



Rainfall monitoring with microwave link networks –state of the art

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For the purpose of hydrological applications, meteorology, climate monitoring and agriculture, accurate high resolution rainfall monitoring is highly desirable. Often used techniques to measure rainfall include rain gauge networks and radar. However, accurate rainfall information is lacking in large areas in the world, and the number of rain gauges is even severely declining in Europe, South-America and Africa. The investments required for the installation and maintenance of dense sensor networks can form a large obstacle. Over the past decade, various investigations have shown that microwave links from cellular communication networks may be used for rainfall monitoring. These commercial networks are installed for the purpose of cellular communication. These consist of antennas that transmit microwave link signals through the atmosphere over a path of typically several kilometers. Microwave signals are sensitive to rainfall at the frequencies that are typically used. The loss of signal (attenuation) over the link-path, which is logged in real-time by cellular communication companies for quality monitoring, can therefore be interpreted as a rainfall measurement. In recent years, various techniques have been developed to quantitatively determine rainfall from these microwave link attenuations. An overview of error sources in this process, quantitative rainfall determination techniques, as well as the results of various validation studies are provided. These studies show that there is considerable potential in using commercial microwave link networks for rainfall monitoring. This is a promising development, as these networks cover 20% of the land surface of the earth and have high density, especially in urban areas where there is generally a lack of in situ ground measurements.