



### A Methodology Using Radar to Detect Climate Change in Raingauge Station Statistics

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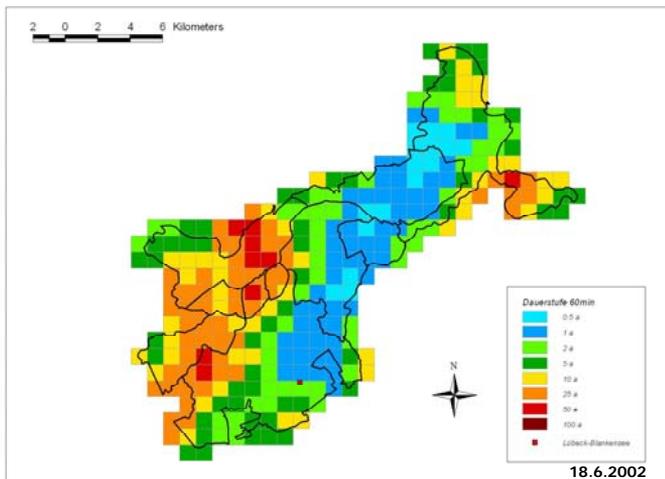
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Design rainfall in urban hydrology is carefully deduced from evaluated station measurements, which have been observed for many years. It is however well-known that extreme rainfall has a high spatial variability. For this reason it is interesting to examine the relevant precipitation events for the production of the design rainfall with the help of weather radar data to obtain more spatial details.

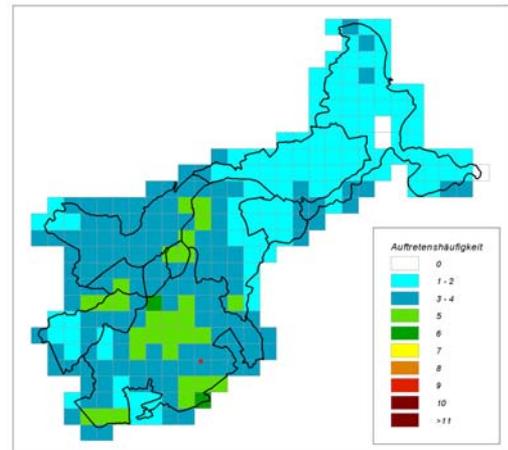
The BMBF project URBAS (prediction and management of flash floods in urban areas) examined the spatial development of 14 heavy rainfall events over the city of Luebeck between 2000 and 2005. The events were the events in the partial extreme value series with a return period beyond one year.

One main questions for the investigation was:

- Is a trend from the past measurements discernable?



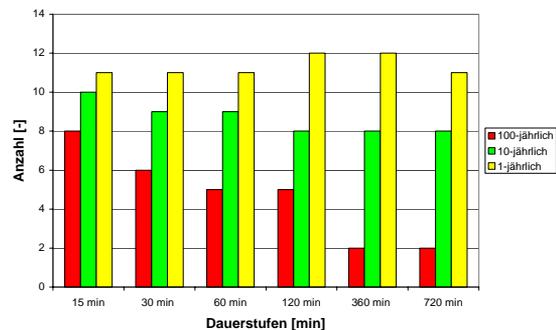
Return periods of the maximum hourly sums of the event of June 18, 2002



Frequency of hourly sums with a return period of 5 years or more (from 14 analysed events)

#### Performed analyses:

- Determination of the return period (1a - 100a) from the radar-derived precipitation sum for each pixel (1 km<sup>2</sup>) according to the statistics of the Blankensee station (1969-2002) and for the intervals, specified above
- Evaluation of the number of events exceeding the return periods of 1, 5, 10, 20, 100 years



Number of events in Luebeck between 2000 and 2005 with return periods of 1, 10, 100 years

#### Database:

- Radar data from the DWD (German weather service), location Hamburg-Fuhlsbuettel
- Rain gauge station data from Luebeck Blankensee (DWD)
- additional daily rain gauge data from 4 DWD stations
- several extreme rainfall statistics of the DWD

#### Methodology:

The raingauge based statistics is used as a reference for the probability of exceedance for given rainfall amounts. Radar data is providing the spatial extent of extreme events.

The hypothesis is that the probability of occurrence of extreme rainfall is similar for different rain intervals of the same return period.

Therefore, for all radar pixels over the city of Luebeck the maximum values for each event and for the predefined intervals of 5, 15, 30, 60, 120, 360, 720 and 1440 minutes were calculated.

**The following conclusions could be drawn:**

- Extreme precipitation up to 6 hours occurred in the last 6 years more frequently than expected by the statistics. This leads to the conclusion that the 30 year statistics is not static any more, i.e. is not applicable to the most recent 6 years. Thus, a climate change could be detected in the currently available measurements.
- Systematic spatial differences in the distribution of extreme precipitation within Luebeck are probable, but the existing data base does not permit to derive conclusions on regular patterns.

URBAS Project Homepage: <http://www.urbanesturzfluten.de>