University of Stuttgart
Institute for Modelling Hydraulic and Environmental Systems

Spatial and temporal variability of rainfall on different time scales

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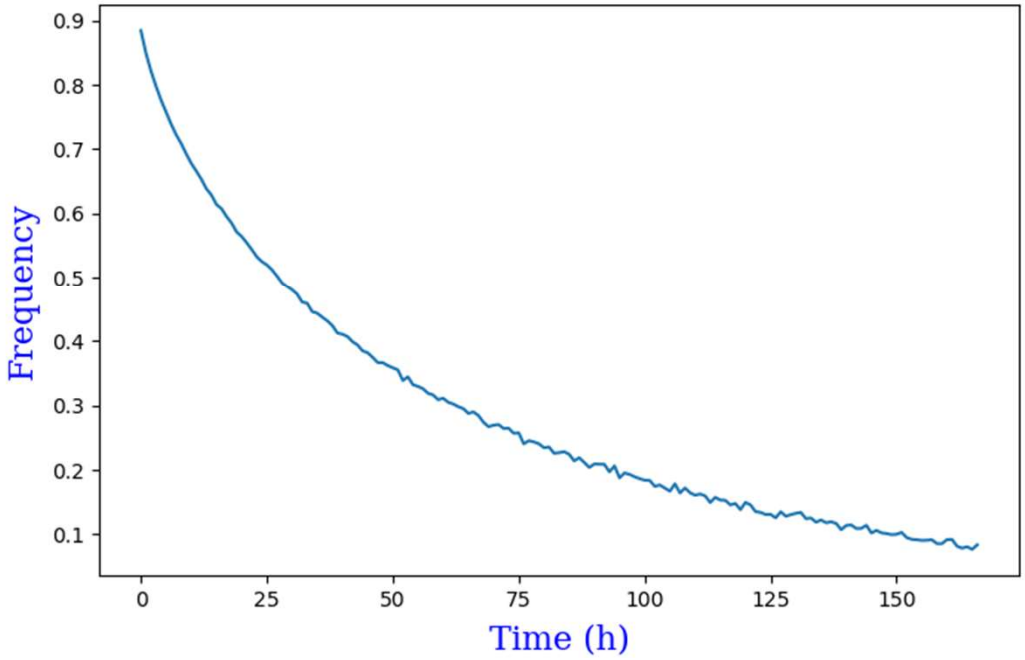
Rainfall

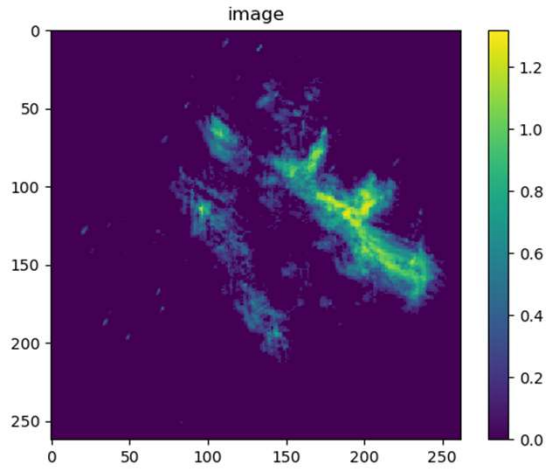
- Observation – need treatment
  - Interpolation
  - Correction (Radar)
- Design scenarios
  - Temporal behavior (IDF – AIDF curves)
  - Full timeseries (Extremes and long series)
- Space time series
- Climate change rainfall
  - Meteorological models produce rainfall
    - Consistent (physics)
    - Does not look like rain (bias, dependence problems)
- Application of WEATHER GENERATORS

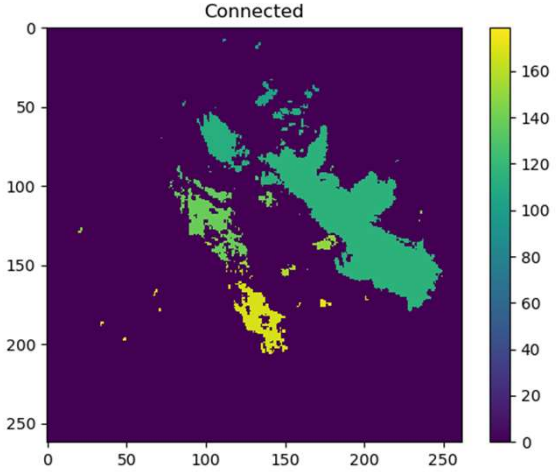
Properties of rainfall

- Scale dependent
- Zero inflated



Radar rainfall





What to do with the zeros?

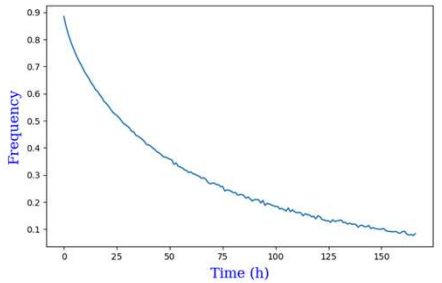
Throw them away?

Rainfall

- Considering zeros
  - Changes the variograms
    - Lower variogram sill
    - Larger range
    - Different anisotropy

  - Do not throw away zeros to investigate rainfall occurrence patterns
    - Indicator variograms
  - Throw zeros – except bounding zeros for variogram calculations for amount estimations
  - Bring these togather
  - Truncated Gaussian unites both but is usually false (also in time)

Time series: rainfall occurrence



Indicator transformation:

The indicator series has the same zero frequency on all scales

0.0 0.0 1.2 3.2 1.1 0.3 0.0 0.0 … 0.0 0.0 0.9 0.6 3.3 0.0 0.0 …

0 0 1 1 1 1 0 0 … 0 0 1 1 1 0 0 …

Simulate the 0-1 sequence so that it fits all scales (zero probabilities)

for example MCMC

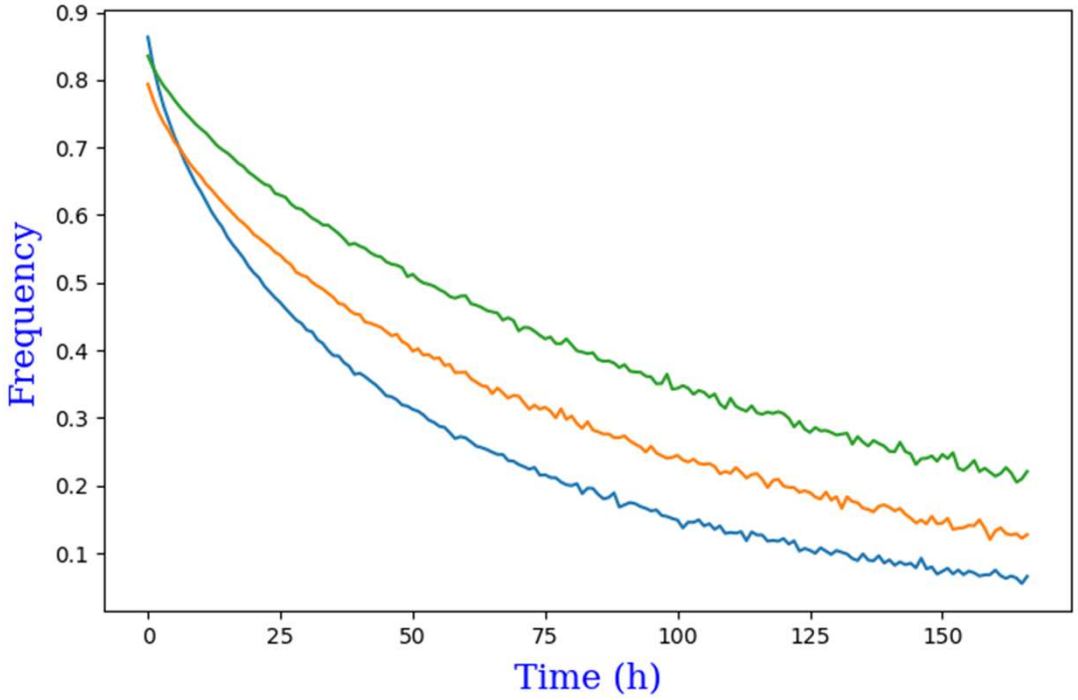
Remove the far zeros:

x 0 1 1 1 1 0 x … x 0 1 1 1 0 x …

(at least 70 % of the data are fixed and removed)

Populate the events

Rainfall occurrence iterative simulation



Rainfall amounts

For individual events:

x 0 1 1 1 1 0 x

Populate the events according to internal structure reflecting 0-s

FFT-MA

Can be extended to multisite

Keep indicator cross-correlations (multiple lags)

Can reflect annual cycles

Can be conditioned on CPs

Summary

Precipitation – zero inflated for „short time scales“

- Separate occurence process and quantities
- Point observations – remove „far“ zeros

Space time:

- Event objects (3D)
- Event characterisation dependent population

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Danke!

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