Geophysical Research Abstracts
Vol. 21, EGU2019-12358-1, 2019
EGU General Assembly 2019

Characterising rainfall spatial variability within Melbourne CBD using opportunistic sensing

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Rainfall remains one of the most challenging meteorological variables to measure accurately. Dense rain gauge networks combined with operational weather radars are widely considered as the most reliable source of rainfall rate estimates. However, both of these measurements do not perform well in dense urban environments. Appropriate locations to install rain gauges are usually problematic to find among high-rise buildings and densely constructed areas; these same buildings also create ground clutter for weather radars. Thus, there is often no or limited information on the spatial variability of rainfall in inner cities. Fortunately, dense networks of Commercial Microwave Links (CML) are often associated with dense population, e.g. inner cities, and the attenuation of their received signal level during rainfall can provide an additional and independent source of observation for precipitation estimation.

In this study, a network of 18 CMLs with frequencies ranging from 22 to 38 GHz covering about 3 sq.km were used to characterise the spatial variability of rainfall around the Melbourne CBD. Most CML transmitters and receivers are located on rooftops of high-rise buildings, and at elevations above ground ranging from 200 to 260 m. Preliminary results show significant spatial variability of both intensity and cumulative rainfall amount across these CMLs. Two nearby rain gauges located within 5 km distance from the CBD also show similar variability of cumulative rainfall amounts.

This study shows that the use of CML signal attenuation is able to provide unique observations of rainfall intensities and cumulative amounts in a large Metropole CBD, where other estimates of rainfall are non-existent, and where the exposure of individuals to extreme weather events is the greatest due to the concentration of inhabitants per sq.km.