URBAN WEATHER GENERATORS

Csilla Viktória Gál
Dalarna University, Department of Energy and Construction Engineering
e-mail: cga@du.se

1. Aim

This study evaluates the performance of three urban canopy models that can derive local-scale 'urbanized' air temperature from rural observation and urban land use and built form characteristics.

Models:

- Urban Weather Generator (UWG)
- Vertical City Weather Generator (VCWG)
- Surface Urban Energy & Water Balance Scheme (SUEWS)

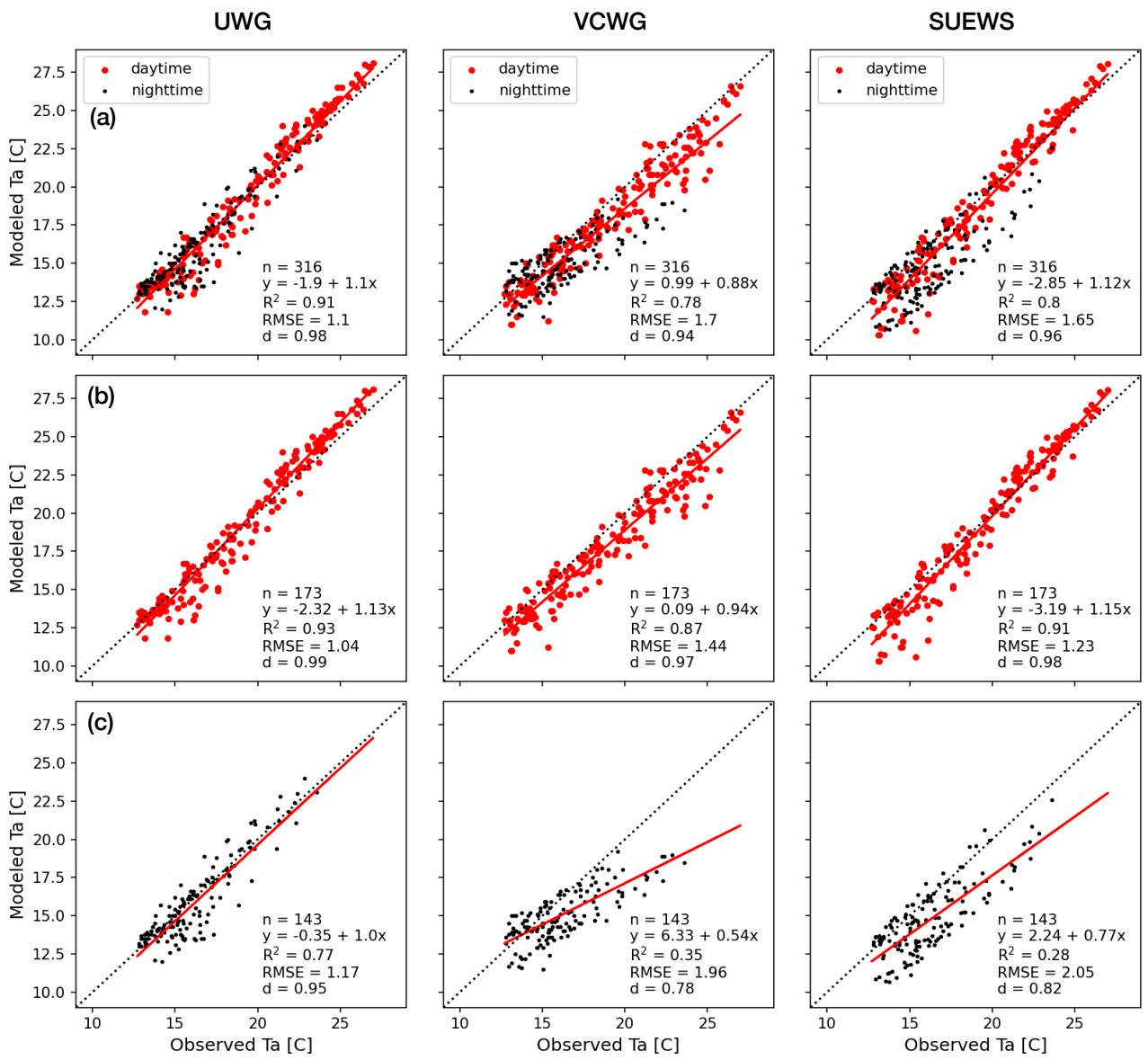
2. Materials and methods

The models are evaluated against a two-week-long measurement, conducted in the neighborhood of Újlipótváros (Budapest). ERA5 data is used to force the models.

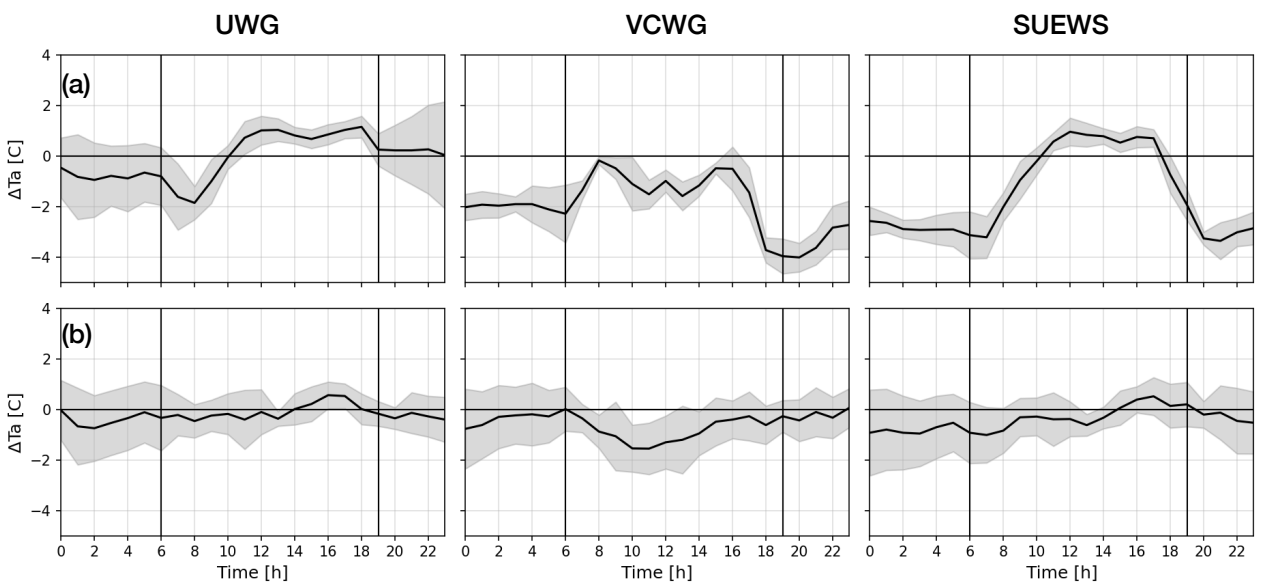
The calculated statistical measures include Willmott's index of agreement (d) and the root mean square error (RMSE)

3. Results

(below) The diurnal course of model errors. Results from different models are presented in different columns. The rows refer to values calculated for (a) anti-cyclonic and (b) cyclonic periods.



(above) Scatter plot of observed and modeled air temperature values. The rows refer to the models' (a) overall, (b) daytime and (c) nighttime performance, while the columns refer to different models (UWG, VCWG and SUEWS, from left to right).



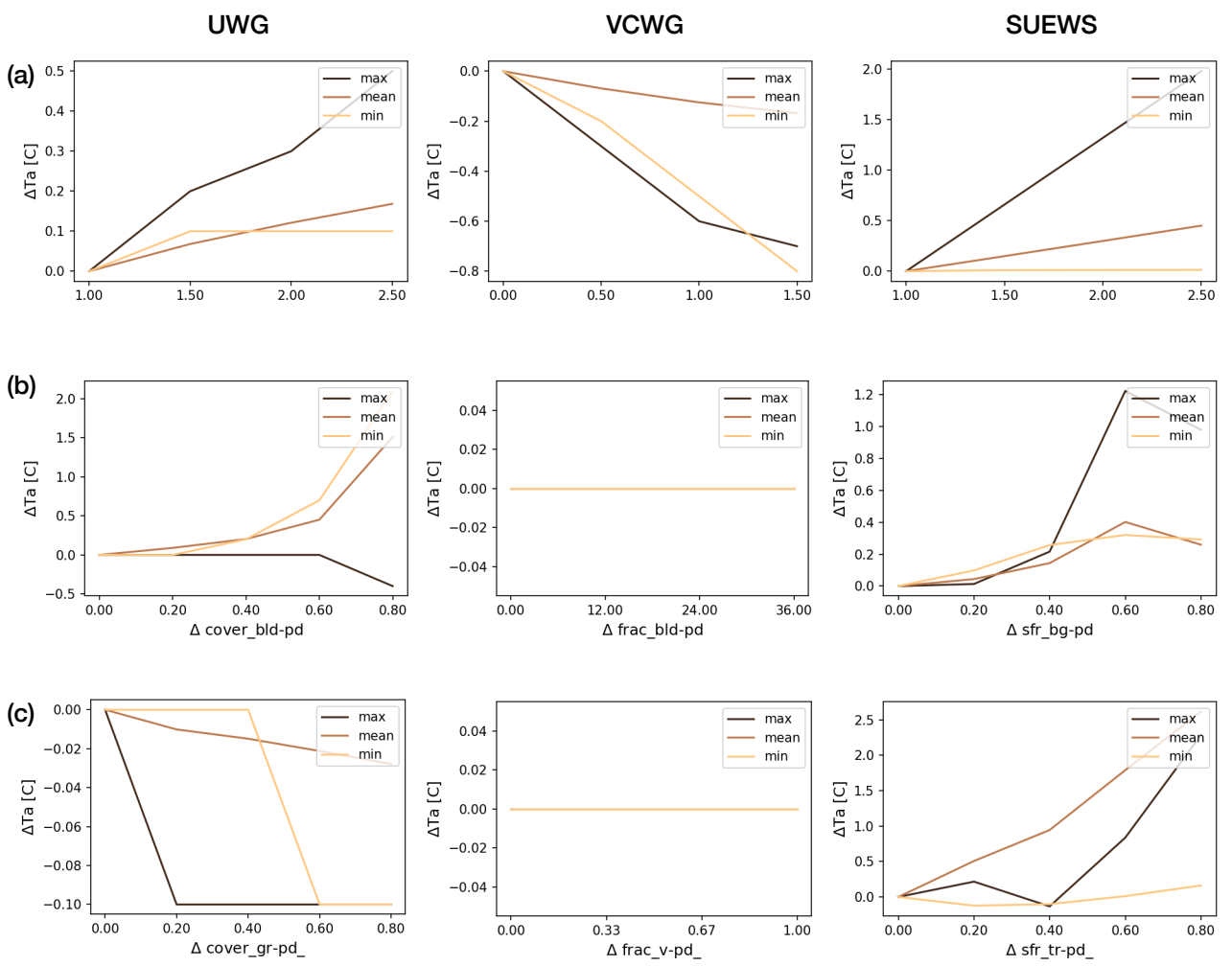
(below) Model sensitivity to (a) shortwave radiation, (b) building fraction and (c) tree/vegetation fraction at low building density. The columns refer to result from different models.

NOTE: The vertical axes have different scales and independent variables compared are similar, but not identical due to different model architectures.

4. Conclusions

The general results indicate good agreement between modeled and observed values (RMSE 1–2°C). However, the disaggregation of data found nighttime conditions during anti-cyclonic periods to be the most challenging for all models (RMSE 1.5–3°C, not shown).

The sensitivity analyses shed light to the effect of different modeling approaches, as well as to discrepancies in the models. Since most of these numerical simulation tools are under development, the author hopes to see their advancement and improvement in the future.



5. Acknowledgement

The author is grateful to the Hungarian Meteorological Services for the data provided.