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Real-time areal precipitation determination from radar by means of statistical objective analysis

G. Heinemann and E.-M. Gerstner

Meteorologisches Institut der Universität Bonn, Auf dem Hügel 20, D-53121 Bonn, Germany, email: gheinemann@uni-bonn.de

Precipitation measurement by radar allows areal rainfall determination with a high spatial and temporal resolution. However, hydrological applications require an accuracy of the precipitation quantification which cannot be obtained by today's weather radar devices. The quality of the radar-derived precipitation can be significantly improved with the aid of ground measurements. In this paper, a complete processing pipeline for real-time radar precipitation determination using a modified statistical objective analysis method is presented. Thereby, several additional algorithms, such as a dynamical use of Z-R relationships, a bias correction and an advection correction scheme are employed. The performance of the algorithms is tested for several case studies. The quality of the radar precipitation estimation is then evaluated by RMS differences (radar-rain gauge) to independent measurements of hourly and daily precipitation sums for two summer seasons (eight months). We show a reduction in the radar-rain gauge RMS difference of up to 59% for the optimal combination of radar processing algorithms, comprising an advection correction, a separation between convective and stratiform precipitation events, a bias correction and a statistical objective analysis.