



Real-time adjusting of rainfall estimates from commercial microwave links

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Urban stormwater predictions require reliable rainfall information with space-time resolution higher than commonly provided by standard rainfall monitoring networks of national weather services. Rainfall data from commercial microwave links (CMLs) could fill this gap. CMLs are line-of-sight radio connections widely used by cellular operators which operate at millimeter bands, where radio waves are attenuated by raindrops. Attenuation data of each single CML in the cellular network can be remotely accessed in (near) real-time with virtually arbitrary sampling frequency and convert to rainfall intensity. Unfortunately, rainfall estimates from CMLs can be substantially biased. Fencl et al., (2017), therefore, proposed adjusting method which enables to correct for this bias. They used rain gauge (RG) data from existing rainfall monitoring networks, which would have otherwise insufficient spatial and temporal resolution for urban rainfall monitoring when used alone without CMLs. In this investigation, we further develop the method to improve its performance in a real-time setting.

First, a shortcoming of the original algorithm which delivers unreliable results at the beginning of a rainfall event is overcome by introducing model parameter prior distributions estimated from previous parameter realizations. Second, weights reflecting variance between RGs are introduced into cost function, which is minimized when optimizing model parameters. Finally, RG data used for adjusting are preprocessed by moving average filter. The performance of improved adjusting method is evaluated on four short CMLs (path length < 2 km) located in the small urban catchment (2.3 km²) in Prague-Letnany (CZ). The adjusted CMLs are compared to reference rainfall calculated from six RGs in the catchment.

The suggested improvements of the method lead on average to 10% higher Nash-Sutcliffe efficiency coefficient (median value 0.85) for CML adjustment to hourly RG data. Reliability of CML rainfall estimates is especially improved at the beginning of rainfall events and during strong convective rainfalls, whereas performance during longer frontal rainfalls is almost unchanged. Our results clearly demonstrate that adjusting of CMLs to existing RGs represents a viable approach with great potential for real-time applications in stormwater management.

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References:

Fencl, M., Dohnal, M., Rieckermann, J. and Bareš, V.: Gauge-Adjusted Rainfall Estimates from Commercial Microwave Links, *Hydrol Earth Syst. Sci.*, 2017 (*accepted*).