Geophysical Research Abstracts
Vol. 14, EGU2012-11818, 2012
EGU General Assembly 2012

Continuous rainfall measurements using commercial backhaul links in the alpine and pre-alpine region of Southern Germany

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Measuring rain rates over complex terrain is afflicted with large uncertainties. Rain gauges are increasingly affected by wind and exposure induced errors and weather radar measurements in mountainous regions are hampered by beam blockage and enhanced bright band interception.

We present results from a new method to estimate near surface rain rates exploiting attenuation data from commercial microwave links in the pre-alpine and alpine region of Southern Germany. This technique makes use of the fact that microwave radiation is considerably attenuated when passing through precipitation. We record received signal level (RSL) data with minute resolution using small data loggers at the towers which send the records to a database server via GSM.

Unfortunately precipitation is not the only source of attenuation along a microwave link path. Several other atmospheric parameters can cause significant changes in RSL. Thus large RSL fluctuations occur in periods without rain which makes the determination of attenuation caused by precipitation not straightforward. To be able to derive meaningful precipitation information from the RSL data, the time series is divided into wet and dry periods. To perform this wet/dry classification for our continuous minute resolution RSL data from July 2010 to October 2010, we introduce a new method to detect wet and dry periods using spectral time series analysis.

The algorithm's performance and its limitations are analyzed using rain gauges as ground truth for event detection. It proves to perform well for all five commercial backhaul links. Although the threshold used in the algorithm has to be adjusted for different links to get optimal performance, it is stable within a certain range of threshold values.

We show a comparison of the derived rain rates with rain gauge and weather radar measurements for the entire test period from July 2010 to October 2010. The resulting correlations differ for different links and reach values of $R^2 = 0.80$ for the link-gauge comparison and $R^2 = 0.84$ for the link-radar comparison.