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Implementation of temporal and spatial variable relationships of radar reflectivity and rainfall rate in a network of X-band radars

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The relationship between radar reflectivity factor Z and rain rate R depicts the only possibility of rain rate estimation when using simple backscatter radars without dual polarized moments. In general, fixed climatological power-law relations are applied for operational use. In order to reduce the bias and large variability between radar rainfall and ground measurements, local adjustment with precipitation measurements from a ground-based network of rain gauges is required.

Within the project PATTERN (Precipitation and Attenuation Estimates from a High Resolution Weather Radar Network) the University of Hamburg and the Max-Planck-Institute for Meteorology set up a network consisting of four low-cost X-band radars. The network is completed by seven vertically pointing micro rain radars (MRR), providing drop size spectra as well as reflectivity and rain rate for 31 height levels. The MRRs are used for calibration purposes as well as for estimation of instantaneous local Z-R relationship in common intersecting volumes of X-band radar and MRR.

Within the X-band radar network a correlation analysis technique is used to detect local time-dependent Z-R relationships using MRRs. In a first step a standard Z-R relation is used for the estimation of the rain field. The detected local Z-R relationships are then applied to the reflectivity measurements of the X-band radar network at co-located X-band and micro rain radar positions. In a last step the newly gained information is distributed in the area using a cell tracking algorithm. The application of this processing chain leads to more accurate quantitative radar rainfall rates in comparison to rainfall estimates based on common climatological relations especially for short integration times and for cells of high reflectivity representing regions with heavy precipitation.

The presentation will give an overview of the technique used to derive present Z-R relationships at the MRR sites as well as the implementation in the X-band radar network using the cell tracking algorithm.
Rain fall estimates based on the newly derived algorithm will be discussed on radar data measured within the PATTERN X-band radar network during a 6 months period in 2013.