

## Annual report 2024 for Flagship Pilot Study URB-RCC

Status and progress during the year including scientific highlights (and images if possible), end to end perspective and participants engaged in the project

- Starting date of FPS URB-RCC: 01 May 2021.

### Phase 1 of FPS URB-RCC milestones:

**Analysis of existing datasets is resulting in following papers:**

- Convection-permitting RCM datasets:
  - Preprint: Michau et al. Projected Evolution of the Urban Climate and Heatwaves using an Ensemble of Convection-Permitting Regional Climate Models.  
<https://doi.org/10.21203/rs.3.rs-5309528/v1>
  - In preparation: Le Roy, B. et al. How do convection permitting climate models improve the representation of Urban Heat Islands compared with standard regional climate models? *Climate Dynamics*.
- CORDEX-CORE RCM dataset:
  - Paper in final stages of preparation for submission:  
Representation of global mega-cities and their urban heat island in CORDEX-CORE regional climate model simulations. Collaborators include: Gaby Langendijk, Jesus Fernandez, Javier Diez-Sierra, Matthias Demuzere, Lluís Fita, Tomas Halenka, Peter Hoffmann, Diana Rechid, Rita Nogherotto, Natalia Zazulie, Erika Coppola, among others.
- FPS overview paper published:
  - Towards better understanding the urban environment and its interactions with regional climate change-The WCRP CORDEX Flagship Pilot Study URB-RCC. *Urban Climate*, 58, 102165. <https://doi.org/10.1016/j.uclim.2024.102165>

### Phase 2 of FPS URB-RCC milestones:

#### **STAGE-0 test simulations**

Short description: evaluation simulations (ERA5.1), for 5 months in 2020 (incl. a heatwave and heavy precip. event), Paris region.

- STAGE-0 simulations completed (Figure 1):
  - 18 institutions, 9 RCMs
  - 40 simulations: 36 shared, 1 running, 3 completed
  - Sensitivity runs: 28x WRF, 3x CNRM-AROME, 2x CCLM, 2x RegCM
  - Simulations shared via DKRZ, we would like to acknowledge the support to the FPS URB-RCC by the DKRZ in providing storage and computing resources for the analysis of the STAGE-0 simulations
- Various analyses of STAGE-0 data are currently underway, 5 main topics/papers:
  1. UHI and overall analysis, leads: Tomas Halenka & Michal Belda
  2. Land-surface characteristics, lead: Sun Chun Kwok
  3. Heat stress, and biometeorology, lead: Ana Casanueva
  4. Precipitation analysis, lead: Andres Simon-Moral
  5. WRF sensitivity simulations, differences, and land-atmosphere feedbacks, lead: Josipa Milovac.

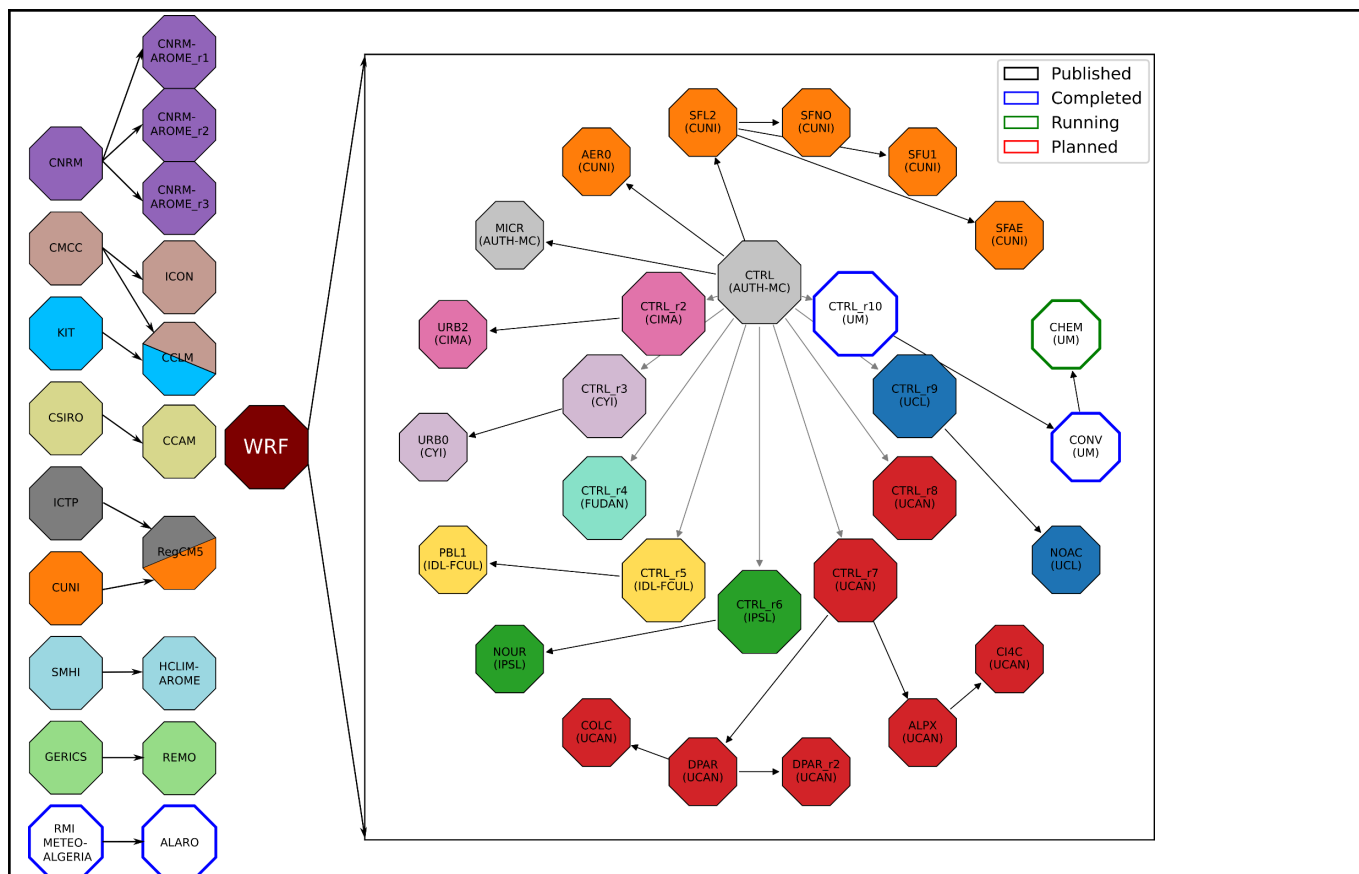


Figure 1. Overview of STAGE-0 simulations, status Jan. 2025. Credit: Josipa Milovac.

### STAGE-1 Protocol Development

Short description: 10-years evaluation runs (ERA5.1), 2000-2009, km-scale spatial resolution, Paris Region and global satellite cities (various cities across the globe).

- Protocol developed in the 2nd half of 2024 and finalised and distributed in Jan. 2025.
- In alignment with the EU Horizon I4C project.
- Global satellite cities selection.

### Summary of each workshop/activity held during the year

Title, date, short description, location, website, links	Responsible person/s	Funder
Side meeting at EURO-CORDEX GA, 22 January	Tomas Halenka, Peter Hoffmann, Gaby Langendijk	-
Annual meeting, 26-27 june, virtual <i>Discussed the preliminary results of STAGE-0 simulations and outlined the directions for STAGE-1 simulations.</i>	Tomas Halenka, Peter Hoffmann, Gaby Langendijk	-
FPS STAGE-0 analyses meetings, 4x, virtual	Tomas Halenka, Peter Hoffmann, Gaby Langendijk, all	-
FPS STAGE-1 Protocol development meetings, 3x, virtual	Tomas Halenka, Peter Hoffmann, Gaby Langendijk, all	-

### Related publications during the year

Title, journal and link to publication	Author/-s	Date
Towards better understanding the urban environment and its interactions with regional climate change-The WCRP CORDEX Flagship Pilot Study URB-RCC. <i>Urban Climate</i> , 58, 102165. <a href="https://doi.org/10.1016/j.uclim.2024.102165">https://doi.org/10.1016/j.uclim.2024.102165</a>	Langendijk, G. S., Halenka, T., Hoffmann, P., Adinolfi, M., Campino, A. A., Asselin, O., ... & Yuan, J.	2024
Projected Evolution of the Urban Climate and Heatwaves using an Ensemble of Convection-Permitting Regional Climate Models. <a href="https://doi.org/10.21203/rs.3.rs-5309528/v1">https://doi.org/10.21203/rs.3.rs-5309528/v1</a>	Michau, Y., Lemonsu, A., Lucas-Picher, P., Bastin, S., Caillaud, C., de Vries, H., ... & Coppola, E.	Under review pre-print, 2024
On the Deep learning approach for improving the representation of urban climate: the Paris urban heat island and temperature extremes. <i>Urban Climate</i> , 56, 102039. <a href="https://doi.org/10.1016/j.uclim.2024.102039">https://doi.org/10.1016/j.uclim.2024.102039</a>	Johannsen, F., Soares, P. M., & Langendijk, G. S.	2024
Effects of urban areas on the diurnal cycle of temperature and precipitation in a global climate simulation. <i>Quarterly Journal of the Royal Meteorological Society</i> , 150(765), 4885–4914. <a href="https://doi.org/10.1002/qj.4847">https://doi.org/10.1002/qj.4847</a>	Katzfey, J., Schlünzen, K.H. & Hoffmann, P.	2024
Long-term impact of urban areas on meteorological conditions over Central Europe. Submitted to <i>Annals of the New York Academy of Sciences</i>	Villalba-Pradas, A., Karlický, J. Huszár, P., Žák, M., Halenka, T.	Under review

### Planned activities for next year

#### Key activities:

- Conduct STAGE-1 simulations, see above for description.
- Advance the analysis of STAGE-0 simulations, see above the main analysis topics and papers in the pipeline.
- Finalize analyses around existing datasets and submit related papers, esp. CORDEX-CORE and CP simulations.

#### Sessions at conferences:

- Urban Climate session EGU25 CL2.3: “Urban climate: observations, modelling, science tools and climate action for cities”. Conveners related to FPS: Gaby Langendijk, Rafiq Hamdi  
More info: [Session CL2.3](#)
- International Conference on Urban Climate 12 (ICUC12), 7-11 July 2025, PM6 session: "Mesoscale modelling and climate change – Interactions between urban and regional climate processes"  
Conveners: Peter Hoffmann, Gaby Langendijk, Tomas Halenka, Mathew Lipson, Quang-Van Doan. More info: [Session PM6](#)
- BACO2025, Busan, Korea, 20-25 July 2025, IAMAS-IACS-IAPSO Joint Assembly, M20 Symposium on “High resolution modelling of regional and local climate”, Conveners: Tomas Halenka  
Co-conveners: Gaby Langendijk, Peter Hoffmann, Diana Rechid, Lee Welhouse.

We expect that FPS members will be active at the aforementioned conferences (among other conferences) and present the latest results arising from the FPS activities.

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**Any other positive news or stories within your FPS during the year**

- **Connection to IPCC Special Report on Climate Change and Cities**

Tomas Halenka was nominated and selected for the Scoping Meeting of the IPCC Special Report (SR) on Climate Change and Cities. He participated in the meeting in Riga, 16-19 April 2024, bringing in relevant topics from the FPS into the outline of the SR.

Four representatives within and/or close to the FPS URB-RCC community were selected as lead authors of the SR: Rafiq Hamdi, Rita Nogherotto, Alexander Baklanov, Stefan Sobolowski.

- **Connection to IPCC AR7 WG-I**

Tomas Halenka was nominated and selected for the Scoping Meeting of the IPCC AR7 for WG-I Report. He participated in the meeting in Kuala Lumpur, 9-13 December 2024, bringing in relevant topics from the FPS into the outline of the WG-I Report of AR7.

**Contact person/-s**

Tomas Halenka, Gaby S. Langendijk, Peter Hoffmann.

Website FPS: [https://ms.hereon.de/cordex\\_fps\\_urban/](https://ms.hereon.de/cordex_fps_urban/)

**Please remember to inform IPOC about news, calls, activities or other information that can be shared with the community during the year! We want to show your work at the website and on social media.**

If more space is needed just add rows in the table.

The report is due the 15<sup>th</sup> of February each year and should be sent to [ipoc@cordex.org](mailto:ipoc@cordex.org).