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

Research questions

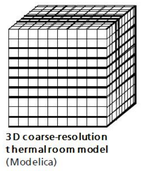
Characterisation of indoor heat stress
- How is indoor heat stress influenced by outdoor climate and position of a room within a building, especially during extreme events?
- How is indoor heat stress distributed within a single room?

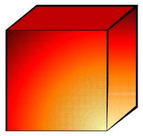
Reaction of humans to indoor heat stress
- Does air-conditioning have a positive effect on patients in hospital rooms?
- How do people change their behaviour in periods of exposure to indoor heat stress?

Quantification of indoor heat stress
- Which bio-thermal index is most suitable to quantify indoor heat stress?
- Which method should be used to quantify heat-stress hazards?

Assessment of adaptation strategies to climate change in urban planning
- Which adaptation strategies to climate change in urban planning show the capacity to reduce indoor heat-stress hazards?

Research approach





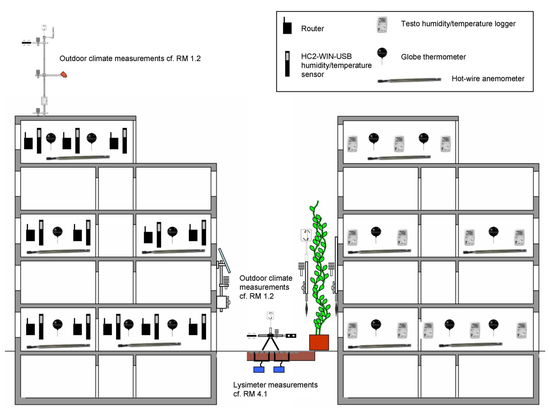
Link to evaluate indoor simulations (RM 2.2)

Measurement of meteorological parameters indoors and subsequent calculation of different bio-thermal indices like UTCI, PMV etc.
Measurements will be accompanied by a questionnaires study (RM 3.2).

Link to clinical data obtained from patients (RM 3.1)

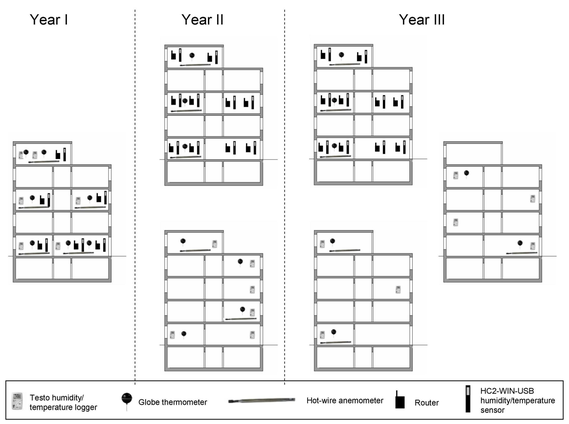
Link to outdoor measurements (RM 1.2)

Main objective of the initial phase of the first year is to investigate how the meteorological parameters are varying within the rooms and to derive a minimal set of sensors to obtain representative heat stress data for a particular room.



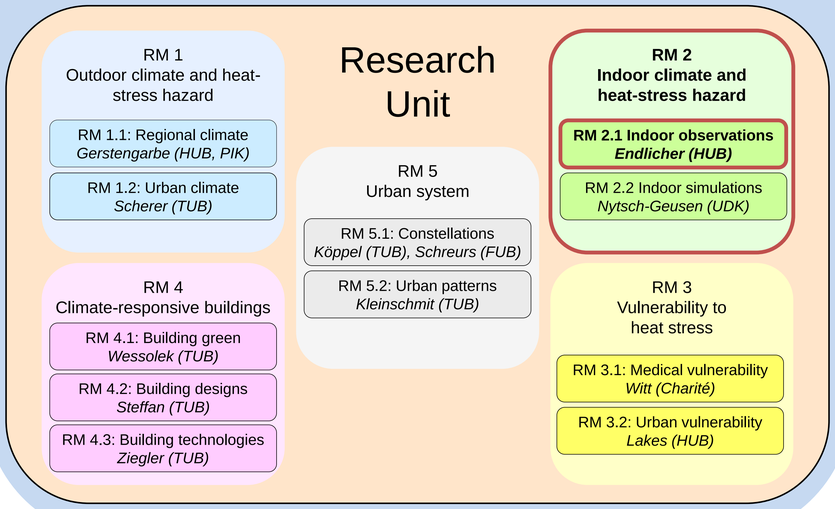
Schematic set-up of indoor measurement equipment during the first year

Extension to further buildings



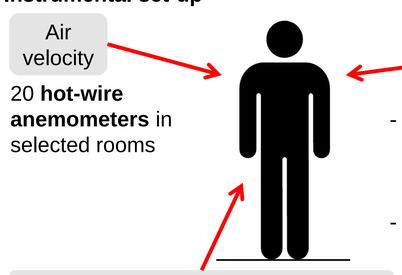
Schematic development of indoor measurement set-up during the three years

Sub-project 2.1
Indoor observations



Methodology

Instrumental set-up



20 **hot-wire anemometers** in selected rooms

- 20 **globe thermometer** will measure the globe temperature, which is used to calculate mean radiant temperature
- supported by the occasionally use of a **thermographic camera** (FLIR B365)

- 25 **HC2-WIN-USB** sensors from rotronic will be used to establish a wireless mesh network
- 75 **Testo 175-H2** loggers will be used in rooms and locations with no internet access

Quantification of indoor heat stress and heat-stress hazard
Computation of hourly heat-stress intensities, the annual mean magnitude of heat-stress events and indoor heat-stress hazard

Questionnaires study
Asks for information about self-reported perception of indoor heat stress, self-estimated vulnerability and measures to reduce heat stress

Work schedule

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

WP	Description	Work schedule
100	**Project management**	
110	Reporting	
120	Logistics and organisation	
200	**Individual research**	
210	Quantification of day- and night-time indoor heat stress	
211	Measurement of meteorological parameters indoors	
212	Sensitivity of different bio-thermal indices to varying meteorological parameters	
300	**Collaboration within the Research Module (RM)**	
310	Validation of the indoor climate system models (ICSM_fine, ICSM_coarse), based on indoor observations	
400	**Collaboration within Research Links (RL)**	
410	Linkages between indoor heat-stress hazard and vulnerability	
420	Indoor heat stress in hospital, variation of indoor climate for patients	
500	**Collaboration within Research Clusters (RC)**	
510	From regional weather and climate to indoor and climates	
520	Present-day heat-stress hazards, vulnerabilities and risks	
530	Effectiveness of actions for reducing heat-stress risks	
600	**Collaboration within the Research Unit (RU)**	
610	Projected heat-stress hazards, vulnerabilities and risks	
620	Transferability of the methodology to other mid-latitude cities	
630	Identification of future research and development activities	
640	Preparation of the follow-up proposal	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