment properties

β Transfer function parameters

Problems

- Non uniqueness of the model parameters → ill defined f
- "Common" path

- Alternatives: use the parameters of the most similar catchment
- Similarity as a distance

Alternative

- Parametric approach – fit a function on the space
- Nearest neighbor
- Alternative – manipulate (transform) the space
  - Similar become close to each other
  - Similar is what behaves similarly
  - Two catchments are similar if they perform with equal quality if the same model parameters are used
  - Model based similarity

Motivation

- Regionalisation:
  - Observable catchment characteristics → model parameters

$$L : C, \theta, I \rightarrow L \quad (\text{Quality - Likelihood})$$

  - Observable catchment characteristics and model parameters → Quality (vector ?)

Motivation

- Regionalisation function *f*:

$$f : C \rightarrow \theta \quad \text{(Regionalisation)}$$

$$L(C, f(C), I) \quad \text{(Quality/Likelihood)}$$

- Problems:
  - L has to be defined over many catchments and parameter sets

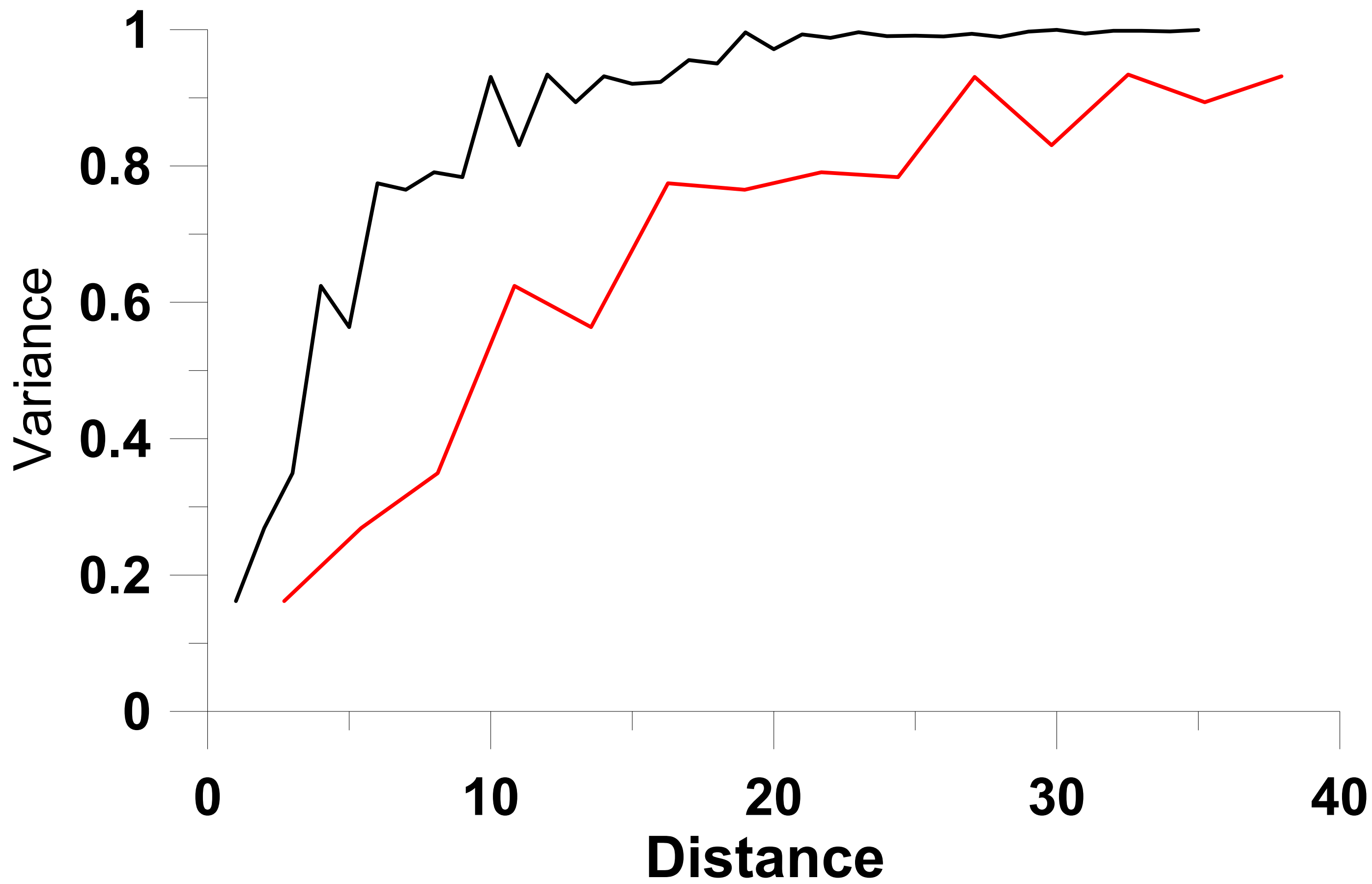
Continuity assumption

$$\frac{1}{N_D} \sum_{d(C_i, C_j) < D} \left\| L(C_i, \theta, I) - L(C_j, \theta, I) \right\| \to \min$$

D distance limit

Variance function with unknown distance

Which is better ?



Problems

- Variogramm without locations and measurement values
- B unknown
  - B is good if
    - Close points lead to small differences
    - Monotonic
- Find B by minimizing the a non parametric distance based approach

Mapping of catchment characteristics to define a distance

$$B : C \rightarrow u \ \text{ in } \ \Re^k$$

$$d(C_1, C_2) = \left(\sum (u_i^{(1)} - u_i^{(2)})^2 \right)^{\frac{1}{2}}$$

How to find transformation B

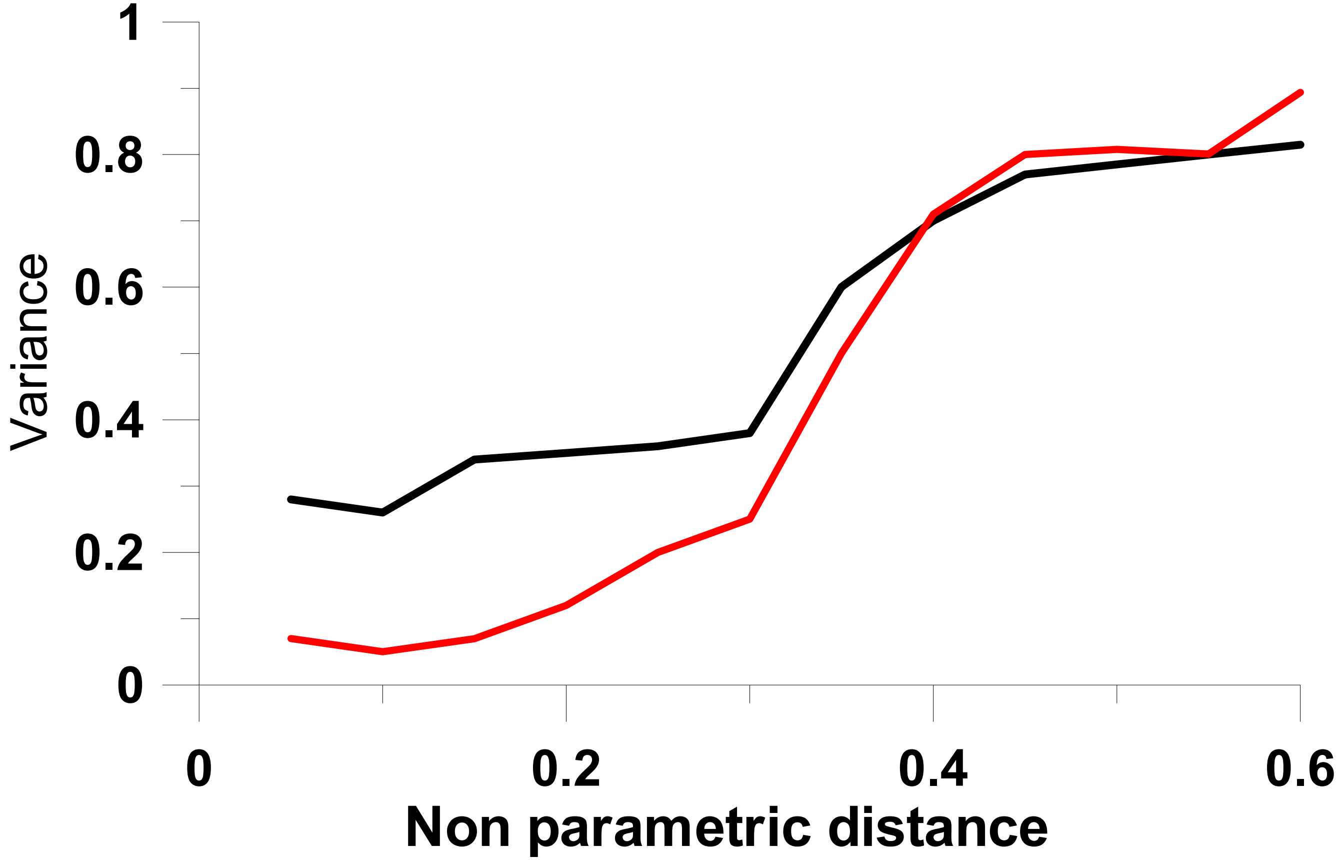
- Close „points“ – small variance
- non parametric approach

$$\Gamma(h) = \frac{1}{N(h)} \sum_{d(i,j)<h} \left\| L(C_i, \theta_i, I) - L(C_j, \theta_j, I) \right\|$$

$$\Gamma^*(p) = \frac{1}{N(p)} \sum_{d(i,j)<h(p)} \left\| L(C_i, \theta_i, I) - L(C_j, \theta_j, I) \right\|$$

$$\left| \{(i,j); d(i,j) < h(p)\} \right| = p \frac{n(n+1)}{2}$$

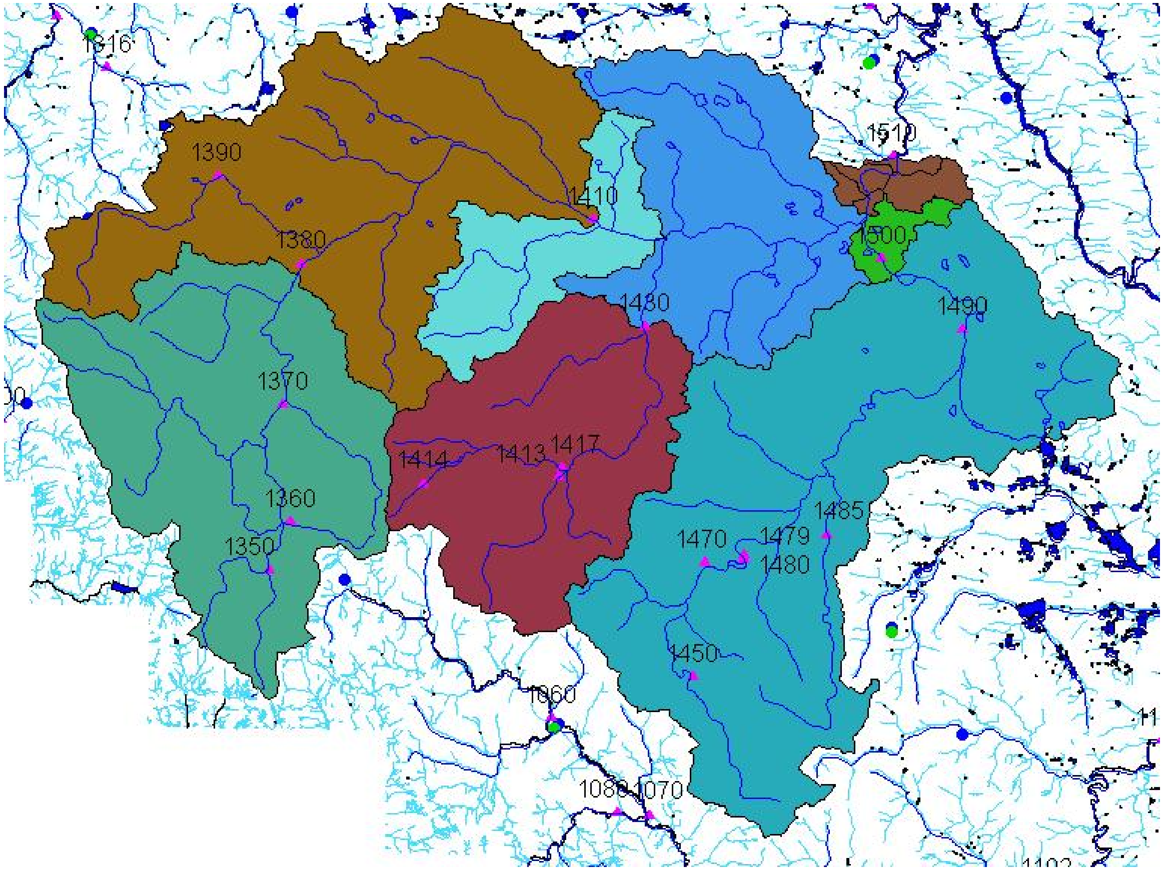
Distance – pairs function



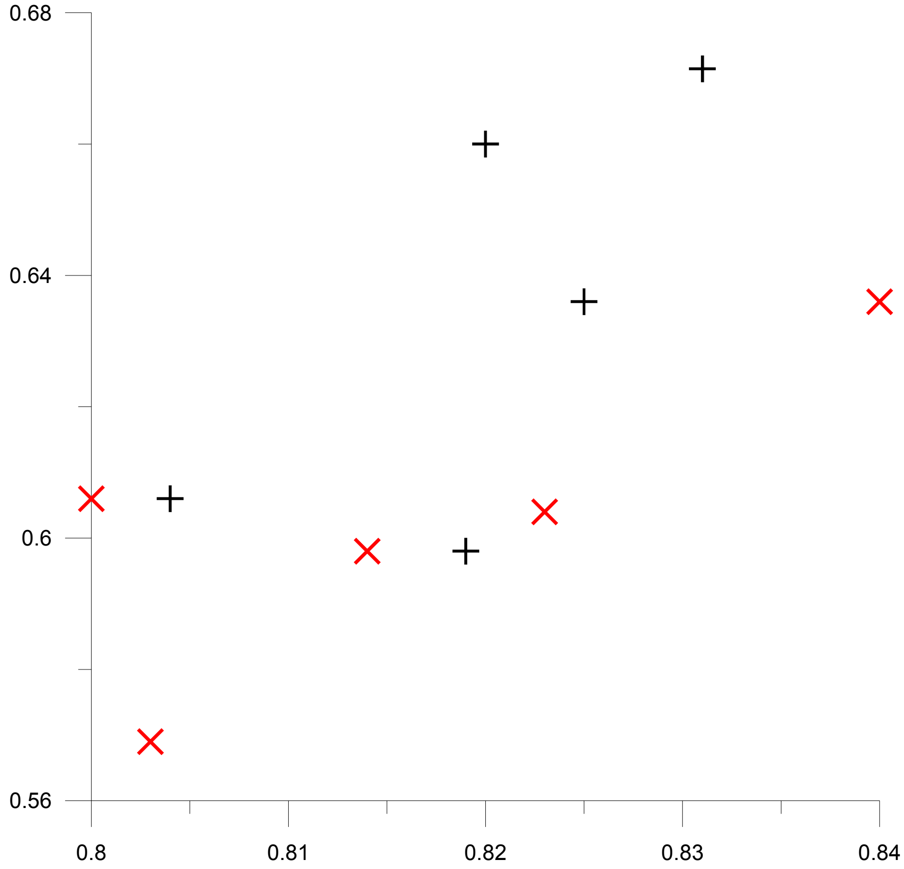
Updating priors

- Additional information:
  - Regionalisation of statistics (mean – extremes …)
  - Upstream – Downstream discharges

Otava catchment (CZ)



1 vs 4 subcatchments



Summary

- Transformations of the space can help for transfer of parameters
- Transferability of L has to be checked in space and time
- Updating
  - Soft local
  - Hard regional information