A Novel Method for Absolute Calibration of Radars

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Accurate rain rate estimates are of great interest for many fields of application in meteorology and hydrology. Generally, C-band radar networks operated by the National Weather Services or smaller X-band radar systems used for research purposes are used in order to obtain area covering rain rate information. Here, the radar calibration is a limiting factor for the quality of quantitative rain rate estimates. At present, there is no well-established method for operational determination of the device-specific calibration with respect to the measured radar reflectivity. However, the accuracy of this quantity is the basis for a reliable derivation of rain rate estimates.

Within the project Precipitation and Attenuation Estimates from a High-Resolution Radar Network (PATTERN) a novel Triple Radar Absolute Calibration (TRAC) method is proposed and analysed. The TRAC method requires radars operating in a frequency range strongly attenuated by water (e.g. X- or K-band) and utilises this effect in a networked environment. While the attenuation estimates along a horizontal measuring path between two radars allow for a relative calibration of the devices, the additional drop size distribution information from a third, vertically oriented radar beneath the measuring path yields an absolute calibration. The TRAC method features the advantage of an implementation without needing any previously calibrated reference device.

The theoretical framework of the TRAC method is presented and its potential to perform absolute calibration is analysed using simulated data, starting from idealized rain structures and then using more realistic patterns. The sensitivity study focuses on the absolute calibration of the vertically oriented radar.