



URBAN LAND USE IN COSMO-CLM MODEL

A comparison of three parameterizations for Berlin

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Motivation

→ Three **different parameterizations** for urban land were **independently implemented** into the model COSMO-CLM since 2010.

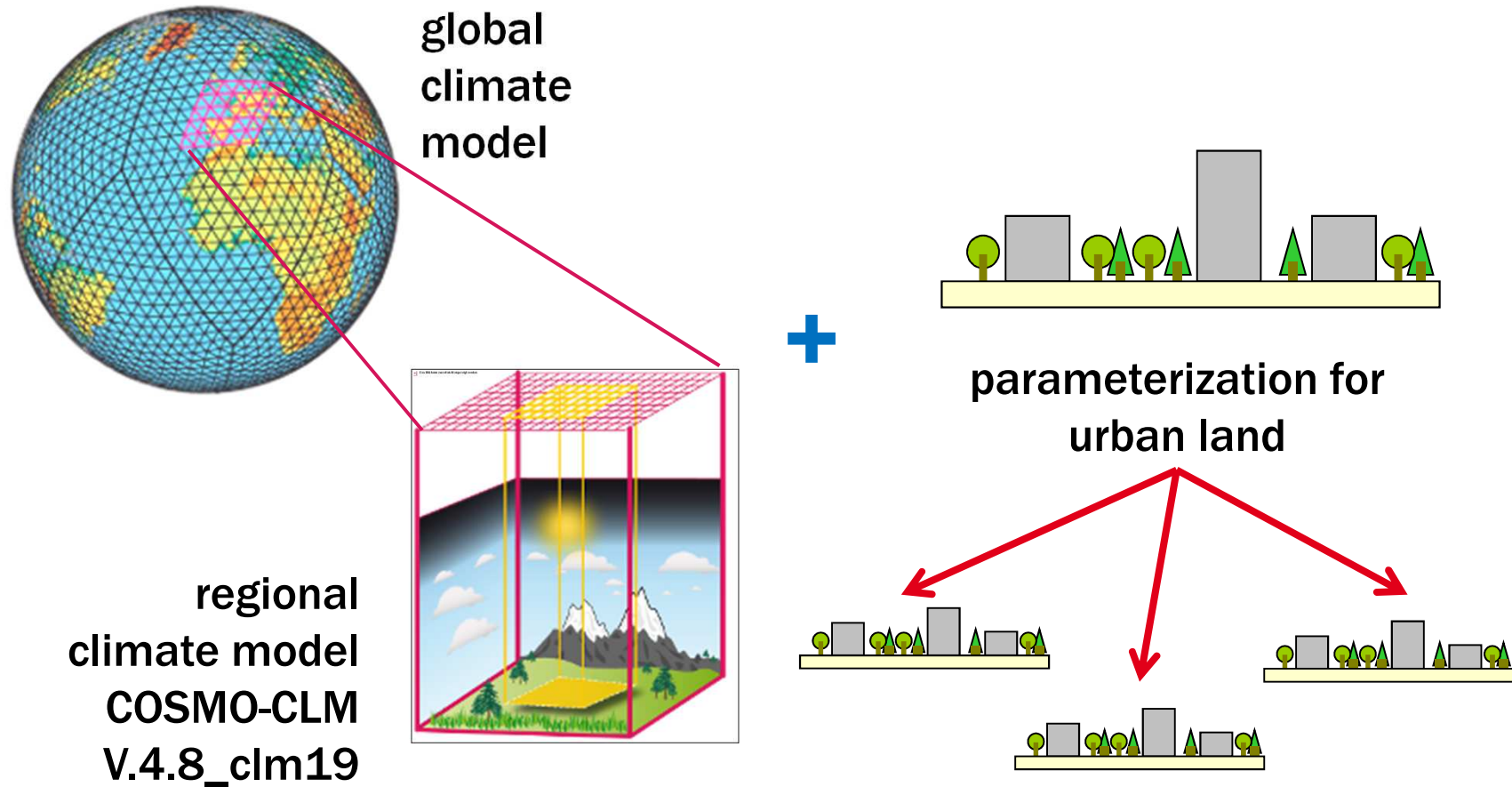
Objectives

- **Compare** the existing **urban parameterizations** in COSMO-CLM on a real site application
- Chosen site: **Berlin** urban area
- Chosen variable: **temperature**





Model COSMO-CLM





Model domains and simulations

4 model domains
6 model simulations
Simulated time: 2002

Simulation 1 (domain 1, $\Delta x = 24$ km)



Simulation 2 (domain 2, $\Delta x = 7$ km)



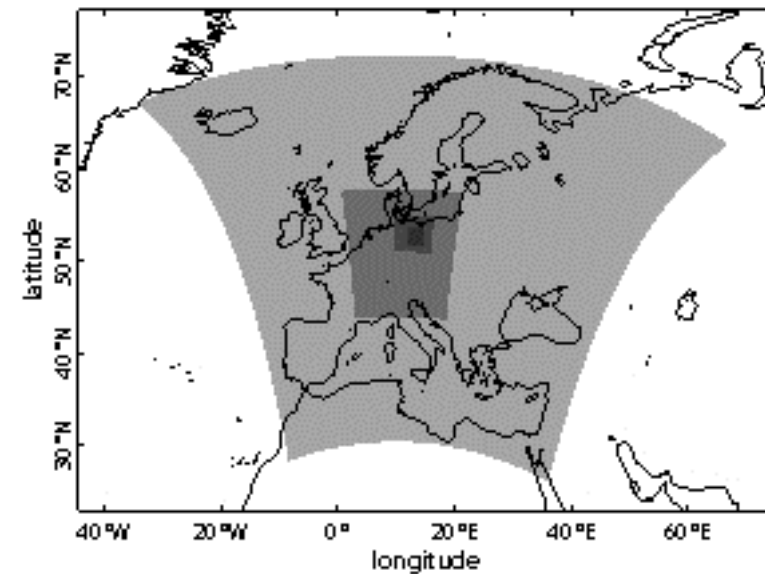
Simulation 3 (domain 3, $\Delta x = 3$ km)

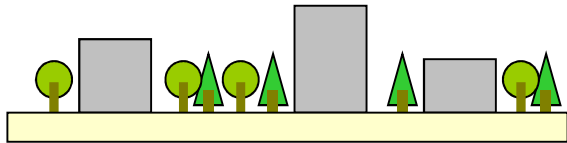


Simulation 4a (domain 4, $\Delta x = 1$ km) + urb.param. 1

Simulation 4b (domain 4, $\Delta x = 1$ km) + urb.param. 2

Simulation 4c (domain 4, $\Delta x = 1$ km) + urb.param. 3





3 parameterizations for urban land

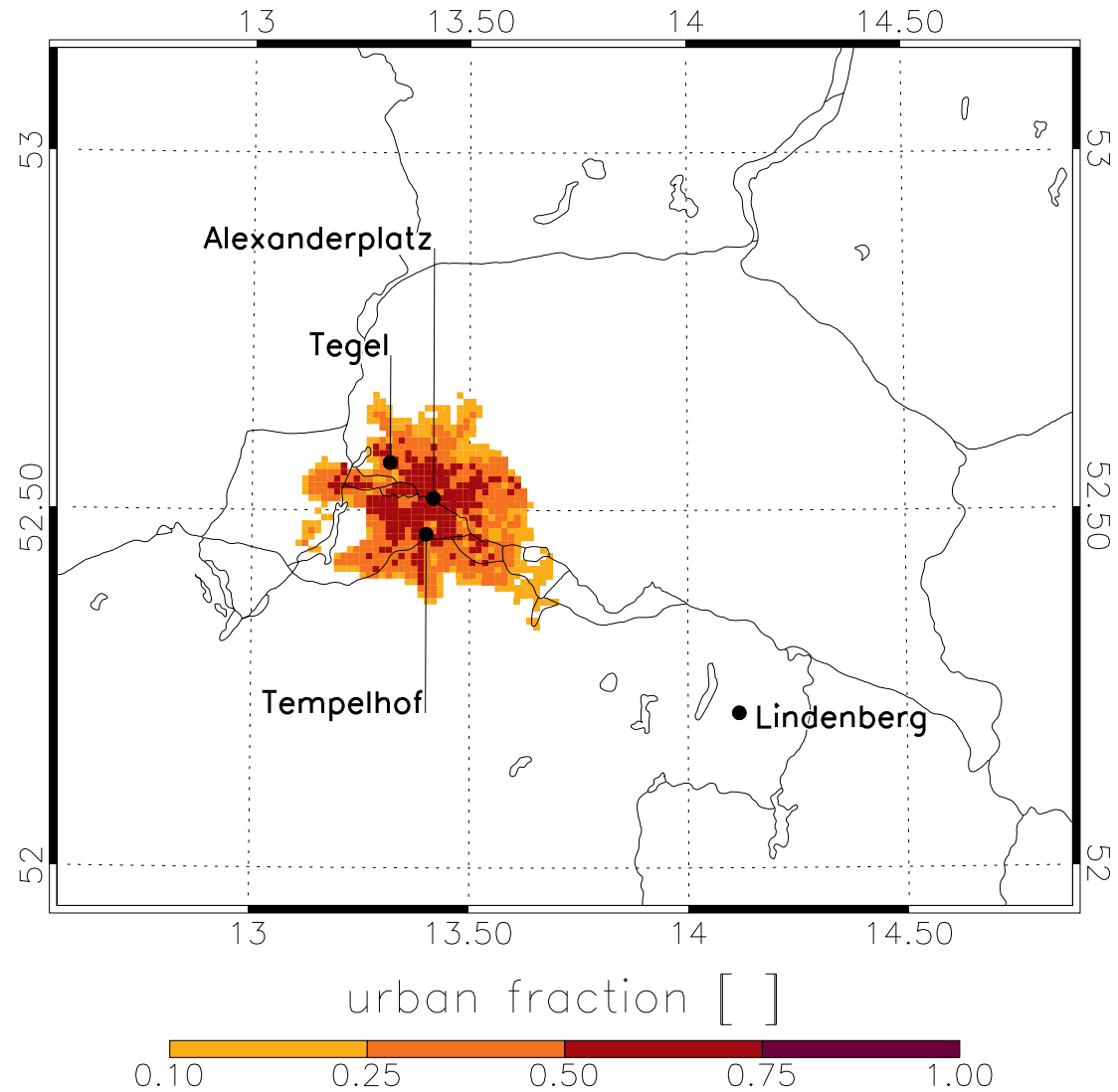
	MLUCM multi-layer urban canopy model	SLUCM single-layer urban canopy model	BULK bulk urban canopy model
Geometry of buildings	n layers	1 layer	no
Evaporation	no	yes	no
Snow cover	no	yes	no
Anthropogenic heat flux	modelled	modelled	prescribed



Model domain: Berlin

→ Stations with temperature observations:

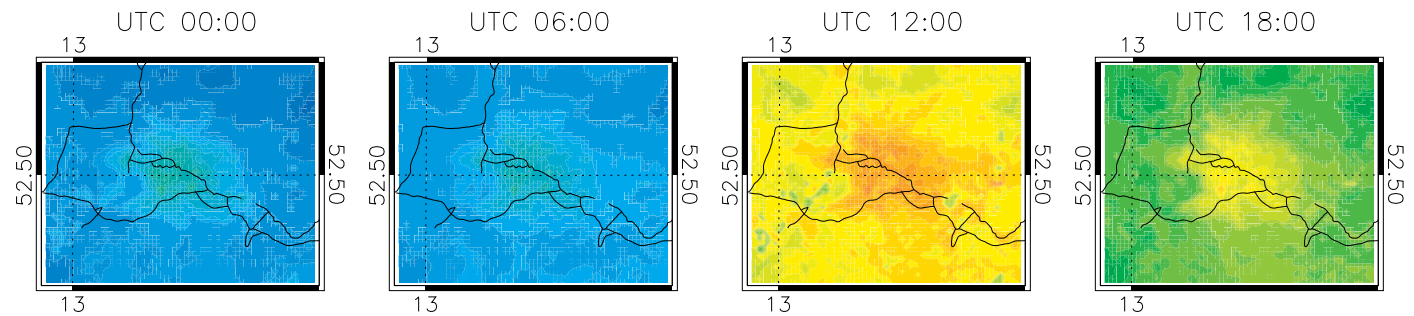
Station name	description
Alexanderplatz	built-up site
Tempelhof	airport
Tegel	airport
Lindenberg	grass field



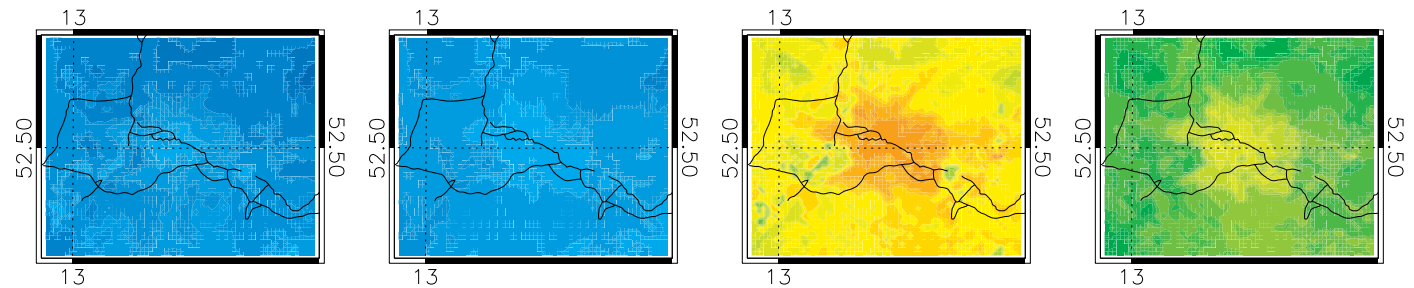


Results: 2-m temperature averaged over July 2002

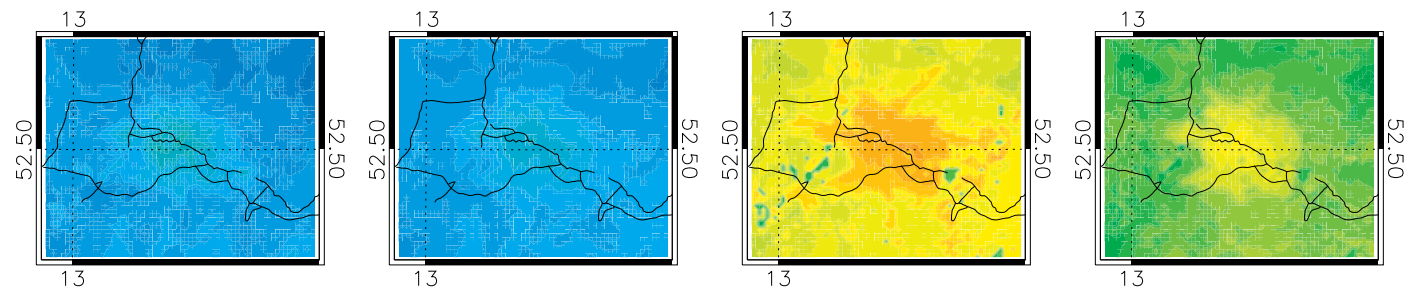
MLUCM



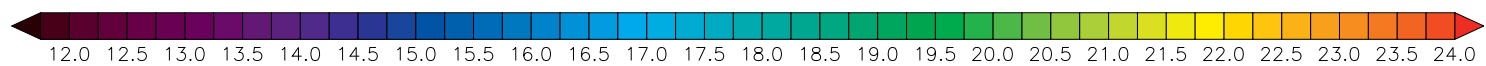
SLUCM



BULK



T [C]





Results: mean daily UHI = $T_{\text{Alexanderplatz}} - T_{\text{Lindenberg}}$ at 2 m

Mean UHI

observations **0.99 °C**

MLUCM **1.53 °C**

SLUCM **1.33 °C**

BULK **1.95 °C**

Legend:

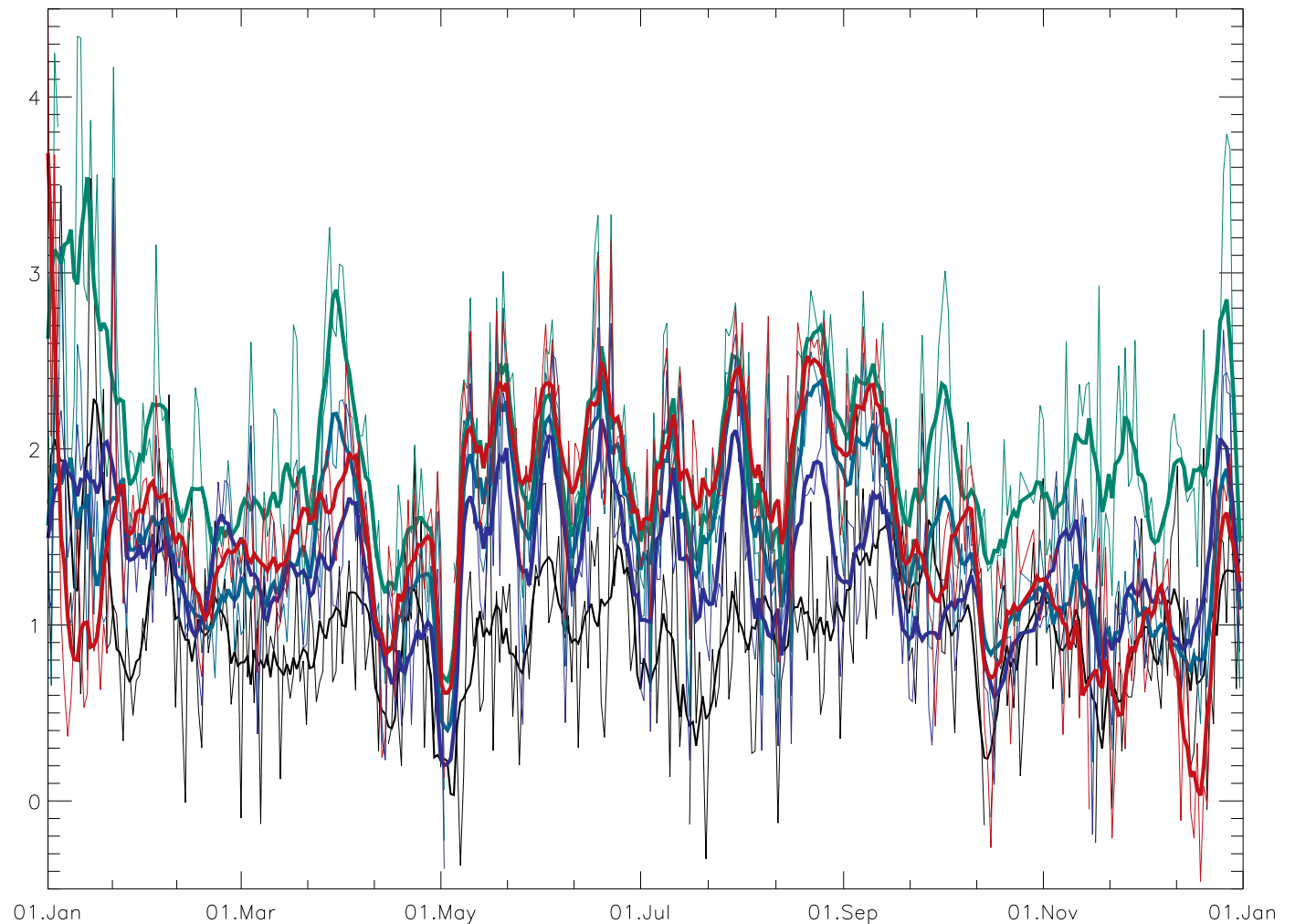
--- observations

--- MLUCM

--- SLUCM

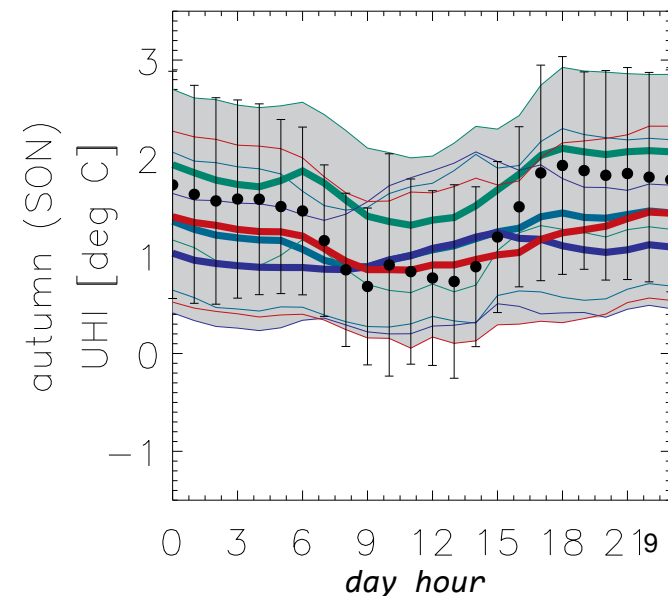
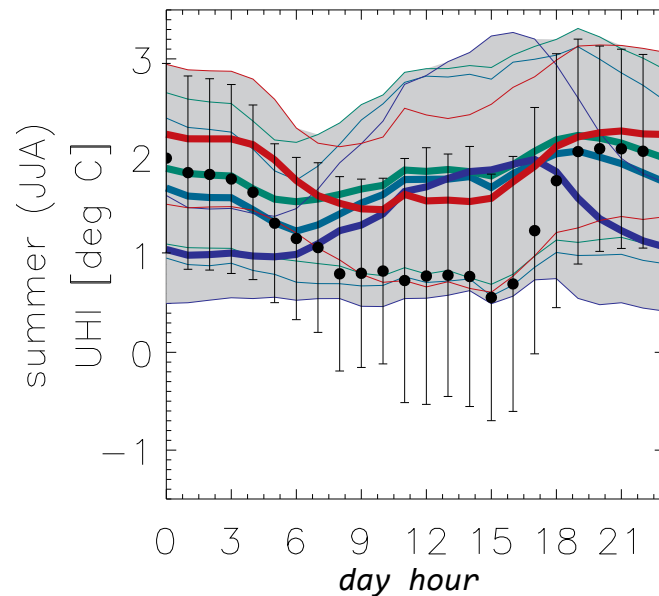
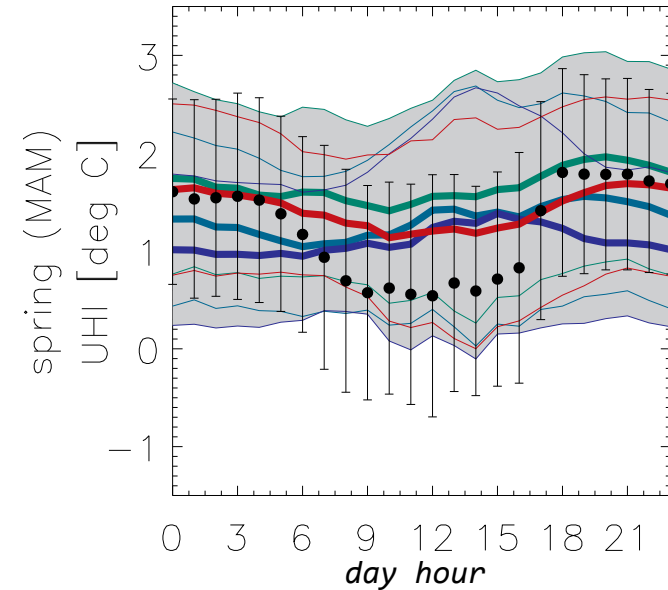
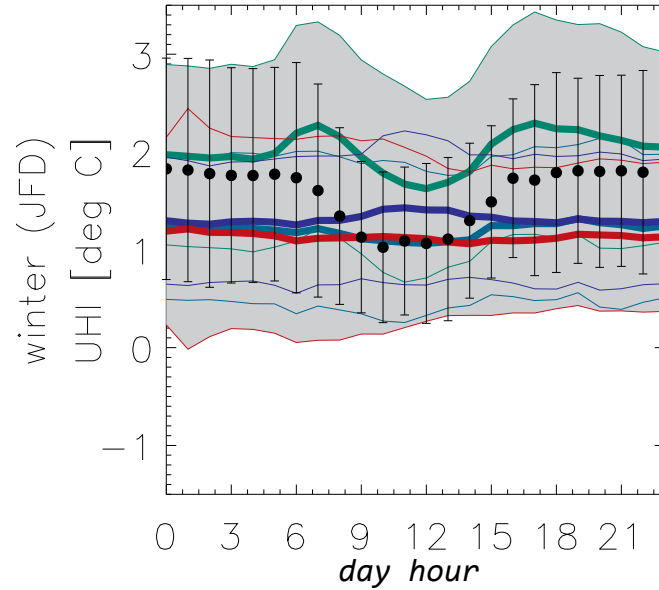
--- BULK

--- BULK_{0-flux}





Results: average UHI in different seasons



Legend:

--- observations

--- MLUCM

--- SLUCM

--- BULK

--- BULK_{0-flux}



Conclusions:

- No model performs best for all seasons
- Choice of the model should be guided by its properties / resolved processes

*More details in: K. Trusilova, S. Schubert, H. Wouters, B. Früh, S. Großmann-Clarke, M. Demuzere, P. Becker: **The urban land use in the COSMO-CLM model: a comparison of three parameterizations for Berlin** submitted to the Meteorologische Zeitschrift Special Issue "Recent developments in regional climate modelling with COSMO-CLM,,*





Climate Limited-area
Modelling Community

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Thank you!

