EGU21-8454, updated on 23 Jan 2022
https://doi.org/10.5194/egusphere-egu21-8454
EGU General Assembly 2021

Citywide rainfall estimates from hundreds of E-band CMLs

Manuel F. Rios Gaona, Martin Fencl, and Vojtech Bares
Czech Technical University in Prague, Department of Hydraulics and Hydrology, Prague, Czechia (riosgman@cvut.cz)

Commercial Microwave Links (CMLs) have demonstrated to be a valuable complementary measuring technique with regard to rainfall measuring. Their intrinsic characteristics give them an edge over traditional networks such as meteorological radars, satellites, and rain gauges. For instance, given their high density, especially in urban areas, they offer a higher spatial (and even temporal) resolution against rainfall observations from rain gauges. Moreover, they observe rainfall in a close proximity to the ground surface compared to radar and/or meteorological satellites. As their use in monitoring rainfall is in its "early stage", there are still some challenges to overcome, e.g., a low accuracy when observing light rainfall.

In general, CMLs networks used to operate within the C, X, Ku, K, and Ka bands of the electromagnetic spectrum (i.e., ~4 - 40GHz) over distances varying from hundreds-of-meters to tens-of-kilometres. A big advantage offered by these bands is the linear relationship between rainfall intensity and power attenuation, which actually is the cornerstone of rainfall retrievals from CMLs. Nevertheless, as the continuously increasing demand for a larger throughput in such networks, mobile operators are gradually moving into the 71 - 86 GHz region, i.e., the E band. This fact alone brings more challenges in the retrieval of rainfall as the relationship between rainfall intensity and power attenuation not only starts departing from linearity in this band but also is more sensitive to the drop size distribution of rainfall. On the other hand, over such frequencies/band, it is possible now to reliably monitor rainfall intensities lower than 1 mm/h, which was practically impossible with lower-frequency CMLs.

Our work focuses on the performance of ~250 E-Band CMLs over a continuous period of ~7 months in 2020. These CMLs are part of a larger network located in the city of Prague (Czech Republic) and its surroundings. We evaluate their performance against a local network of ~50 rain gauges. We demonstrate the potential of E-band CMLs in retrieving accurate estimates for both light and heavy rainfall. Recently, there has been only few studies focused on E-band links. Our contribution to the field is in performing analyses over a larger spatio-temporal scale.