GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung
HoWa PRO
Universität Augsburg University

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Development of a Python framework for QPE using radar and CML data

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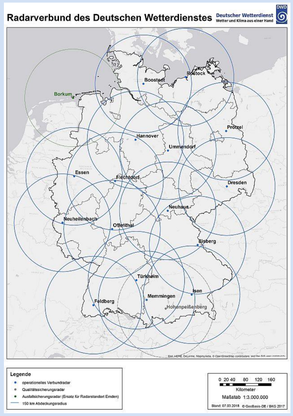

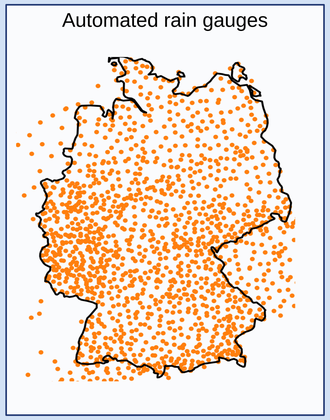

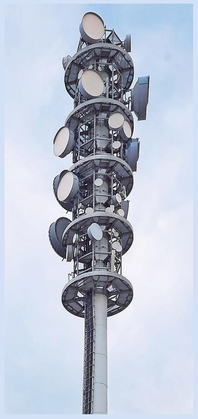

Fig. 1) Radar composite (left) and rain gauges (mid) covering Germany. Photo (© Cynthia Ruf) of a CML antenna (right).

Radar adjustment using rain gauges is a widespread concept. However, due to the relatively low coverage of rain gauges radar adjustment can be further improved by adding additional opportunistic data sources. Using a dense network of CMLs allows radar-based precipitation estimates to better quantify small extreme weather events, especially in urban areas.

Project HoWa-PRO

Climate change increases the probability of local extreme weather events and its impacts, e.g. flash floods. The goal of HoWa-PRO is to provide more precise predictions of and early warnings against dangers of flooding in small catchment areas. To achieve this goal, opportunistic data from the attenuation of CML signals are used, in addition to the observation network of the DWD consisting of weather radars and stations. The new precipitation product including CML data is used together with meteorological forecast products (e.g. ICON-D2) to generate hydrological forecasts for 48 hours via a precipitation runoff model every hour. Results are presented in an interactive dashboard where also former events can be analyzed. For a practically oriented realization, workshops will be carried out to determine the needs and state of knowledge of users of the warning system. Scenario-based serious games and a modular training concept support that realization (for more information, see www.howa-pro.sachsen.de).

HoWa-PRO was launched in the course of the announcement „Innovation im Einsatz – Praxisleuchttürme der zivilen Sicherheit“ of the BMBF as part of the program „Forschung für die zivile Sicherheit“ of the German government.

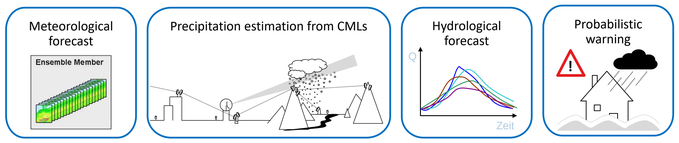

Fig. 2) Modules of the HoWa-PRO flood risk management system

pyRADMAN

At DWD we implemented a new modular software framework called pyRADMAN to enhance flexibility of the operational processing system RADOLAN (www.dwd.de/radolan).

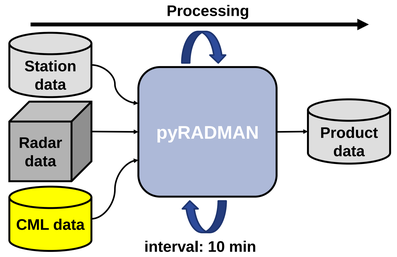

Fig. 3) Technical infrastructure at DWD

For adjustment, several parameters like
- data sources (such as radar, rain gauge and CML)
- accumulation times
- adjustment methods
- starting time of processing

can be configured.

Reprocessing mode

pyRADMAN’s reprocessing mode has been implemented for validation and investigating QPEs based on new sets of parameters.

Routine mode

In routine mode, pyRADMAN currently produces QPEs every 10 min. For validation purposes, the adjustment method is based on RADOLAN. i.e. ratios and differences between radar-based precipitation estimates and gauge measurements are determined and used for correction of the QPE.

First results

First results of adjusted radar data using pyRADMAN are demonstrated in Figures 4 (c) and (d).
As shown in Figure 4 (b), we achieve almost the same result as data adjusted by RADOLAN. Even if only plausibility checked rain gauge data with shorter delivery time are used, the difference to RADOLAN adjusted data remains small. An adjustment procedure using CML data will be implemented in the next step.

Data sources

- CML data of 10,000 sender-receiver pairs with a time resolution of 10 sec are available every minute
- Radar data from 17 locations in Germany are delivered every 5 min
- 1,400 rain gauges with a time resolution down to 1 min are accessible every 10 min for DWD in total. Plausibility checked data from 900 gauges are delivered after 5 min, quality checked data from 1,400 gauges after 25 min

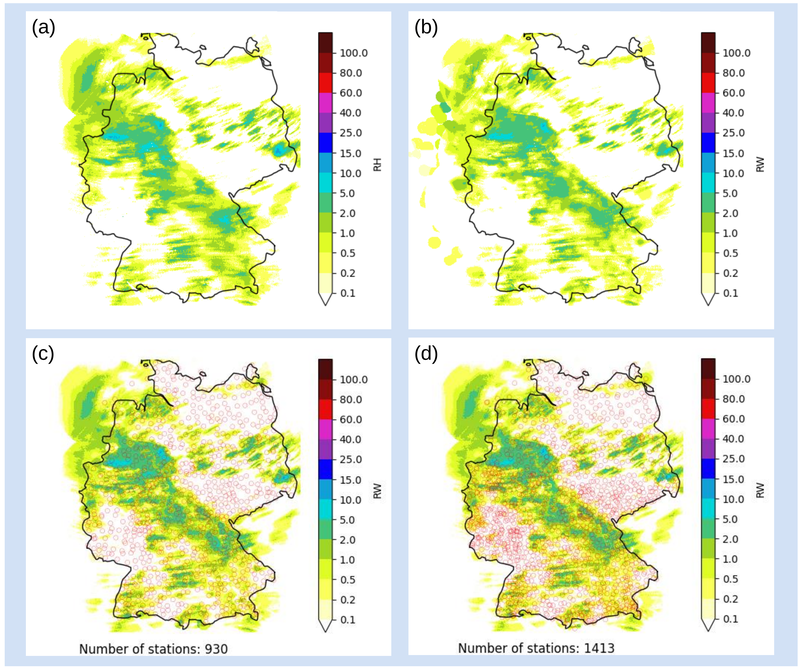

Fig. 4) (a) Initial radar data, (b) Adjusted by RADOLAN with quality checked rain gauges, (c) Adjusted by pyRADMAN with plausibility checked rain gauges, (d) Adjusted by pyRADMAN with quality checked rain gauges.

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