Royal Netherlands Meteorological Institute
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Calling for rain: Rainfall maps from cellular communication networks P 010

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1. Introduction

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.

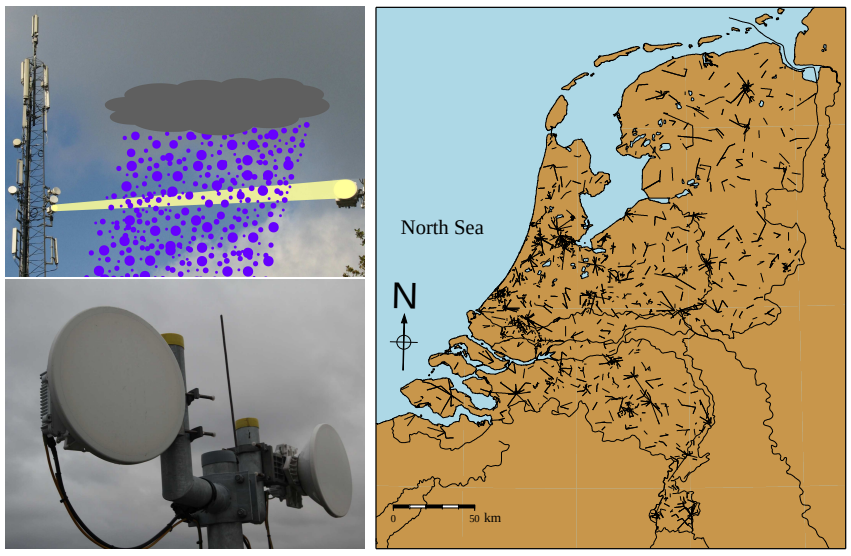

Figure 1: *Estimate rainfall from microwave links in cellular communication network (Overeem et al., 2013).*

Networks of microwave links are used in mobile telecommunication. The principle of rainfall estimation using commercial microwave links is that electromagnetic signals transmitted from one mobile telecommunication antenna to another are attenuated by rainfall (Figure 1). From the decrease in received power, the path-integrated attenuation, and, subsequently, the path-average rainfall intensity can be derived (e.g., Messer *et al.*, 2006; Leijnse *et al.*, 2007; Overeem *et al.*, 2013).

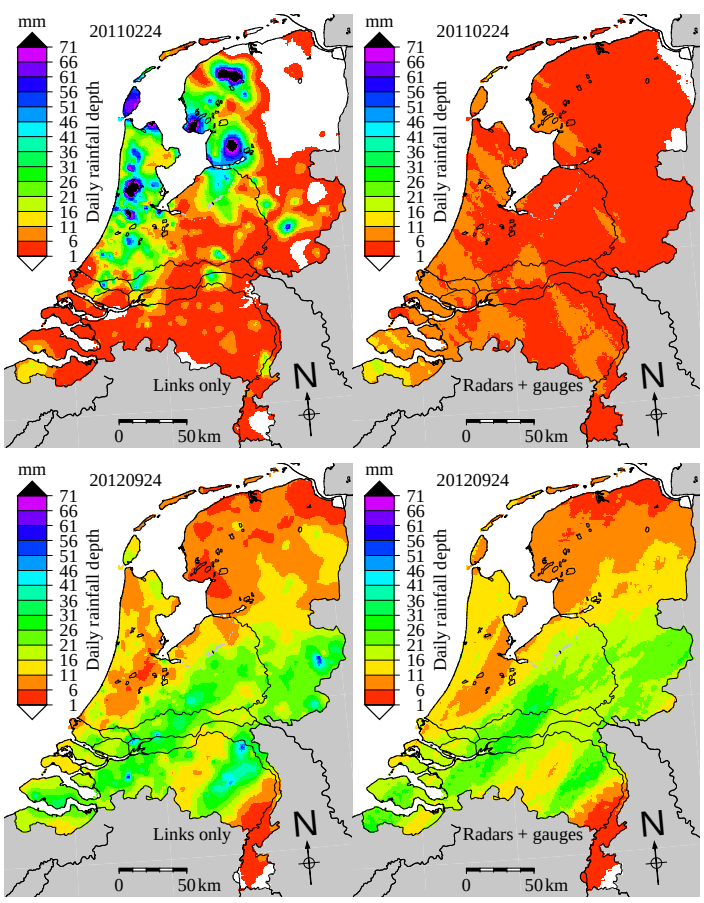

Figure 2: *Daily rainfall maps from links (left) and radars + gauges (right).*

2. Results

The 15-min rainfall intensities from a commercial microwave link network are interpolated using ordinary kriging to obtain 15-min rainfall maps. These are accumulated to daily rainfall maps. Figure 2 shows two of these rainfall maps. One compares fairly well, while the other deviates significantly. This is likely related to melting precipitation on the antennas or on the link path. Figure 3, based on a period of 3 years of data (Jan 2011 - Jan 2014), demonstrates the usefulness of microwave links for rainfall estimation.

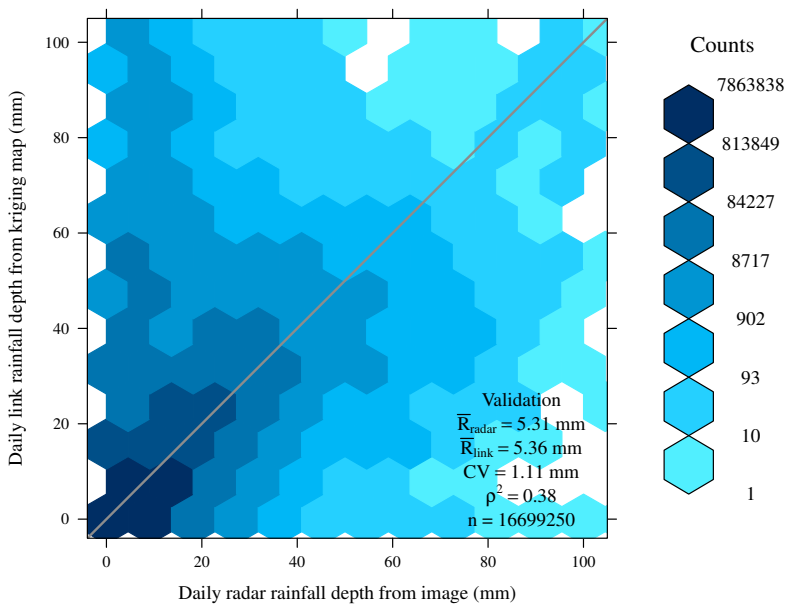

Figure 3: *Scatter plot of daily rainfall: Link vs radars + gauges.*

3. Conclusion

Networks of commercial microwave links hold a promise for measuring rainfall, particularly in those areas where few surface rainfall observations are available. This potentially allows for global land-surface rainfall monitoring (Figure 4).

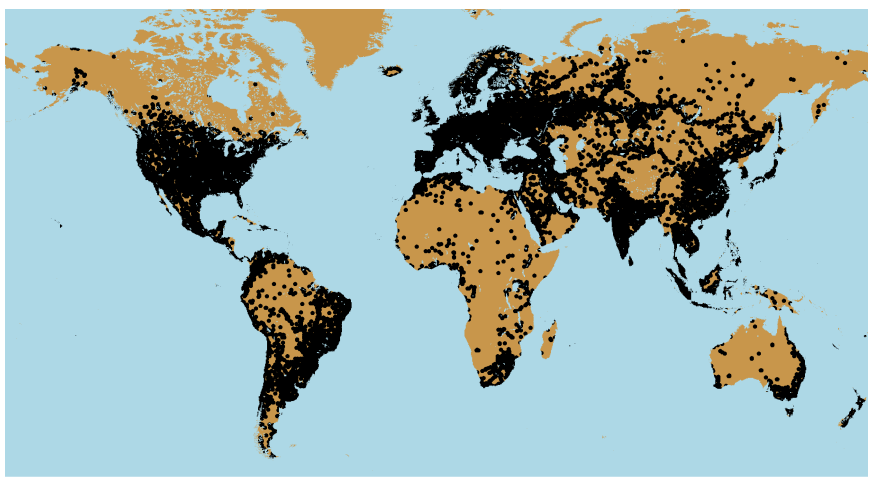

Figure 4: *World map of estimated cellular telephone coverage (Overeem et al., 2013).*

References

Leijnse, H., Uijlenhoet, R., and Stricker, J.N.M., 2007: Rainfall measurement using radio links from cellular communication networks. *Water Resources Research*, 43, W03201.

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