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HEAT IN CITIES ACROSS THE GLOBE:
WHAT CAN THE CORDEX-CORE REGIONAL CLIMATE MODEL ENSEMBLE TELL?

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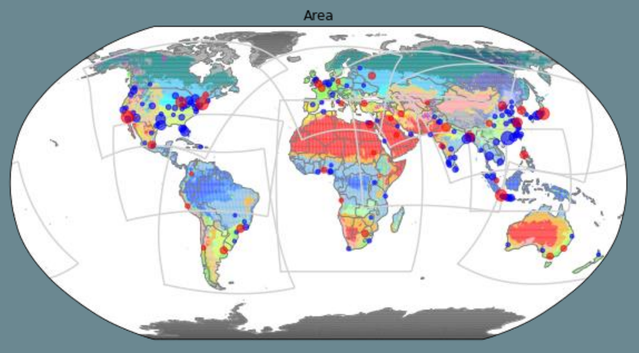
*DELTARES, THE NETHERLANDS

RESEARCH QUESTIONS

- How are urban areas represented in the CORDEX-CORE dataset, wr.t. the land surface description?
- How do regional climate models (RCMs) capture and project the urban-rural temperature contrast and heat extremes on the 0.22° grid resolution in cities across the globe for different levels of climate change?

CITY SELECTION

Selection criteria:
- City size: area (km2) and population
- Climate classification (Köppen)
- Geographic characteristics (in-land, coastal, mountainous)
- Balance across CORDEX-CORE domains
- Climate impact (population, urbanisation, climate risks)
- *Observations available*



Selected cities (red dots) by population size (top) and area size (bottom).

Selected cities (top) and quantities (Q) of cities matching the criteria characteristics (geographic, climate, and domain) (bottom).

1. Jakarta	11. Sao Paulo	21. Moscow	31. Baghdad
2. Manila	12. Paris	22. Montreal	32. Khartoum
3. Mumbai	13. London	23. Seoul	33. Santiago (Chile)
4. Dhaka	14. Istanbul	24. Lima	34. Melbourne
5. Delhi (new Delhi)	15. Los Angeles	25. Lagos	35. Berlin
6. Tehran	16. Beijing	26. Luanda	36. Singapore
7. Cairo	17. Chengdu	27. Riyadh	37. Naples
8. New York	18. Mexico-City	28. Tashkent	38. Bogota
9. Tokyo	19. Johannesburg	29. Sydney	
10. Buenos Aires	20. Chicago	30. Shanghai	

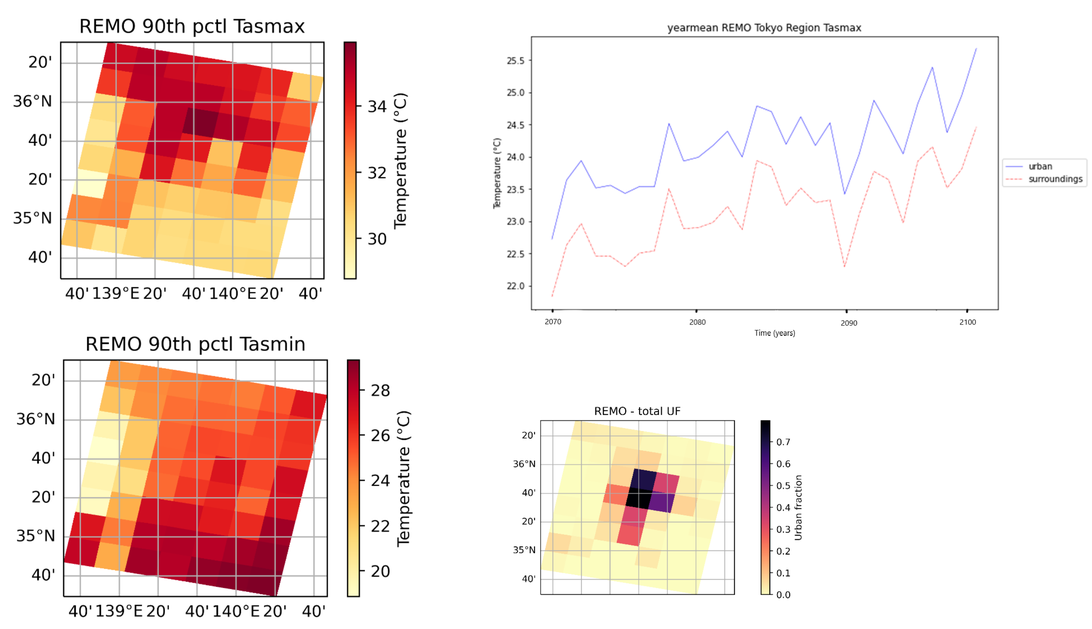
Charact.	Q	*Charact.*	Q	*Charact.*	Q	*Charact.*	Q
Coastal	20	**Af**	2	**Am**	2	**Aw**	2
In-land	19	**As**	0	**BSh**	2	**BSk**	2
Mountain	5	**BWh**	4	**BWk**	0	**Cfa**	5
Africa	5	**Cfb**	6	**Cfc**	0	**Csa**	2
N-America	4	**Csb**	3	**Csc**	0	**Cwa**	2
L-America	6	**Cwb**	2	**Cwc**	0	**Dfa**	1
Europe	6	**Dfb**	3	**Dfc**	0	**Dfd**	0
Oceania	2	**Dsa**	0	**Dsb**	0	**Dsc**	0
C- Asia	5	**Dsd**	0	**Dwa**	1	**Dwb**	0
E-Asia	7	**Dwc**	0	**Dwd**	0	**ET**	1
SE-Asia	4	**EF**	0				

INITIAL FINDINGS

→Urban-rural difference visible in CORDEX-CORE dataset, mainly for 90th percentile heat extreme and year mean of maximum temperature (TasMax).

→Stronger urban signal for minimum temperature (TasMin) than TasMax would be expected as UHI is strongest at night. Probably simple urban schemes of the RCMs do not retain the heat during the day to release it at nighttime.

EXAMPLE: TOKYO

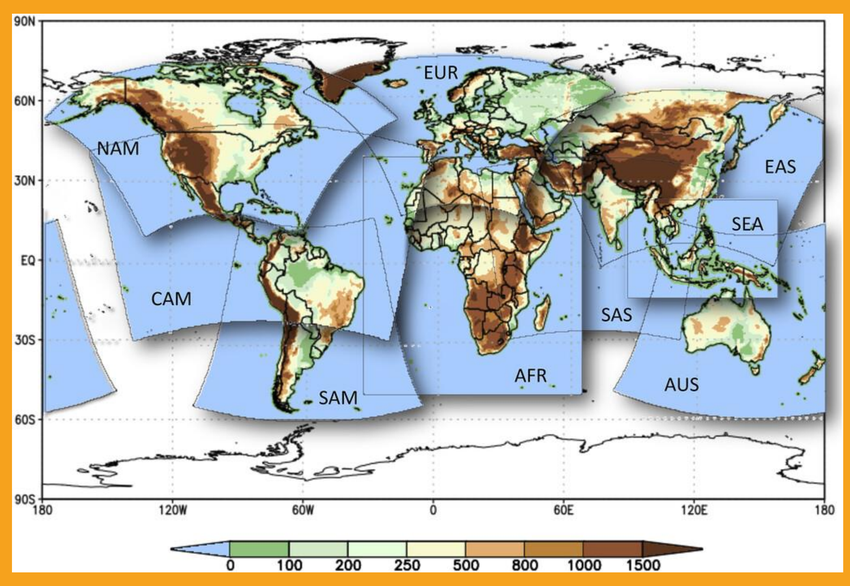


DATASET

CORDEX-CORE dataset at a glance:

- Regional climate models: REMO & RegCM
- Spatial resolution: 0.22° / ~25km
- Climate scenarios: RCP8.5 & RCP2.6
- Simulation period: 1950 (1970) - 2100 historic + projections
  1979 - 2017 evaluation (ERA-Interim)

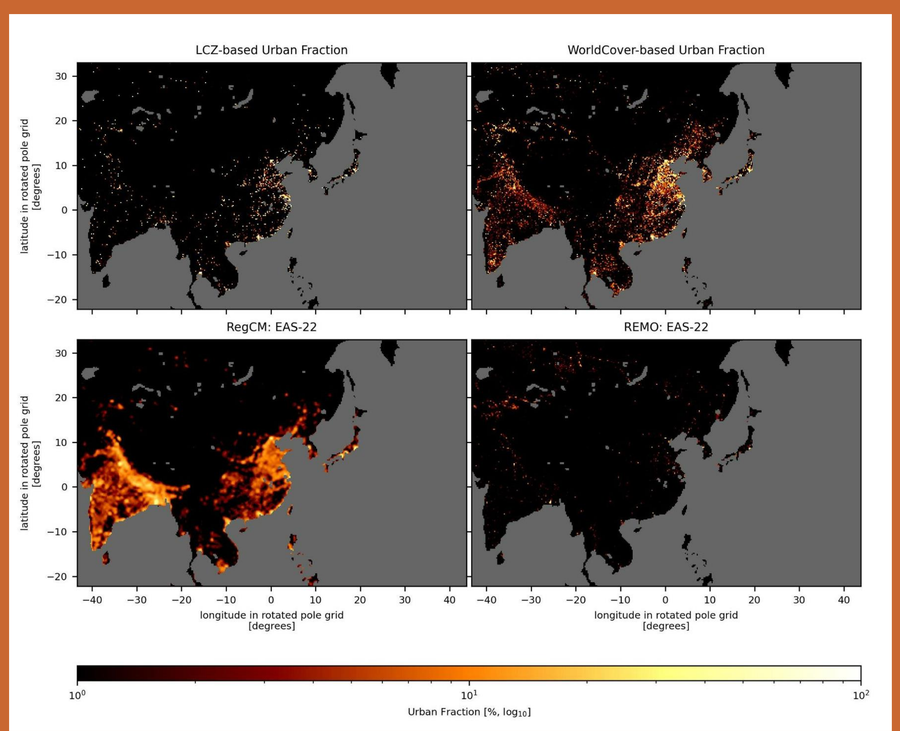
Covers key land areas across the globe, using following domains:

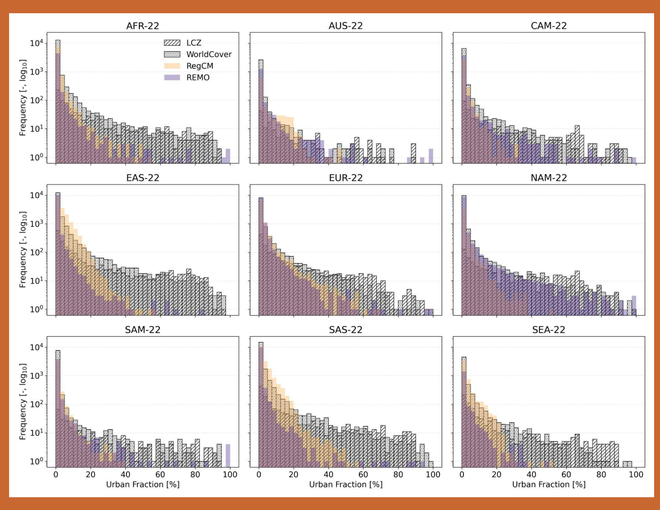


INITIAL FINDINGS

Two urban land surface products are used as a reference urban fraction and its variability/uncertainty, serving as a benchmark for the land surface description of urban areas in the RCMs:

- The 10m resolution ***WorldCover product***, of which the binary urban label is resampled into urban fraction (Pratiman & Roth, 2022, DOI: 10.5281/zenodo.6994974)
- The 100m global ***Local Climate Zone map***, assigning urban fraction provided by Stewart and Oke (2012) look-up table (Demuzere et al., 2022, DOI: 10.5194/essd-14-3835-2022)





Key points:

1. RegCM generally closer to LCZ and WorldCover representation of urban land surface than REMO.

2. Urban land surface in North-America (NAM) & Europe (EUR) relatively well represented by both RCMs.

3. Urban land surface description of both RCMs poorly represent the urban areas in Asia and Africa.

→ Main reasons behind underrepresentation of urban land surface in respective regions is the outdated urban land-use datasets in the RCMs & high urbanisation rates in these regions of the world.
→ It is critical to improve land surface datasets for RCMs to simulate urban areas adequately.

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