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Towards Near Real-time Convective Rainfall Observations over Kenya

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The existing meteorological infrastructure in Kenya is poorly suited for the countrywide real-time monitoring of precipitation. Rainfall radar is not available, and the existing network of rain gauges is sparse and challenging to maintain. This severely restricts Kenya's capacity to warn for, and respond to, weather related emergencies. Furthermore, the lack of accurate rainfall observations severely limits Kenya's climate change adaptation capabilities.

Over the past decade, the mobile telephone network in Kenya has expanded rapidly. This network makes extensive use of terrestrial microwave (MW) links, received signal level (RSL) data from which can be used for the calculation of rainfall intensities. We present a novel method for the near-real time observation of convective rainfall over Kenya, based on the combined use of MW RSL data and Meteosat Second Generation (MSG) satellite data.

In this study, the variable density rainfall information derived from several MW links is scaled up using MSG data to provide full rainfall information coverage for the region surrounding the links. Combining MSG data and MW link derived rainfall data for several adjacent MW links makes it possible to make the distinction between wet and dry pixels. This allows the disaggregation of the MW link derived rainfall intensities. With the distinction between wet and dry pixels made, and the MW derived rainfall intensities disaggregated, these data can then be used to develop instantaneous empirical relationships linking rainfall intensities to cloud physical properties. These relationships are then used to calculate rainfall intensities for the MSG scene. Since both the MSG and the MW data are available at the same temporal resolution, unique empirical coefficients can be determined for each interval. This approach ensures that changes in convective conditions from one interval to the next are taken into account.

Initial results from a pilot study, which took place from November 2012 until January 2013, are presented. The work has been carried out in close cooperation with mobile telephone operator Safaricom, using RSL data from 15 microwave links in rain prone areas in Western Kenya (out of a total of 3000 MW links operated by Safaricom in Kenya). The data supplied by Safaricom consist of the mean, minimum and maximum RSL for each MW link over a 15 minute interval. For this pilot study, use has been made of the MSG Cloud Top Temperature data product from the Royal Dutch Meteorological Institute's MSG Cloud Physical Properties database (http://msgcpp.knmi.nl/).