Comparison of Spatial Interpolation of Precipitation with Emphasis on Extreme Events

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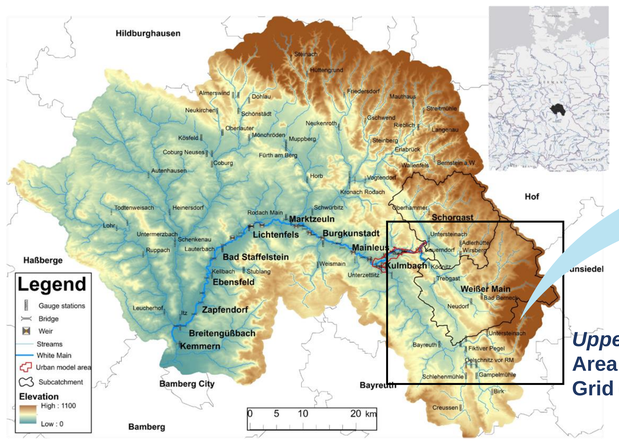
1. Motivation and Objectives

The sparse network of rain-gauges has always motivated the scientists to find more robust ways to include the spatial variability of precipitation. Different simulation and interpolation techniques are amongst one of them. The remote sensing technologies are also widely known to provide a spatial profile of the precipitation, however during extreme events the accuracy of the resulted areal precipitation is still under discussion. Therefore, the aim of this study is to:

- Compare the hourly precipitation results of a flood event from Inverse distance weighting (IDW) method with the gridded rainfall obtained via Turning Bands simulation (TBM).
- Perform the uncertainty analysis of areal precipitation through the TBM simulation and interpolation technique for the Upper Main catchment.

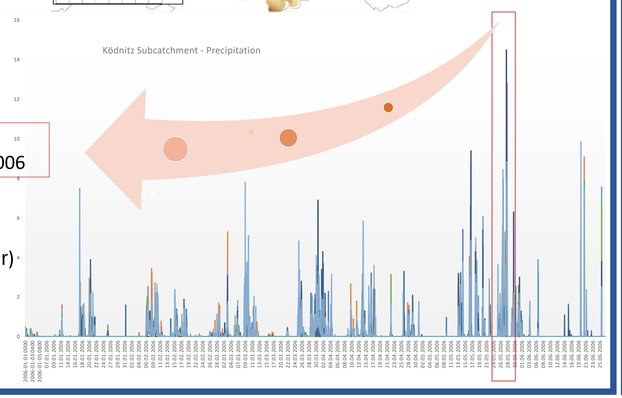
2. Research Method

a) Study Area



Ködnitz Sub-catchment

Upper Main Catchment
Area: 4646 km^2
Grid cell: 1km x 1km



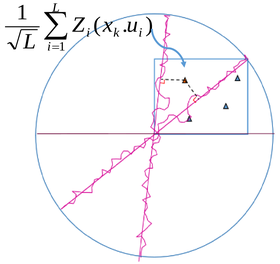
Flood Event:
27.05.2006 – 01.06.2006

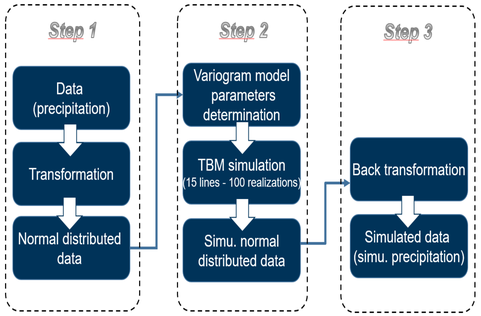
b) Methodology

Turning Bands Simulation Method

- Random lines (bands) with various azimuths are generated around a centroid located at the grid or volume centre, followed by the simulations along each line using the transformed data histogram and variogram.
- Simulation of a 2D field over a set of 15 lines (Package: RGeostats)

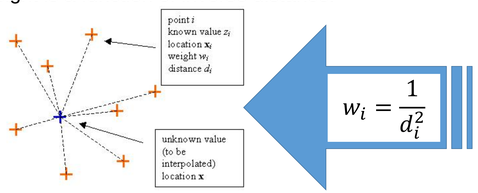
$$Z(x_k) = \frac{1}{\sqrt{L}} \sum_{i=1}^{L} Z_i(x_k . u_i)$$



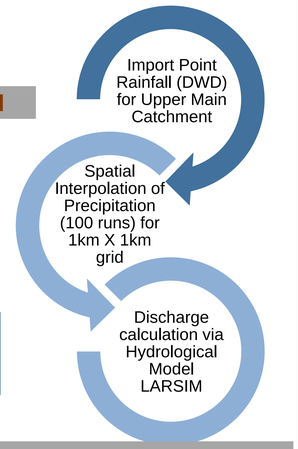


Inverse Distance Weighted Interpolation Method

- In this interpolation method, the sample points are weighted during interpolation such that the influence of one point relative to another declines with distance from the unknown point.
- Weight is a function of inverse distance.

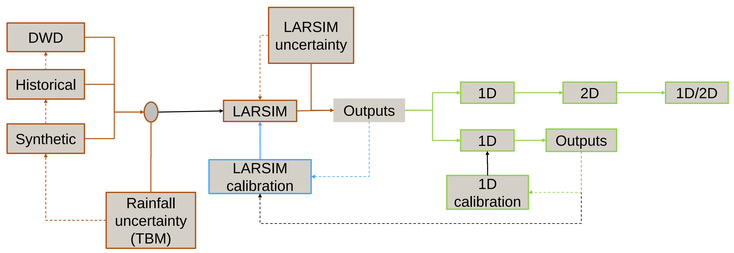


Uncertainty of Precipitation



FloodEvac Tool

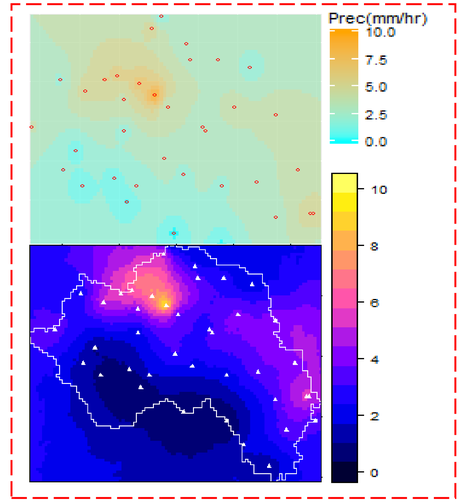
- Rainfall uncertainty
- Rainfall uncertainty + LARSIM uncertainty



3. Results and Discussion

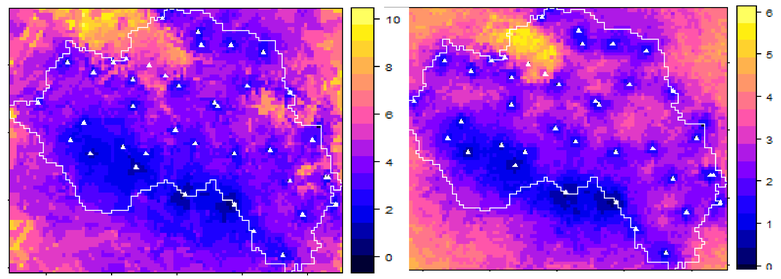
For most of the rain gauges, the TBM and IDW shows smaller uncertainties in a range of three to five kilometres from the stations. On the other hand, the furthest a grid cell is from the input rain gauges, the highest are the uncertainties.

Flood: Upper Main Catchment (27-05-2006 21:00)



IDW
IDW interpolation

Mean via TBM
Mean of 100 realizations



Range plot (left): $R_{max} - R_{min}$,

Interquantile range (right): $R_{95\%\ quantile} - R_{5\%\ quantile}$

where 'R' defines the hourly precipitation for each grid.

4. Future Work

In future, the analysis will also be carried out to compare the forecasted gridded precipitation simulations with the real-time precipitation forecast system (RADVOR).

5. Reference

Houdayer, M., 2016, Stochastic Simulation of Rainfall Fields Using the Turning Bands Method -A Case Study for the White Main Catchment. M.Sc. Thesis, Universität Bayreuth, Faculty of Biology, Chemistry and Geosciences.

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