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Rainfall estimation with microwave links: a substitute for rain gauges? Results from a long-term experiment in Luxembourg-City.

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The potential of microwave links for rainfall estimation is well established. However, applications that show the advantages of this approach in operation remain few. This research illustrates the results of an experimental set-up in Luxembourg-city, where a measuring network has been operational since mid-2010. The experimental network is constituted of 2 dual frequency links (a total of 4 links) that intersect each other and each of them covers a distance of about 4 km. Rain gauges are installed at intermediate locations along the links and a disdrometer allows the estimation of drop size distribution. We checked the performance of different rainfall-attenuation models both based on the attenuation of the individual signals and on the attenuation difference. The model parameters and associated uncertainties were estimated in a Bayesian framework. The calibrated parameters are validated both in different periods and for different links. Results indicate that rainfall estimates based on individual frequency perform better then estimates based on the attenuation difference. We attribute this to the fact that the attenuation difference is potentially more uncertain then the attenuation of individual frequencies. We show that while high intensity rainfall events are well captured, that estimates of rainfall totals related to low intensity rainfall events can be potentially very uncertain. This suggests that microwave links and rain gauges should ideally be used in combination.