**Project: 1508**
**Title: Application and further development of Urban Parameterization in ICON-CLM**
**Report for allocation period 01.07.2025-30.06.2026**

## Idealized Urban Climate Simulations

In a PhD project, we are simulating mesoscale urban-rural interactions in an idealized setup using ICON-CLM (Fig. 1). The setup enables a systematic evaluation on how the regional climate model ICON-CLM and its urban parametrization scheme TERRA_URB behave under controlled changes, but also isolates key urban processes. In the past allocation period we first experimented with an idealized setup. Convective permitting test simulations were performed in relation to the level of idealization, grid spacing, and the optimal boundary condition configuration. The final setup is now complete. Next year, we plan to conduct soil moisture sensitivity tests to explore the interaction between drier soil conditions and urban phenomena such as the thermal urban heat island or urban plume.

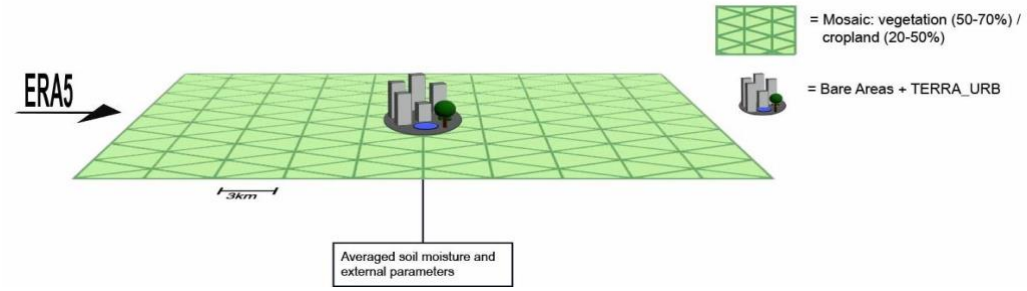


*Fig 1. Schematic illustration of the idealized setup.*

*Conference Contribution: Idealized Soil-Moisture Sensitivity Simulations to Assess Climate-Change Impacts on Urban-Rural Interactions M. Bohmann, P. Ludwig, A. Christen, J.P. Schulz, and J.P.G. Pinto. ICCARUS 2026, Offenbach am Main.*

## Neighborhood-level AI-based UTCI Model

Here, we employ a hybrid meso-to-microscale modelling chain that couples 1km grid spacing ICON-CLM simulations with a deep-learning-based microscale model that resolves individual buildings across the entire Greater Paris agglomeration. The goal is to assess outdoor thermal comfort at one-metre resolution. During the past allocation period, the ICON-CLM simulations were successfully conducted on **CPU nodes**. We also conducted first tests to deploy the deep-learning U-Net model on **GPU nodes** on Levante. In the upcoming allocation period, we plan to run the deep-learning model for the full target domain and to analyse the simulation output.

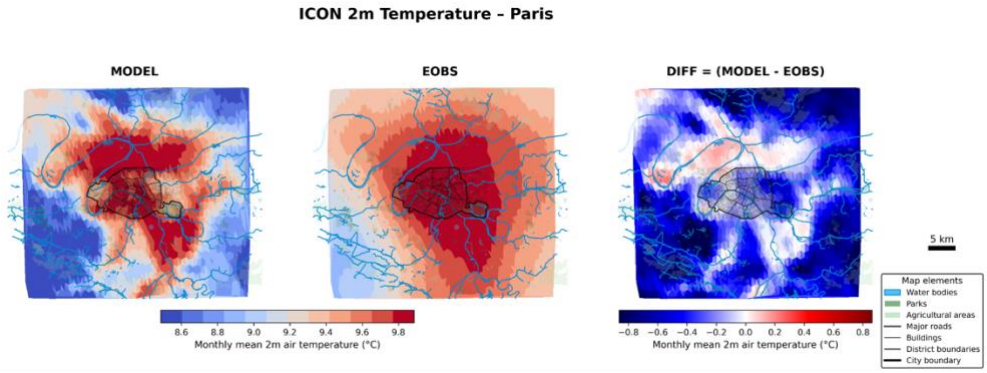


*Fig. 2: Monthly mean 2-m tempertaure over Paris metropolitan area for April 2023. Left: ICON-CLM simulation (0.058◦ grid spacing), Middle: EOBS (0.1◦ resolution), Right: bias (ICON-CLM - EOBS).*

*Conference Contribution: Briegel, F., Bohmann, M., Ludwig, P., Christen, A., and Pinto, J. G.: Coupling physics-based mesoscale weather models and deep-learning microscale models for outdoor thermal comfort assessments., EGU General Assembly 2026, Vienna, Austria, 3–8 May 2026, EGU26-9347, https://doi.org/10.5194/egusphere-egu26-9347, 2026.*

## Contribution to FPS-URB-RCC

During the allocation period, we contributed to the generation of a large RCM-based ensemble focusing on the representation of urban areas (in this case Paris) in RCMs. We complete the evaluation runs, forced by ERA5, for a 10-year period (2000-2009, plus 2-years for spin-up) with COSMO-CLM at 12 km and 3 km grid spacing. Joined analysis of the runs are ongoing, first papers have been submitted (see below). For the next allocation period, GCM driven historical and future scenarios are planned for Paris (see computing time proposal for next allocation period).

In addition, we have completed a 10-year (plus 2-years spin-up) evaluation run with ICON-CLM for Johannesburg (a satellite city in the FPS-URB-RCC activities), also at 12 km and 3 km horizontal grid spacing. Analysis of theses simulations have been started in close cooperation with partners also simulating Johannesburg. A publication is planned to be submitted by the end of this year. For the next allocation period, GCM driven historical and future scenarios are planned for Johannesburg (see computing time proposal for next allocation period).

*Le Roy, B., Rechid, D., Bastin, S., Langendijk, G. S., Zerbst, L., Adinolfi, M., Ban, N., Berthou, S., Bohmann, M. M., Caillaud, C, Cardoso, R. M., De Vries, H., Dobler, A., Fernandez, J., Frisius, T., Goergen, K., Göktürk, O. M, Hodnebrog, Ø, Kartsios, S., Katragkou, E., Milovac, J., Raffa, M., Soares, P. M. M., Sobolowski, S., Tölle, M., Warrach-Sagi, K., Zazulie, N.: How convection-permitting climate models improve the representation of urban temperatures in Europe. Submitted to Climate Dynamics.*

*Diez-Sierra, J., Zazulie, N., Langendijk, G.S., Quintana, Y.,Adinolfi, M., Bohmann, M., Buntemeyer, L., Buonomo, E., Caluwaerts, S., Campanale, A., Cardoso, R.M., Carvalho, D., Casanueva, A., Demuzere, M., Endreny, T., Fernández, J., Ghilain, N., Goergen, K., Halenka, T., Hoffmann, P., Katragkou, E., Kotlarski, S., Ludwig, P., Maurer, V., Milovac, J., Nogherotto, R., Pavlidis, V., Pietikäinen, J-P., Raffa, M., Rechid, D., Schulz, J-P., Serras, F., Simon-Moral, A., Soares, P.M.M., Sobolowski, S., Teichmann, C., Vandelanotte, K., Vanderkelen, I., Wang, F..: Urban climate evaluation in the Upcoming Generation of CMIP6-Driven EURO-CORDEX Regional Climate Simulations. Submitted to Urban Climate.*

*Hoffmann, P.; T. Halenka; G.S. Langendijk; A. Aldama-Campino; S. Bastin; M. Belda; O. Brousse; A. Bushenkova; A. Campanale; A.F. Carril; A. Casanueva; K. Pan Chun; K. Constantinidou; N. Machado Crespo; J. de Leeuw; M. Demuzere; J. Diez-Sierra; Y. Ezber; D. Fenner; J. Fernandez; L. Fita; P. Freisen; F. Johannsen; E. Katragkou; B. Le Roy; A. Lemonsu; M.J. Lipson; P. Ludwig; P. Mercogliano; Y. Michau; J. Milovac; L.E. Muñoz; V. Pavlidis; J.-P. Pietikäinen; D. Rechid; I. Ribeiro; C. Bayu Risanto; J.-P. Schulz; A Simon-Moral; P. M.M. Soares; M. Thatcher; E. Toker; S. Top; A. Villalba-Pradas; F. Wang; J. Yuan; N. Zazulie: Opportunities and challenges in representing the interactions between urban areas and regional climate change in CORDEX - lessons learnt from FPS URB-RCC. Submitted to PLOS Climate.*