Comparison of rainfall retrieval from collocated commercial microwave links with adjusted radar reference

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One of the pivotal variables in the hydrological system processes is precipitation. In this context, many hydrological applications require a reliably captured structure and temporal development of rainfalls. Therefore, the crucial challenge is to monitor rainfall in high spatial and temporal resolution. The opportunistic sensors for rainfall measurements have a great potential since they can complete standard observation networks with high number of alternative measuring sensors. Nowadays, one of the most prominent opportunistic source of rainfall information are telecommunication networks composed of commercial microwave links (CMLs). CMLs can supply dense path-averaged rainfall information derived from power-law relationship of the microwave signal attenuation and the rainfall intensity.

However, the actual implementation and employment requires a careful consideration of the errors and uncertainties of the measurements. In this study, the influence of different state of the rainfall is excluded using the set of pairs of collocated independent CMLs with paths in the immediate vicinity. Therefore, each pair of collocated CMLs can be assumed as identically influenced by the same rainfall conditions, while their characteristics (e.g., lengths, frequencies, polarizations) vary. The dataset consists of 33 rainfall periods within the years 2014 – 2016 monitored by 13 groups of collocated CMLs.

High correlation (around 0.95) was found for collocated CMLs. Compared to conventional rainfall sensors, for example, Peleg et al. (2013) demonstrated a correlation of 0.92 for collocated tipping bucket rain gauges. The CMLs are also compared with the adjusted weather radar rainfall information which is used as a reference. The dispersion of the data within five intensity ranges was used to set the boundaries (5 % and 95 % quantile). Subsequently, the fit of the CML measurements into the boundaries was examined. CMLs with 0.2 dB/mm/h sensitivity had the highest fit ratio, almost 80 %. Contrastingly, sensors with sensitivity 1.5 dB/mm/h just exceeded the fit ratio of 60 %. Observed differences describe the uncertainties which are not directly driven by the propagation of the signal. The uncertainties of CML need to be further studied to maximize the knowledge-based use of the favourable spatial and temporal resolution of this opportunistic sensing network.

References

Peleg, N., Ben-Asher, M., and Morin, E. (2013) Radar subpixel-scale rainfall variability and uncertainty: lessons learned from observations of a dense rain-gauge network, Hydrol. Earth Syst. Sci., 17, 2195–2208, https://doi.org/10.5194/hess-17-2195-2013.

Section: HS7.2: Precipitation variability from drop scale to catchment scale: measurement, processes and hydrological applications

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