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The new real-time radar-gauge-CML adjustment system pyRADMAN at DWD

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Adjusting weather radar data with ground-based precipitation observations is an established way to overcome radar-specific uncertainties. Most commonly, rain gauge data is used for this task. Commercial microwave links (CMLs) deployed by mobile network operators offer another source of rainfall information that can be used to adjust weather radar data. One of the main advantages of CMLs for this task is the real-time availability of their data with a latency of less than a minute. In addition, their large number, with high densities in particular in urban regions, and the path-averaging nature of their measurements have the potential to improve radar adjustment at short aggregation times.

We developed the Python framework pyRADMAN which is capable of merging weather radar with rain gauge and CML data with selectable temporal aggregations from minutes to hours. The path-averaging nature of the CML data is considered when merging with the gridded radar data. Computational efficiency has been taken into consideration in all implementations allowing a full countrywide radar adjustment for Germany, including the required processing of CML rainfall estimates, within 2 minutes with a pure Python implementation. pyRADMAN has now been continuously operating at DWD in real time since August 2023. Currently, real-time data streams from the gridded weather radar composite (based on 17 radar sites), ~1500 rain gauges, and ~5000 CMLs are handled by pyRADMAN, and products consisting of different combinations of sensors are produced for several aggregation times and latencies.

We will show the general concept of pyRADMAN and present results from merging radar data with rain gauge and CML data. Our analysis will consist of selected events and monthly statistics. Results will be shown for aggregation times from 5 to 60 minutes and latencies of production from 5 to 20 minutes (increasing the number of available rain gauges for merging with increasing latency).