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Introduction

Results from **extreme value statistics** of long time series (> 30 years) of rain gauge measurements are important in urban hydrology, e.g. for the **choice and design of measures**. These statistics are often not directly available for the locations where they are required. Therefore, extreme value **statistics from rain gauges** are frequently **not representative** for these locations, leading to uncertainties when using them. Furthermore, historical data are **inhomogeneous in time** when different instruments have been used over time, and they are only **reflecting the past**, not the future (figure 1).

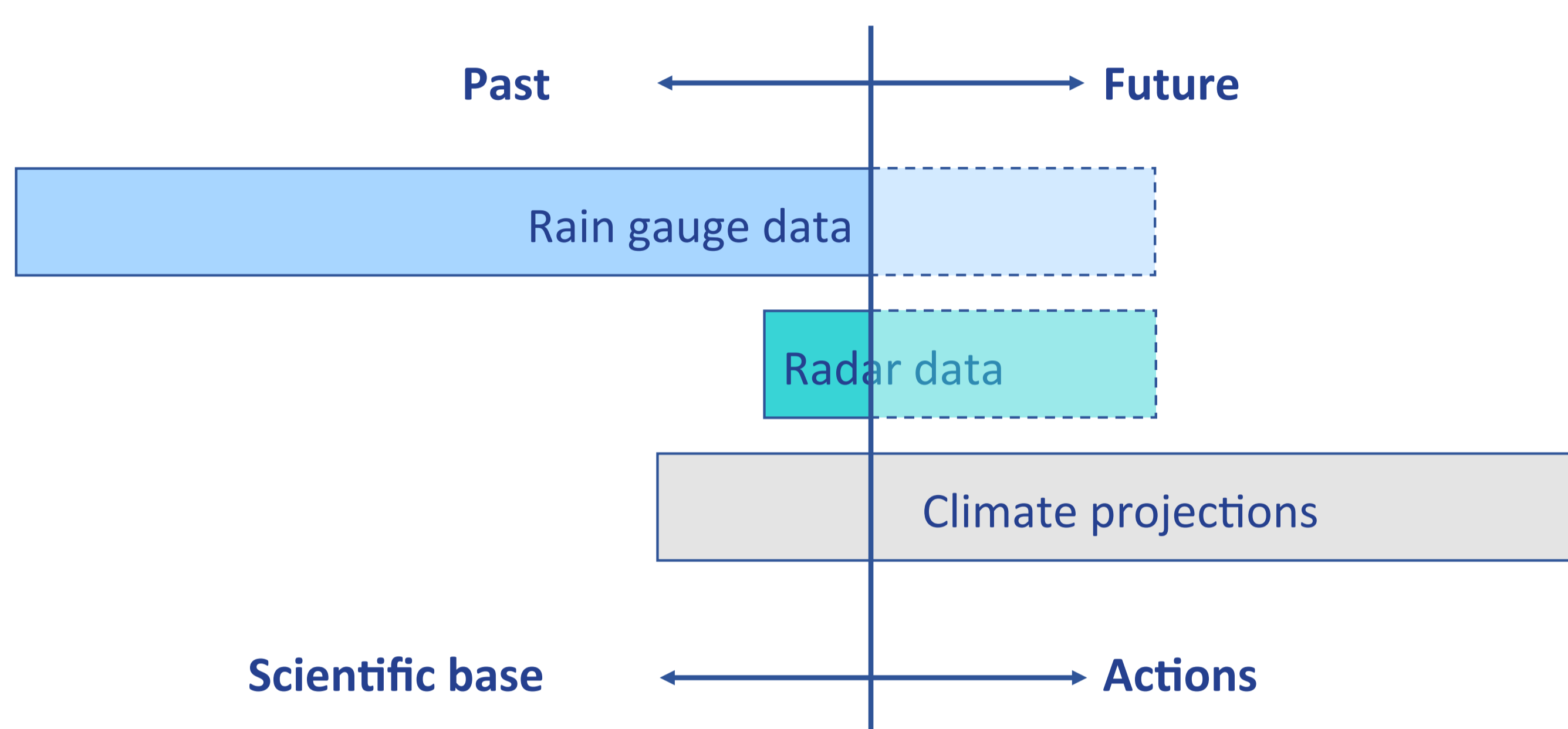


Figure 1: Data availability from different sources

Temporal inconsistencies

Modifications in the precipitation measurement instrumentation have an impact on the obtained data. In particular, extreme values reflect the different sensitivities of instruments, as can be seen in rain gauge data as well as in radar data (figures 2 and 3). Such inconsistencies cannot be quantified.

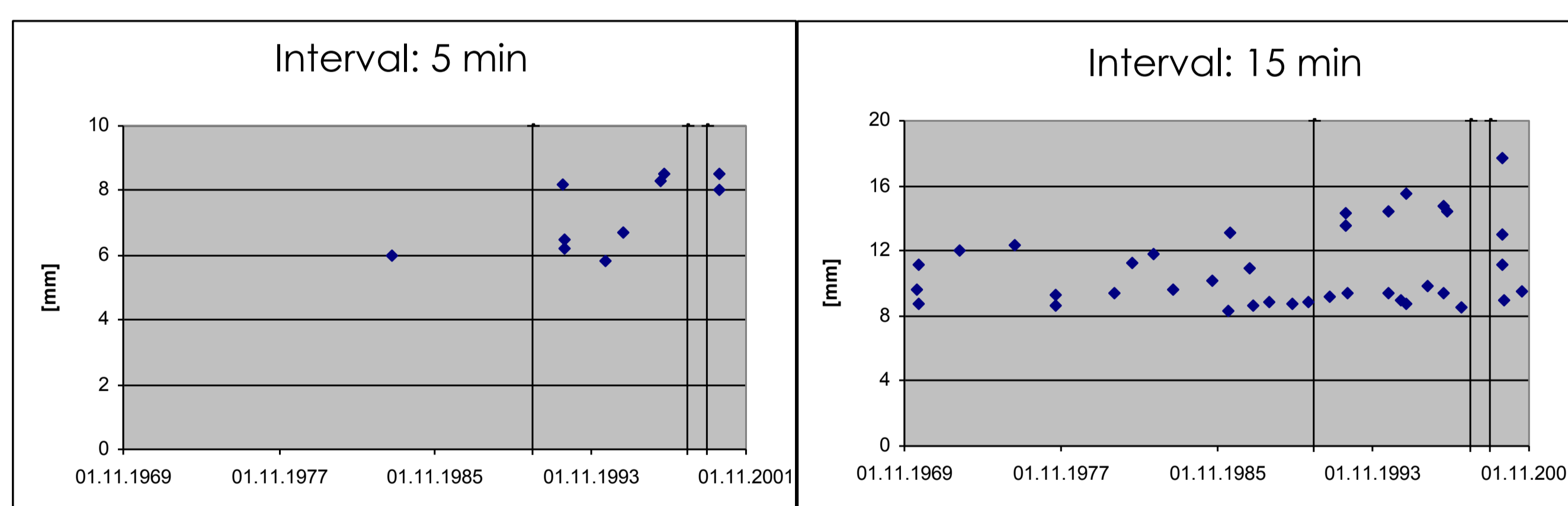


Figure 2: Rain gauges: Depending on the used technology, a difference in occurrence probability of extreme values can be observed.

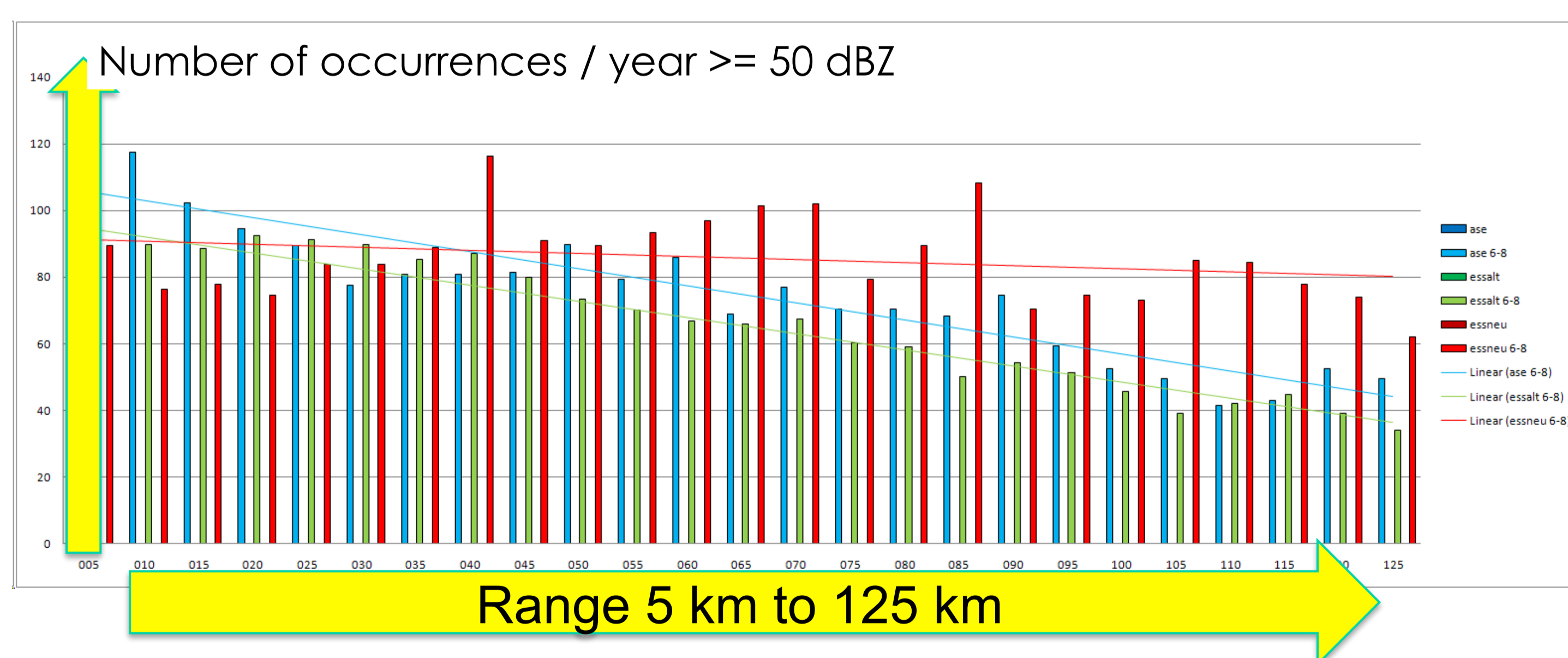


Figure 3: Radar: Depending on the used technology, a difference in occurrence probability of extreme values can be observed (red = new).

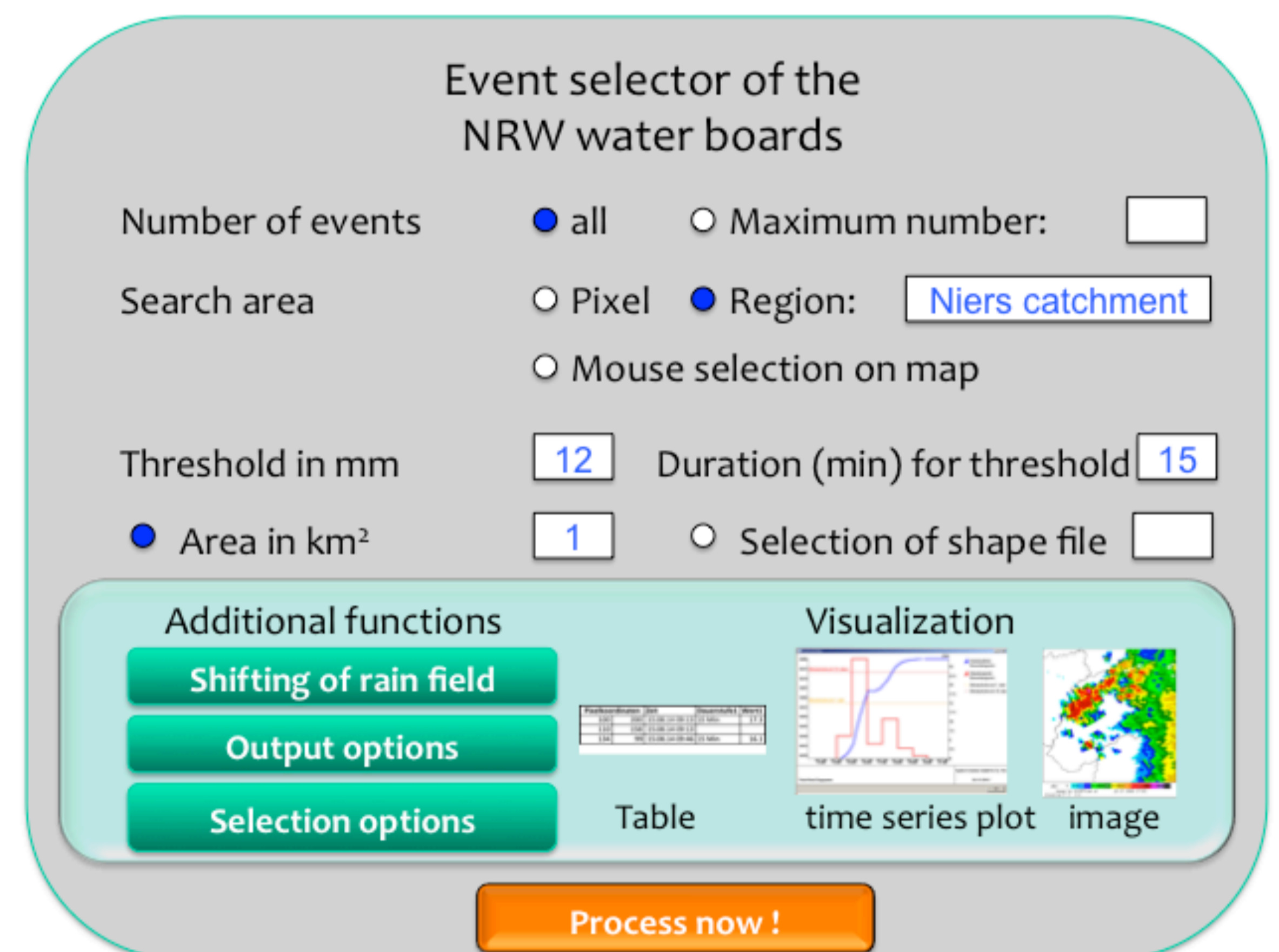
References

- Jasper-Tönnies, A., Jessen, M. (2014), Improved radar QPE with temporal interpolation using an advection scheme. Proc. ERAD, Garmisch, 1-5 September 2014.
- Einfalt, T., Scheibel, M. (2014), Investigating local extreme value statistics based on 10 years of radar observations. Proc. ERAD, Garmisch, 1-5 September 2014.
- Einfalt, T., Mordelt, T., Pfister, A., Scheibel, M., Treis, A. (2015) Setup of a radar event data base for hydrologic applications: purpose and functions, 10th International Workshop on Precipitation in Urban Areas, Pontresina, 1 - 5 December 2015.

Objectives

Assessment of the uncertainties in extreme value statistics from rain gauges and from radar and consequences for design in urban drainage.

Tool



Basic data	Implementation
<ul style="list-style-type: none">Processed and adjusted radar dataYears 2001 - 2016Resolution 5 minutes, 1 km x 1 kmComposite from 4 radarsApproximately 35 000 km²Data points: > 50 billion values	<ul style="list-style-type: none">Web based systemCentral data basePre-processed data for all pixel seriesVisualisation for time series andVisualisation for radar images

Spatial uncertainties

Data were analyzed as single pixels at rain gauge locations and the surrounding 8 pixels (9-pixel-neighbourhood, figure 4). The 30 highest events per pixel and time interval were compared.

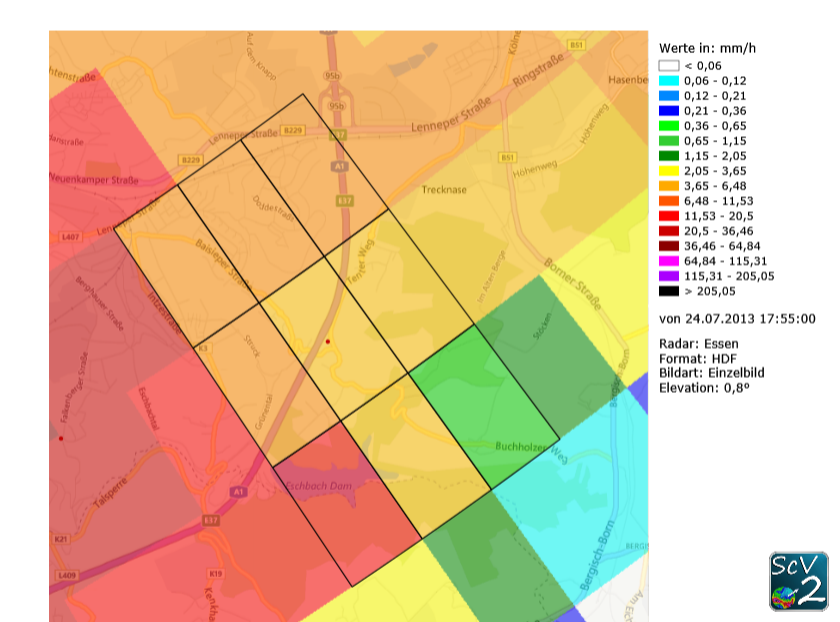


Figure 4: 9-pixel neighbourhood

Results

- The spatial variability of radar data can be interpreted as a function to characterize the **spatial validity of rain gauge data**
- The **uncertainty of extreme rainfall values** at a radar pixel can be assessed (approx. 20%)
- The **variability of extreme values** in a 9-pixel neighbourhood is in the same range as the uncertainty of the values of a rain gauge extreme value statistics (approx. 20 %)
- Extreme values for a 9-pixel-neighbourhood are smaller than extreme values of the centre pixel by 15%
- Radar data at a site **cannot be considered as uniform** in time if the instrument changed over time
- The **distance** of the investigated location from the radar matters – to different degrees for different radars
- The relationship **reflectivity to intensity** plays a major role also on the **subdaily scale**. When using a daily adjustment, the extreme values on the shorter scale may vary in the order of 20% as function of the ZR relationship.