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Cellular networks for reliable urban rainfall monitoring

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Increasing urbanization makes it more and more important to have accurate stormwater runoff predictions, especially with potentially severe weather and climatic changes on the horizon. Such stormwater predictions in turn require reliable rainfall information. Especially for urban centres, the problem is that the spatial and temporal resolution of rainfall observations should be substantially higher than commonly provided by weather services with their standard rainfall monitoring networks. Commercial microwave links (CMLs), pairs of telecommunication antennas, are non-traditional sensors, which have been proposed about a decade ago as a promising solution. CMLs are attenuated by raindrops and the attenuation rate is almost linearly related to the rainfall intensity (Messer et al., 2006).

This contribution presents results of two case studies showing the advantages and limitations of the CML rainfall estimation in the context of urban drainage modelling. The CMLs perform well especially during heavy rainfalls with high space time variability. A CML network is very well suited for urban rainfall monitoring especially in bigger cities where CML lengths correspond to the length scale of subcatchments. CML networks in smaller cities are less dense and CML lengths tend to be here longer which leads to spatial averaging of rainfall peaks. Nevertheless, even here CMLs provide valuable additional rainfall information which can improve rainfall-runoff modelling. The data are technically easily accessible from mobile phone operator's network management centre. The main constraint is currently in finding a suitable business model which would motivate operators to share the CML data also for other than experimental purposes.

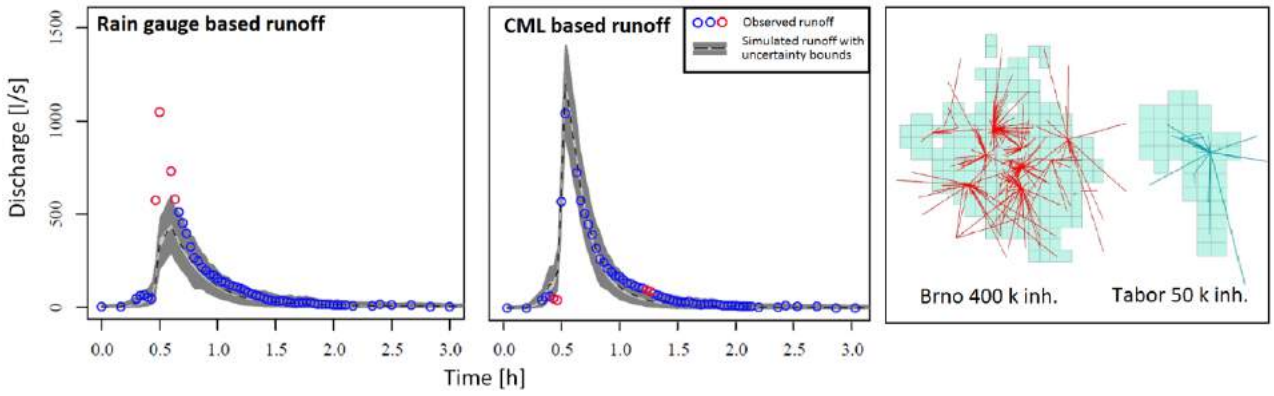

Fig. 1 – Left and middle: Runoff simulated based on three rain gauges about 2.5 km form the catchment located in Prague (CZ) in comparison to the runoff simulated from CMLs. Blue circles depict observed runoff inside of uncertainty bounds whereas red circles are outside of them. Right: CML topology in a city with 50 and 400 thousand inhabitants.

References:

Messer, H., Zinevich, A., Alpert, P., 2006. Environmental Monitoring by Wireless Communication Networks. *Science* 312, 713–713. https://doi.org/10.1126/science.1120034