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Wet/dry-estimation algorithm for commercial backhaul link attenuation data to derive precipitation intensity in alpine terrain

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Improving the estimation of spatial and temporal precipitation distribution is of crucial importance for hydrological analyses. This is particularly true in regions with a coarse station network density or high spatial precipitation variability. A new means to accomplish this task is exploiting attenuation data from commercial backhaul links, which is a useful complementary to traditional rain gauge and radar derived estimations, since it is based on a different spatial and temporal scale.
The attenuation of microwave radiation heavily depends on precipitation intensity along the line of its propagation. However, precipitation is not the only source of changes in signal strength on a point to point backhaul link. Other atmospheric conditions (sun radiation, humidity, temperature) also affect it, albeit with lower impact. That is, the received power of a backhaul link is always fluctuating. Thus, for deriving precipitation intensities, one needs to distinguish between the sources of those fluctuations and define a baseline which the rain induced attenuation refers to. We developed an algorithm based on the spectral analysis of the recorded time series to identify attenuation events caused by precipitation. Going along the time series it analyses the spectrum of a short snippet of points and decides whether or not the current point should be regarded as “wet” (rain) or “dry” (no rain).
Our test site is the alpine area surrounding Garmisch-Partenkirchen (Germany) which is characterized by steep topography with mountain ranges covering altitudes from 600 to nearly 3000 m above sea level. Five commercial backhaul links were equipped with specifically developed GSM data acquisition modules to record minutely averages of the received power. We present results of the first year of observation showing the performance of our wet/dry estimation and a comparison with data from rain gauges and a nearby weather radar.