EMS Annual Meeting Abstracts
Vol. 12, EMS2015-157, 2015
15th EMS / 12th ECAM

Measuring rainfall from cellular communication networks for a 2.5-year period

Aart Overeem (1,2), Hidde Leijnse (2), and Remko Uijlenhoet (1)

(1) Wageningen University, Hydrology and Quantitative Water Management Group, Wageningen, Netherlands (aart.overeem@wur.nl), (2) Royal Netherlands Meteorological Institute, De Bilt, Netherlands

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 communication networks may be used 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 estimation 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, which can be converted to average rainfall intensities over the length of a link. This is particularly interesting for those countries where few surface rainfall observations are available.

A 2.5-year data set from a commercial microwave link network over the Netherlands is analyzed. The data set consists of roughly 2,000 links covering the land surface of the Netherlands (35,500 square kilometers). This study focuses on the overall performance of rainfall estimation using microwave links. Country-wide rainfall maps are retrieved, which are compared to a gauge-adjusted radar data set. The ability of cellular communication networks to estimate rainfall is investigated for different temporal and spatial scales, for different seasons, for extremes, and as function of link network density. Monthly rainfall maps, a spatial validation, and the ability to classify wet and dry periods are presented. To summarize, the results further confirm the potential of these networks for rainfall monitoring.