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Long term country-wide rainfall monitoring employing cellular communication networks

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Accurate rainfall observations with high spatial and temporal resolutions are needed for hydrological applications, agriculture, meteorology, and climate monitoring. However, the majority of the land surface of the earth lacks accurate rainfall information and the number of rain gauges is even severely declining in Europe, South-America, and Africa. This calls for alternative sources of rainfall information. Various studies have shown that microwave links from operational cellular telecommunication networks may be employed for rainfall monitoring. Such networks cover 20% of the land surface of the earth and have a high density, especially in urban areas.

The basic principle of rainfall monitoring using microwave links is as follows. Rainfall attenuates the electromagnetic signals transmitted from one telephone tower to another. By measuring the received power at one end of a microwave link as a function of time, the path-integrated attenuation due to rainfall can be calculated. Previous studies have shown that average rainfall intensities over the length of a link can be derived from the path-integrated attenuation. This is particularly interesting for those countries where few surface rainfall observations are available. Here we present preliminary results of long term country-wide rainfall monitoring employing cellular communication networks.

A dataset from a commercial microwave link network over the Netherlands is analyzed, containing data from an unprecedented number of links ($\sim$ 2000) covering the land surface of the Netherlands (35500 square kilometres). This dataset spans from January 2011 through October 2012. Daily rainfall maps (1 km spatial resolution) are derived from the microwave link data and compared to maps from a gauge-adjusted radar dataset. The performance of the rainfall retrieval algorithm will be investigated, particularly a possible seasonal dependence.