Geophysical Research Abstracts
Vol. 19, EGU2017-16049-1, 2017
EGU General Assembly 2017

Improving rainfall estimation from commercial microwave links using METEOSAT SEVIRI cloud cover information

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The number of rain gauges is declining worldwide. A recent promising method for alternative precipitation measurements is to derive rain rates from the attenuation of the microwave signal between remote antennas of mobile phone base stations, so called commercial microwave links (CMLs). In European countries, such as Germany, the CML technique can be used as a complementary method to the existing gauge and radar networks improving their products, for example, in mountainous terrain and urban areas. In West African countries, where a dense gauge or radar network is absent, the number of mobile phone users is rapidly increasing and so are the CML networks. Hence, the CML-derived precipitation measurements have high potential for applications such as flood warning and support of agricultural planning in this region.
For typical CML bandwidths (10-40 GHz), the relationship of attenuation to rain rate is quasi-linear. However, also humidity, wet antennas or electronic noise can lead to signal interference. To distinguish these fluctuations from actual attenuation due to rain, a temporal wet (rain event occurred)/ dry (no rain event) classification is usually necessary. In dense CML networks this is possible by correlating neighboring CML time series. Another option is to use the correlation between signal time series of different frequencies or bidirectional signals. The CML network in rural areas is typically not dense enough for correlation analysis and often only one polarization and one frequency are available along a CML. In this work we therefore use cloud cover information derived from the Spinning Enhanced Visible and Infrared Imager (SEVIRI) radiometer onboard the geostationary satellite METEOSAT for a wet (pixels along link are cloud covered)/ dry (no cloud along link) classification.
We compare results for CMLs in Burkina Faso and Germany, which differ meteorologically (rain rate and duration, droplet size distributions) and technically (CML frequencies, lengths, signal level) and use rain gauge data as ground truth for validation.