







Research questions

Data analysis 2000 – 2010:

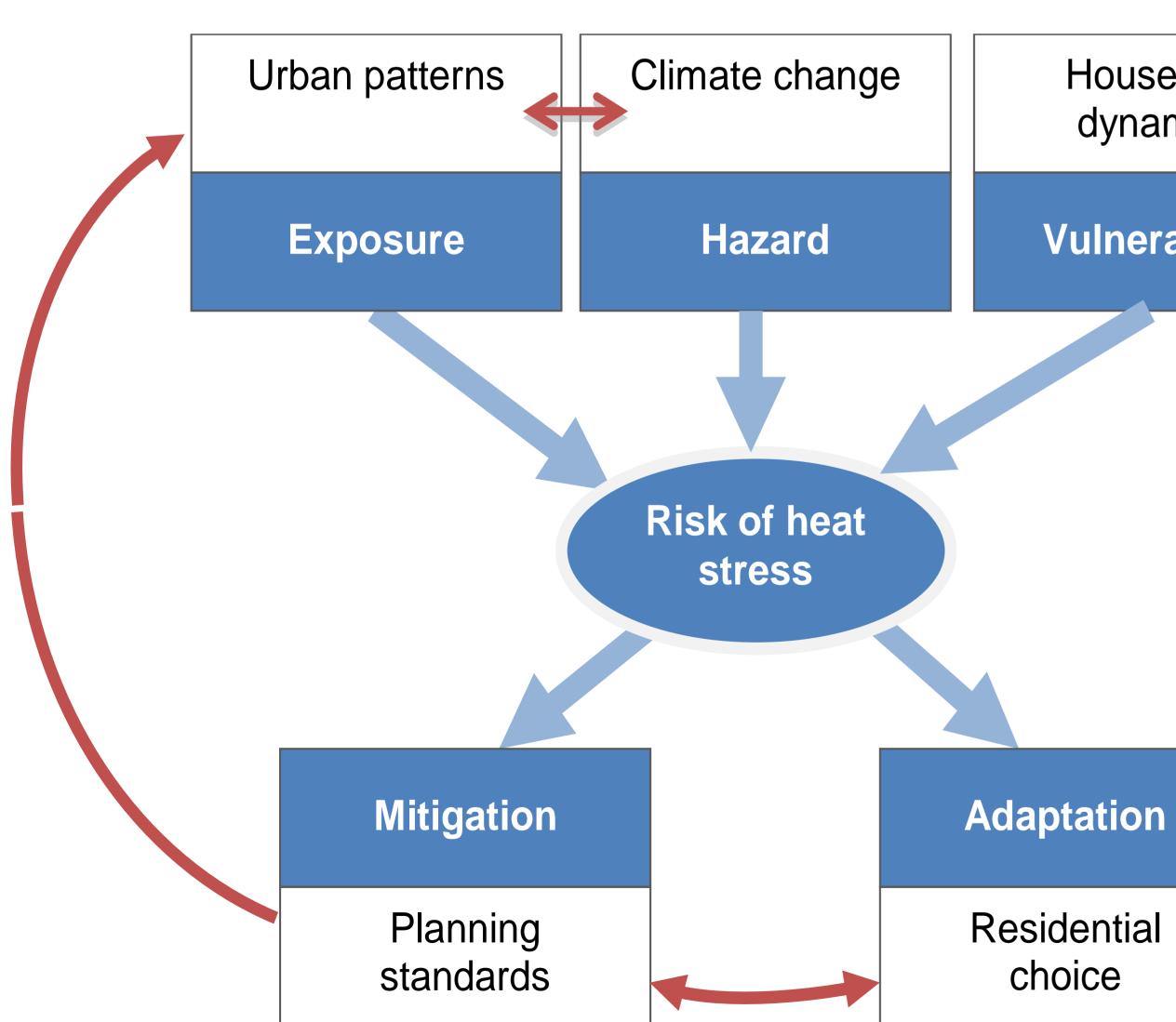
- How can urban patterns be translated into goal-oriented land-use types?
- What are the main drivers of changing urban patterns?
- How is local urban climate (including local heat-stress risks) linked to urban patterns in terms of land use?

Scenario analysis 2010 – 2050:

- How do urban patterns and heat stress risk change under different urban development and climate scenarios within the study area?
- If climatic conditions influence individual or household decisions on residential choice, what are the effects of such adaptation measures on the urban form and consequently on the distribution of heat stress risk again?
- How do possible mitigation measures set by planning authorities affect the future urban form and consequently the local distribution of heat stress risks?

Methodological research questions:

- How can the complexity of the urban system be translated into a representative model to improve understanding, particularly in terms of interrelations between demography, economy, climate change, urban heat stress, policy and behaviour?
- Which model techniques are suitable to uncover these interrelations on different spatial scales?



Research approach

Figure 1: Conceptional model (blue arrows: central interrelations; red arrows: driving forces of urban patterns)



UCaHS - Urban Climate and Heat Stress in mid-latitude cities in view of climate change

RM 1 Outdoor climate and heatstress hazard

RM 1.1: Regional climate Gerstengarbe (HUB, PIK)

> RM 1.2: Urban climate Scherer (TUB)

RM 4 Climate-responsive buildings

> RM 4.1: Building green Wessolek (TUB)

RM 4.2: Building designs Steffan (TUB)

RM 4.3: Building technologies Ziegler (TUB)

Research Unit

RM 5 Urban system

RM 5.1: Constellations Köppel (TUB), Schreurs (FUB)

RM 5.2: Urban patterns Kleinschmit (TUB)

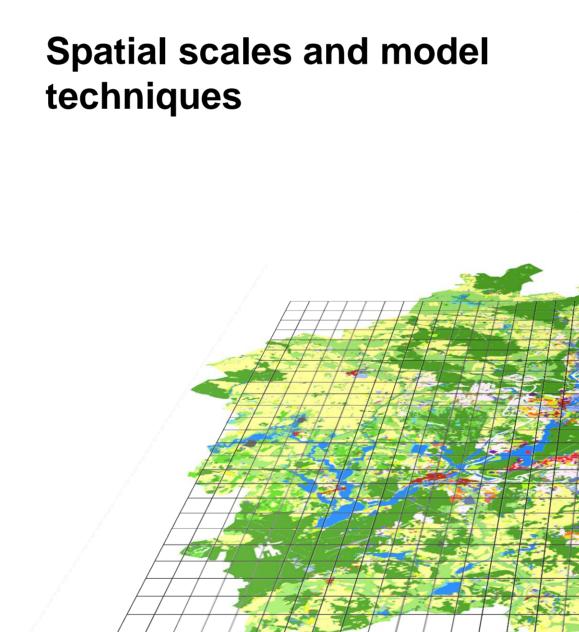


Figure 3: Cellular automaton to cover local dynamics for the entire study area and Agent-based modelling to cover dynamics on the building scale for representative neighbour-hoods in the study area

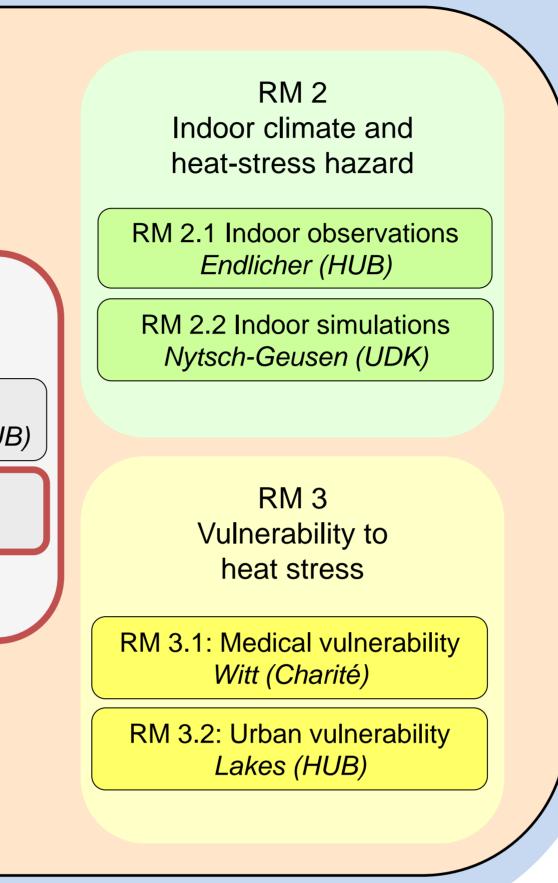
Figure 4: **Projections** Change of heat-stress (HS) hazard and risks as assessed from nine different projections of urban climate (UC) and urban development (UD)

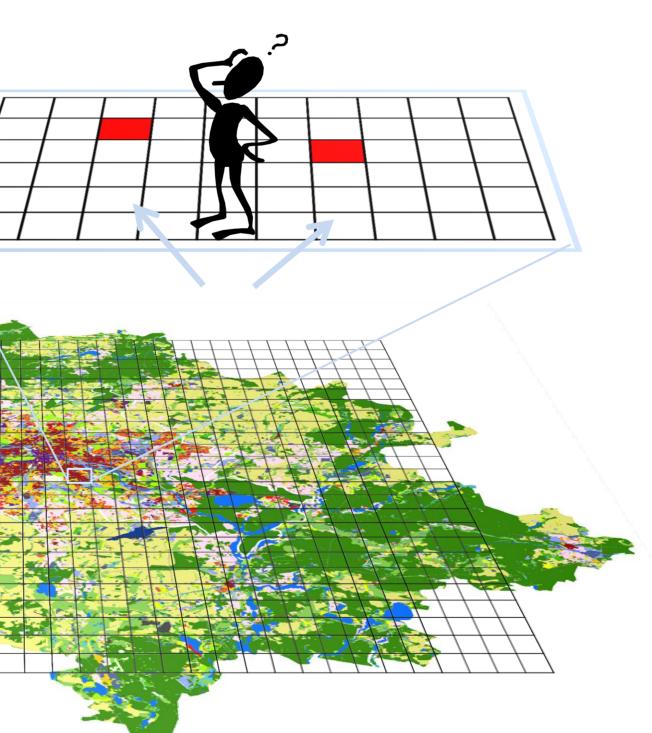
	UD 1	UD 2	UD 3
UC 1	HS	HS	HS
	1.1	1.2	1.3
UC 2	HS	HS	HS
	2.1	2.2	2.3
UC 3	HS	HS	HS
	3.1	3.2	3.3

Household dynamics Vulnerability

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Sub-project 5.2 Urban patterns





Meso scale (entire region)	System dynamics Household dynamics Demand/Supply of residential uses (different structures) and other land uses	Regional climate Based on knowledge from research unit
Local scale (50x50m ² cells)	Cellular automaton Land-use maps /urban patterns Residential dynamics	Impact model 1 Urban green Bioclimate Potential of heat stress risks and adaptation
Building scale (buildings)	Agent-based model Detailed individual housing decisions	Impact model 2 Potential heat stress risks Adaption to heat stress risks Effects on urban patterns

Figure 2: Model components and techniques on different spatial scales



WP	Description
100	Project management
110	Reporting
120	Logistics and organisation
200	Individual research (deta
210	Data acquisition and pre-p
220	Storylines for land-use sce
230	Spatial model building
231	Urban pattern simulation a
232	Agent-based simulation to
240	Report and Synthesis
300	Collaboration within the
310	Promising planning and go stress
400	Collaboration within Res
480	Specific vulnerable groups
490	Urban climate projections
500	Collaboration within Res
520	Present-day heat-stress h
530	Effectiveness of actions for
540	Efficiency of actions for re
600	Collaboration within the
610	Projected heat-stress haz
620	Transferability of the meth
630	Identification of future rese
640	Preparation of the follow-u
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Methodoloav

Work schedule

Table 1: Work packages (WP) and associated work schedule (in half-yearly intervals)

	Schedule			
)				
ailed WP description in 3.2.1)				
processing				
enarios				
and risk probabilities				
o formalise actions of adaptation to HS				
Research Module 5 "Urban System"				
overnance constellations to tackle heat				
search Links (RL)				
6				
search Clusters (RC)		ł		
azards, vulnerabilities and risks				
or reducing heat-stress risks				
ducing heat-stress risks				
Research Unit (RU)				
ards, vulnerabilities and risks				
nodology to other mid-latitude cities				
earch and development activities				
up proposal				



