1 Motivation

- Future rainfall time series are important for rainfall-runoff modeling and derived flood frequency analysis
- Time series of climate models show high uncertainties
- Alternative: Rainfall time series generation with a cascade model

Aim: Generation of future high-resolution rainfall time series

2 Study area & data

- Lower Saxony with 5 recording rain gauges (Fig. 1)
- Related REMO raster cell time series (3 realisations), 10 x 10 km
- C20 (1971-2000), short (2021-2050) and long-term (2071-2100) future

3 Analysis of REMO data

- Comparison of station and REMO data → Observation vs. C20 (Table 1)
- Comparison of rainfall characteristics in C20, near- and long-term future (Table 2 & Fig. 3)

4 Disaggregation model

- Disaggregation with a multiplicative cascade model according to Müller & Haberlandt (2015) (Fig. 2)
- Parameter for b=3: P(1/0/0), P(½/½/0), P(½/½/½)
  → for two volume classes
- Parameter for b=2: P(1/0), P(0/1), P(x/(1-x)), F(x)
  → for four position and two volume classes
- Parameter can be estimated directly from high-resolution time series by aggregation
- Parameter are interpretable in a physical way

5 Climate change implementation

- Estimation of cascade model parameters (Par) for C20-period, near- and long-term future from REMO data
- Adding of ΔPar to parameters from observed time series → future parameter
- Possible solutions:
  - Spatial downscaling of REMO data & subsequent parameter estimation
  - Bias correction of the parameter estimated from REMO

6 Results

- Unrealistic rainfall extremes are generated for future periods (Fig. 4)
  → in comparison to control period (with parameters only estimated from observed series)
- Main reason: Parameter differences for first splitting with b=3 (Table 3):
  → P(½/½/½) is overestimated by the REMO data for the upper volume class

7 Summary & Outlook

- Climate changes in REMO are not robust
- Parameter from REMO and stations differ significantly for b=3, less for b=2
- Parameter for splitting with b=3 are of major importance for the generation of extreme values
- Differences for b=3 result from spatial resolution of the data sets
- Possible solutions:
  - Spatial downscaling of REMO data & subsequent parameter estimation
  - Bias correction of the parameter estimated from REMO

References