# How to evaluate rainfall estimation performance?

## A discussion of thresholds, spatial and temporal aggregations for one year of country-wide CML rainfall estimation

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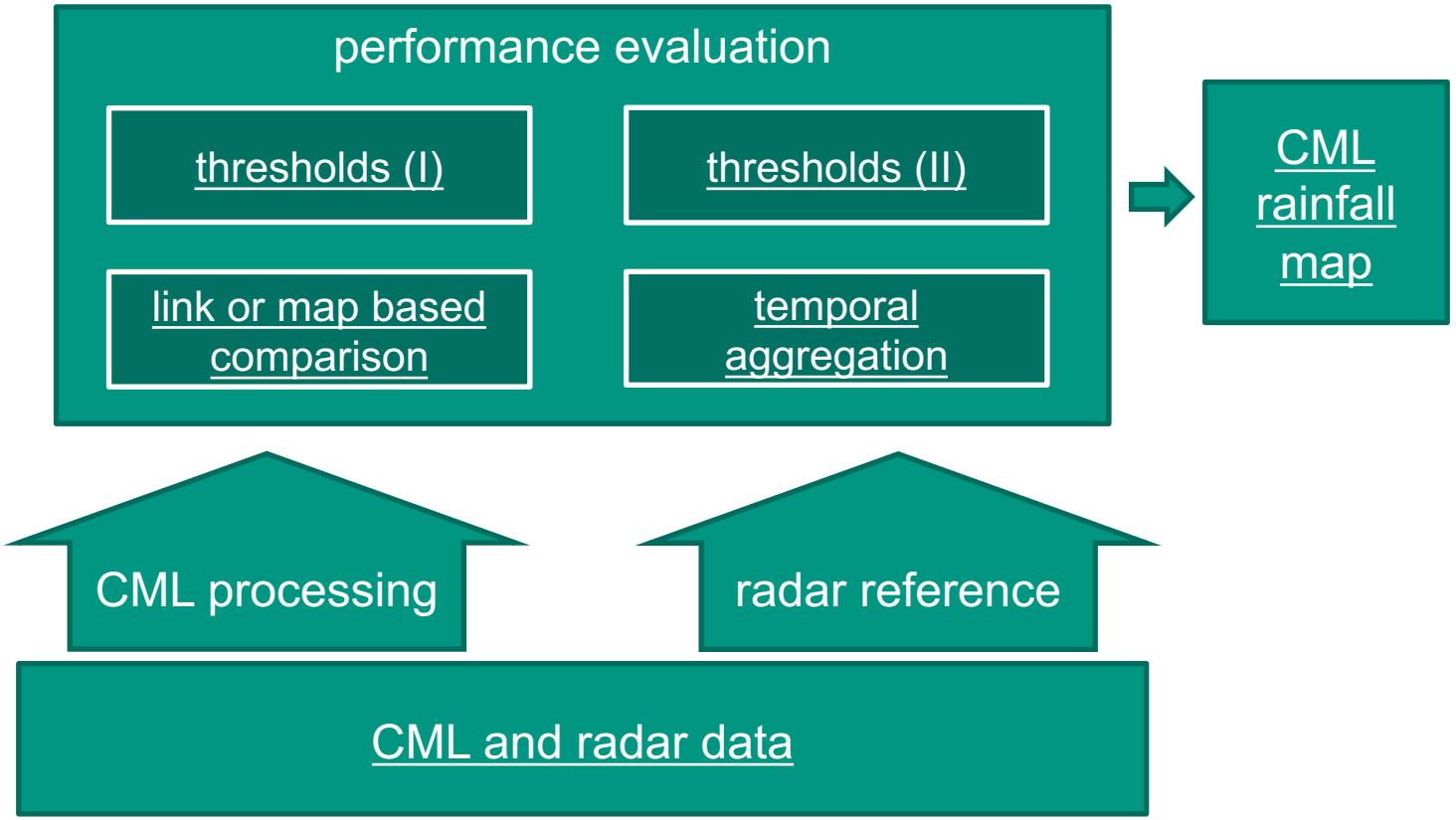
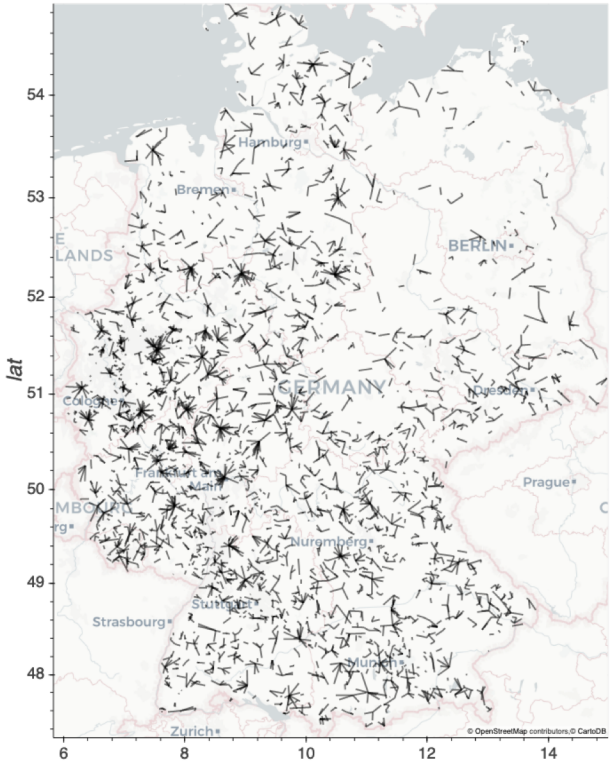





underlined text is linked

# CML data set

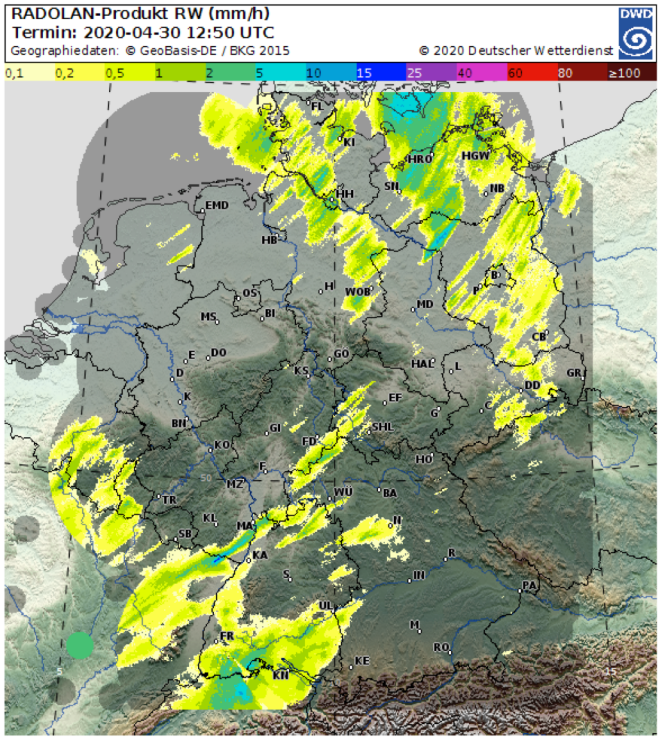



| | |
|---|---|
| Number of links | ~4000 |
| Temporal resolution | 1 min |
| Variables | TX, RX |
| Power resolution | 0.3 or 1.0 dB |
| Length | 0.3 – 35 km (Ø 7 km) |
| Frequency range | 10 – 40 GHz |
| Analyzed period | Sept. 2017 – Aug. 2018 |

More info on the data sets and processing is available in Graf et al. 2019

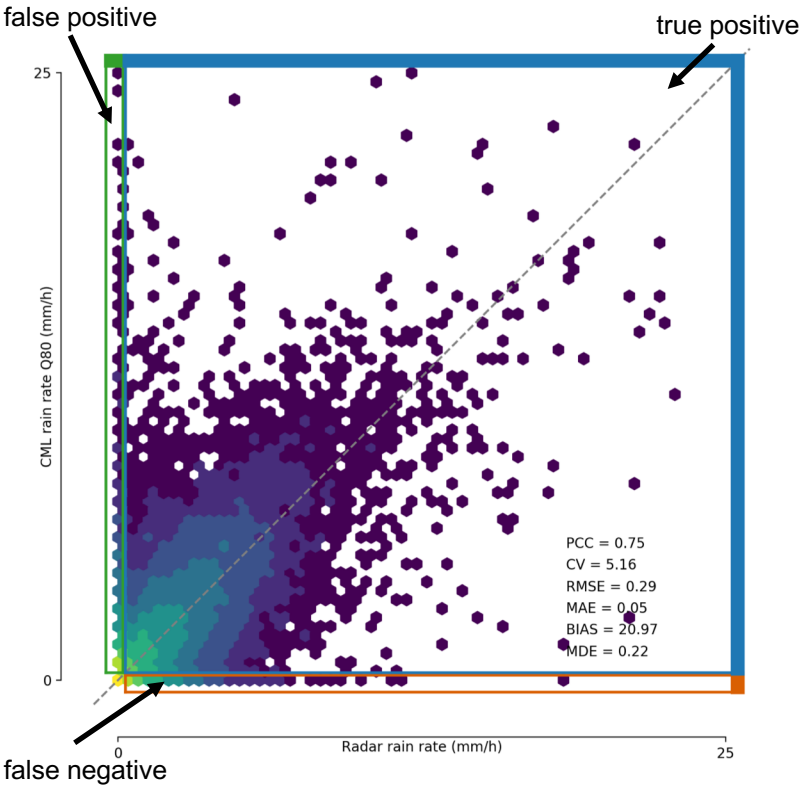
# Radar: RADOLAN-RW

| | |
|---|---|
| Data from | 17 weather radars ~1000 automatic rain gauges |
| Temporal resolution | 1 hour |
| Spatial resolution | 1 x 1 km |
| Gauge adjustment | Mixed additive and multiplicative |
| Available at | German Weather Service |

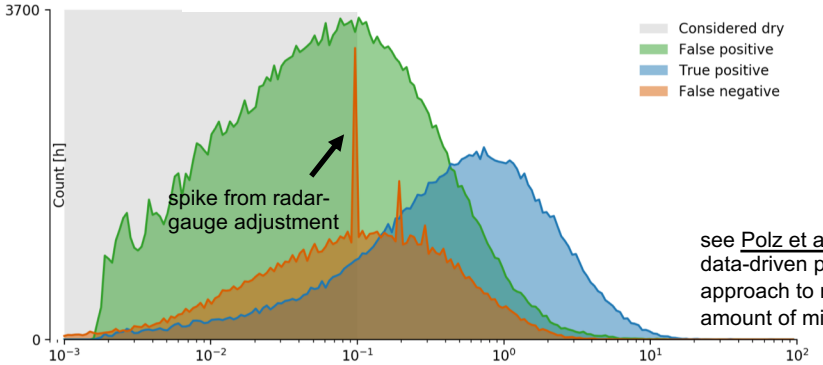


# The impact of the threshold on false positive and false negative rates and the resulting misclassified rain rates

a) hourly, link-based comparison

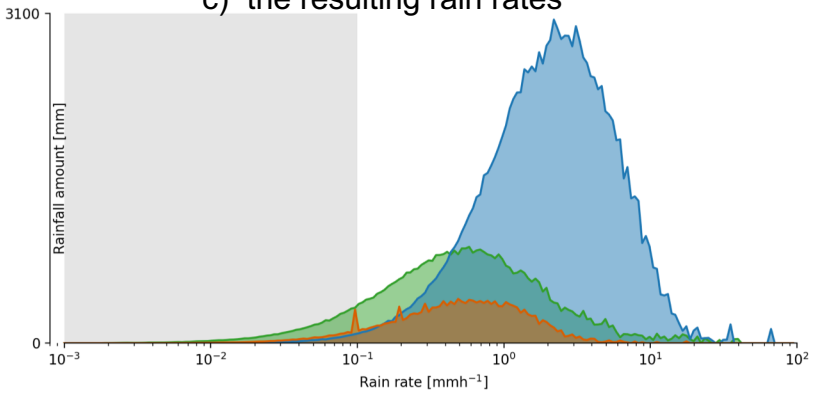



b) hourly count of false and true classifications for certain rain rates



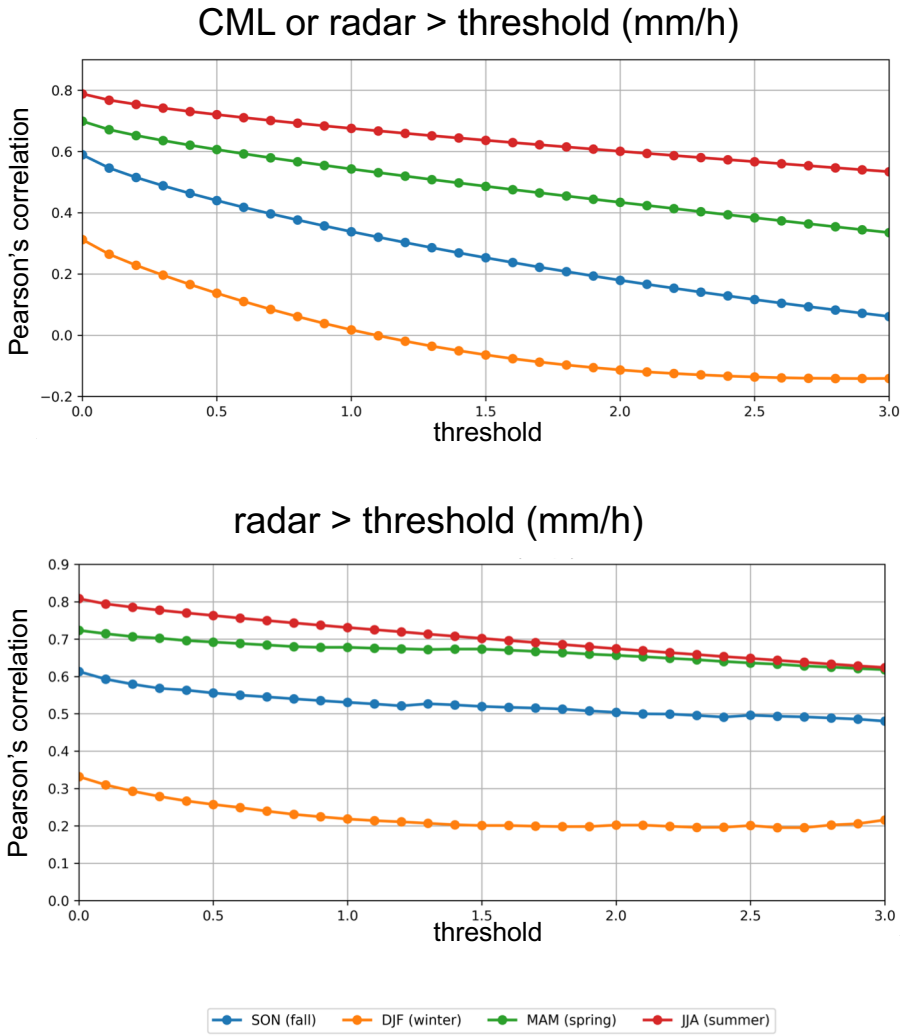

see Polz et al. 2019 for an data-driven processing approach to reduce the amount of misclassification

c) the resulting rain rates




- scatter plot and measure seem look quiet good, but…
  - the amount of misclassification in b) looks severe
  - while the resulting rain rates in c) are small
- the choice of an adequate threshold (here they grey area in b) and c) -> 0.1 mm/h) is important and misclassification and the resulting rain rate have to be considered

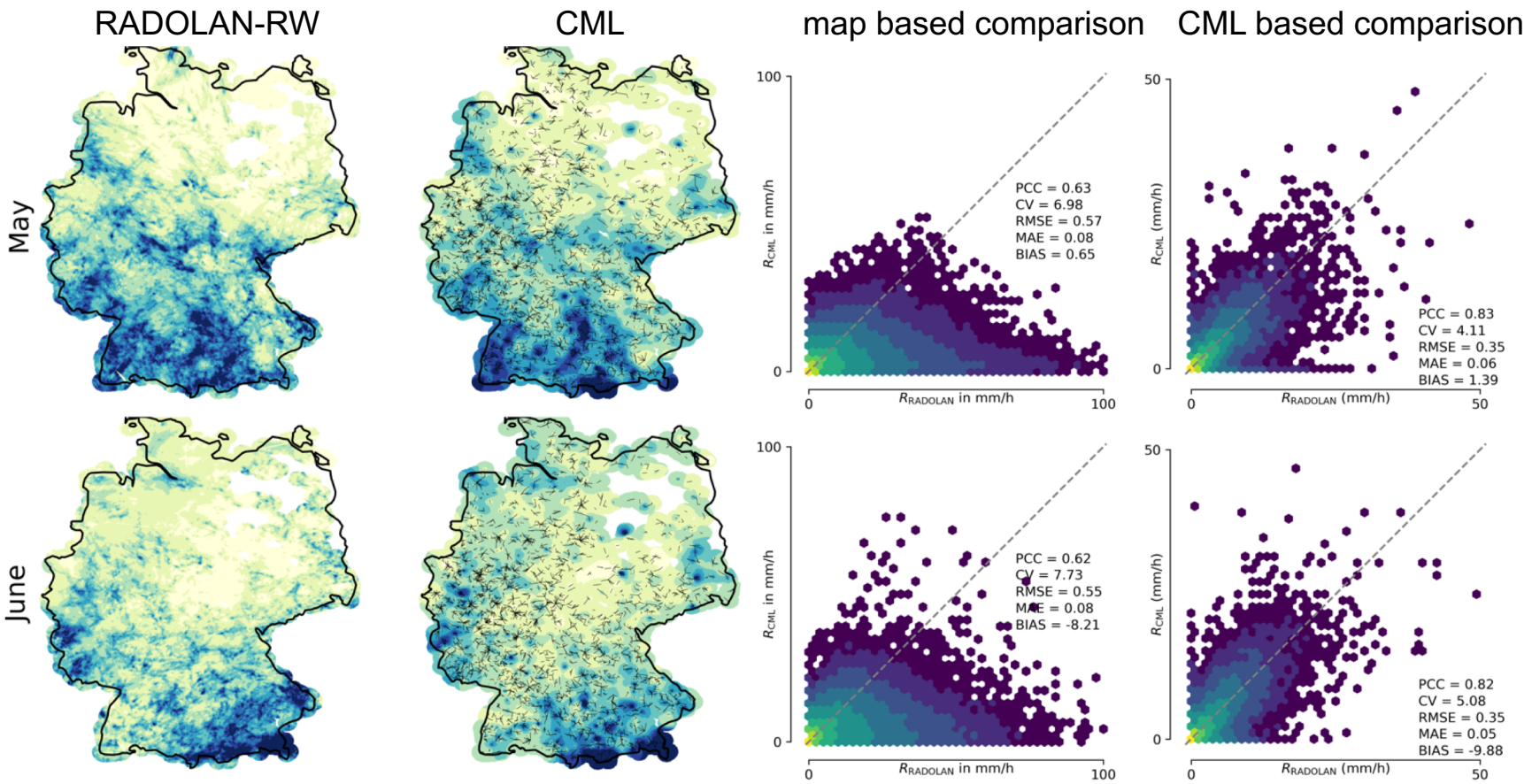
# The variance of correlation with different thresholds




- Higher threshold results in a decrease of correlation
- Correlation is higher when only for the reference a threshold is considered because all falsely classified CML rain events (false positives) are omitted

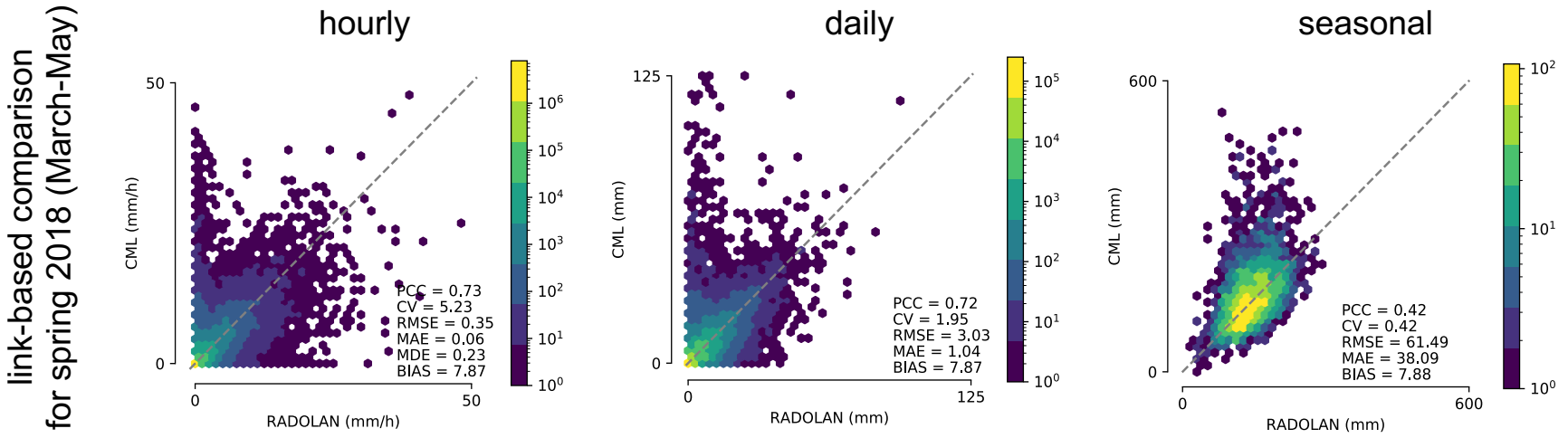
→ The choice of a threshold and to which part of the data it is applied has a considerable influence on the comparison between CML and reference rainfall data

# The difference between a link and map-based evaluation




- CMLs underestimate maxima found in RADOLAN in the map based comparison because:
  - CMLs give a path averaged rain rate mostly over 3 -15 km
  - rainfall maxima in the CML maps can only occur at the synthetic observation points at the center of each CML
  - Rainfall events might not intersect with a CML, especially during small convective summer events
- Nevertheless, spatial patterns and rainfall depth are considerably good

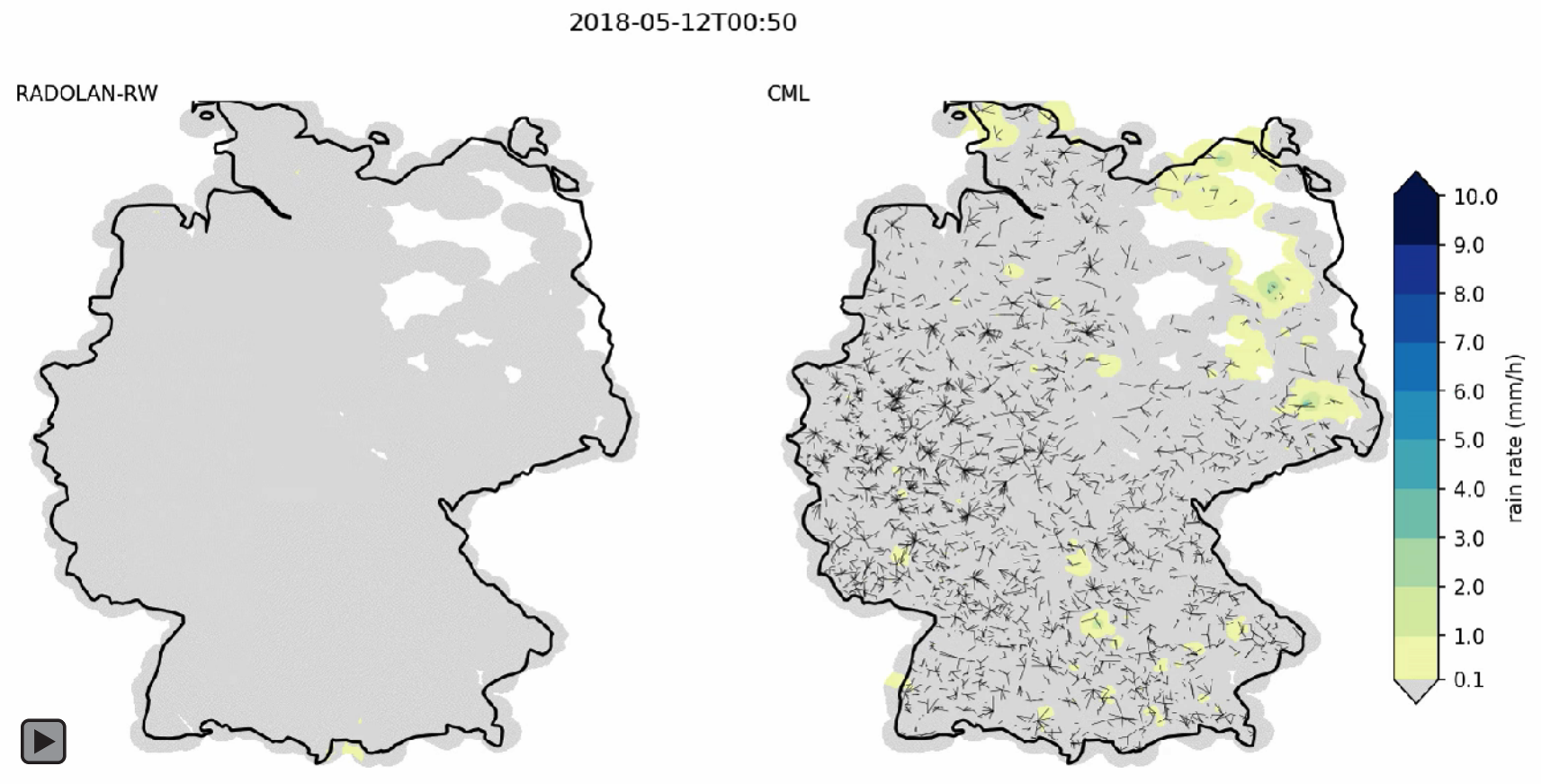
# The effect of temporal aggregation on performance measures




- With increasing aggregation the visual agreement rises, while correlation decreases especially for seasonal sums
- The CV decreases while RMSE and MAE rise due to higher values
- The bias remains the same
- Individual CMLs with great differences to the reference become visible in a seasonal (or monthly) aggregation

# A CML rainfall map example

Download animated rainfall map from zenodo (1.1 MB)




Rainfall maps from CML and RADOLAN-RW data
from 12. – 14. May 2018 (30 km coverage around CMLs)