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TERRESTRIAL ENVIRONMENTAL OBSERVATORIES

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

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1. Motivation

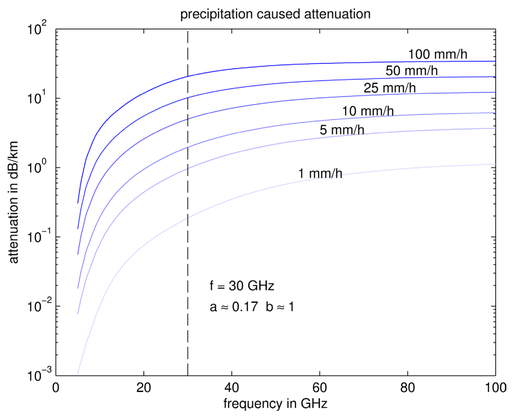
Estimating the spatial and temporal distribution of precipitation is of crucial importance for hydrological analyses. This is particularly true in regions with a high spatial precipitation variability like the Alps. Unfortunately the established precipitation observation methods lack the desired accuracy there because of the complex terrain. To improve this situation the **PROCEMA** project **exploits attenuation data from commercial microwave backhaul links** complementing rain gauge and radar derived measurements.

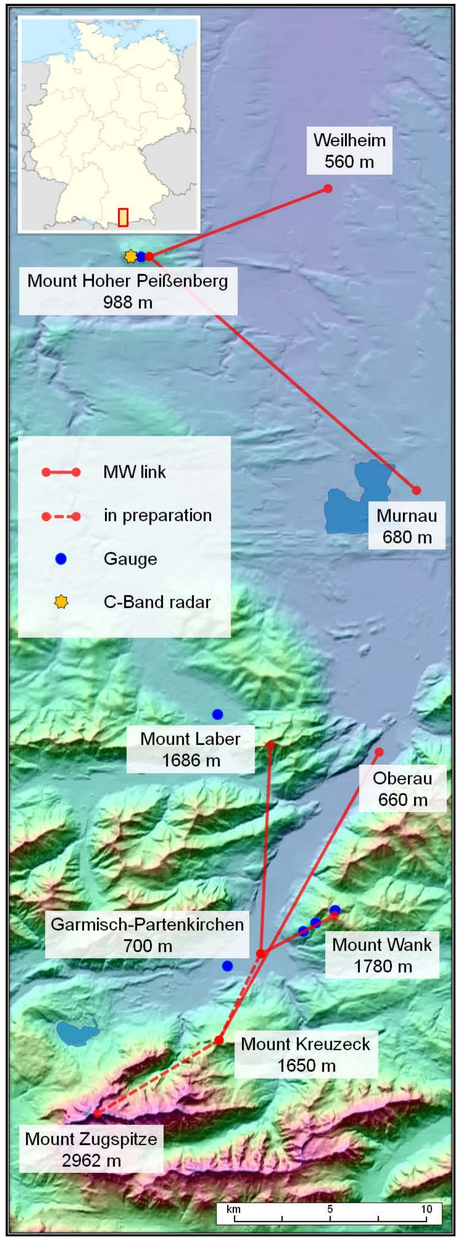
2. Measurement principle

Power law relation between rain rate R in mm/h and line integrated attenuation A in db/km

$$A = aR^b$$

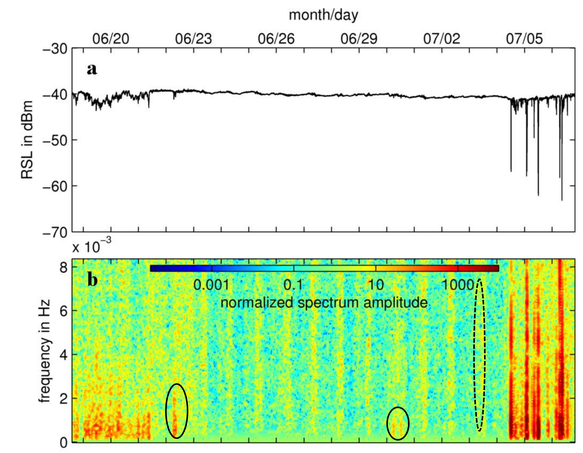
with constants a and b depending on frequency





3. Baseline determination

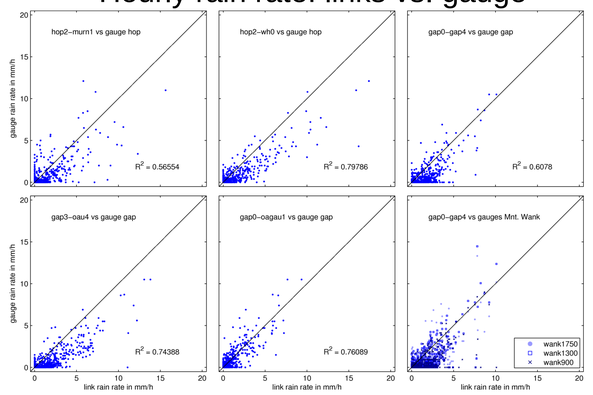
The fluctuations of the received signal level (RSL) during dry weather (Figure a) make a dynamic attenuation baseline necessary. This baseline is derived using a **wet/dry classification** which identifies wet (rainy) periods. A new baseline is set for each continuous wet period according to the dry period before. The decision whether a period is wet or dry is based on **spectral analysis** of the time series around the period of interest. Rainy periods are identified by strong **deviation of amplitudes** in the low frequency regime (Solid circle in Figure b), in contrast to dry periods, where the deviation is distributed evenly over the whole frequency range (dotted circles).



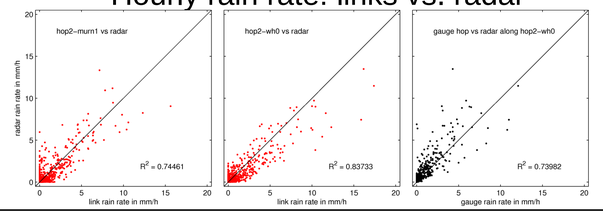
4. Results

From the attenuation, rain rates are derived with a minute resolution. For comparison with radar and gauge data hourly averages are used. The plots on the right show all hourly **rain rates from July to October 2010**. Good correlation, especially with the radar data averaged along the links can be observed(only two links had radar coverage). For comparison with radar data there are in particular less outliers then with the gauge data.

Hourly rain rate: links vs. gauge



Hourly rain rate: links vs. radar



5. Conclusion

Microwave backhauls links provide a good and inexpensive tool for precipitation observation with a much higher spatial representativeness than rain gauges.

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