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Observation, evaluation and application of rainfall from microwave link networks in Sweden

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Accurate measurements of rainfall are very important, as extreme events can cause flooding, which results in damage of property and can cost lives. Climate projections expect the rainfall to get more extreme in the coming decades. Current measurements are mostly based on rain gauges and weather radar. While rain gauges give accurate point measurements, they give very little insight in the spatial distribution of rainfall. Radar gives good spatial coverage, but has lower quality due to several factors, like uncertainty in the conversion of a measured reflected volume in the air to ground rainfall, attenuation and clutter. Derivation of rainfall from microwave link networks (MLNs) allows the possibility of creating high resolution maps both in time and space. The method is still fairly new and offers many opportunities as MLNs are present in most of the world, with an obvious strong correlation in highest density of links and people.
Since 2015 SMHI has worked on implementing the method and improved upon it using a bias correction method based on link length. The first trial was established in the Gothenburg area, where rainfall maps at a one-minute and 0.25 km^2 resolution area generated from 364 microwave links. The results showed that the MLN rainfall correlated very well with local rain gauge measurement and actually outperformed radar measurements. As a result of this trial SMHI is able to process the data in near real-time (less than a minute) and in an operational prototype one-minute rainfall maps for the Gothenburg area are generated (http://www.smhi.se/om-webbplatsen/om-smhi-se-lab/microweather-livedata/).

In this presentation, we will give an overview of recent and on-going MLN research at SMHI including e.g. the following studies:

• Decorrelation properties. A recent follow-up study in Gothenburg looked at the correlation of local (municipal) gauges and microwave links, respectively, with a gauge in the national meteorological network. It was shown that the decorrelation with increasing distance was similar for the gauges and the links, supporting the potential of MLN rainfall.

• Hydro-dynamic modelling. Rainfall input based on gauges, radar and microwave links were used to simulate inflow to the Ryaverket treatment plant in Gothenburg through the main sewer system. Evaluation at four locations indicated an added value of the MLN rainfall, as compared with the other sources.

• Optimal gridding. A new method to define the optimal spatial and temporal grid resolution based on the topology of the MLNs is being developed. By looking at the variability of rainfall using variograms the potential quality of grid points can be estimated.