Identification and Quantification of Uncertainties Related to Using Distributed X-band Radar Estimated Precipitation as input in Urban Drainage Models

The Local Area Weather Radar (LAWR) is a small scale weather radar providing distributed measurements of rainfall primarily for use as input in hydrological applications. As any other weather radar the LAWR measurement of the rainfall is an indirect measurement since it does not measure the rainfall, but the energy reflected from the raindrops in the atmosphere. As result a calibration from reflectivity to rainfall intensities is required. This thesis focuses on identifying and estimating uncertainties related to LAWR rainfall estimates. In this connection the calibration procedure is a key element.

A LAWR is normally calibrated against a single rain gauge, which is the normal procedure used to calibrate weather radars. Based on a large set of rain gauge data collected during this project, the uncertainties related to assuming a single gauge representative for a whole LAWR pixel are quantified using statistical methods. Furthermore, the present calibration method is reviewed and a new extended calibration method has been developed and tested resulting in improved rainfall estimates. As part of the calibration analysis a number of elements affecting the LAWR performance were identified and possible improvements suggested. The LAWR is designed to provide rainfall data, especially for urban drainage applications, and as part of the thesis the integration of LAWR data into the DHI software application MIKE URBAN has been analyzed. The work has resulted in identification of scaling issues in connection with boundary assignment besides general improved understanding of the benefits and pitfalls in using distributed rainfall data as input to models. In connection with the use of LAWR data in urban drainage context, the potential for using LAWR data for extreme rainfall statistics has been studied revealing interesting new spatial characteristics of extreme rainfall events not earlier observed.