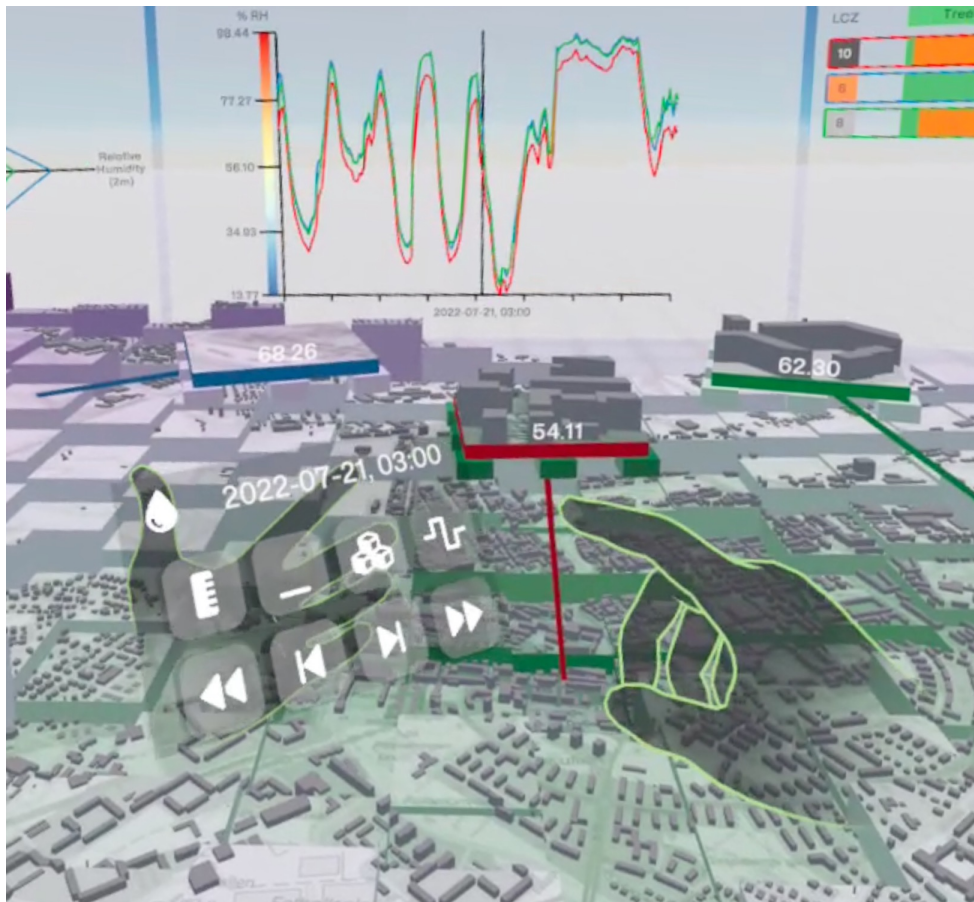


SMHI, Norrköping den 23 - 24 september 2026

Meteorologisk metodkonferens



Interaktiv visualisering av urban värme

Katerina Vrotsou, LiU &
Jorge H. Amorim, SMHI,
m.fl.



Varför forska om **värme** i Sverige?

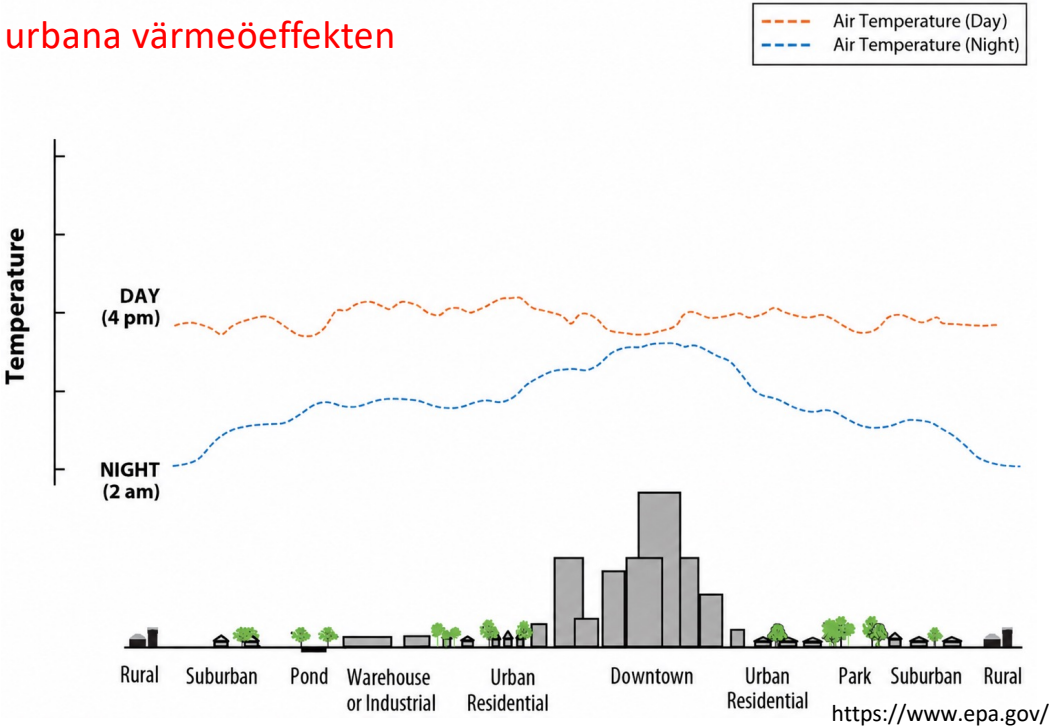
Bild: Sveriges Radio

Hälsoeffekter: vad kan vi lära oss från tidigare somrar?

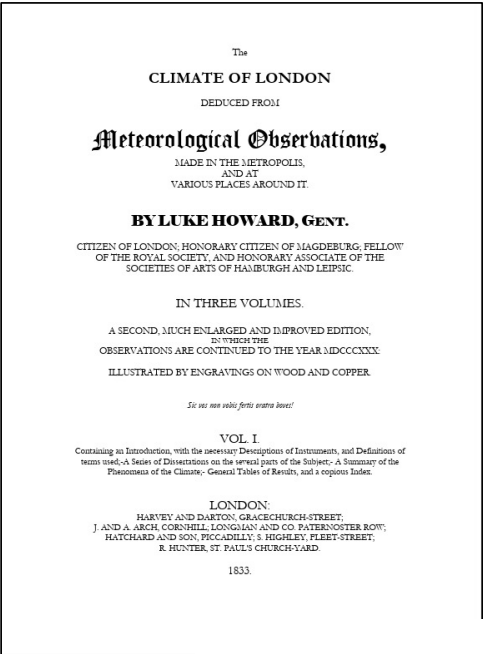


Städerna skapar sitt eget klimat

Den urbana värmeeffekten

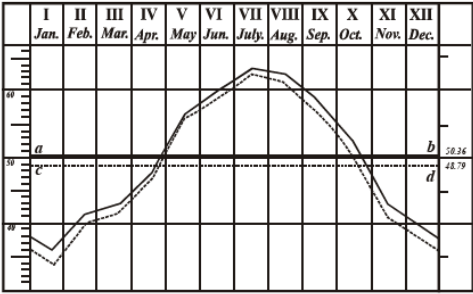


“Urbana värmeöar förstärker ofta effekterna av värmeböljor i städer.” (IPCC, 2018)



inget ny
effekt!

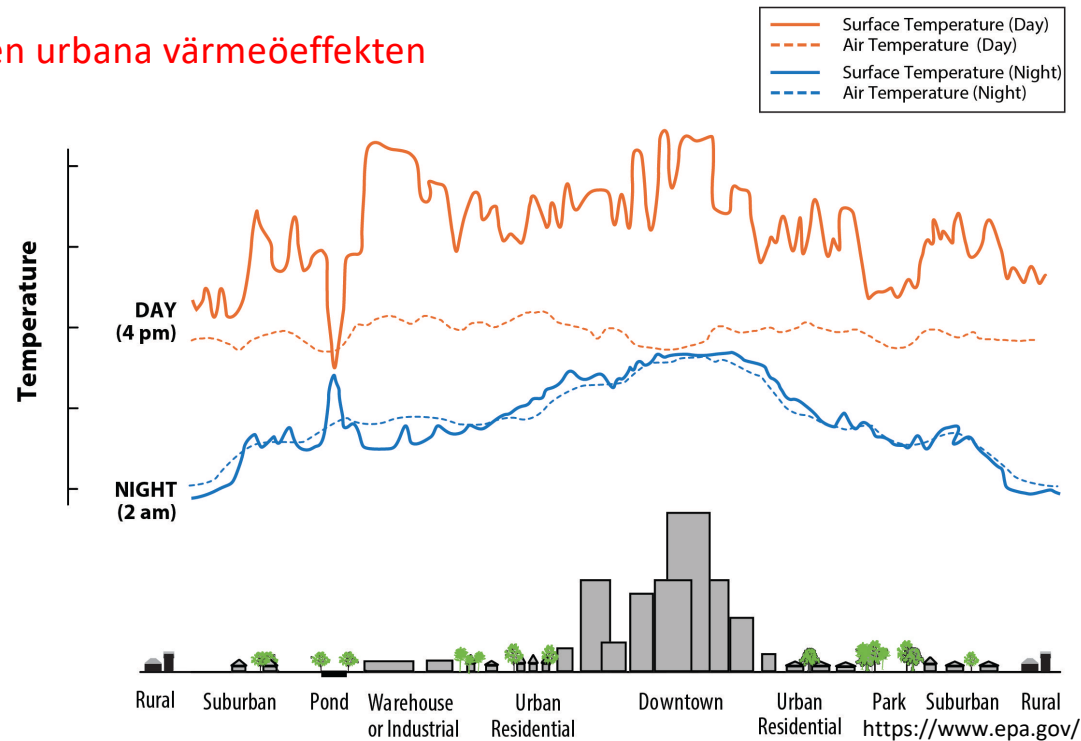
Fig. 3.



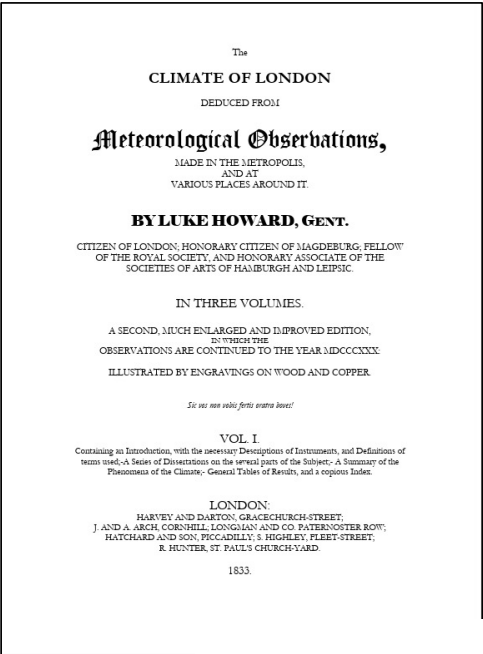
In Fig. 3, the full line presents the Monthly mean of London, as given in the Table, the dotted line that of the country; the horizontal lines a-b c-d are on the respective annual Means; and both curves are on the same scale.

Städerna skapar sitt eget klimat

Den urbana värmeöeffekten

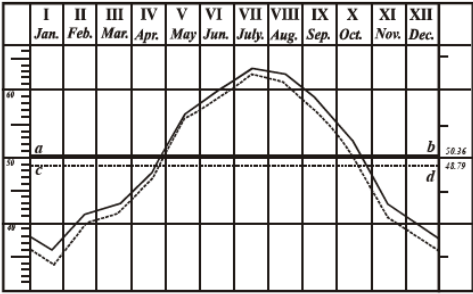


“Urbana värmeöar förstärker ofta effekterna av värmeböljor i städer.” (IPCC, 2018)



inget ny
effekt!

Fig. 3.



In Fig. 3, the full line presents the Monthly mean of London, as given in the Table, the dotted line that of the country; the horizontal lines a-b c-d are on the respective annual Means; and both curves are on the same scale.

staden - en mosaik av olika mikroklimat



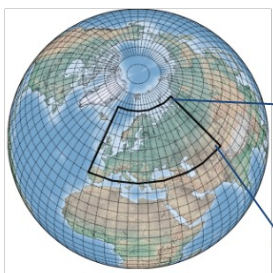
”lokala klimatzoner”

Dynamisk nedskalning av stads klimatet

Global Climate Model (GCM)

EC-Earth3

(upplösning: ca. 80 km)



Regional Climate Model (RCM)

HCLIM43-AROME

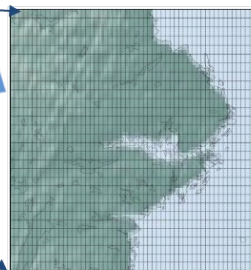
(ca. 12 km)



Convection-Permitting model (CPM)

HCLIM43-AROME

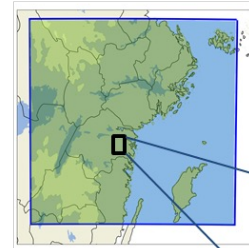
(ca. 3 km)



Land Surface model (LSM)

SURFEX offline

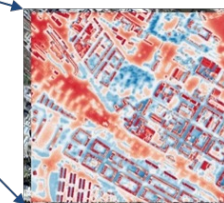
(ca. 300 m)



Radiation model

Solweig

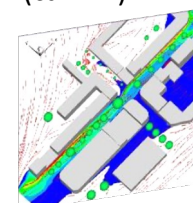
(ca. 1m)



CFD model

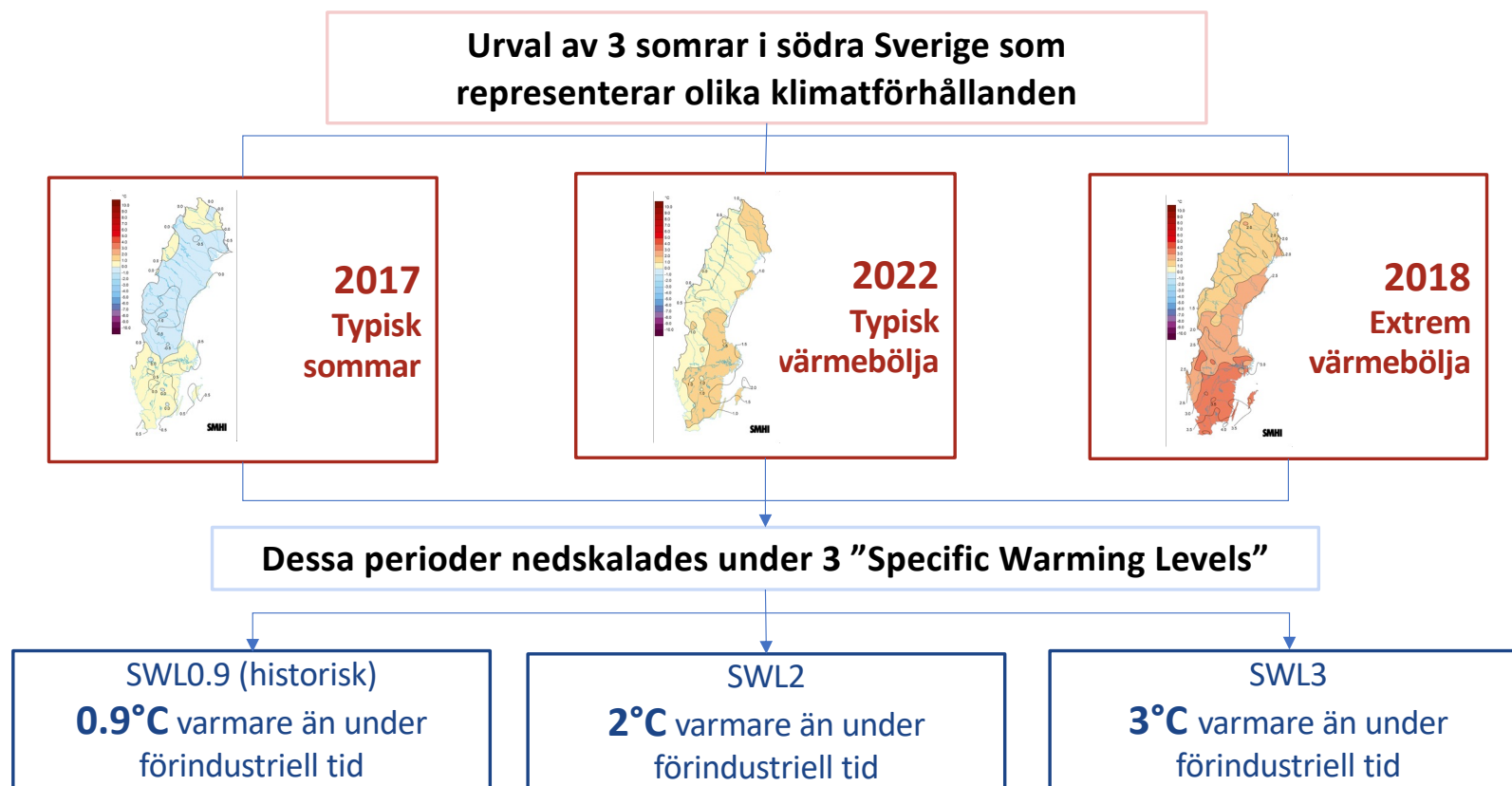
OpenFoam

(ca. 1m)



Mål: Ta fram högupplösta simuleringar av det urbana klimatet och föra ner klimatsignalen ner till individskala

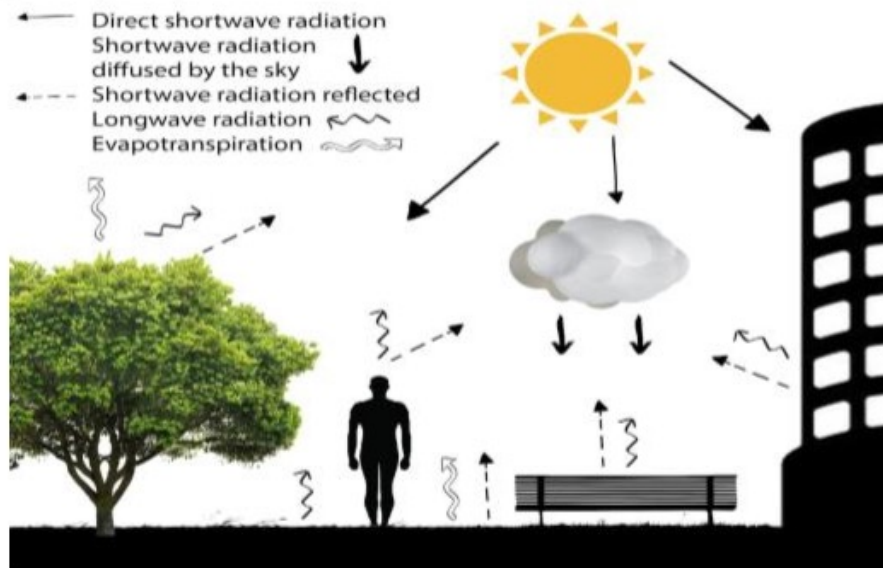
Händelsebaserad dynamisk nedskalningsteknik



"Specific Warming Levels" (SWLs) motsvarar specifik temperaturökning oavsett när denna punkt nås i framtiden

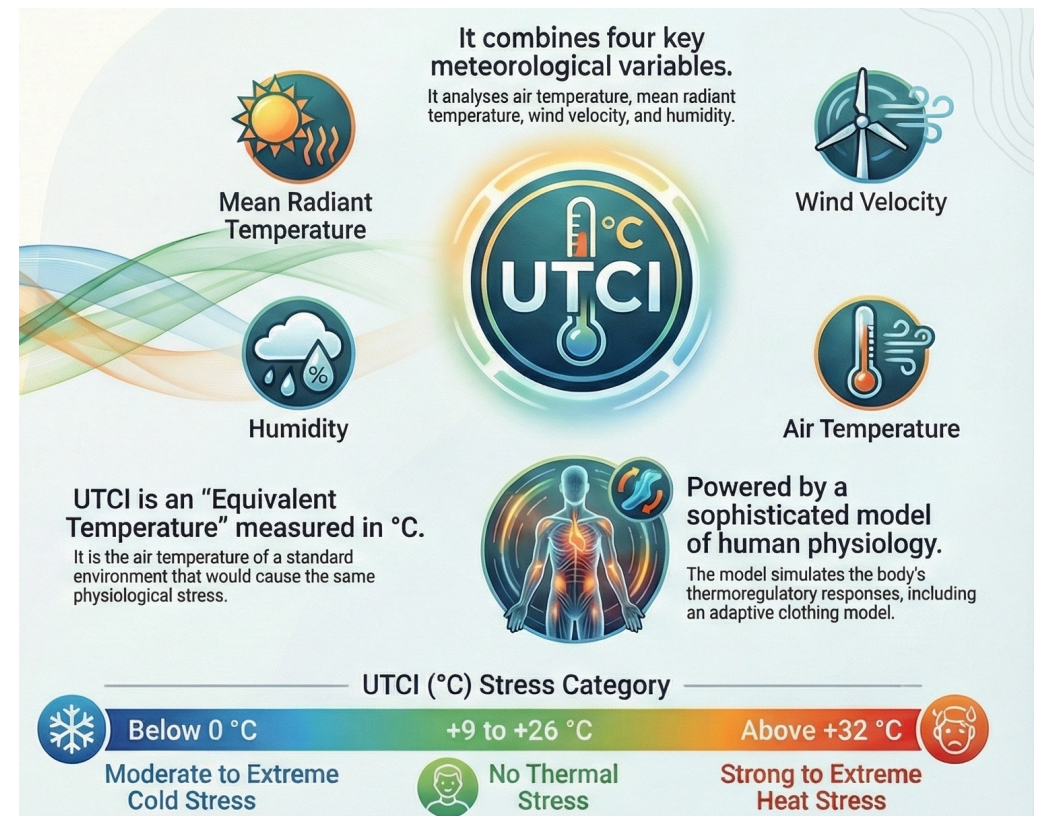
Värmestress indikatorer

Strålningstemperatur



Naboni et al., 2020

Universal Thermal Climate Index (UTCI)



Visualisering – 2 forskningsprojekt

- BRIGHT – Formas
- Immersive Analytics for Urban Heat –
Norrköping fund

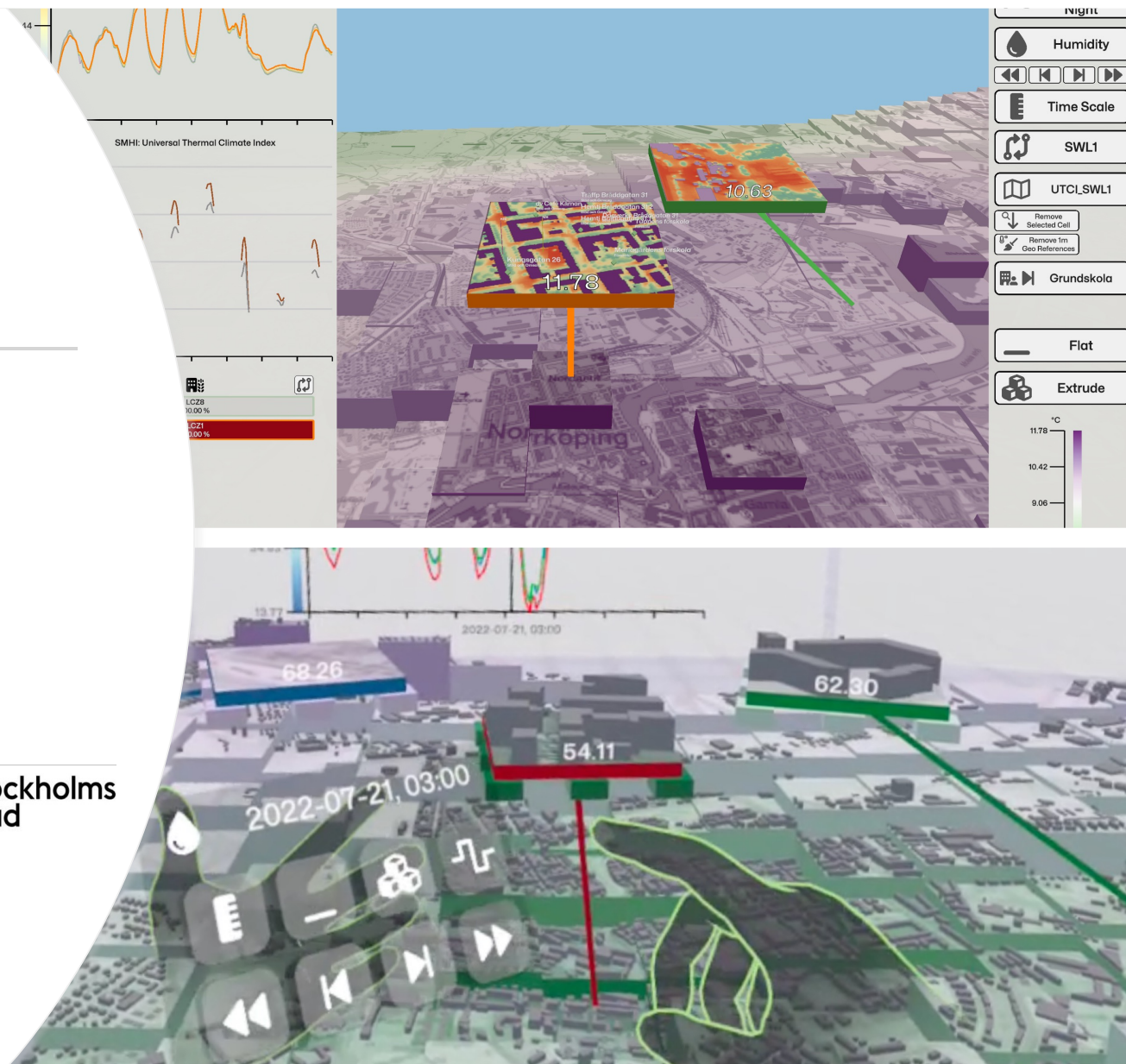
SMHI



li.u



Linköping
Där idéer blir verklighet

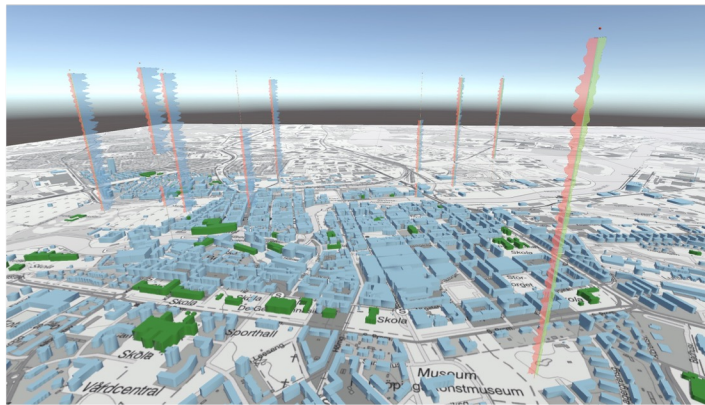
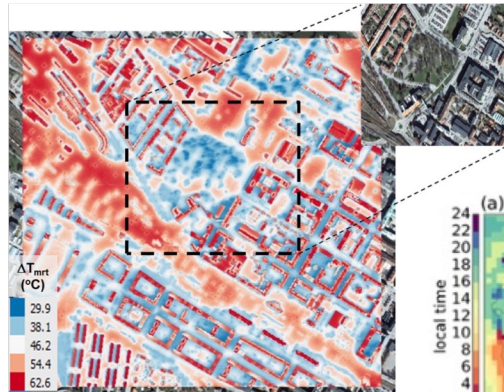
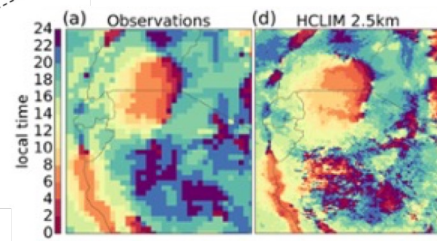


IA4UH

undersöka användningen av **immersiva miljöer** för visualisering och utforskning av **effekterna** och de **bidragande faktorerna** vid (extrema) väderhändelser i urbana områden, med fokus på att kartlägga och förstå förekomsten av **urban värme** i Norrköpings kommun

IA4UH

Source: Internal Project Prototype.



Source: [SMHI](#) and [SMHI](#).

**Meteorological
Observations =
Sensor Measurements**

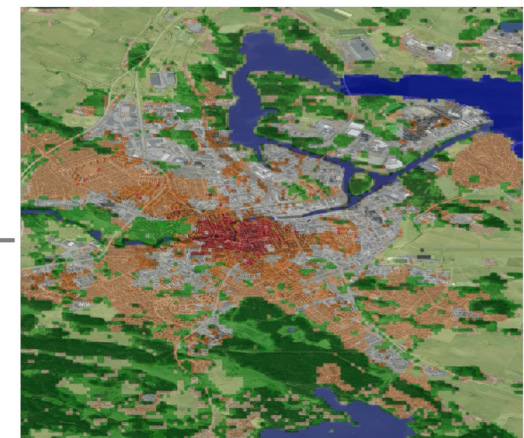
**Contextual Urban
Planning Information**

**Project Interface(s): Immersive
Contextual Urban Climate Analysis**

**Regional
Climate
Models**

**Urban Climate
Characteristics**

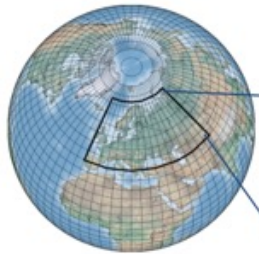
Source: kartor.norrkoping.se



Source: SMHI (via Isabel Ribeiro).

IA4UH

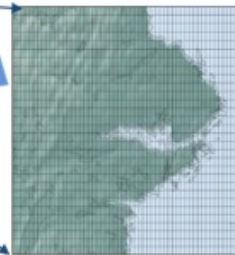
Global Climate Model (GCM)
EC-Earth3
(upplösning: ca. 80 km)



Regional Climate Model (RCM)
HCLIM43-AROME
(ca. 12 km)



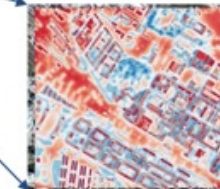
Convection-Permitting model (CPM)
HCLIM43-AROME
(ca. 3 km)



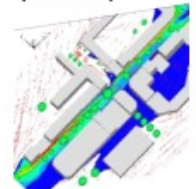
Land Surface model (LSM)
SURFEX offline
(ca. 300 m)



Radiation model
Solweig
(ca. 1m)



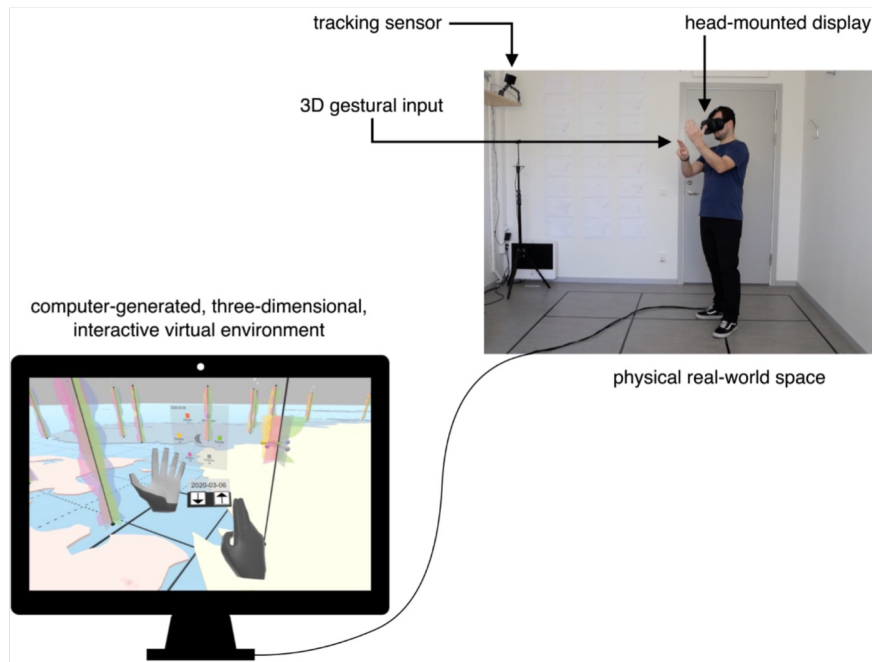
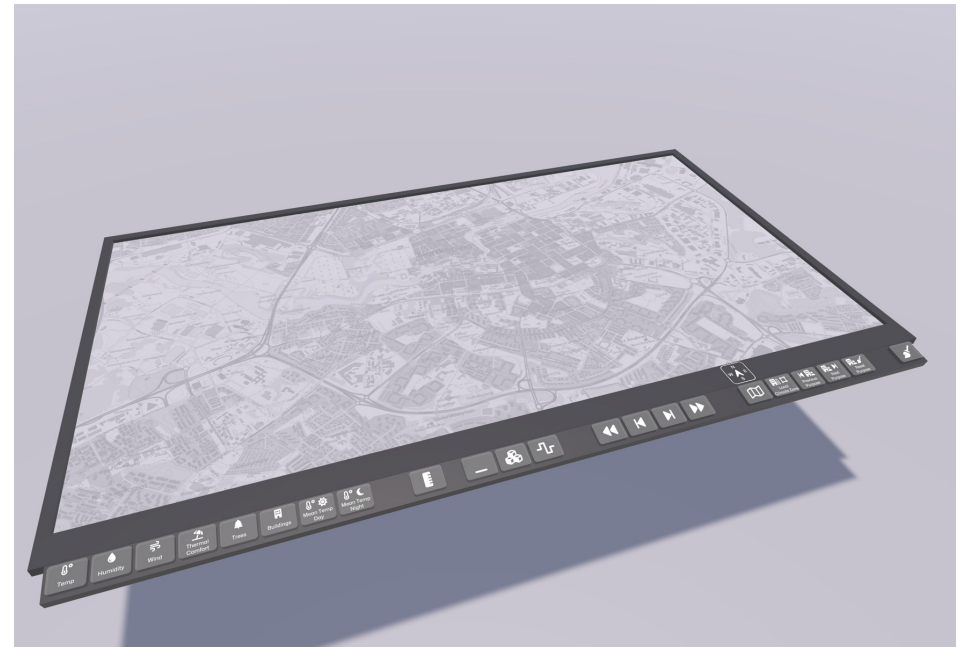
CFD model
OpenFoam
(ca. 1m)



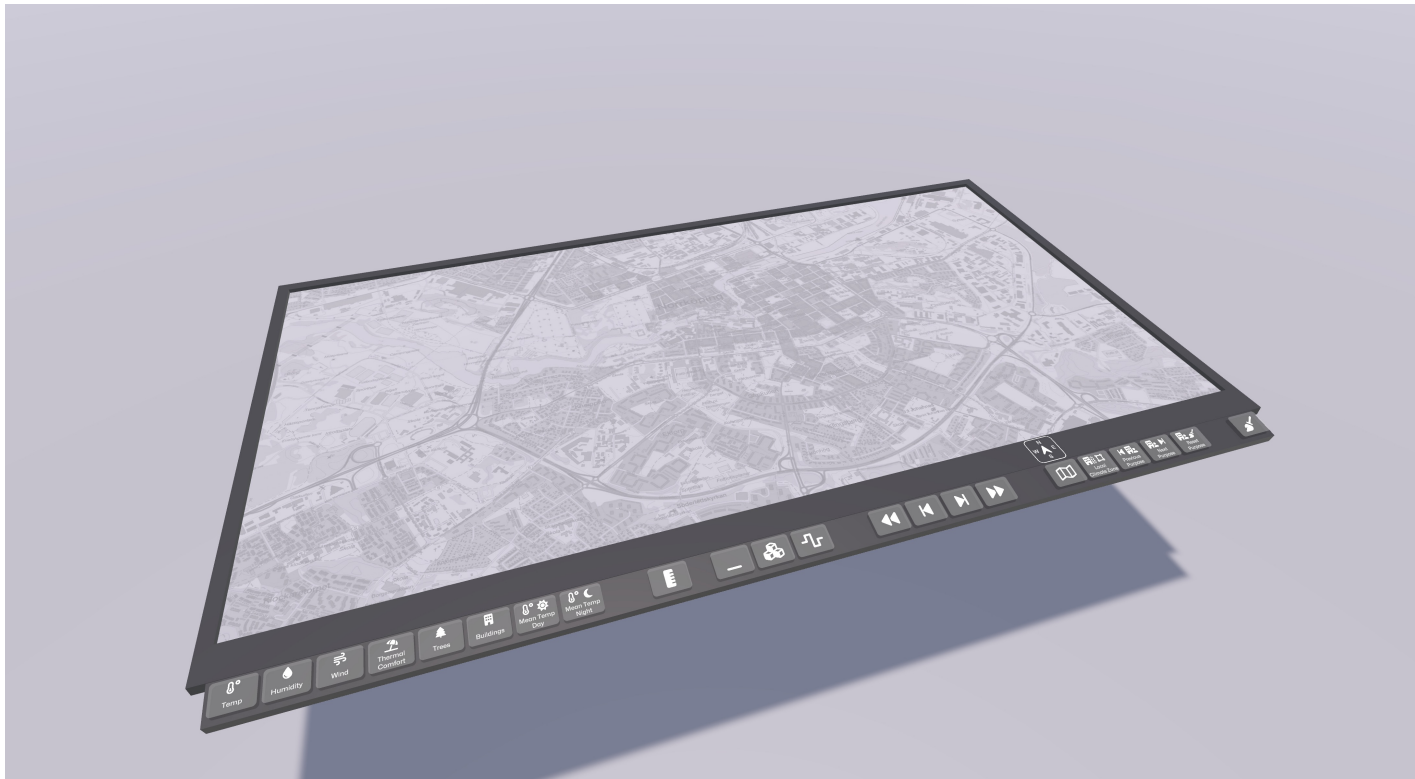
IA4UH

Virtual Reality

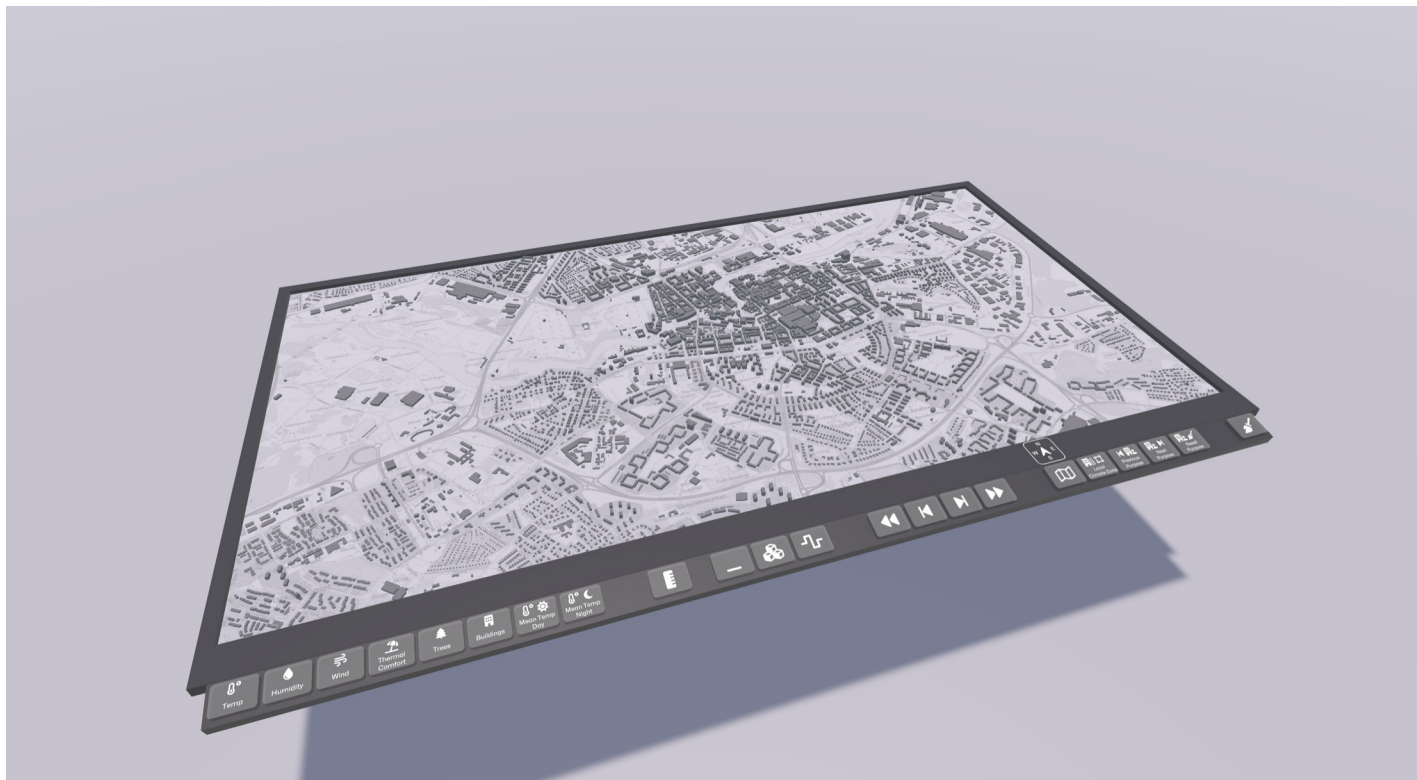
Year 1: Immersive Analytics



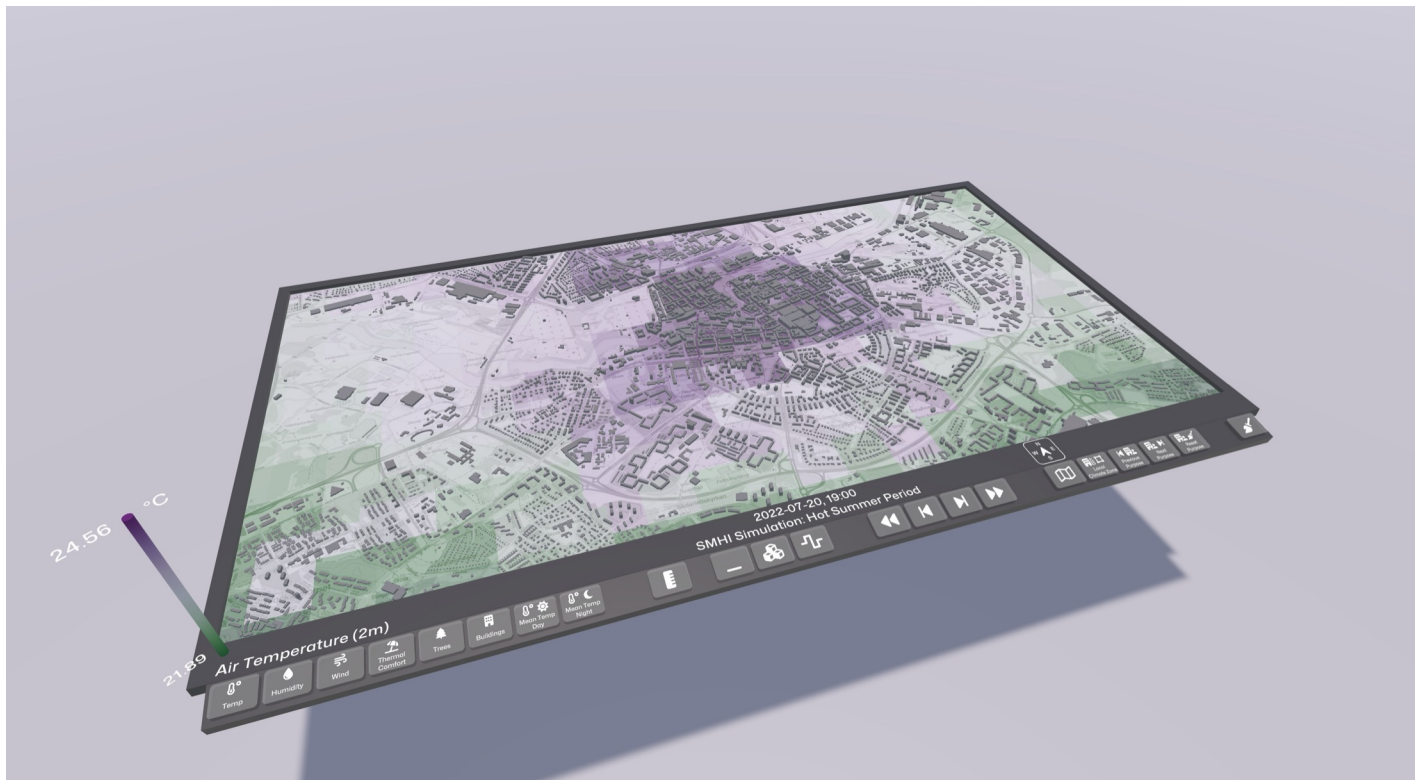
IA4UH



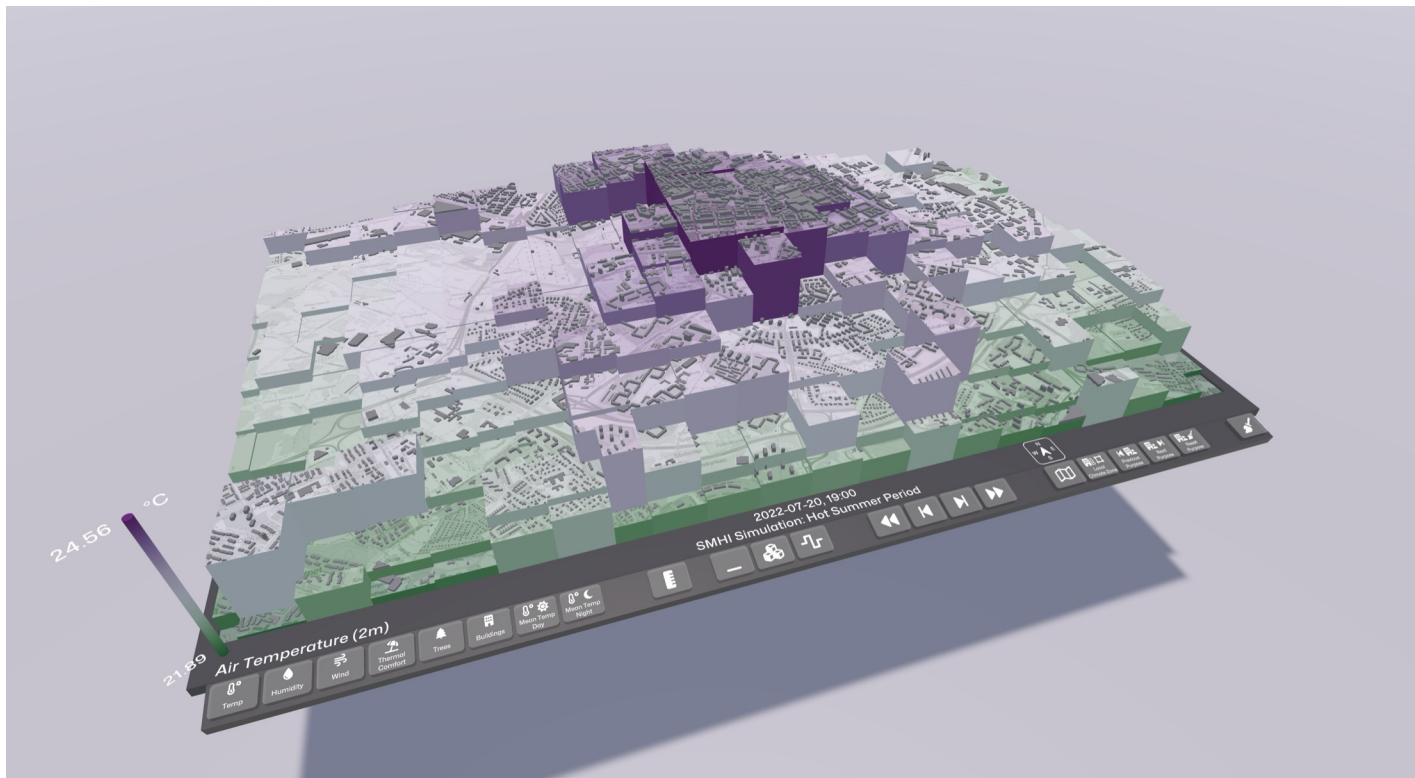
IA4UH



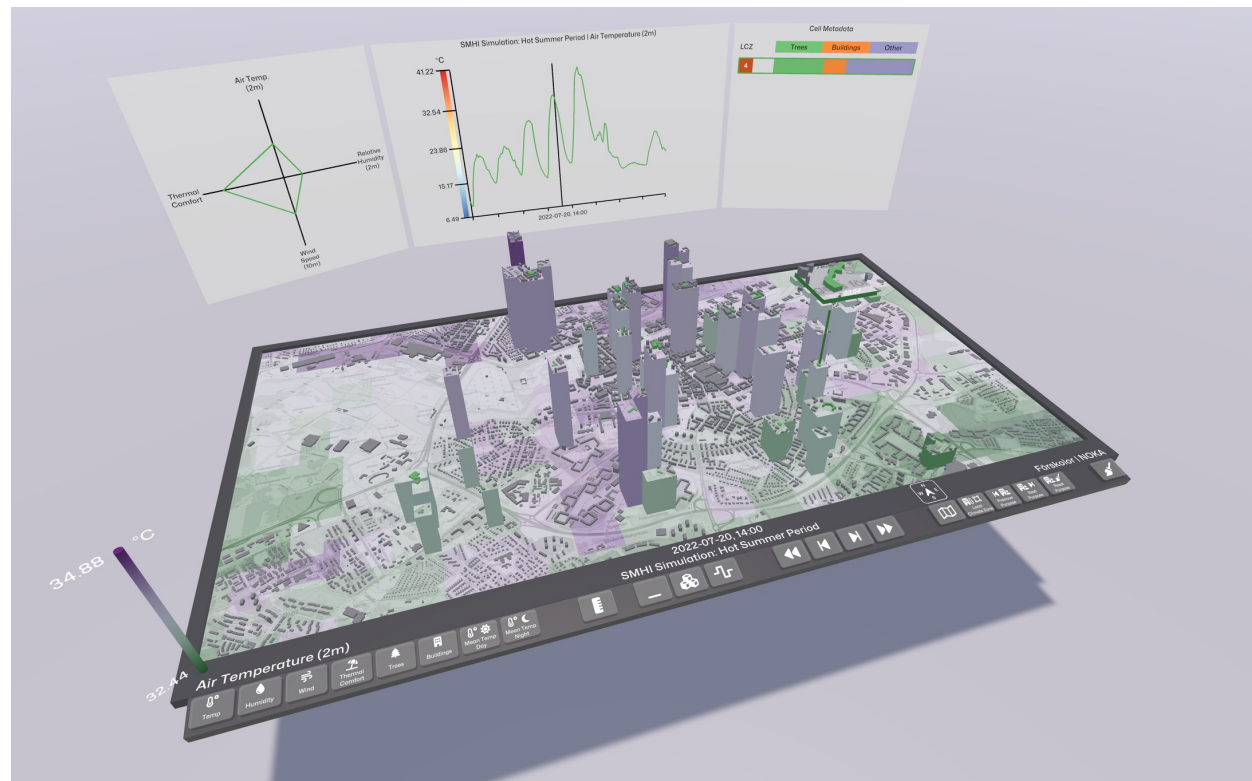
IA4UH



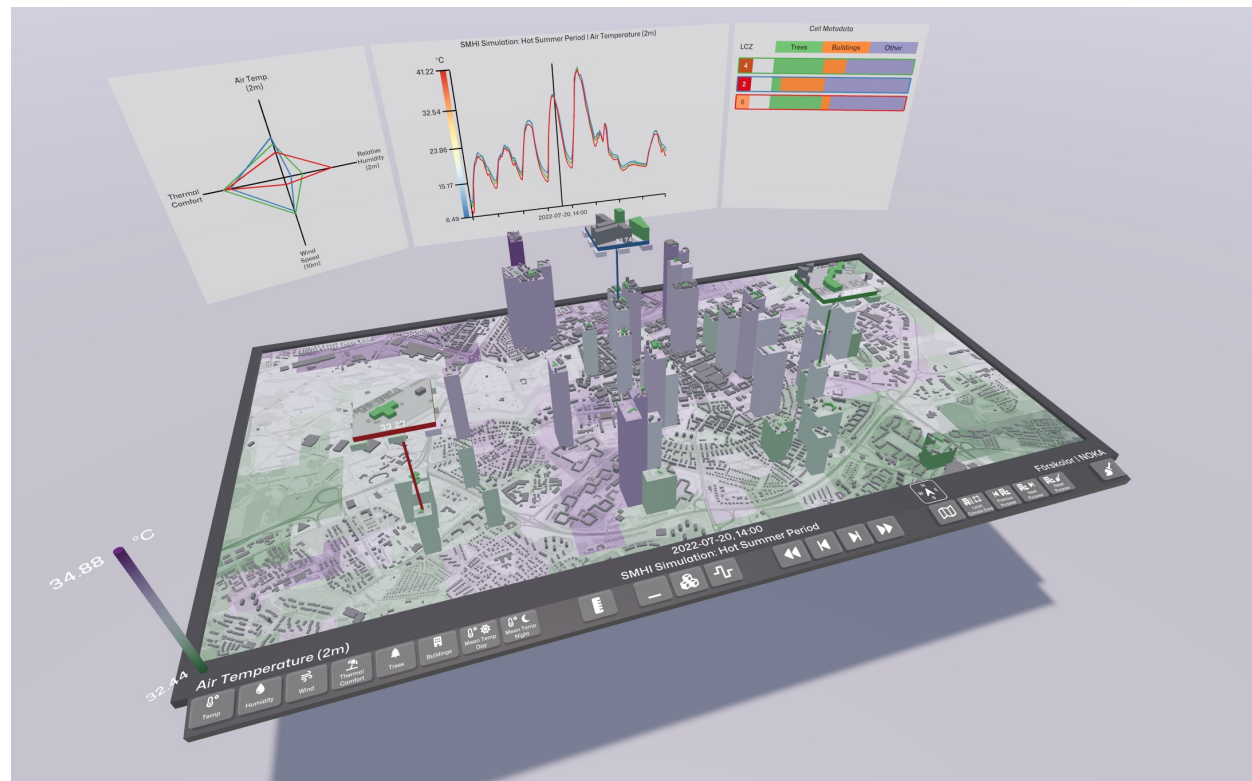
IA4UH



IA4UH

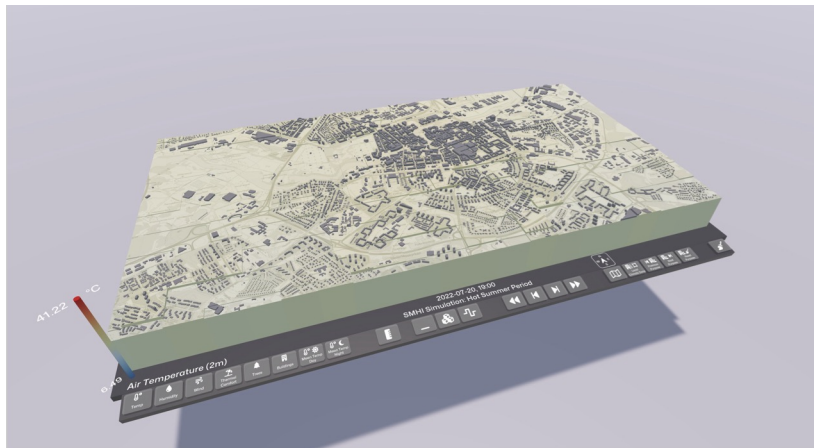


IA4UH



IA4UH

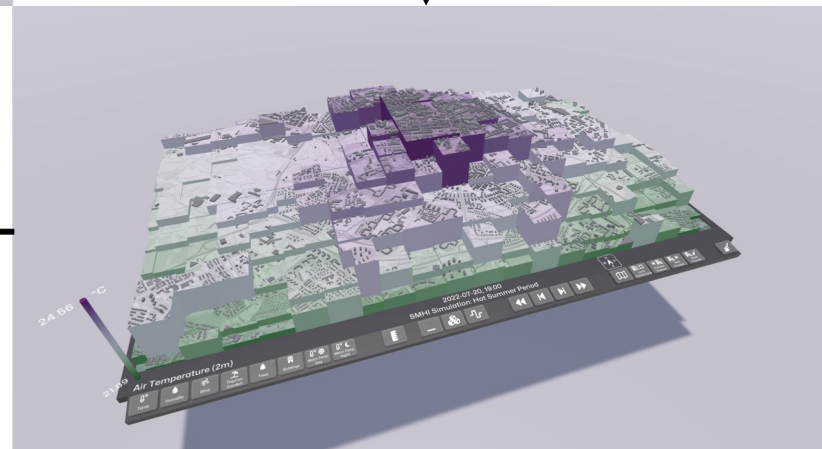
- 24 h
- 7 dagar



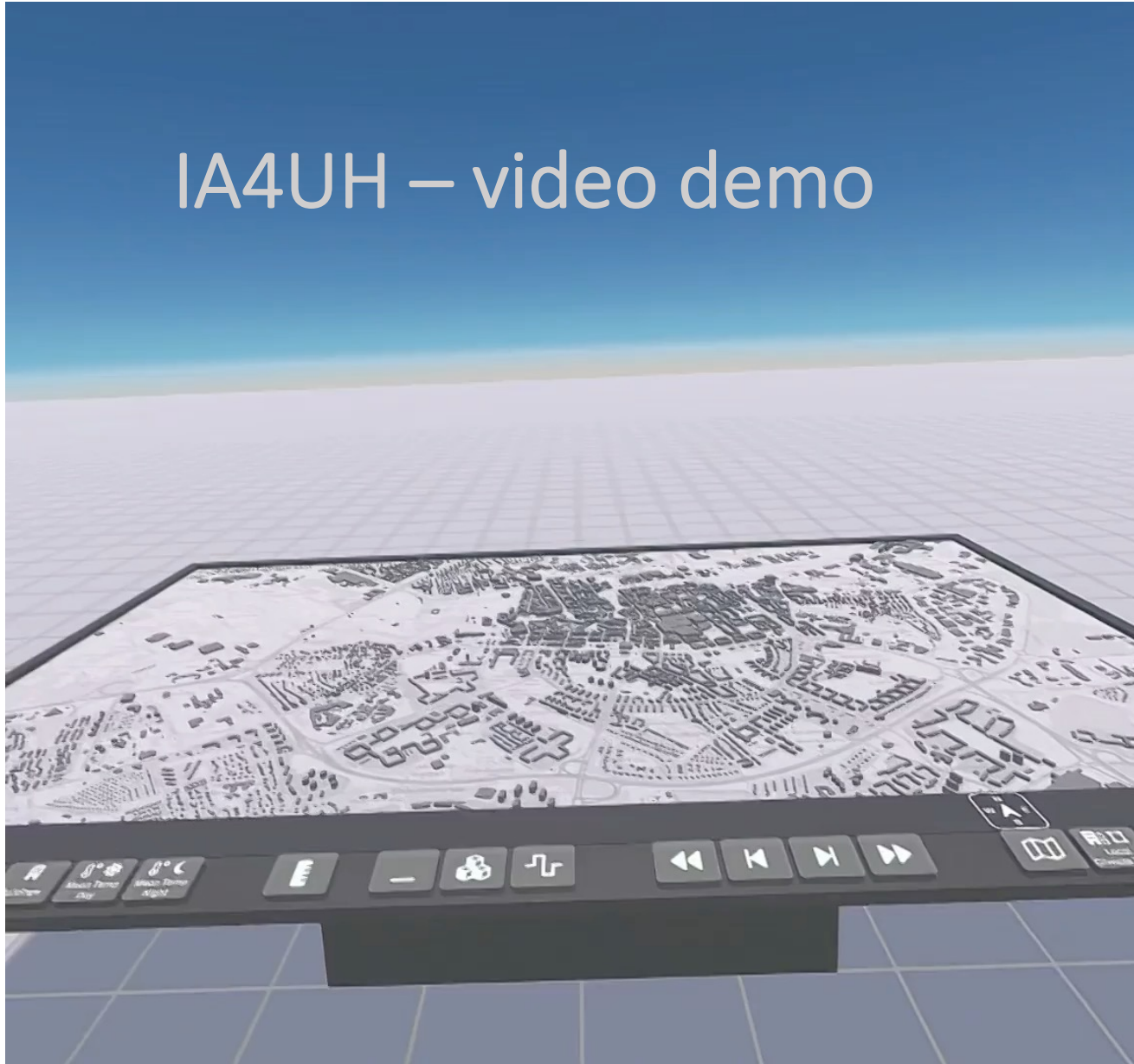
Time-Series
(min/max of 7-day hot summer period)



Time Step
(hourly min/max)

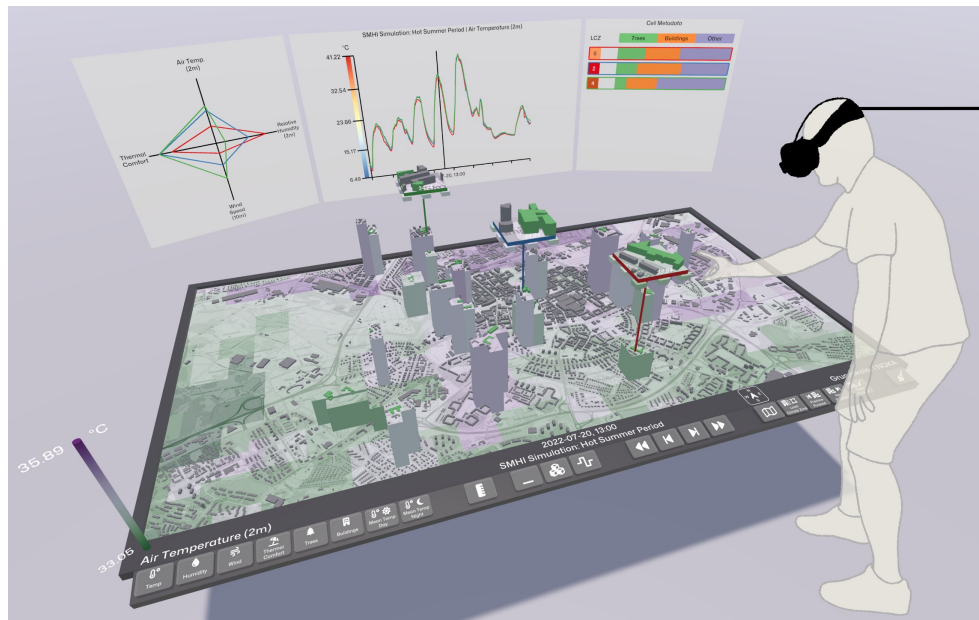
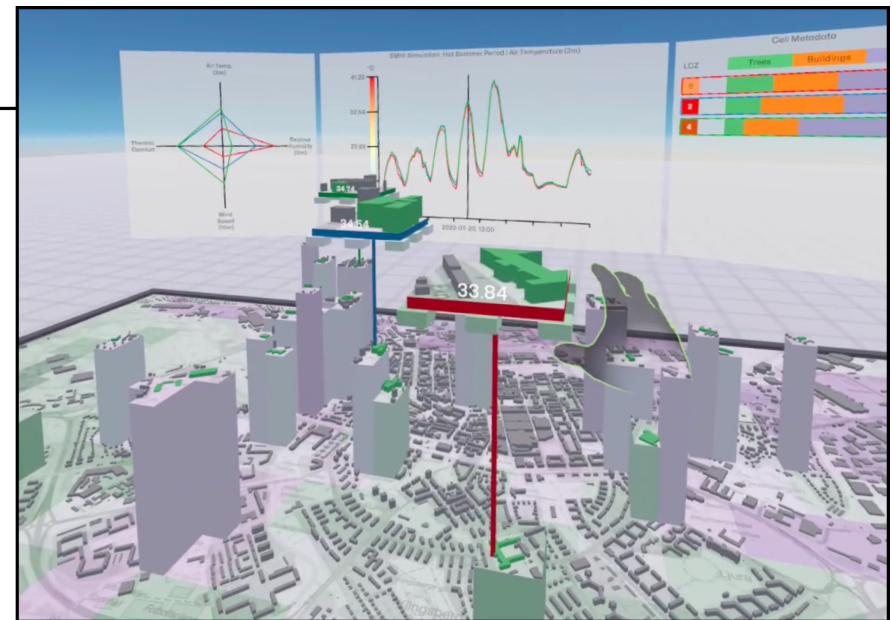


IA4UH – video demo

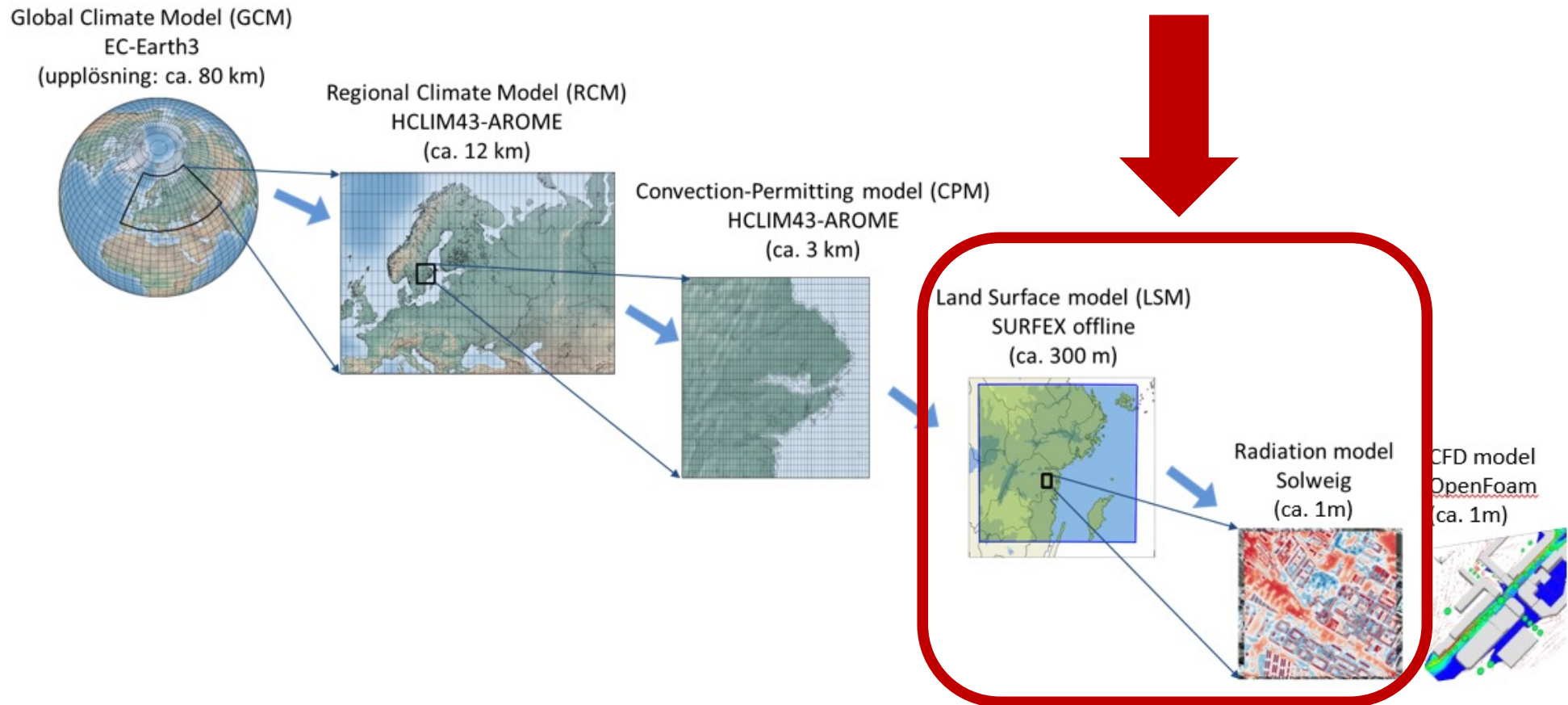


Virtual Table
Metaphor

IA4UH

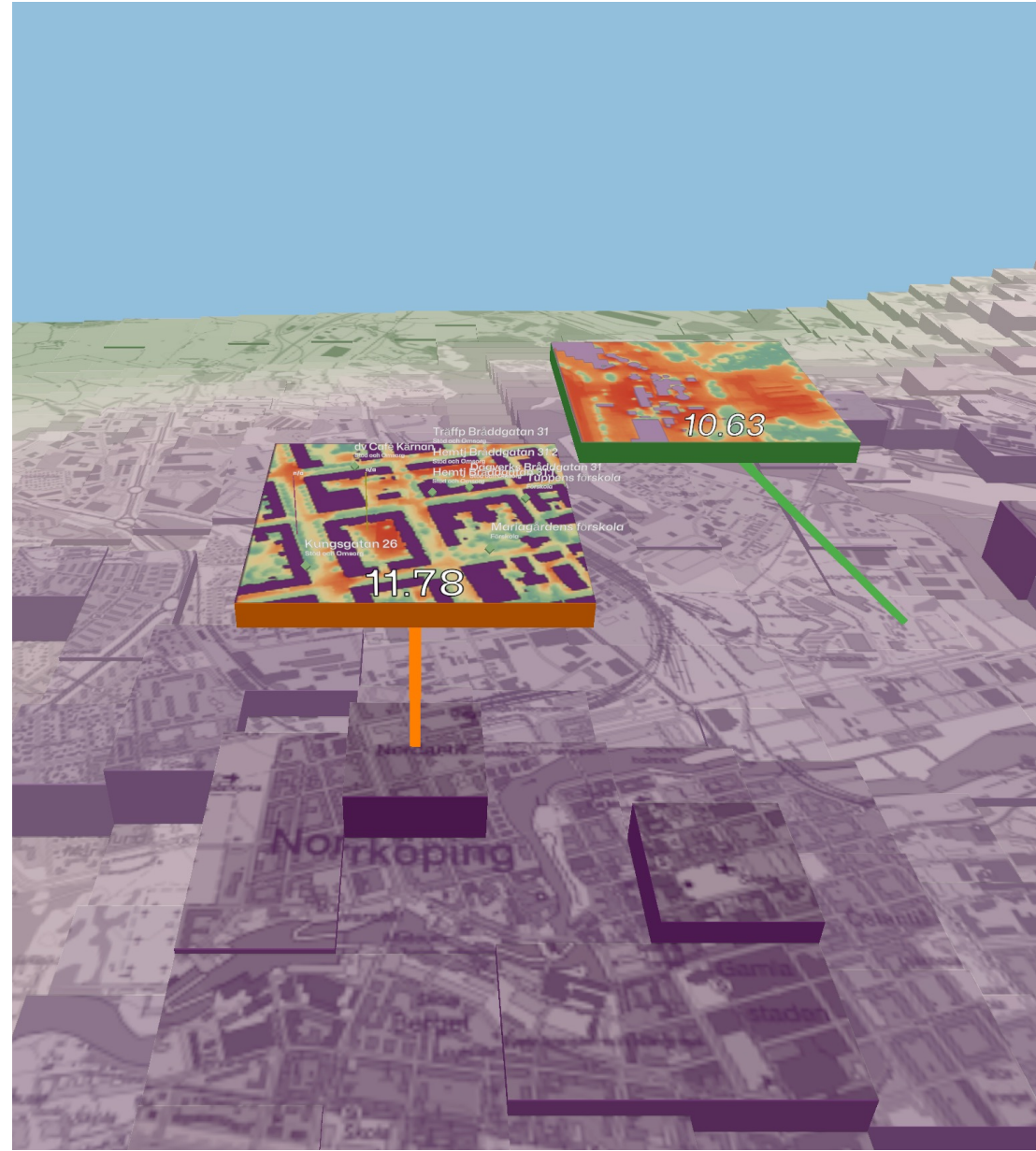


BRIGHT



BRIGHT

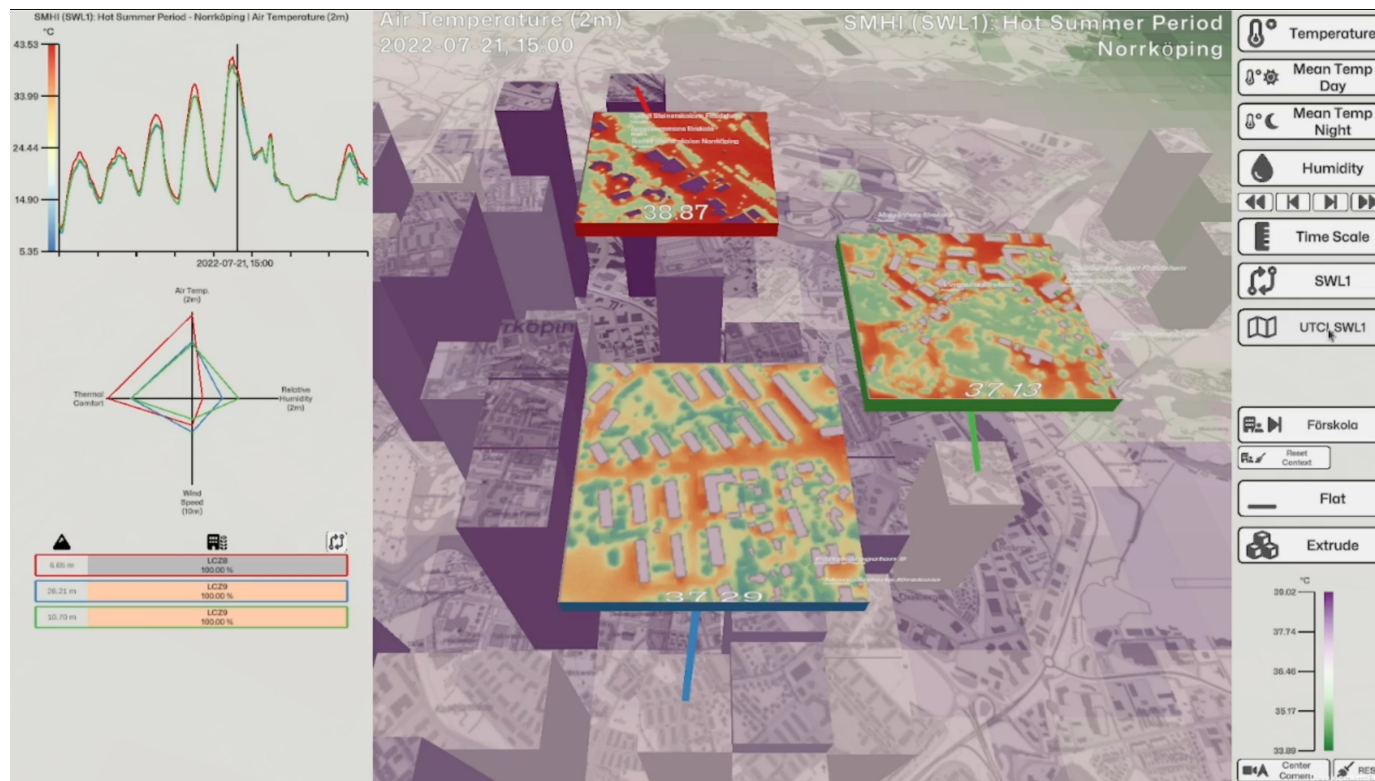
- Web-baserad
- Stakeholder tillgänglighet
- Flera städer
 - Norrköping
 - Linköping
 - Stockholm
- Högupplösta detaljer (MRT, UTCI)



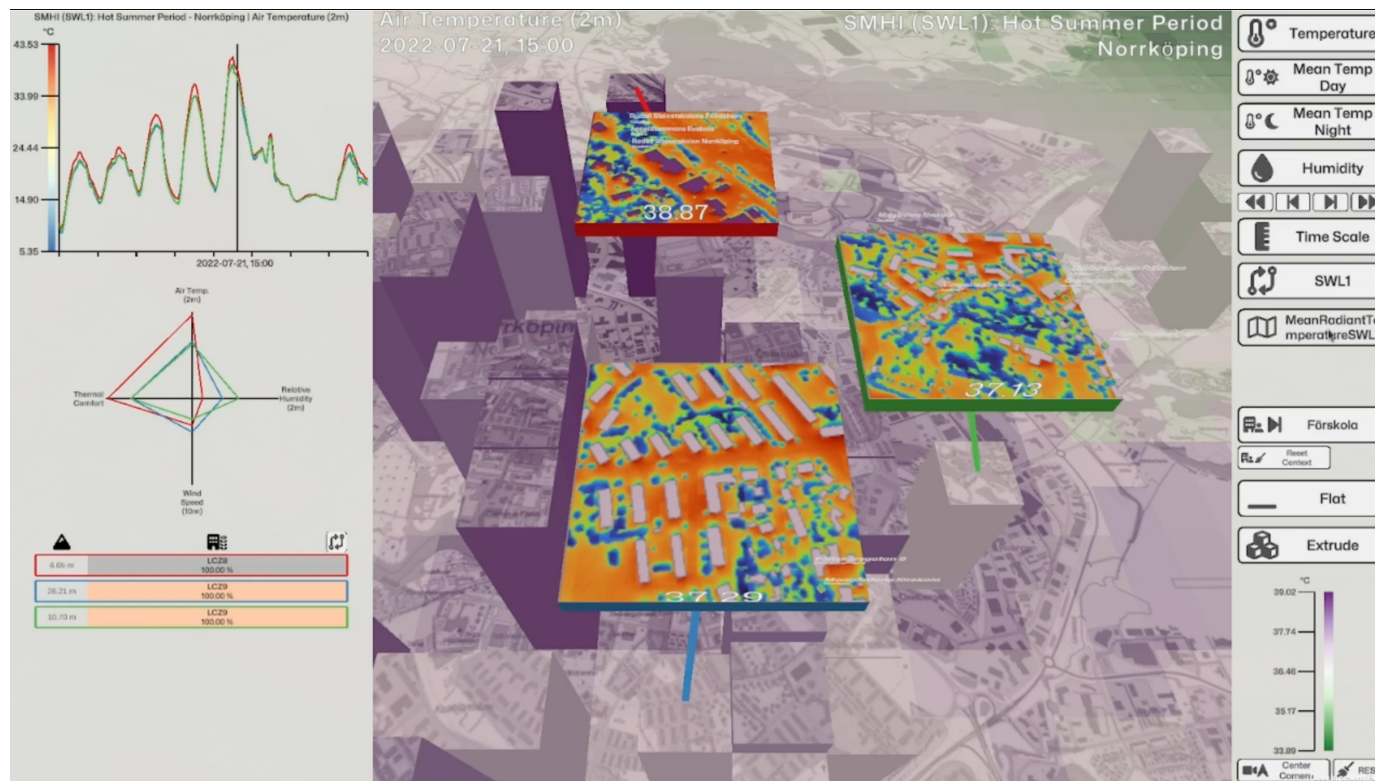
BRIGHT



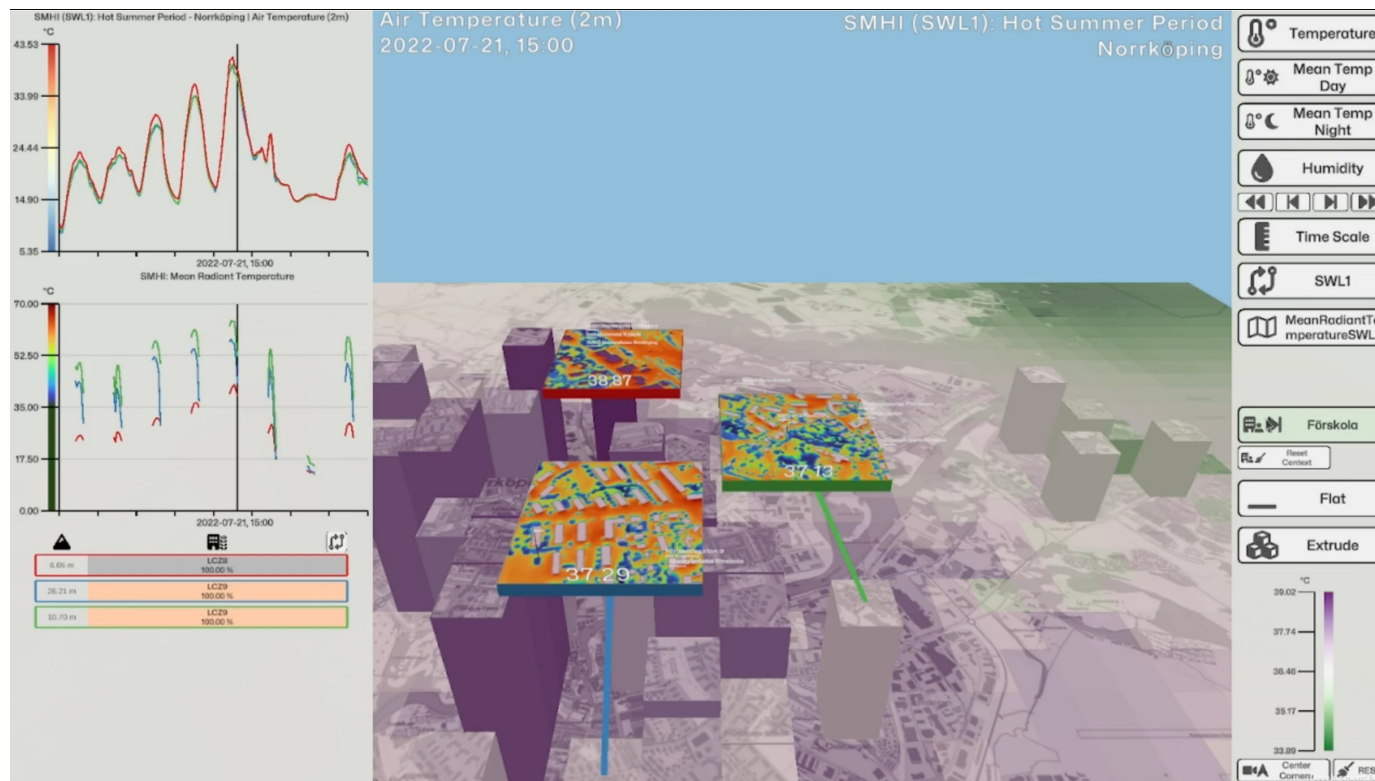
BRIGHT



BRIGHT



BRIGHT



BRIGHT – video demo

BRIGHT Visualization Tool

Select a City Scenario:

Norrköping Linköping Stockholm



Nästa steg



Stort tack till hela teamet!



SMHI

Jorge H. Amorim
Isabel Ribeiro
Fuxing Wang
Aitor Aldama Campino
Christian Asker



LiU / iVis

Katerina Vrotsou
Nico Reski
Andreas Kerren

LiU / TEMAM

Tina Neset
Lotten Wiréhn
Carlo Navarra



LNU / VRxAR Labs

Aris Alissandrakis
(at Chalmers as of Oct. 2024)

