Sensitivity Study for a Reflectivity Retrieval within the testbed of an X-band radar network

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In recent years the development of high-resolution weather radars (HRWR) is becoming popular. These low-cost systems with small antennas operate in high frequency ranges such as X-band. At this frequency the radar signal is affected by attenuation. Since 2011, the University of Hamburg and the Max-Planck-Institute of Meteorology operate a network of four X-band radars in the North of Hamburg. This initiative is part of the project PATTERN (Precipitation and Attenuation Estimates from a High-Resolution Weather Radar Network) which intends to demonstrate that a network can overcome the drawback of attenuation. In regions that are covered by more than one radar, it is possible to derive both, intrinsic reflectivity and specific attenuation. Here, a retrieval that combines the information of networked radars is required.

Within the project PATTERN, three different retrieval methods, to calculate the specific attenuation from this multiple radar observations setup, are first tested for an one-dimensional setup along connecting lines of two radar systems looking at each other. One of the tested methods is based on the solution of specific attenuation distribution by the integral equation for the reflectivity factor and is related to the retrieval published by Chandrasekar and Lim (2008). Because this algorithm shows the most robust results it is adapted to a two-dimensional application. For detailed studies on the accuracy of the used retrieval method and its sensitivities against shortcomings of real observations, an idealized model based environment within the testbed of PATTERN is chosen. Therefore, the observed logarithmic reflectivity is simulated by a radar forward operator. All settings, input fields and relations are exactly known.

The presentation will describe the used retrieval method as well as the sensitivity study. The sensitivity of the retrieval will be presented in statistical numbers, with respect to disturbed situations. Furthermore, we will discuss the benefits of the algorithm.

References: Chandrasekar, V. and S. Lim, 2008: Retrieval of Reflectivity in a Networked Radar Enviroment. J. Atmos. Oceanic Tech., 25, 1755-1767.