

Remko Uijlenhoet, Hidde Leijnse, and Aart Overeem

Calling for rainfall observations: Country-wide rainfall maps from cellular telecommunication networks.

The severely declining number of rain gauges in Europe and South-America, combined with the very limited extent of the African observation network, calls for alternative sources of rainfall information. Microwave links from operational cellular telecommunication networks may be employed for rainfall monitoring, potentially over large parts of the land surface of the earth. Along such links radio signals propagate from a transmitting antenna at one base station to a receiving antenna at another base station. Rain-induced attenuation and, subsequently, path-averaged rainfall intensity can be retrieved from the signal's attenuation between transmitter and receiver. We show how such a commercial cellular communication network can be employed to retrieve the space-time dynamics of rainfall for an entire country (the Netherlands, ~35,500 km²), based on an unprecedented number of links (~2600) and a rainfall retrieval algorithm that can be applied in real-time. This demonstrates the potential of cellular communication networks for real-time rainfall monitoring, in particular over those parts of the world, where networks of dedicated ground-based rainfall sensors are often virtually absent (e.g. Africa) as well as densely populated delta regions where rainfall information is crucial for operational water management.