Czech-German transboundary rainfall fields generated from two independent networks of commercial microwave links

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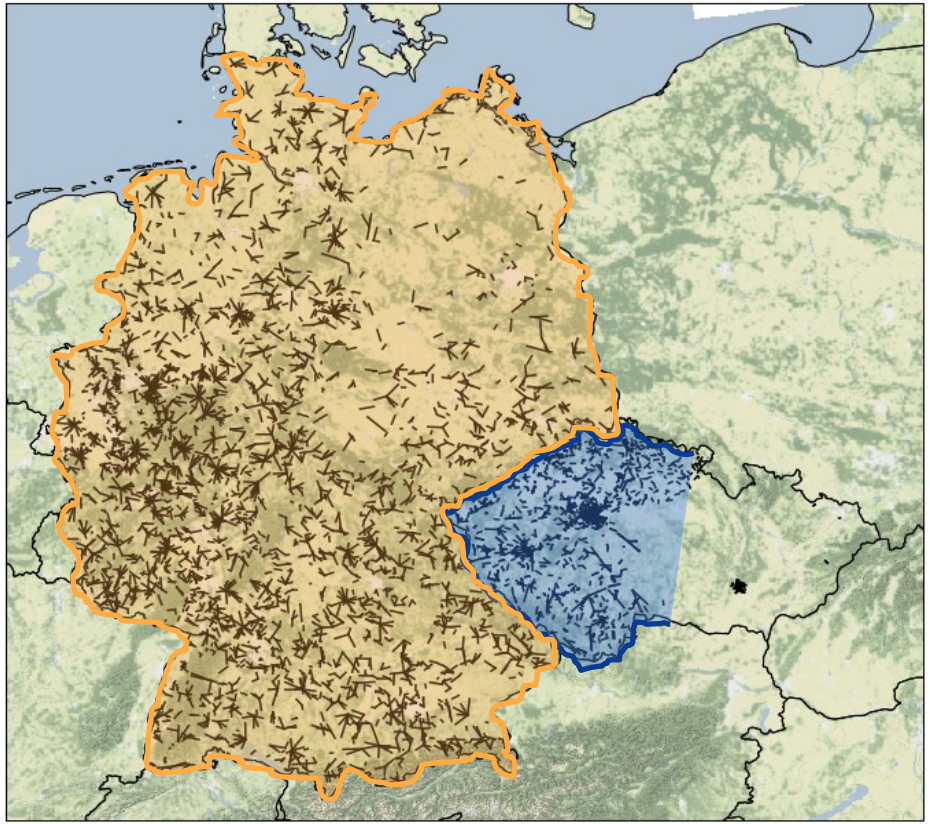
Context

- Significant improvements in CML rainfall retrieval and its application during last decade
- Processing methods are developed and tested on individual data sets
- Collection of independent country-wide data sets with *“homogenoues”* spatial coverage and high temporal sampling in DE and CZ

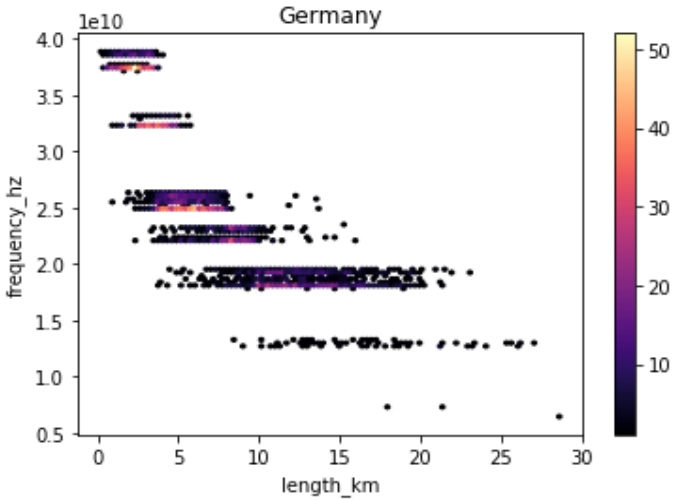
Creating benchmark transboundary CML data set

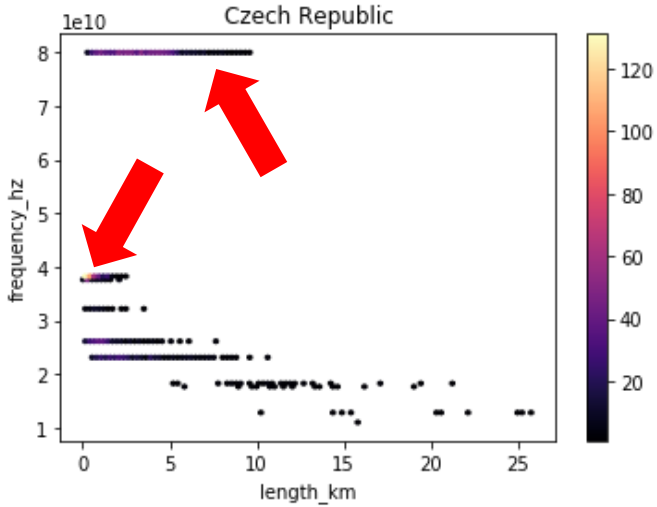
Testing of developed processing methods

Reconstruction of transboundary rainfall maps



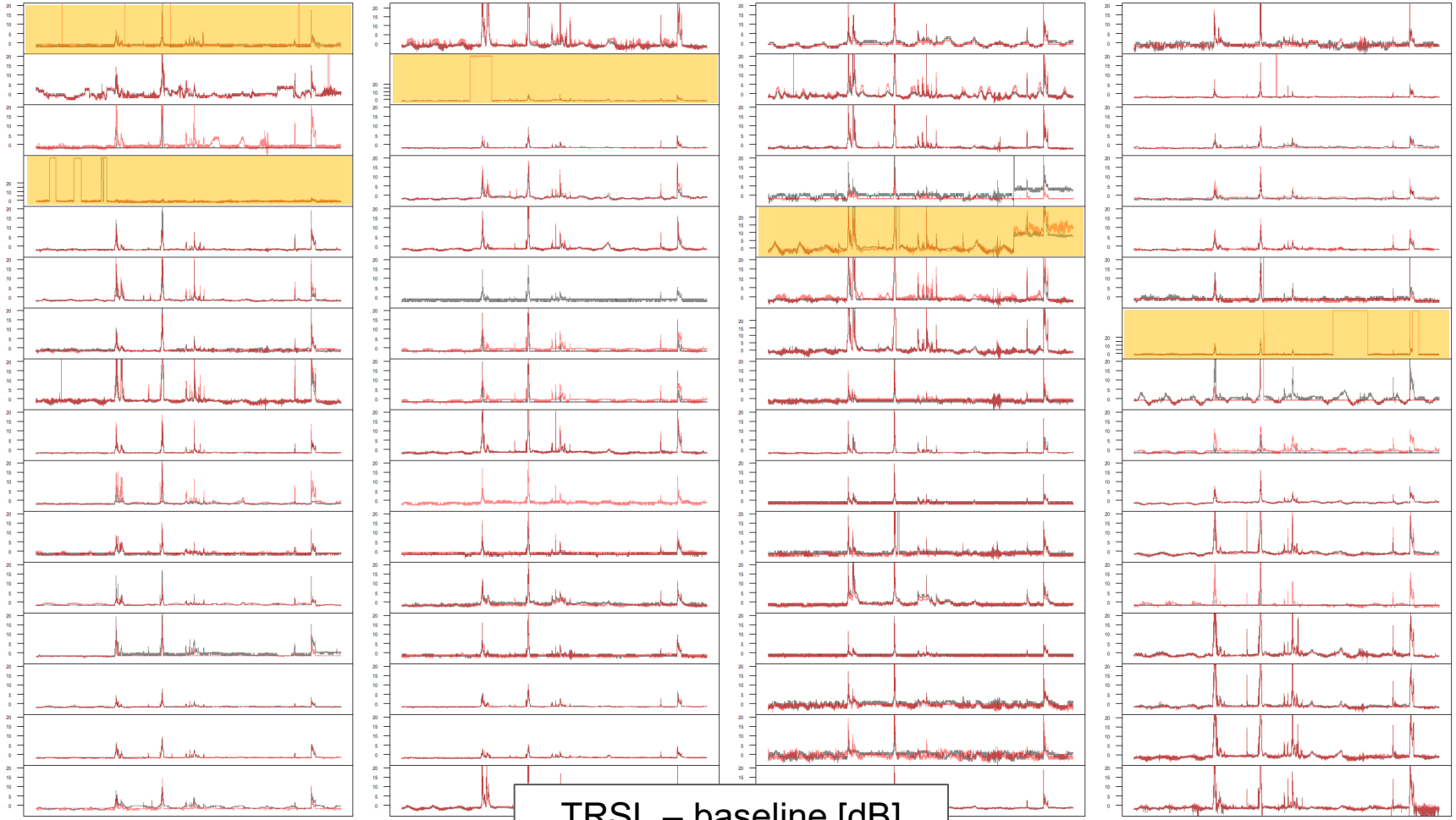
DE 4000 CMLs, CZ 2000 CMLs



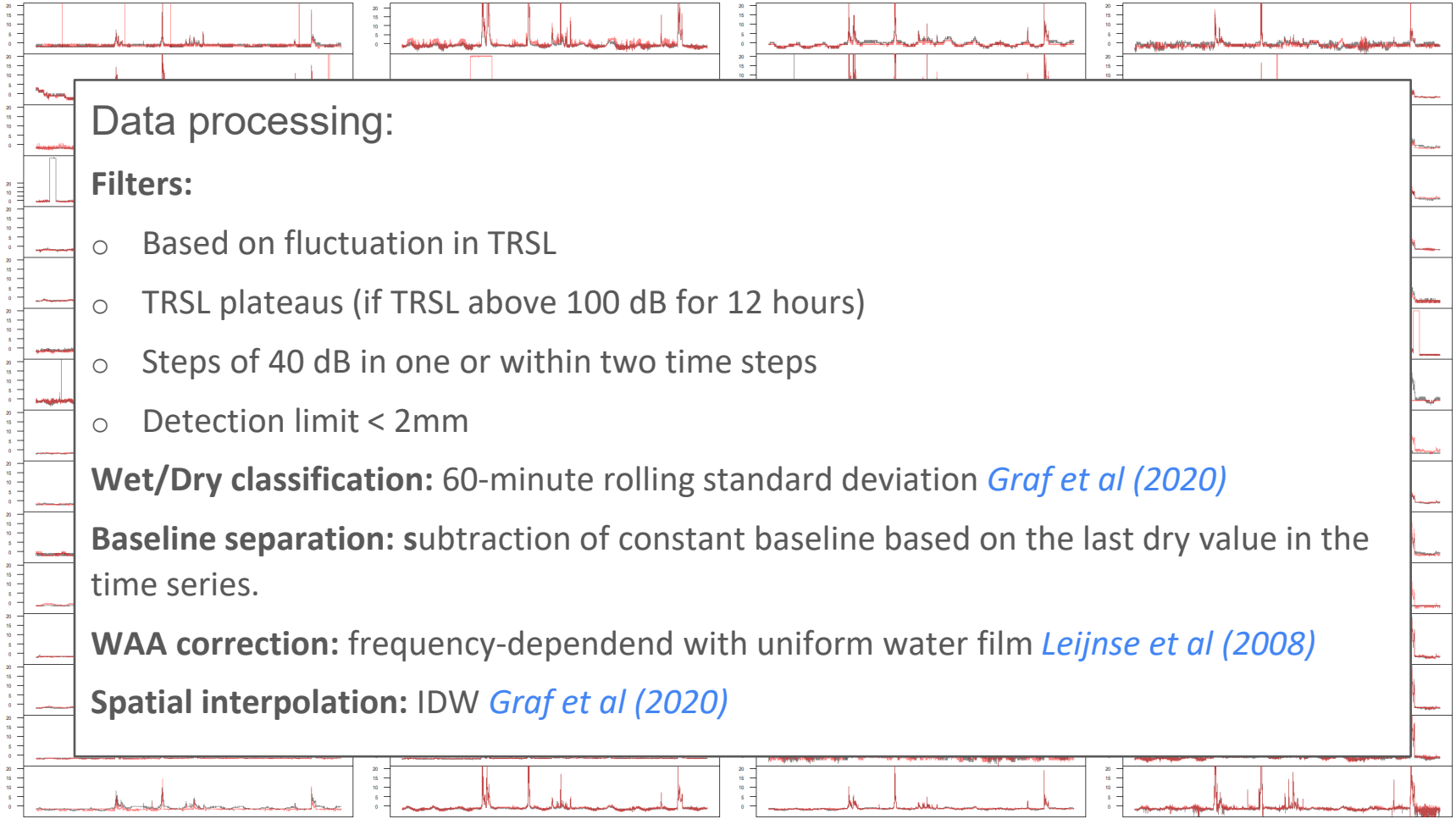


- Focus on selected ROI 400 km x 500 km including mountainous border regions between CZ and DE
- 1580 CMLs (Bavaria, Saxony, western CZ)
- Evaluated time period June 2021 (longer dry periods with several intense rainfalls)

- Data set specifications
  - Similar DAQ systems (SNMP, TRSL, 1 min time resolution, real time)
  - Wide range of sensor characteristics – frequency bands and path lengths
  - E-band (80 GHz) only in CZ dataset
  - Much more very short CMLs in CZ dataset (< 500 m)



TRSL – baseline [dB]



Data processing:

Filters:

- Based on fluctuation in TRSL
- TRSL plateaus (if TRSL above 100 dB for 12 hours)
- Steps of 40 dB in one or within two time steps
- Detection limit < 2mm

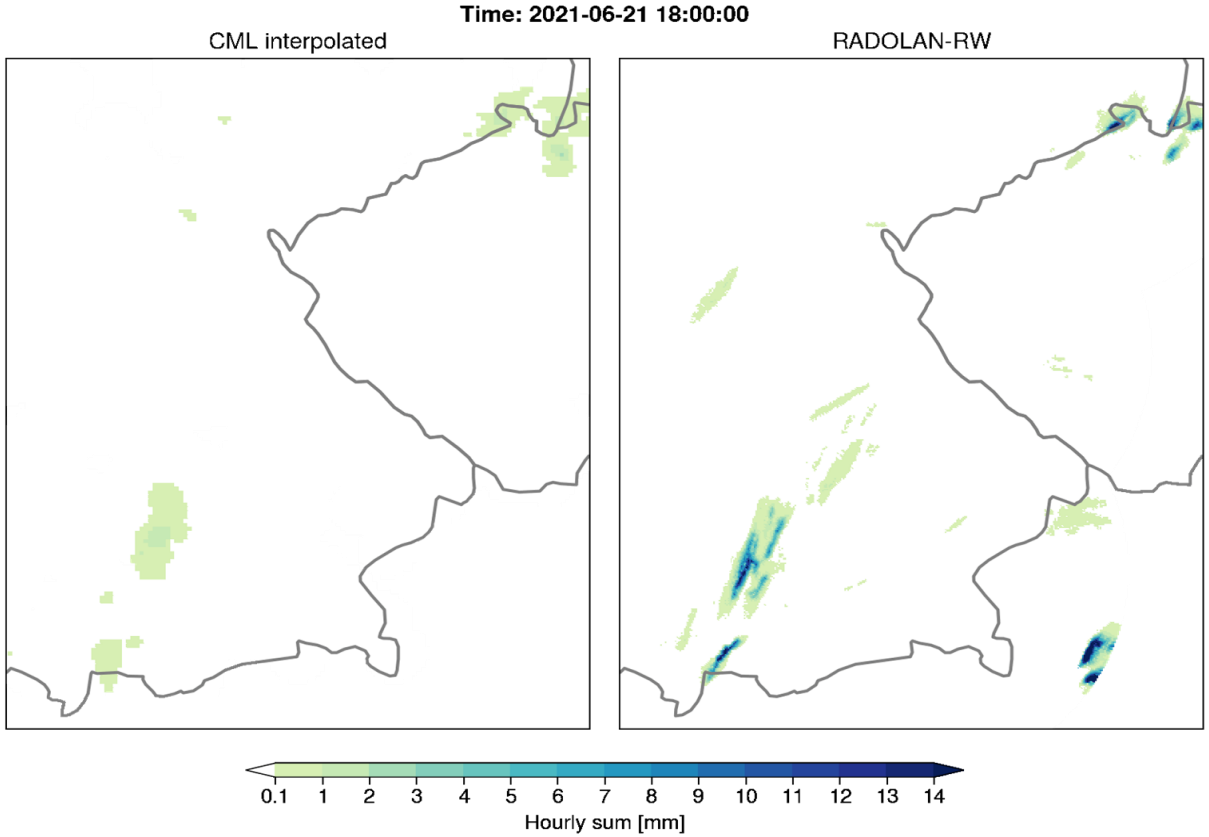
Wet/Dry classification: 60-minute rolling standard deviation *Graf et al (2020)*

Baseline separation: subtraction of constant baseline based on the last dry value in the time series.

WAA correction: frequency-dependend with uniform water film *Leijnse et al (2008)*

Spatial interpolation: IDW *Graf et al (2020)*

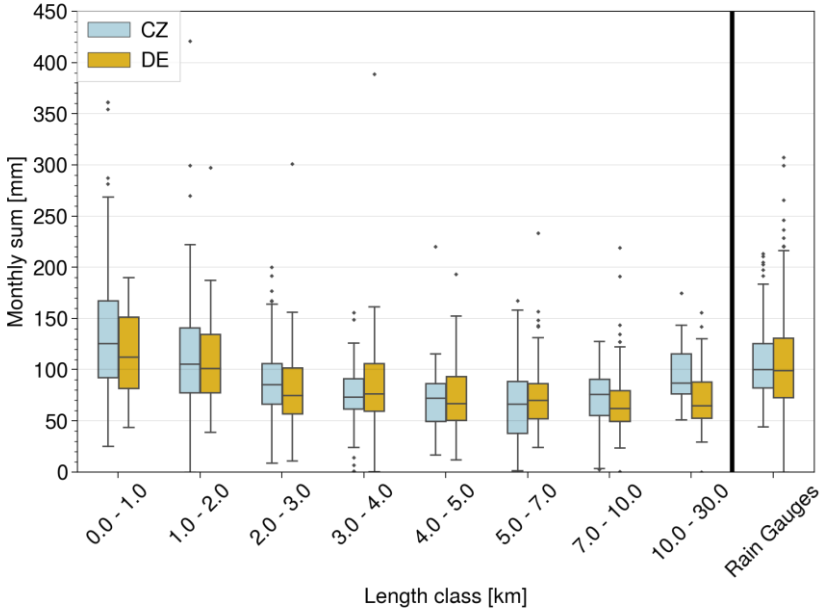
Generated CML transboundary map



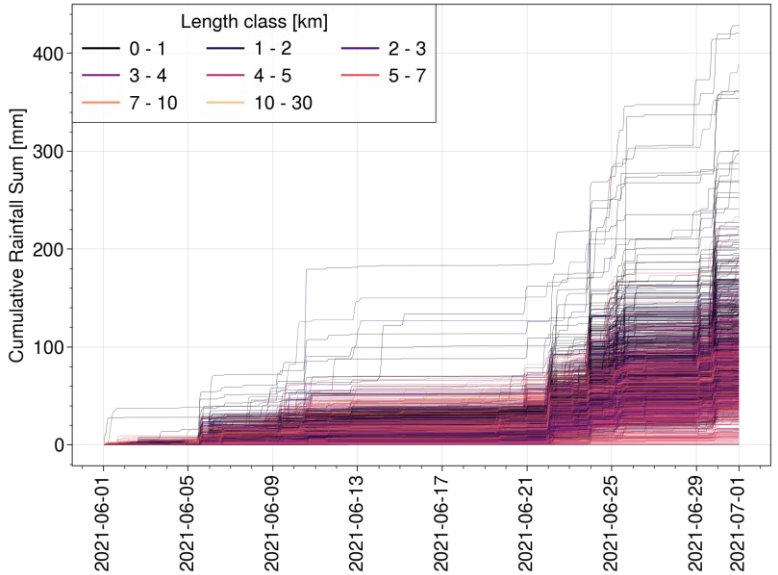
- Event 21/06/2021 – 22/06/2021
- Hourly cumulative rainfall depths
- Reference RADOLAN-RW

CML monthly sums vs RGs reference

Monthly sums for length bins



Cumulative monthly sums by CML lenghts



Length class [km]	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 7	7 - 10	10 - 30
Count DE	8	52	94	95	107	160	175	123
Count CZ	110	179	131	89	64	102	62	29

Challenges

- Signal blackouts during wet periods (differ in DE and CZ data set)

EGU22-11125 | Presentations | HS7.2
Chwala et al.: Missing extremes in CML rainfall estimates due to total loss of signal

- Large differences in length/frequency distribution including many E-band CMLs (80 GHz)

EGU22-9515 | Presentations | HS7.2
Fencl et al.: Effect of diverse microwave link characteristics on rainfall retrieval errors

- Correction of Wet Antenna Attenuation – remaining strong bias in rainfall estimates

Lessons learned

- First-ever transboundary CML derived rainfall maps
- Many aspects of DE and CZ CML data are similar, but not identical
- Specific details require attention - network heterogeneities, different frequency bands

Outlook

- Validation – path-integrated RADOLAN reference, extension of the validation period
- Improvement of spatial interpolation (Random Mixing EGU22-10355 Nico Blettner et al.)