Current and future CML-rainfall estimation in Germany:

Click → Improved data processing, real-time rainfall maps and fusion with weather radar data

No update on this topic today

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DWD

Improved data processing

Our recently improved CML data processing shows good results for a 1-year comparison with radar

- Improved wet-dry classification
- Improved wet antenna compensation

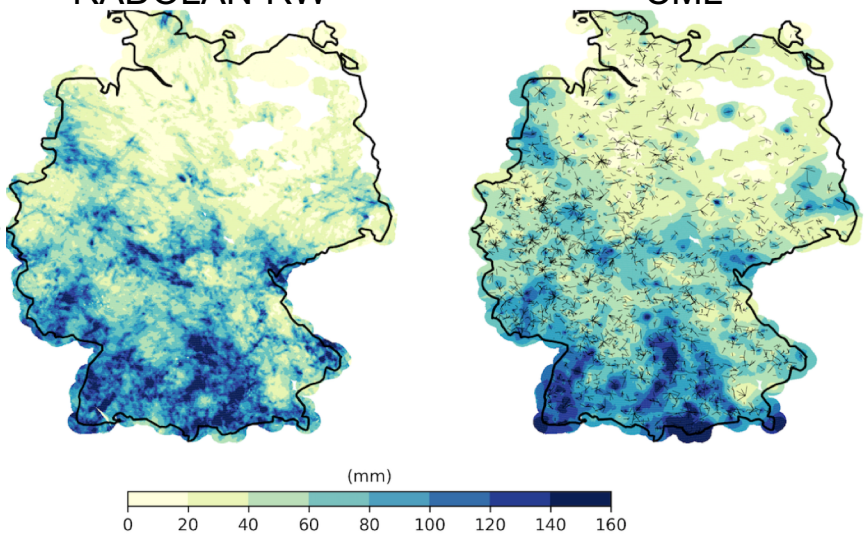
- Still using IDW for spatial interpolation
  (different variants of Kriging that we tried did not give us better results)

Monthly sum of **hourly rainfall** maps

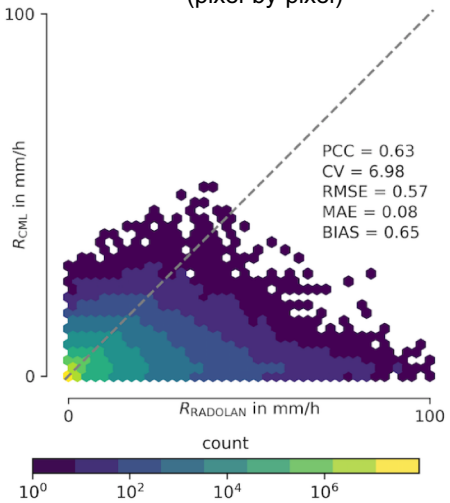
May 2018

RADOLAN-RW

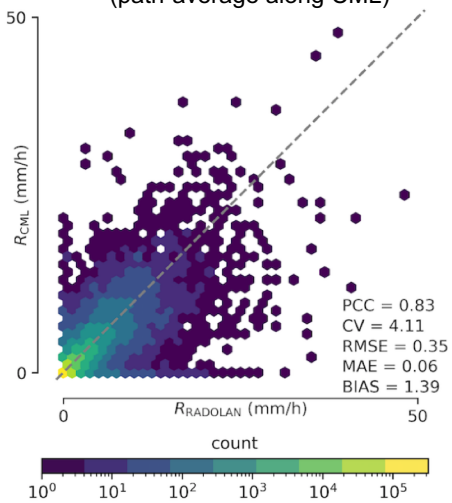
CML



map-based
(pixel-by-pixel)



Link-based
(path-average along CML)



More plots and details in *Graf et al,* HESS, 2020 [accepted for publication] https://www.hydrol-earth-syst-sci-discuss.net/hess-2019-423/

There is still room for improvement

Get rid of as many false positives as possible…

…but also reduce false negatives

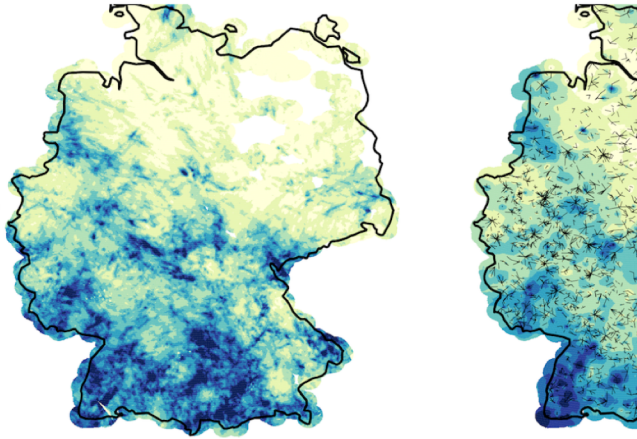
Improve spatial interpolation

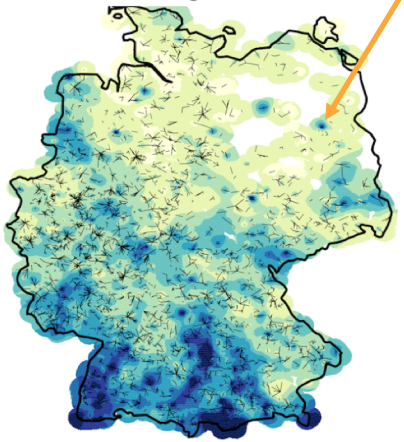
Monthly sum of hourly rainfall maps

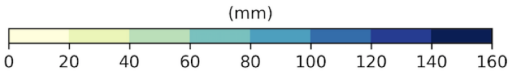
RADOLAN-RW

CML

May







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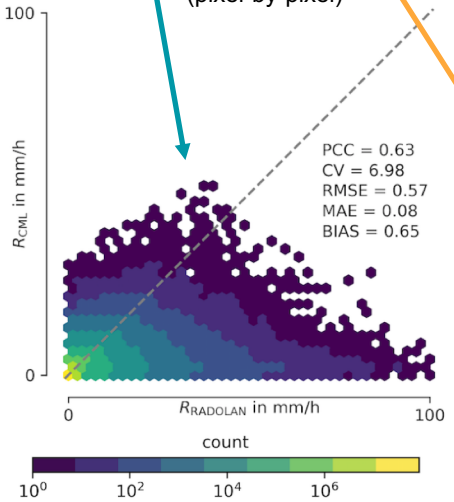
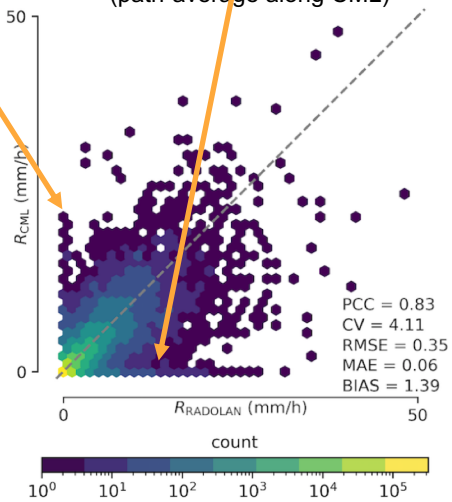
(pixel-by-pixel)



Link-based

(path-average along CML)



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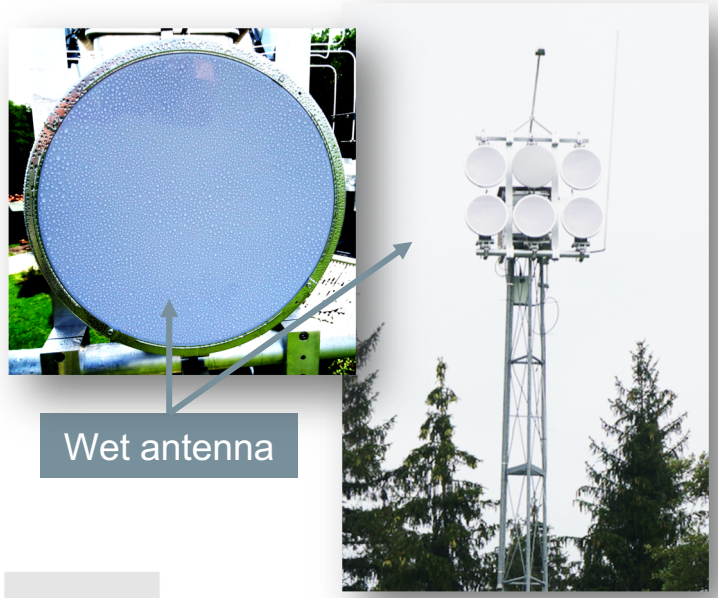
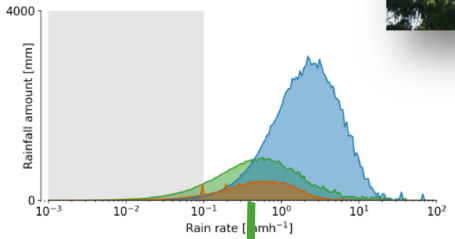
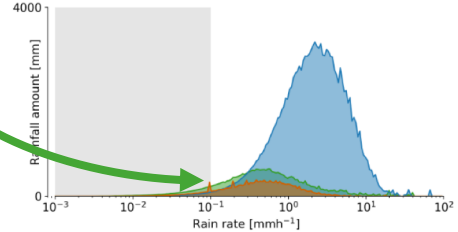
Upcoming work

- Detailed study of wet antenna effect with a dedicated field experiment (6 CML antennas, 6 frequencies, dual-pol) Moroder et al., 2019, IEEE TIM
- Improvement of rain event detection in noisy CML-time series using a deep convolutional neural network to reduce false-positive and false-negative rainfall (EGU2020 display, AMTD Discsussion Paper)
- Get more CML data in Burkina Faso and do country-wide CML rainfall maps there (BMBF project AgRAIN)





Reduced false-positive rainfall with CNN method

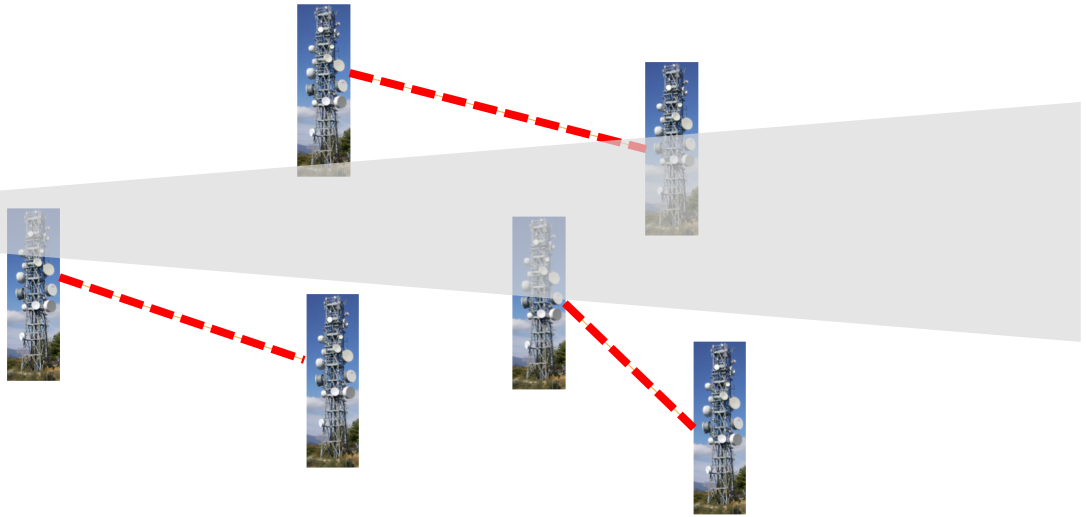


Fusion of CML and weather radar data

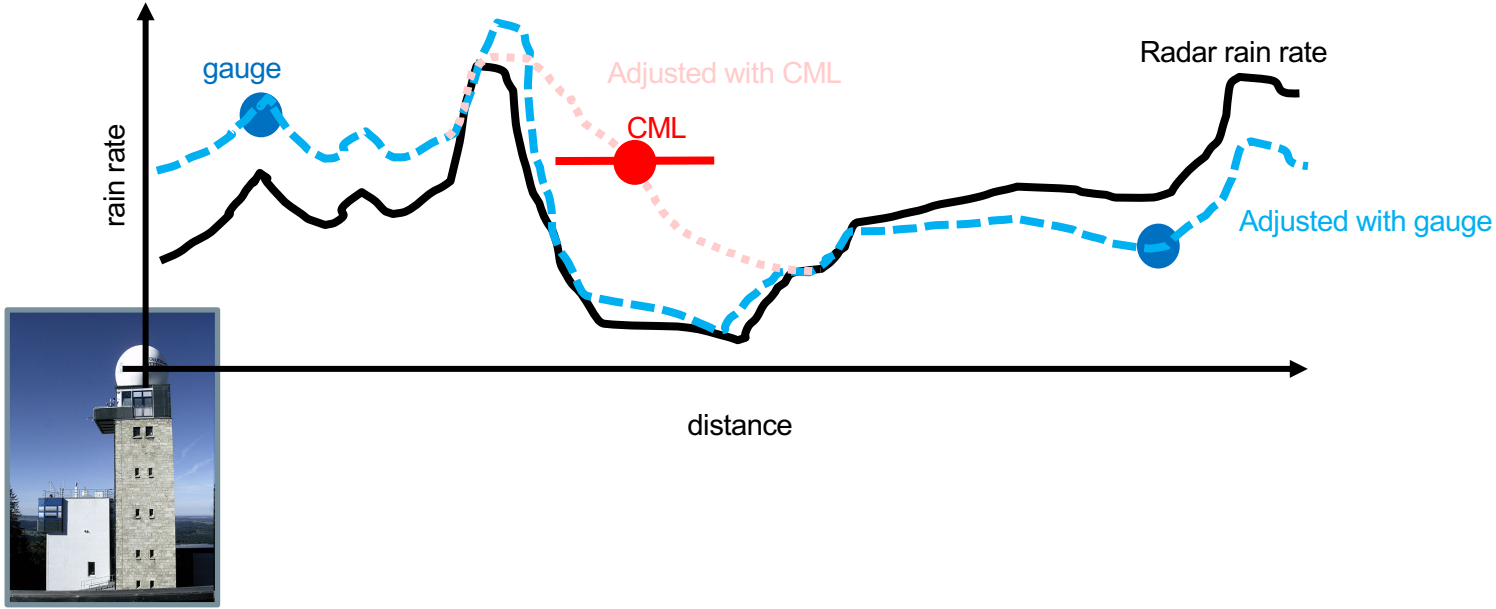
We are currently working towards adding CML data to the real-time radar-gauge adjustment RADOLAN

- Project goals: Build a continuously running demonstrator for RADOLAN-CML adjustment to improve QPE and subsequently improve hydrological modeling of flooding events

- Info on project: https://www.howa-innovativ.sachsen.de/



The idea is simple: We “just” add the CML rainfall estimate as additional rainfall information to the RADOLAN adjustment procedure



First results: 24h sums of hourly rainfall on 13.04.2018

RADOLAN-RW:

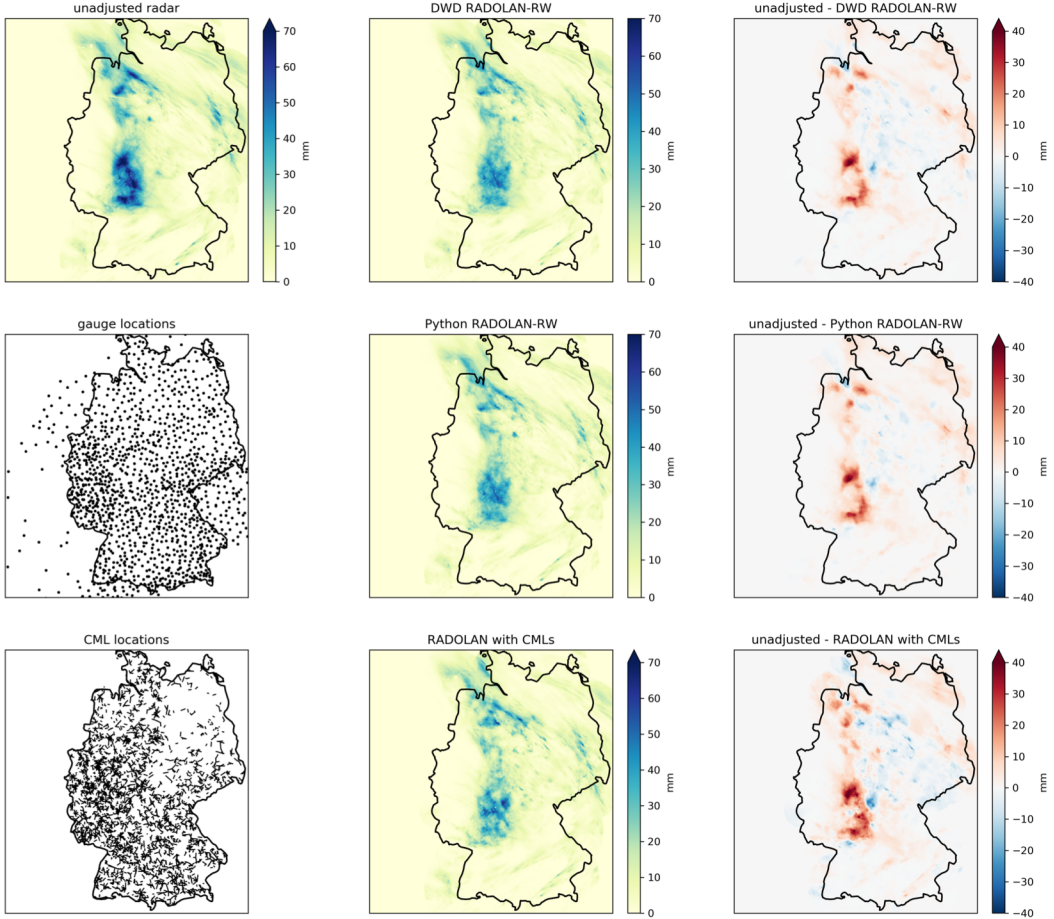
- Processed data from DWD archive

Own implementation of RADOLAN-RW

- Using uncorrected RADOLAN + Gauges
- Python implementation using *wradlib* and *xarray*

Hourly RADOLAN adjustment only with CMLs

- Using uncorrected RADOLAN + preprocessed CML QPE

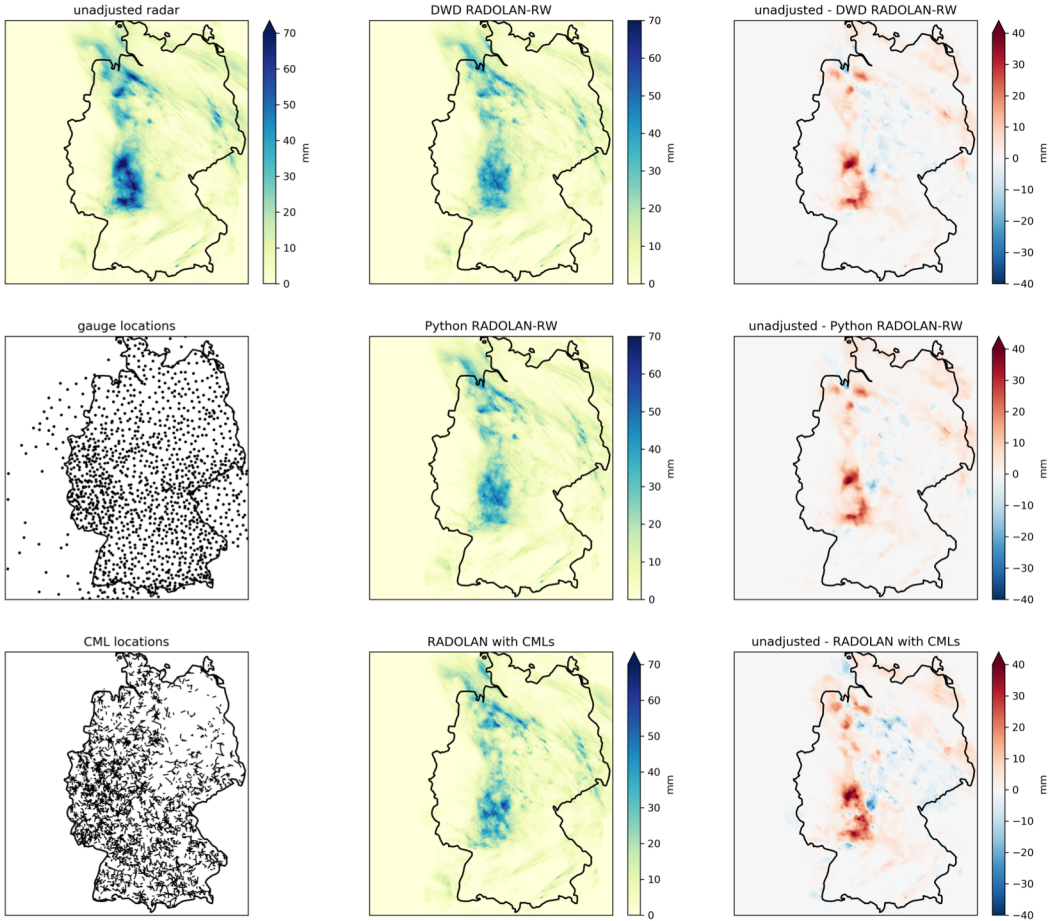


Conclusion from first hourly RADOLAN-CML results

- Results from own Python-RADOLAN-RW implementation are very close to existing RADOLAN-RW
- Results from RADOLAN with only CMLs are very similar to RADOLAN with gauges

Next steps:

1. Combined adjustment with gauges and CMLs at the same time
2. Study improvements for selected rain/flood events
3. Try 5-minute RADOLAN adjustment with CMLs (which should work better than with gauges, because CMLs already provide ”integrated rainfall observations”)



Acknowledgments

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References

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Moroder, C., Siart, U., Chwala, C., & Kunstmann, H., 2019. Microwave Instrument for Simultaneous Wet Antenna Attenuation and Precipitation Measurement. IEEE Transactions on Instrumentation and Measurement, 1–1. https://ieeexplore.ieee.org/document/8938783

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