Precipitation observation with commercial microwave links in the alpine region of Garmisch-Partenkirchen

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Quantification of precipitation in mountainous regions is still a scientific and technical challenge. Weather radar applications suffer from beam blockage and clutter, preventing accurate measurements close to the ground. Enhanced bright band interception adds additional uncertainty. Rain gauge measurements in steep terrain and high elevations, on the other hand, are difficult to perform and have limited reliability, for example due to undercatch errors.

Attenuation data from commercial microwave links (MW-links) can provide valuable information on precipitation, complementing radar and gauge observations. These MW-links are widely used to provide the backbone of the cell phone network but are also in operation for company intranet infrastructures. In our lab at KIT/Campus Alpin we access data from several MW-inks in the pre-alpine and alpine region of Garmisch-Partenkirchen, provided by Ericsson GmbH and additionally by a local ski resort company, the Bayerische Zugspitzbahn.

We have analyzed five month of continuous MW-link data in the region between Garmisch-Partenkirchen and the DWD research radar at Mount Hoher Peißenberg. For the detection of rain events in the MW-link time series we have developed a classification method based on short-term Fourier transform. The MW-link derived rain rates compared very well to the rain rates derived from radar data, with values of R squared larger than 0.81.

Furthermore we elaborate on the different methods to acquire the data from the MW-link operators. The different methods, as well as the different microwave link hardware types, provide raw data with different temporal resolution and power quantization. Hence, the required processing steps have to be adjusted to the data. We evaluate the performance of four methods to identify rainy periods in the different types of MW-link raw data.