

RUHR-UNIVERSITÄT BOCHUM

TEMPORAL AND SPATIAL PATTERNS IN MODEL EVALUATION – A COMPARISON OF PALM SIMULATIONS FOR GERMAN CITIES WITH CROWDSOURCED AIR TEMPERATURE DATA

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SCREEN CAPTURE
WELCOME

Motivation

- Climate change & climate adaptation
- Previous study: Applicability of crowdsourced data for model evaluation

→ transferability of method to different cities

→ identification of weaknesses in either measurement or model

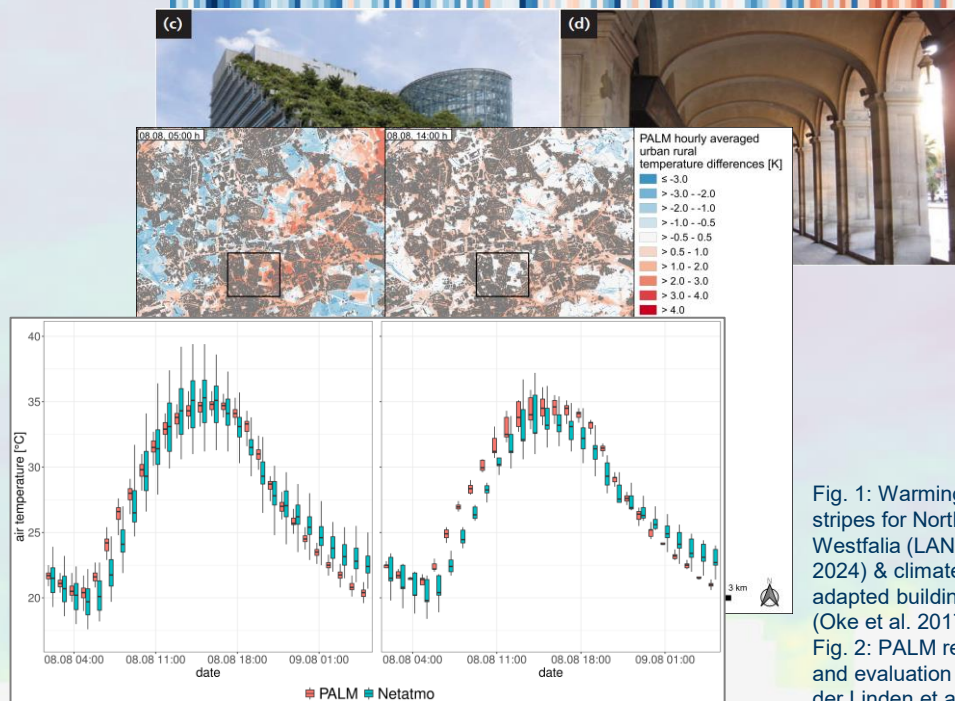


Fig. 1: Warming stripes for North-Rhine Westfalia (LANUK 2024) & climate adapted buildings (Oke et al. 2017)
Fig. 2: PALM results and evaluation (van der Linden et al. 2023)

Methods

- **Study period: hot episode in August 2020**
 - 06.08.2020 06:00 – 09.08.2020 06:00
 - Daytime maximum air temperature > 30 °C
- **Quality controlled, crowdsourced air temperature data for evaluation (Fenner et al. 2021)**
 - Metadata check
 - Outlier detection
 - Data validity check
 - Identification of indoor stations
 - Spatial buddy check
 - Temporal interpolation

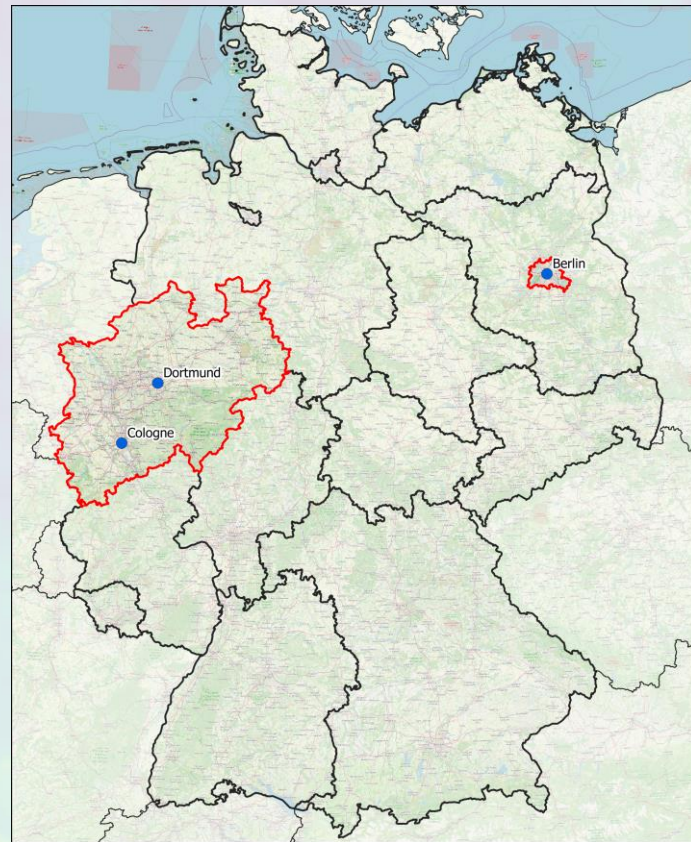


Fig. 3: Study areas (background map: OSM)

Methods

PALM Model configuration

- Offline nesting with COSMO-D2 data & synthetic turbulence generator
- Online nesting with three domains
- 24 h surface spin-up
- LSM, BSM, PCM, BIO
- RRTMG & RTM

Domain	Extent	dx/dy	dz
Parent	~ 28 x 28 km	32	16
Child 1	~ 8 x 8 km	8	4
Child 2	~ 2 x 2 km	2	2



Fig. 4: Nesting configuration for Dortmund and available Netatmo stations for evaluation (background map: Google)

Results

Dortmund

- High daytime air temperature
- Clear UHI pattern

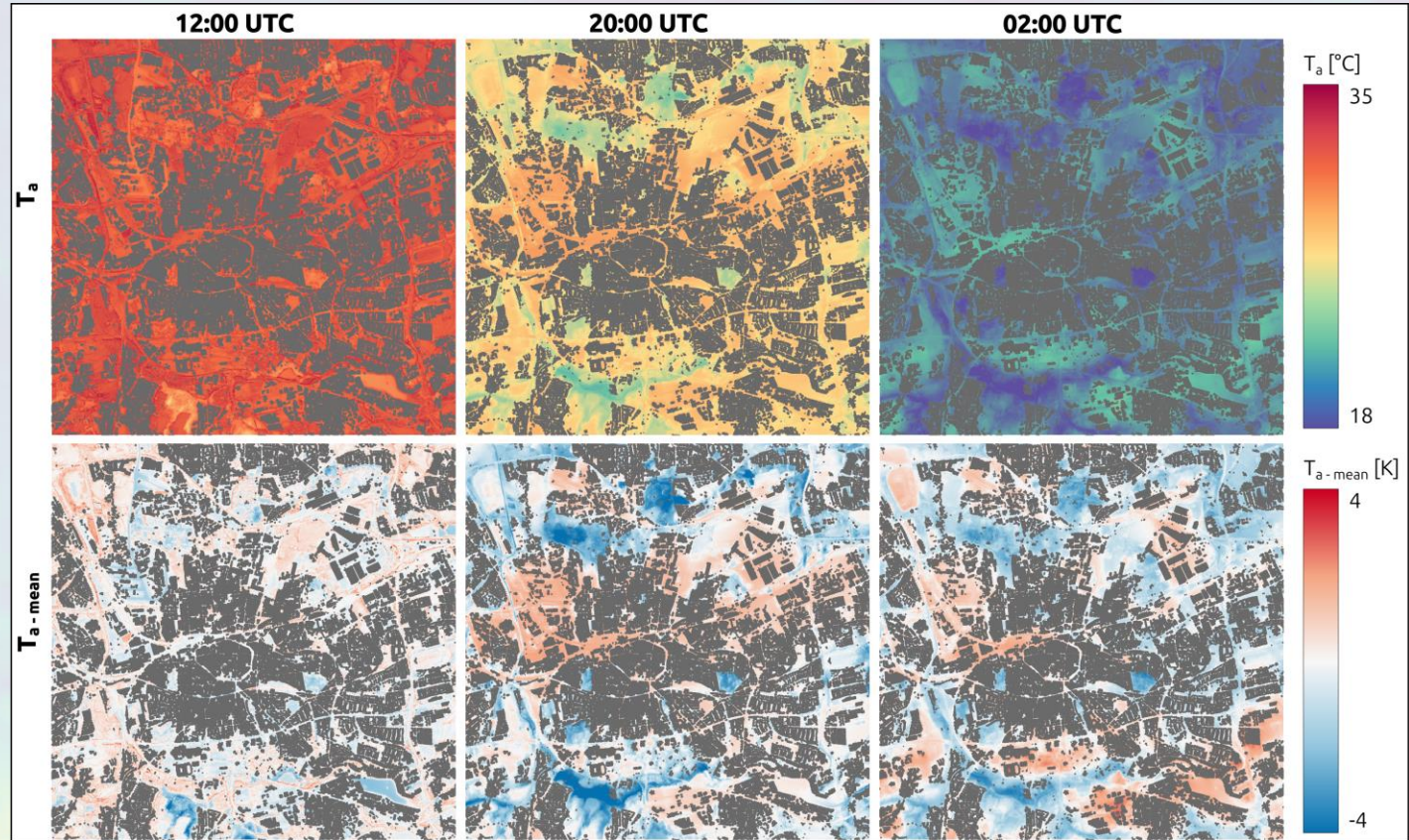


Fig. 5: PALM 2 m air temperature and air temperature differences in Dortmund, 07.08.2020 to 08.08.2020

Evaluation

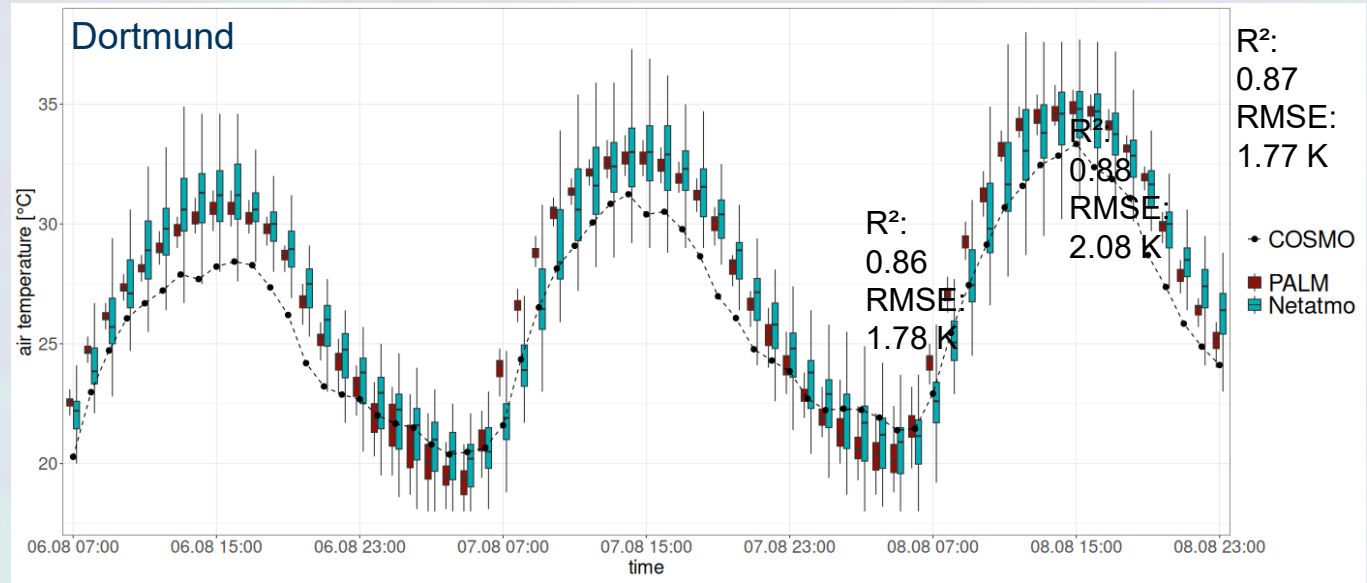


Fig. 6-8: Boxplot time series of PALM 2 m air temperature and Netatmo air temperature in Dortmund, Cologne & Berlin

Evaluation

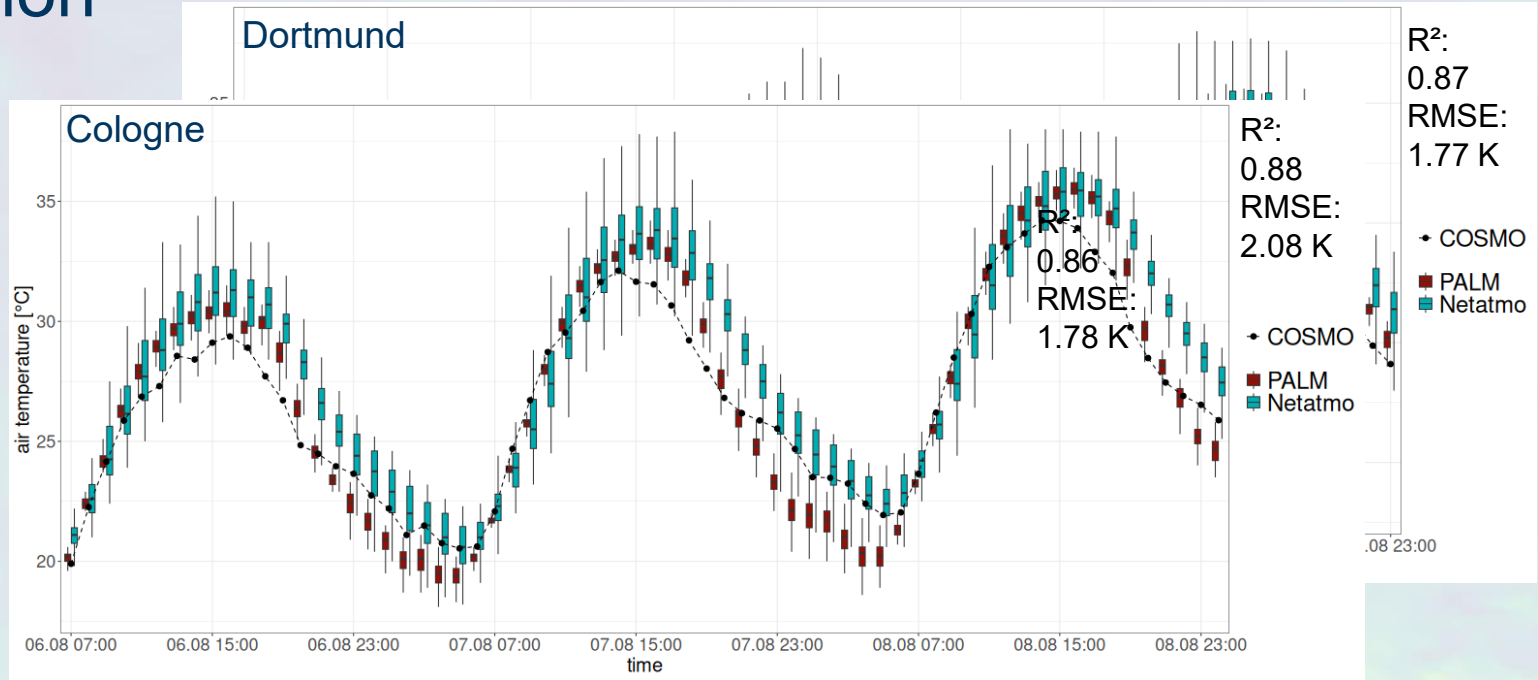


Fig. 6-8: Boxplot time series of PALM 2 m air temperature and Netatmo air temperature in Dortmund, Cologne & Berlin

Evaluation

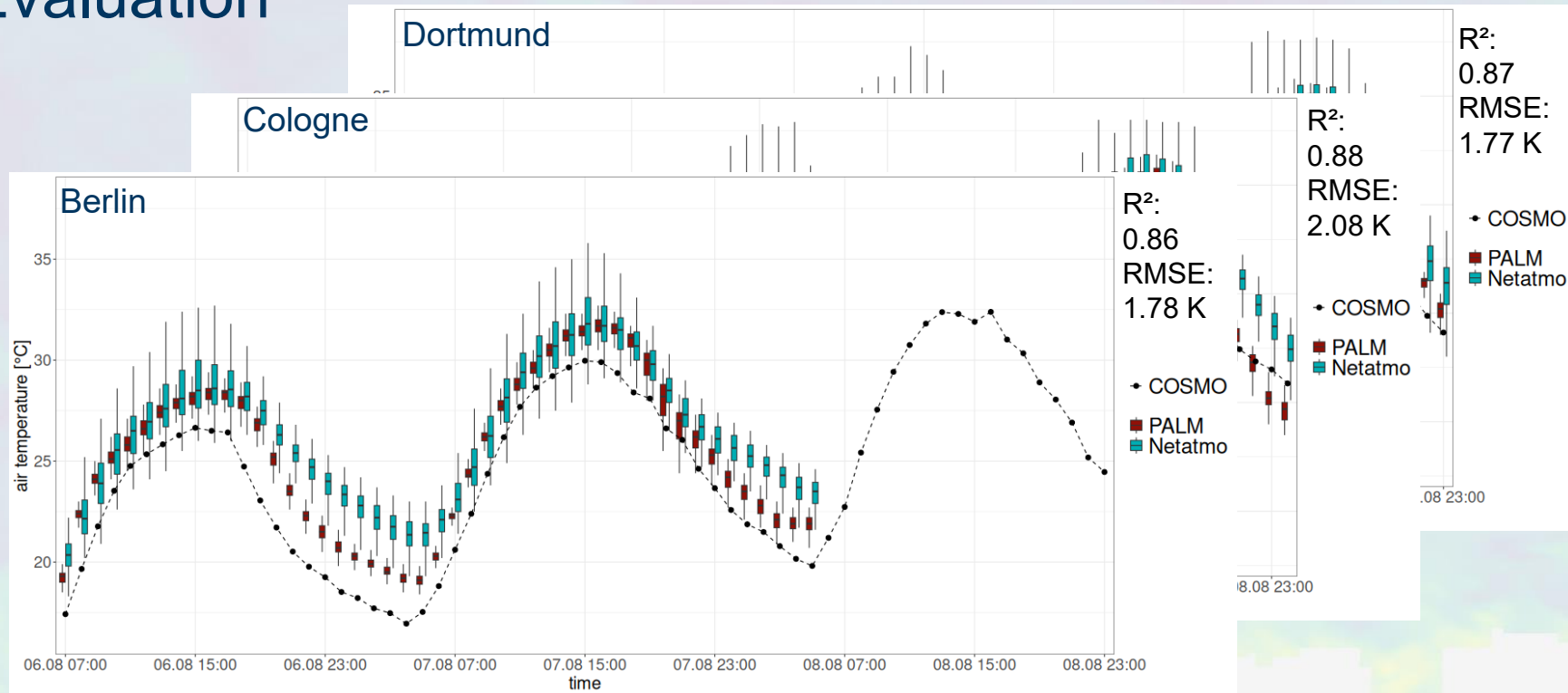


Fig. 6-8: Boxplot time series of PALM 2 m air temperature and Netatmo air temperature in Dortmund, Cologne & Berlin

Evaluation – spatial patterns

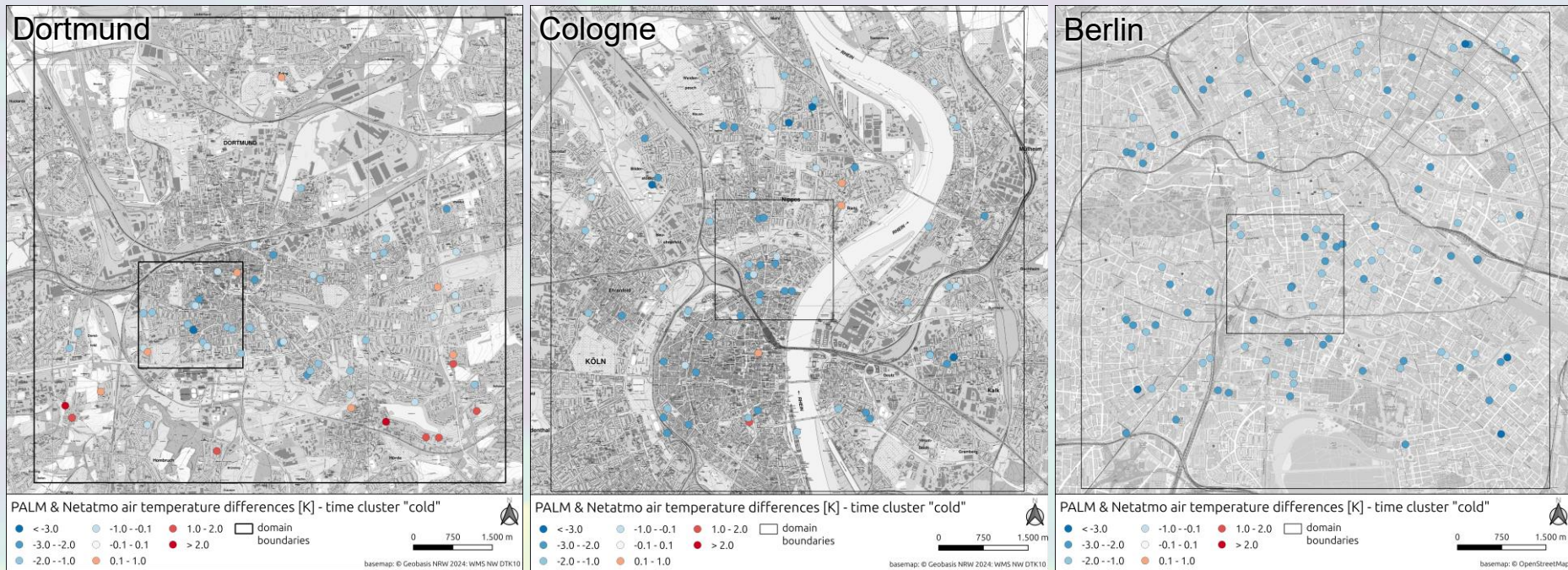


Fig. 9-11: PALM 2 m air temperature and Netatmo air temperature differences in Dortmund, Cologne & Berlin averaged for the coldest hours

Evaluation

Spatial patterns - Dortmund

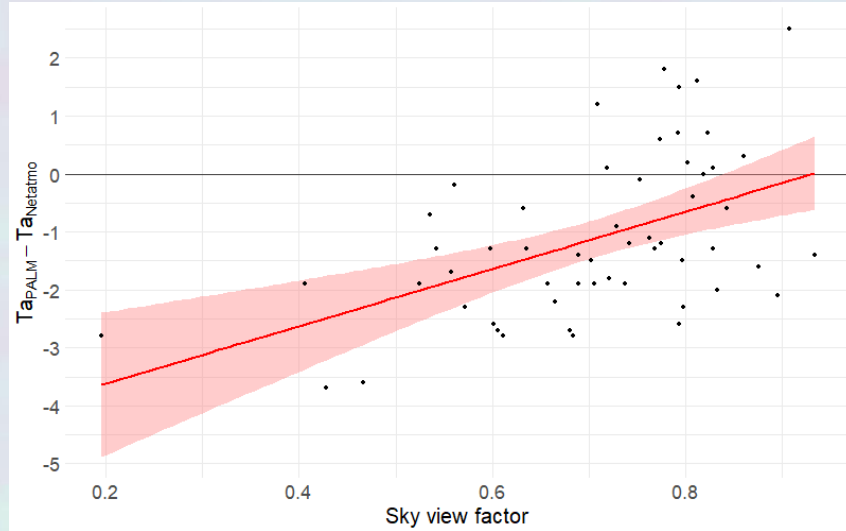


Fig.12: Linear regression between PALM and Netatmo air temperature differences and the sky view factor, timestep 08.08.2020 23:00h UTC

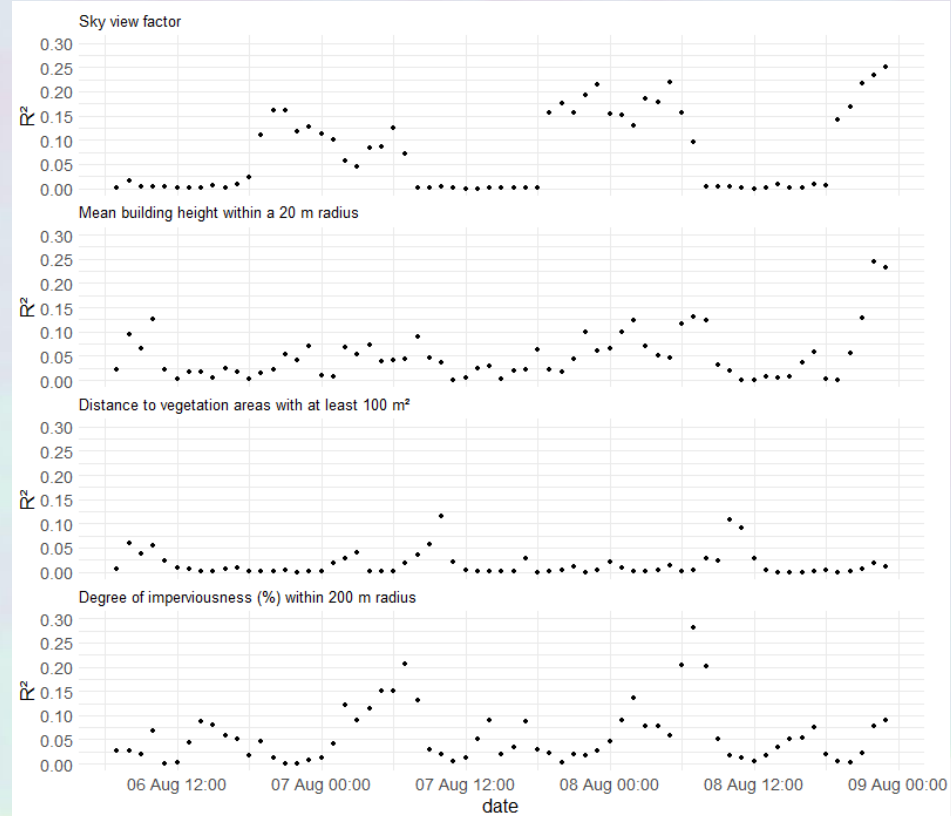


Fig.12: Time dependent R^2 for different spatial factors

Discussion & first conclusions

- **Model evaluation with crowdsourced data transferable ✓**
- **Restrictions**
 - Number of available stations
 - Data from single stations not valid
 - Uneven distribution of stations
 - Radiation errors at daytime
- **Temporal patterns in Cologne & Berlin**
 - Potential source: dynamic input → Radović et al. 2024
- **Spatial patterns in Dortmund**
 - Possibly related to density of urban structure & radiation model → TenStream

Thank you for your attention!

Let's connect:



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