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Exploiting a dense Commercial Microwave Link (CML) network in Nigeria for high-resolution near-surface rainfall estimates

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High-resolution rainfall data, in both space and time, is essential for a number of life sustaining (hydrological) applications, ranging from flood early warning to (small-holder) agricultural services. Interpolated rainfall maps based on path-averaged rainfall estimates from Commercial Microwave Links (CMLs) present a viable alternative for near-surface high-resolution gridded rainfall data in regions where weather radars are typically not present or not operational, most notably large parts of Africa.

Recent projects in Burkina Faso, Ghana and Rwanda, in addition to multiple proof of concepts in different African countries (Burkina Faso, Cameroon, Kenya, Niger and Zambia) over the past decade, show the added value of CML based rainfall retrievals is increasingly being recognized across the African continent. One of the major challenges in applying this technique over Africa, however, is the lack of adequate near-surface reference data from either rain gauges or weather radars. Although satellite rainfall products are generally available, their temporal or spatial resolution is often too coarse, and their accuracy can be low over the tropics.

In this study we use several months of CML data from a dense network in Nigeria consisting of more than 12,000 links, predominantly over four heavily urbanized areas, to estimate near-surface rainfall rates. The 15-minute minimum and maximum received signal levels, obtained from the network management system of one of the mobile network operators in Nigeria, are used to estimate the path-averaged rainfall intensities. As a point reference we use data from the few available rain gauges. Additionally, we compare interpolated rainfall maps from CMLs to available gridded (satellite) rainfall products on a seasonal basis. In doing so, our aim is to exploit this large CML network to quantify the uncertainty range in rainfall estimates amongst the CMLs themselves, and assess the effect of interpolating path-averaged rainfall intensities from such a dense network with many short links. We also show the locally added value for urban water management applications by using the CMLs to highlight the rainfall variability within a satellite rainfall product pixel.

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Yes

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