Weather radar adjustment with pyRADMAN: Experiments with and without commercial microwave links

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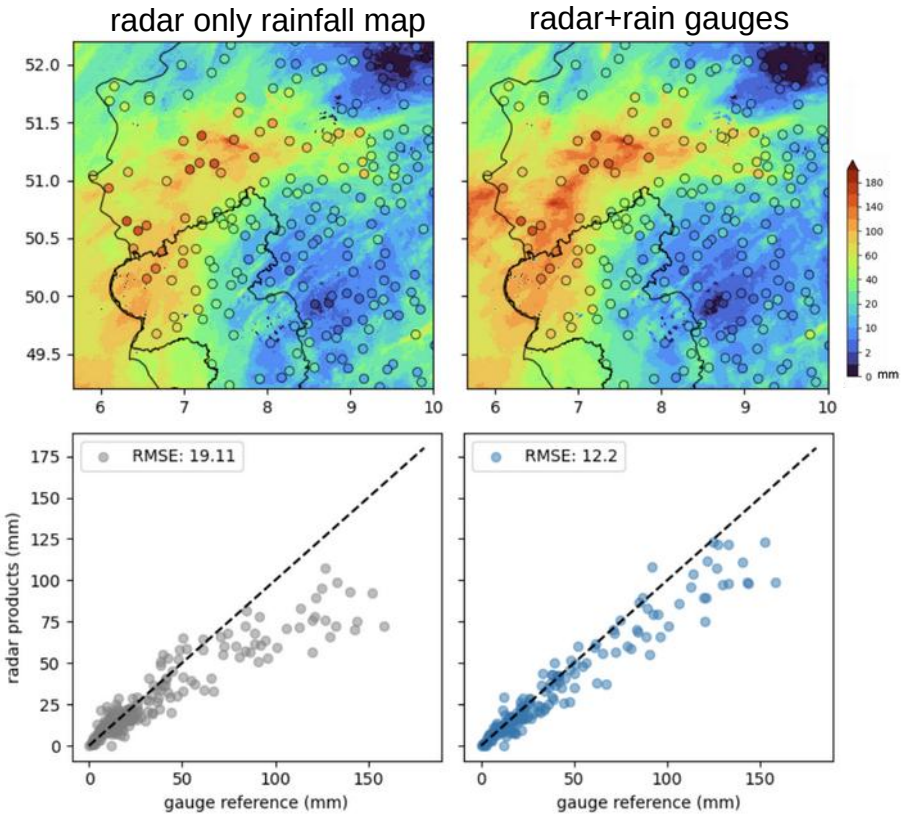
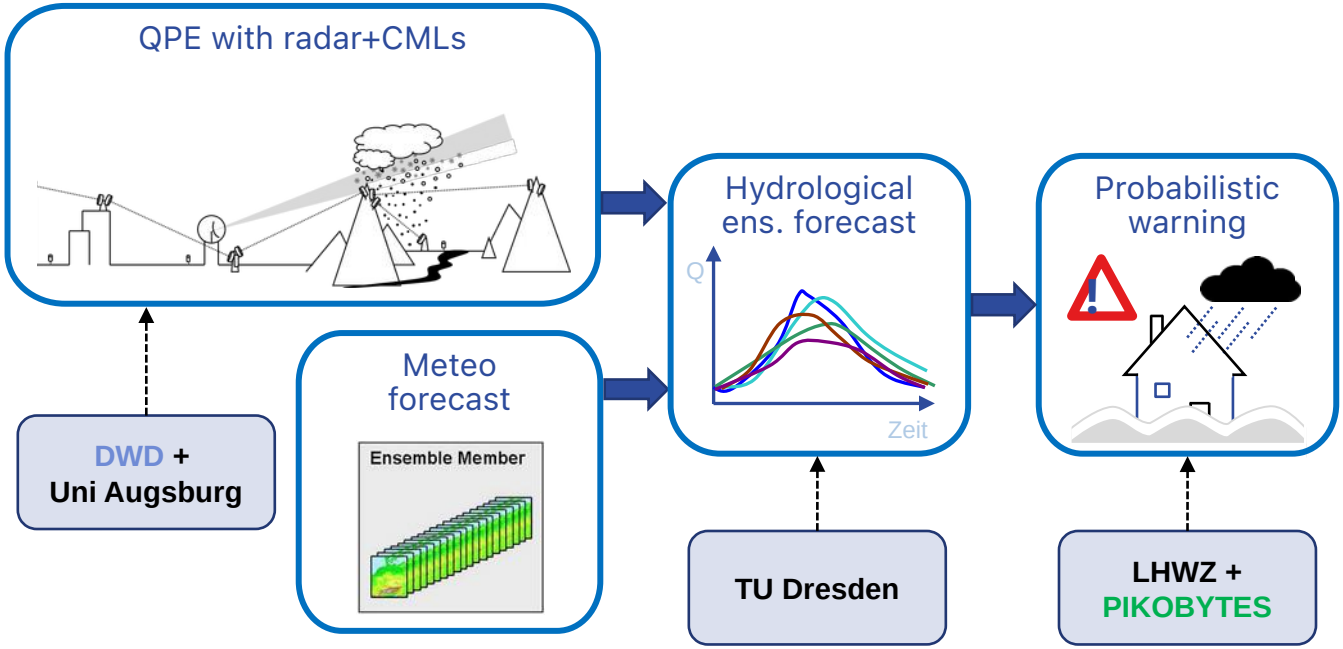
Motivation – Ahrtal July 2021

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Three day rainfall sum

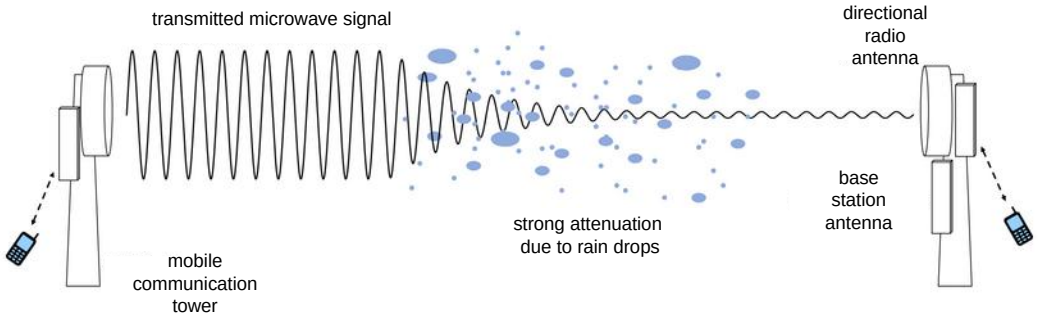


HoWa-PRO

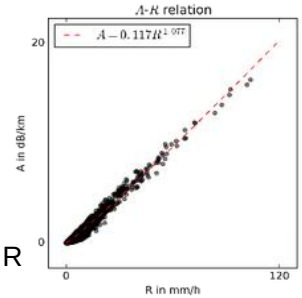


→ *Operational Hydrologic Ensemble Forecasts in Small Catchments – Implementing New Products for Precipitation Estimation and Seamless Predictions* – Grundmann et al. Tuesday 11:15

Rainfall estimation with commercial microwave links (CMLs)



Experimentally measured relation between attenuation A and rain rate R

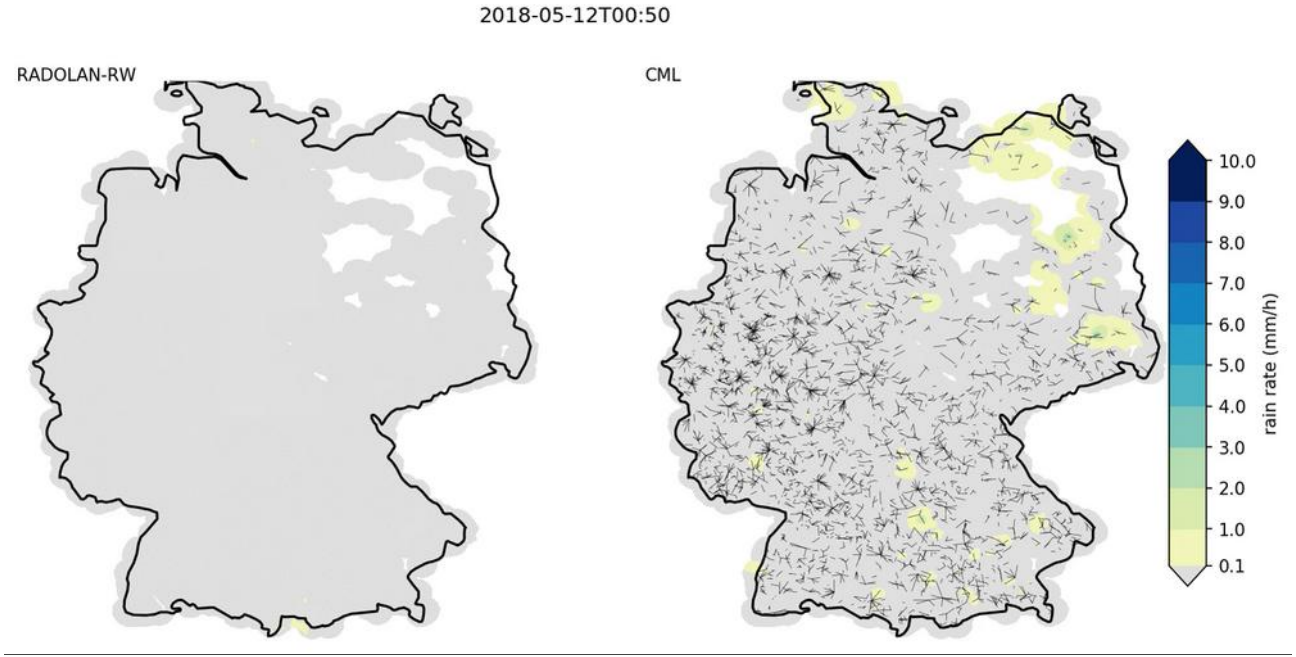


A-R power law: $A = aR^b$

[mm/h]

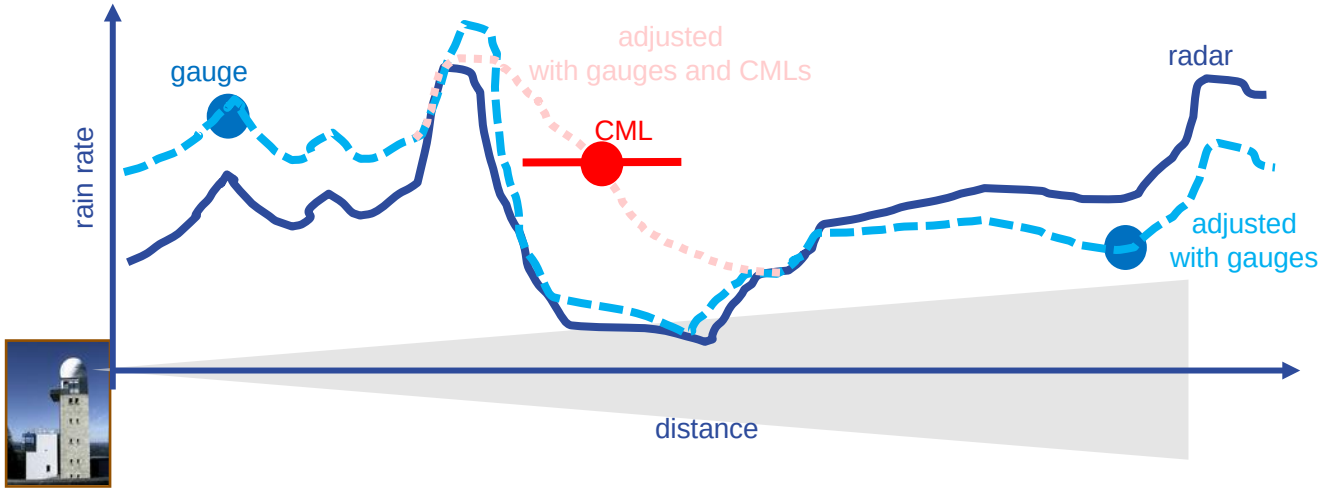
[dB/km]

Rainfall estimation with commercial microwave links (CMLs)

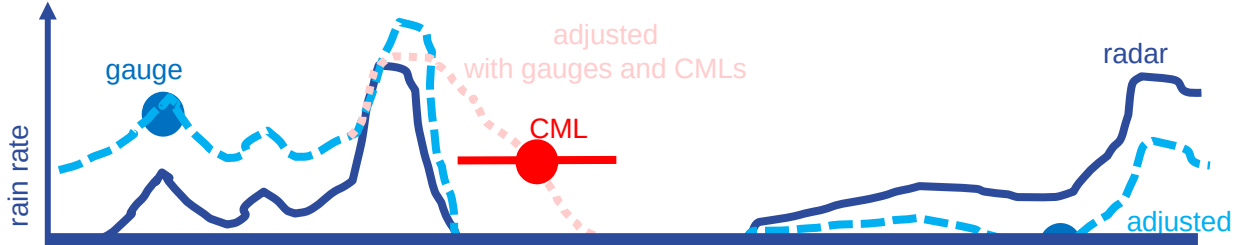


Graf et al. (2020), HESS

Radar adjustment

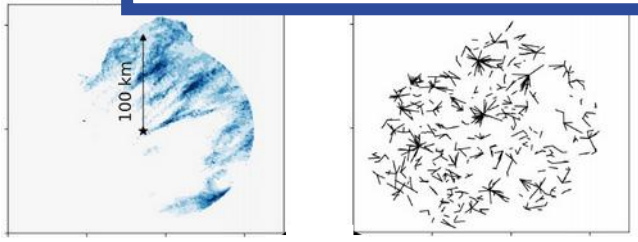


Radar adjustment

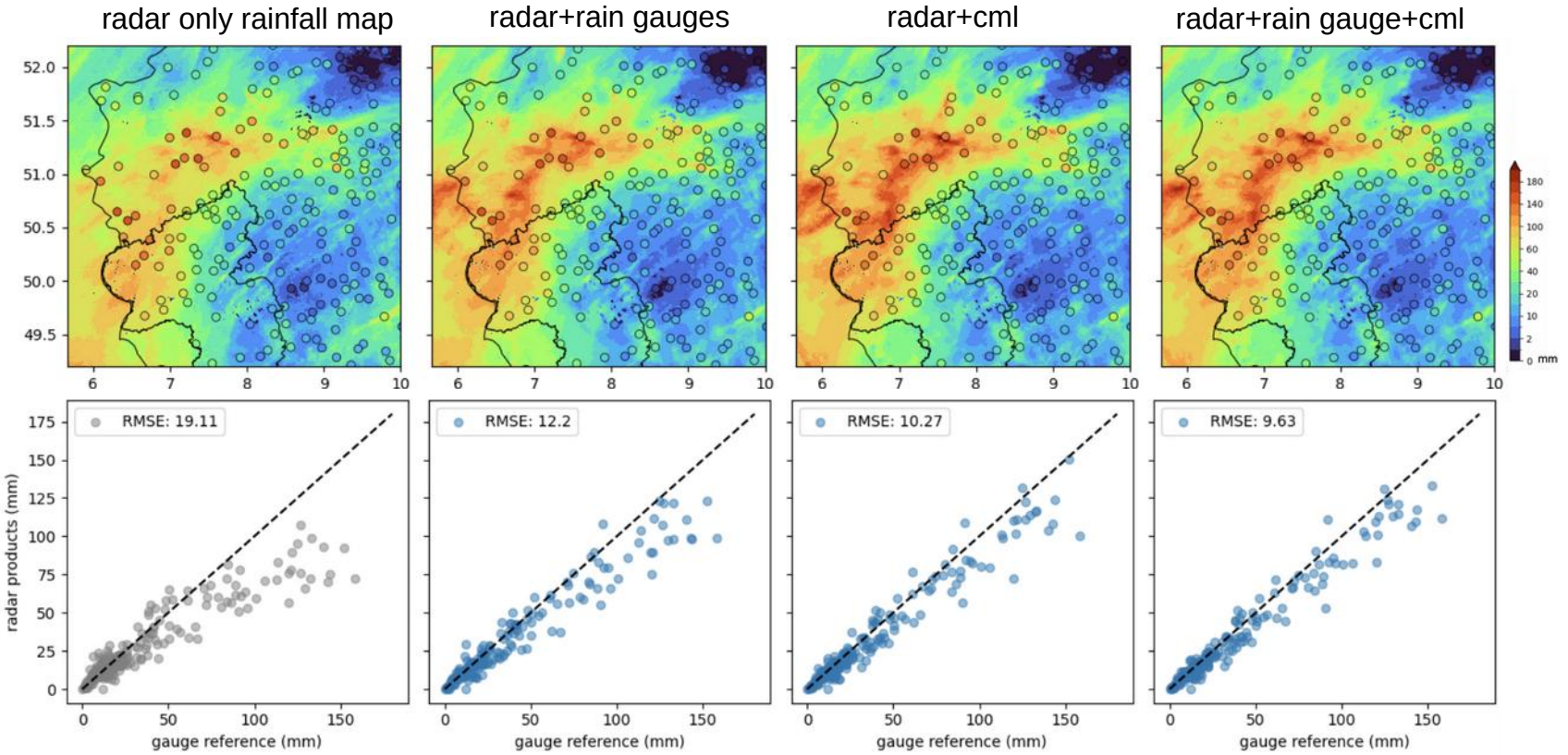


CML adjustment in RADOLAN (DWD)

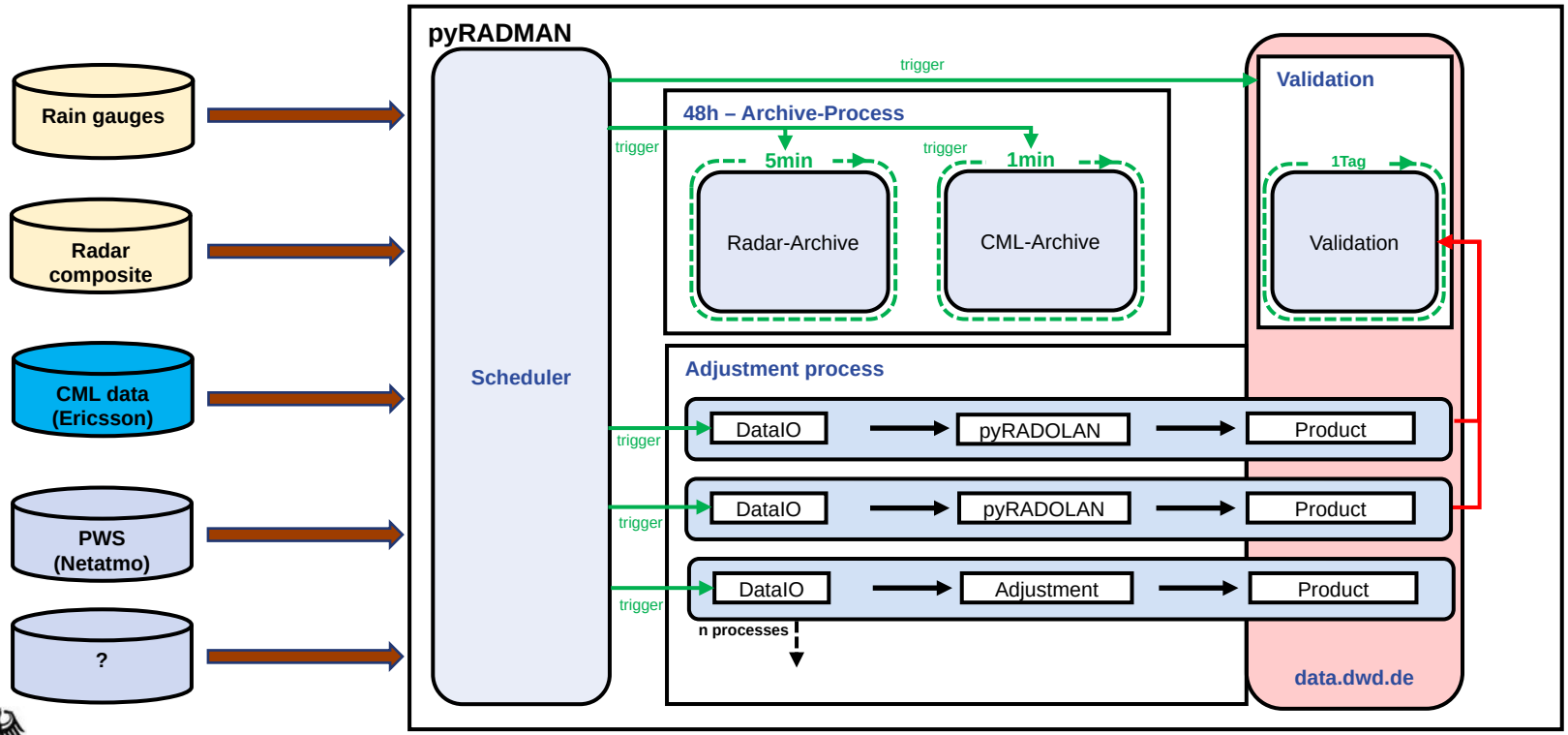
→Use CML and ‚radar@cml' analog to a rain gauge in RADOLAN adjustment (pyRADOLAN)



Results Ahrtal



pyRADMAN – a modulare adjustment software at DWD



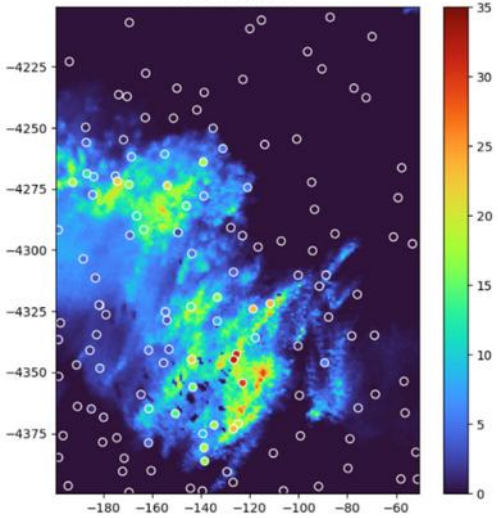
Adjustment Methods

- RADOLAN (operational adjustment routine at DWD)
  - Weighted additive and multiplicative adjustment

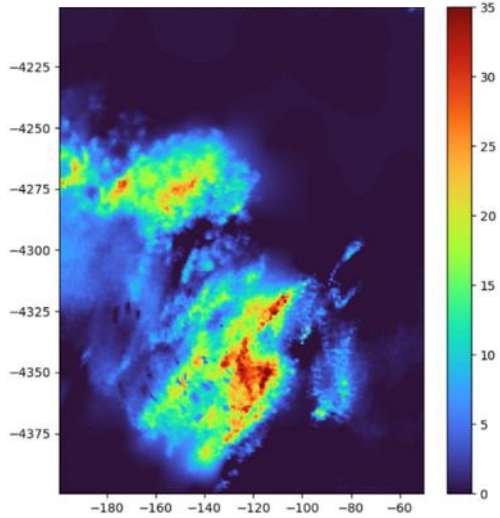
Adjustment Methods

- RADOLAN (operational adjustment routine at DWD)
- Kriging with external drift (KED)

Radar and rain gauge data

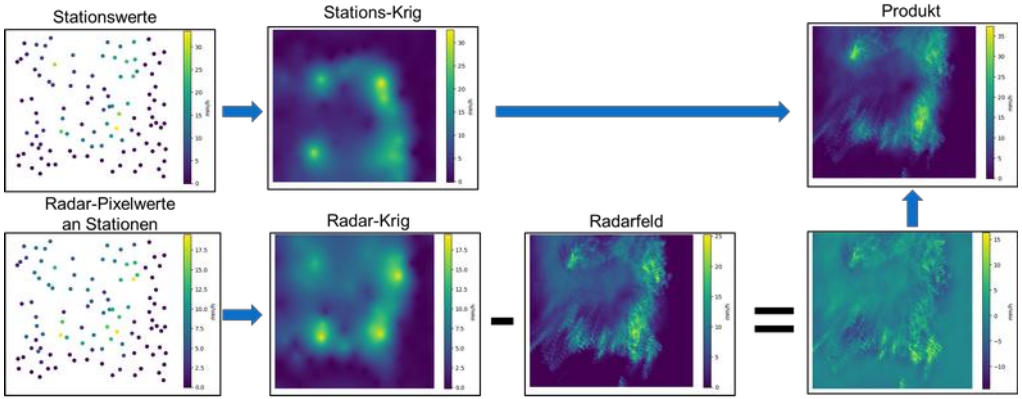


Kriged rain gauge data
with radar as external drift



Adjustment Methods

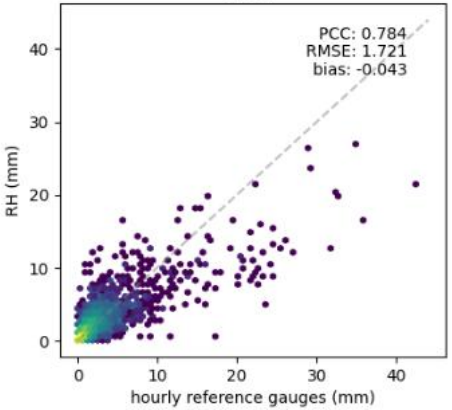
- RADOLAN (operational adjustment routine at DWD)
- Kriging with external drift (kriging rain gauges with radar data as drift)
- Conditional merging (Ehret, 2003)



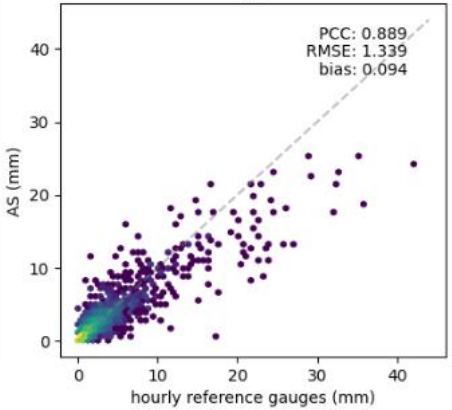
Radar + Gauge adjustment methods

(daily referencere, August 2023)

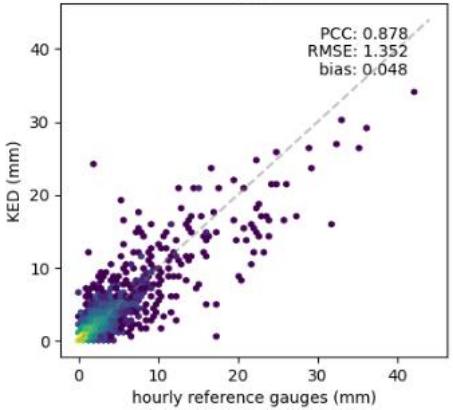
Unadjusted radar



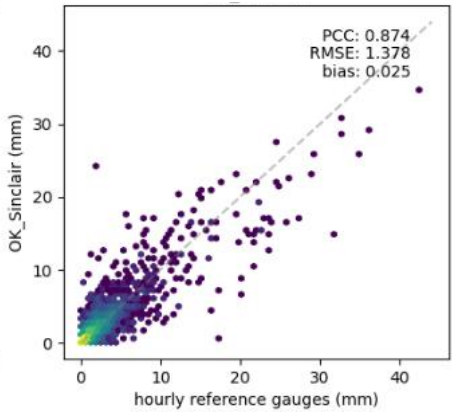
RADOLAN



Kriging with external drift



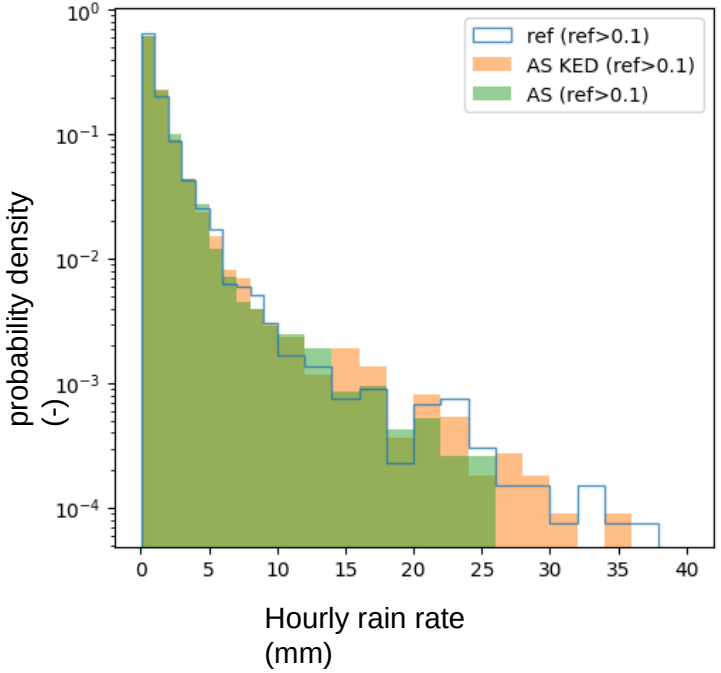
Conditional Merging



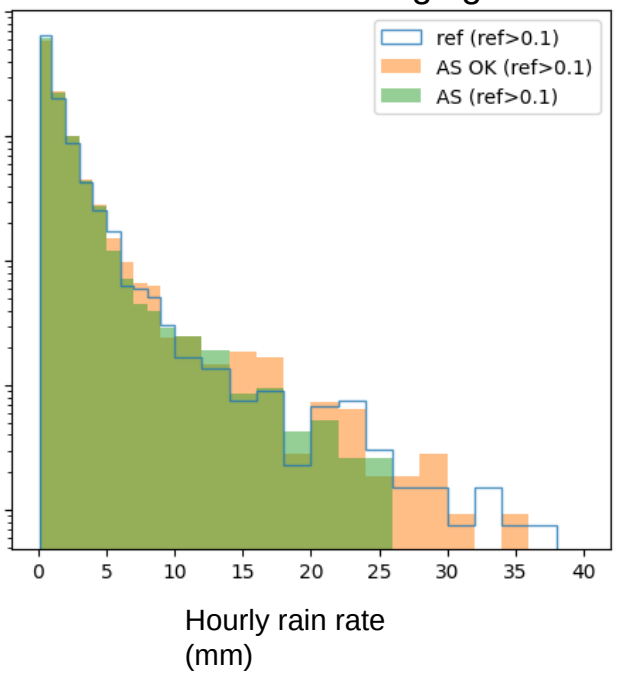
Radar + Gauge adjustment methods

(daily referencere, August 2023)

Kriging with external drift



Conditional merging



Adjustment sensor combinations

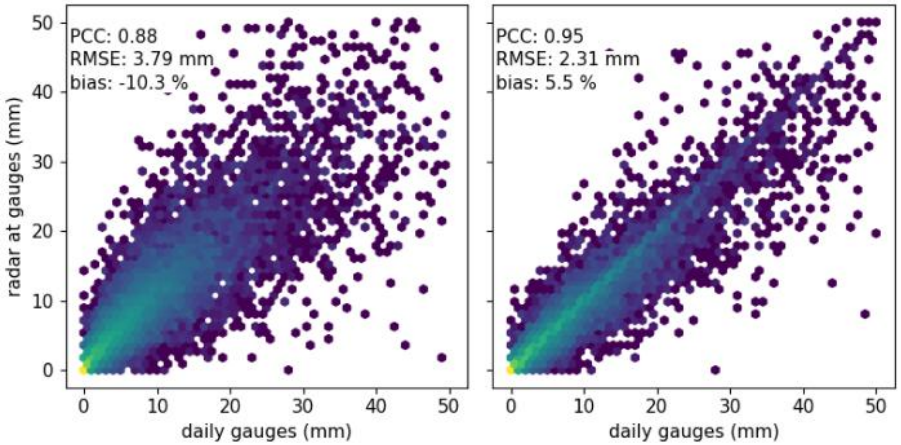
- AS: Radar + rain gauges (as RADOLAN-RW)
- AL: Radar + cml (very low latency)
- AC: Radar + rain gauges + cml (most information)

pyRADMAN product validation

(daily referencere, Augsut 2023)

RY
radar (unadjusted)

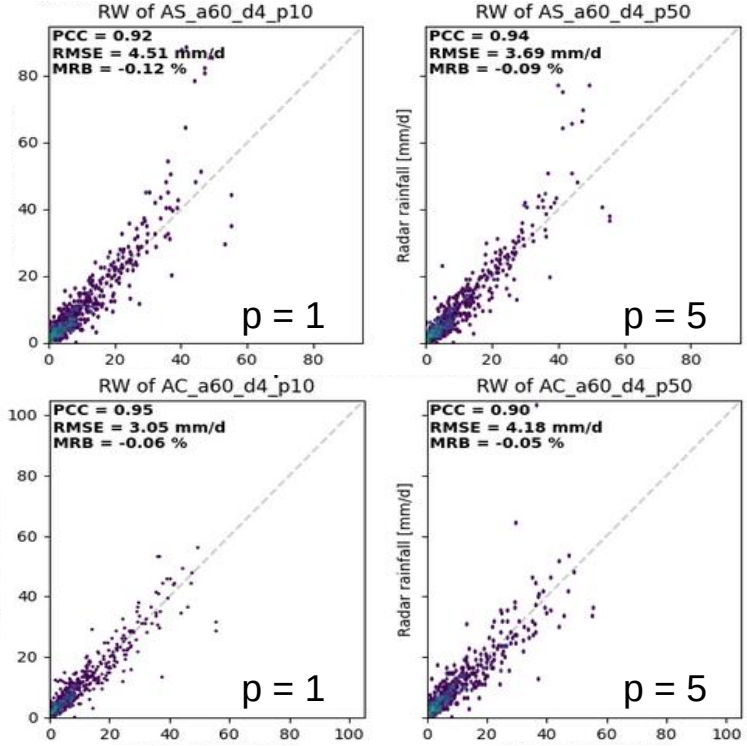
AS
radar + gauges



Sensitivity analysis of RADOLAN parameters in pyRADMAN

Radar + gauge

Radar + gauge + cml



p: inverse distance power

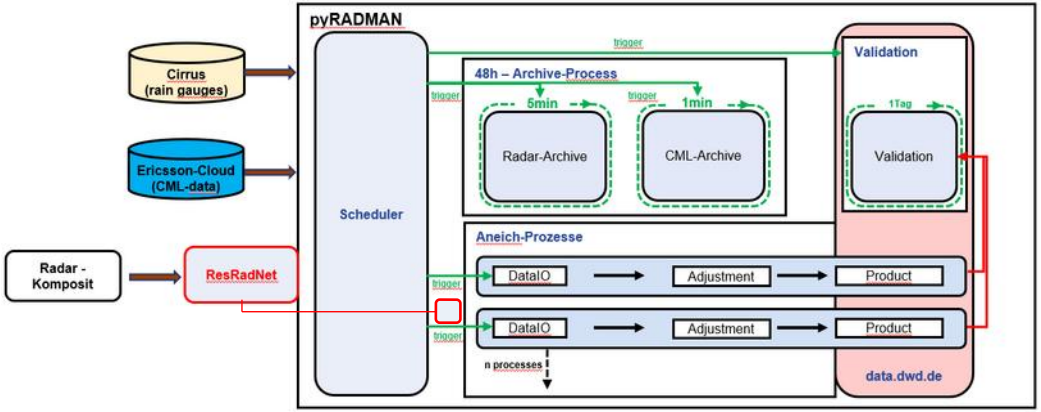
determines degree to which close points are preferred over more distant points

Summary

- pyRADMAN offers modular merging framework

Summary

- pyRADMAN offers modular merging framework
  - *A probabilistic AI-based merging of Commercial Microwave Link and Radar QPE* – Polz et al. Thursday 11:30

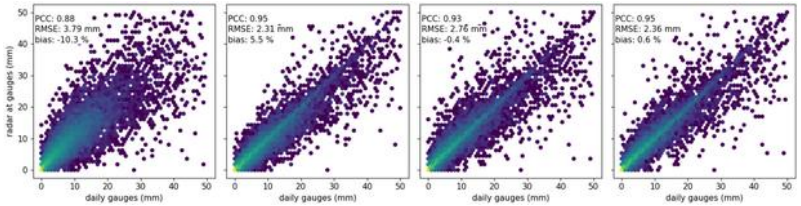


Summary

- ➔ pyRADMAN offers modular merging framework
- ➔ pyRADMAN offers products in a quality of RADOLAN-RW with lower latency

Summary

- pyRADMAN offers modular merging framework
- pyRADMAN offers products in a quality of RADOLAN-RW with lower latency
- CMLs can add value to QPE products



Summary and Outlook

- pyRADMAN offers modular merging framework
- pyRADMAN offers products in a quality of RADOLAN-RW with lower latency
- CMLs can add value to QPE products

- Quasi-operational test of pyRADMAN during this summer
- Started market survey to potentially acquire CMLs on a long term basis
- Real-time PWS data stream during second half of this year

Thank you very much – Questions?

International Conference on Opportunistic Sensing of Precipitation - OpenSense

Final Conference of European COST Action CA20136 OpenSense

Offenbach, Germany

June 25-26, 2025

OpenSense

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

DWD

cost
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The conference will feature research-focused topics on opportunistic sensing data, processing and merging methods, applications, stakeholder involvement, and business models.

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- Please note that there will be **no abstract submission or conference fees**.
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