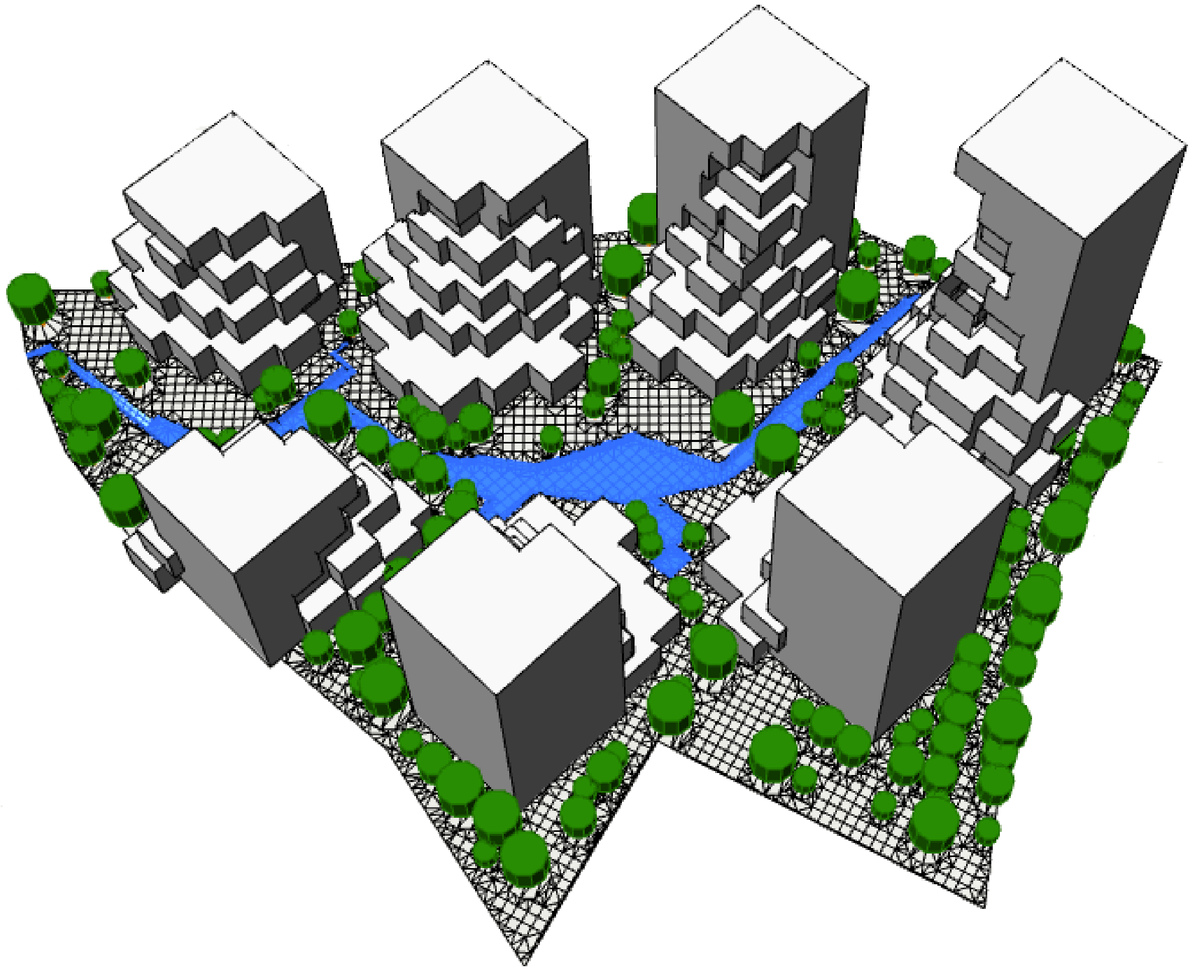
Technical University of Denmark

HYDROTERMIC CONTROL OF THE MICROCLIMATE AROUND BUILDINGS



MASTER THESIS

CHRISTIAN KONGSGAARD NIELSEN

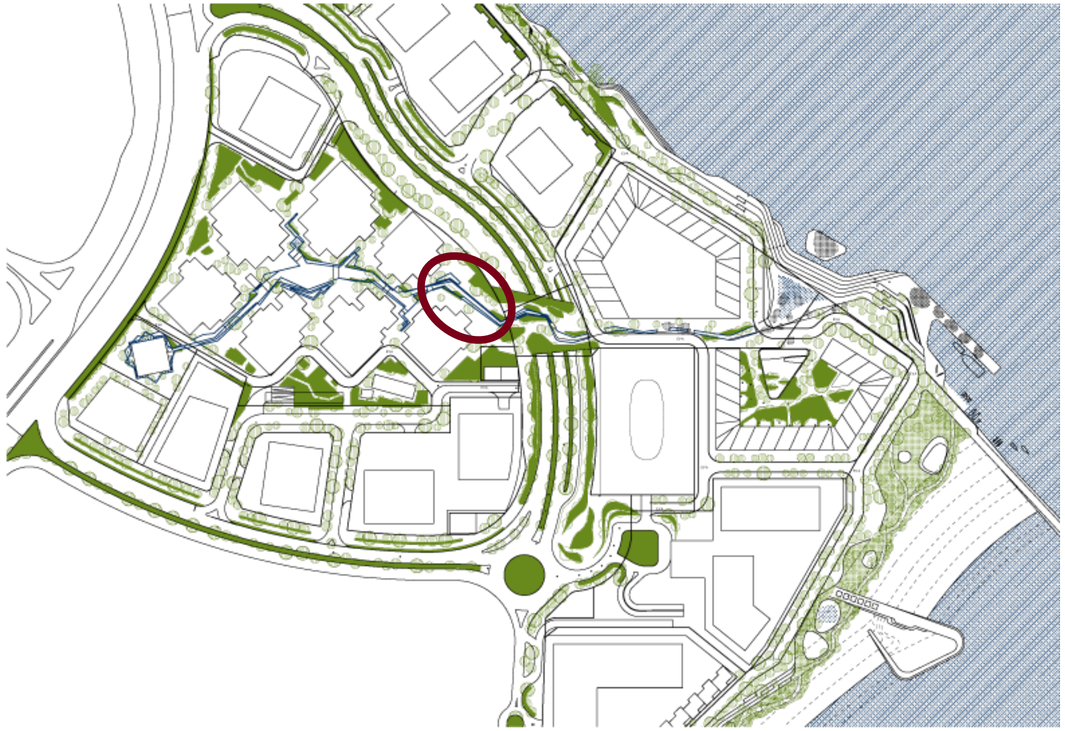
DTU Civil Engineering
Department of Civil Engineering

23. April - 2018

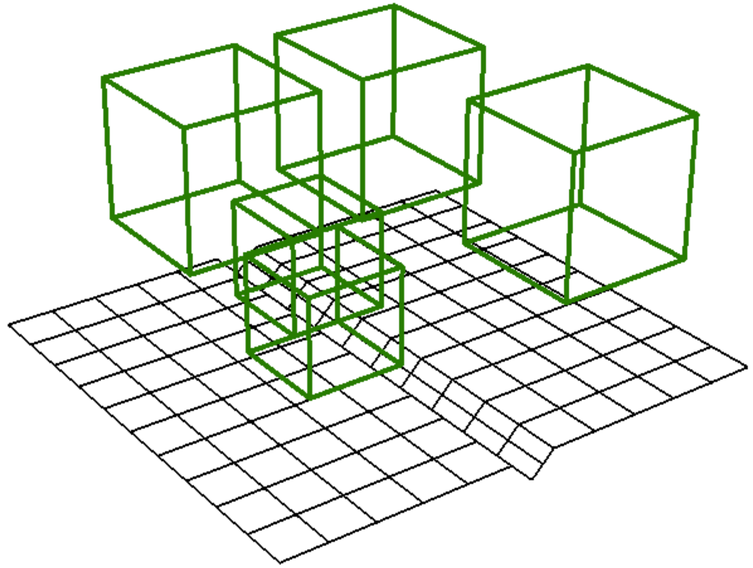
CASE STUDY

- Bjarne Ingels Group (BIG)

Master Plan in Abu Dhabi, UAE

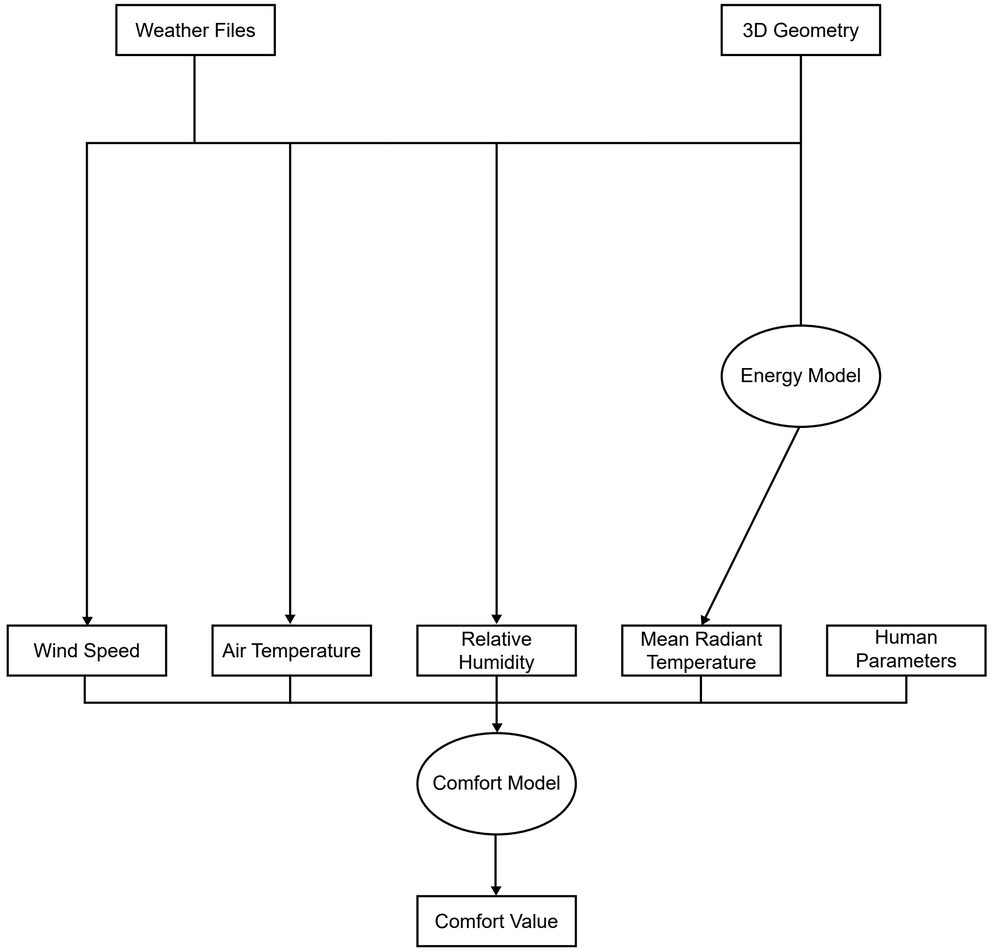


Computational Model



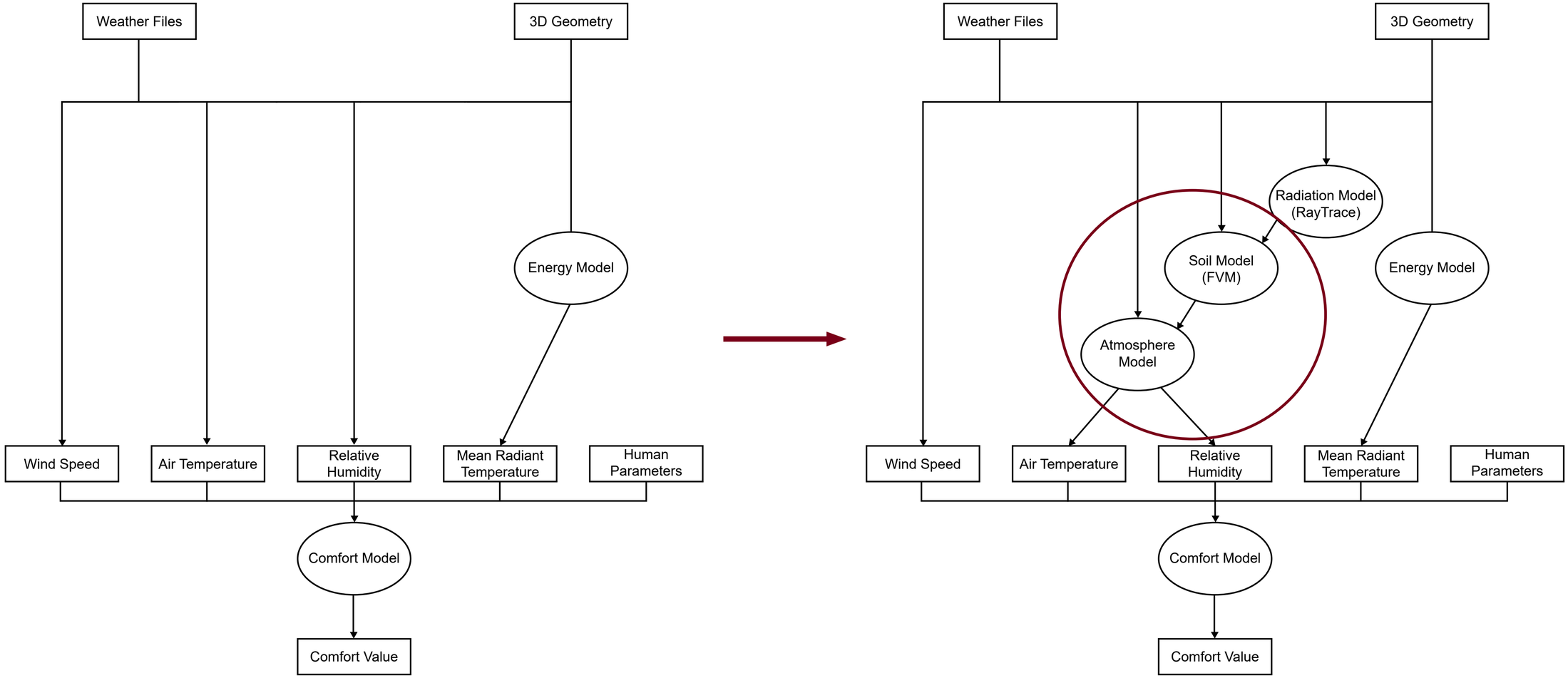
CONCEPTUAL APROACH

- Current Methods



CONCEPTUAL APROACH

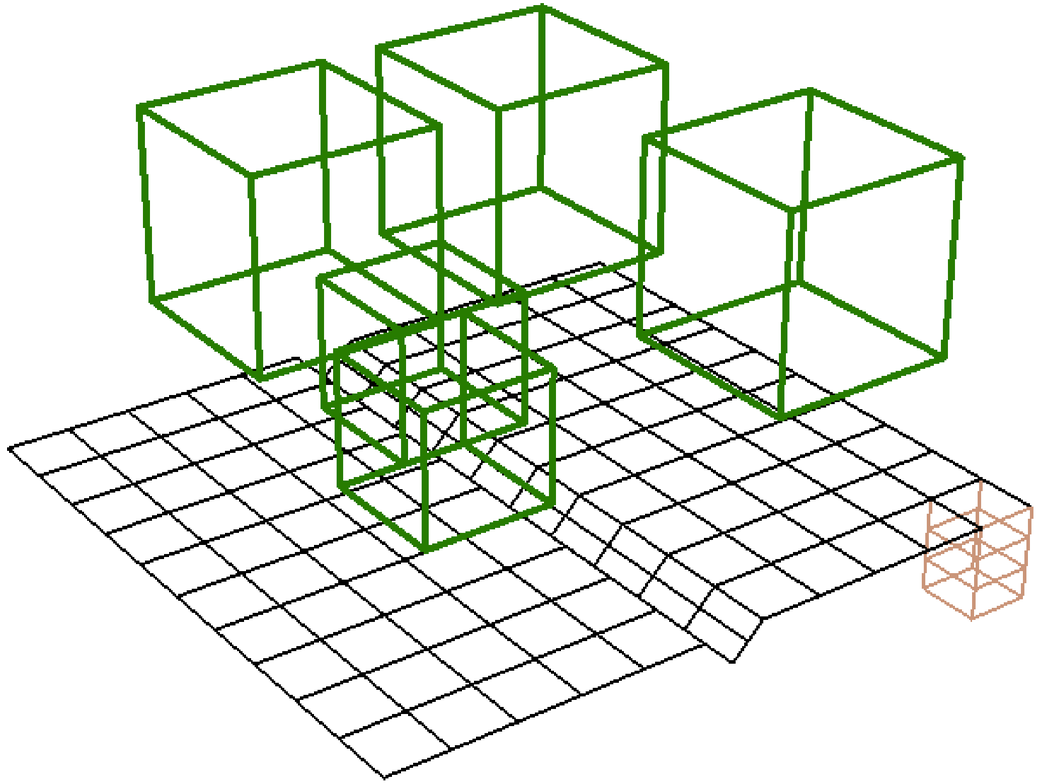
- Proposed Models



SOIL MODEL

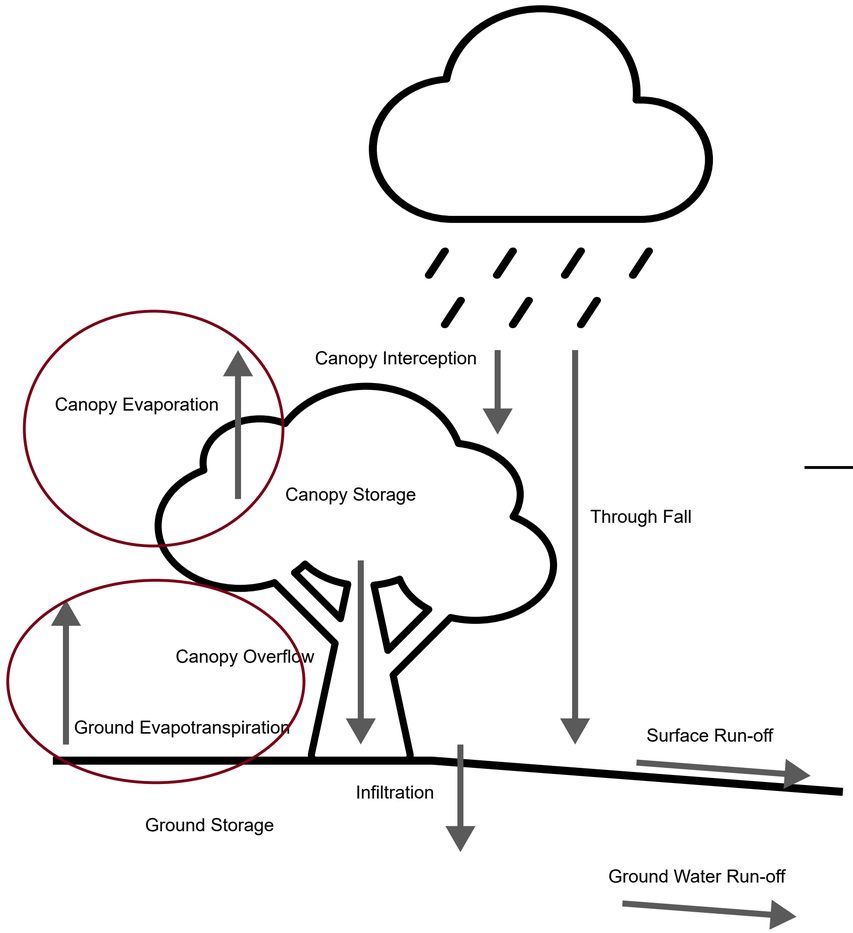
Catchment Modeling Framework (CMF)

- Library for Hydrological Models
- Philipp Kraft, Justus-Liebig Universität Giessen, Germany
- Written in Python
- Wrapper for Grasshopper



SOIL MODEL

- Evapotranspiration

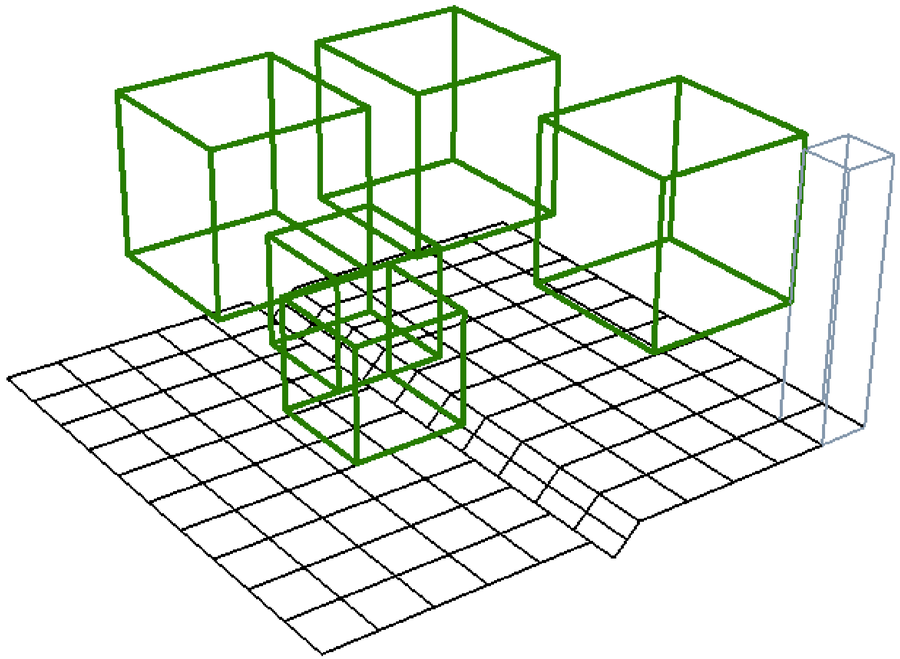


Atmosphere Model → **Comfort Model**

ATMOSPHERE MODEL

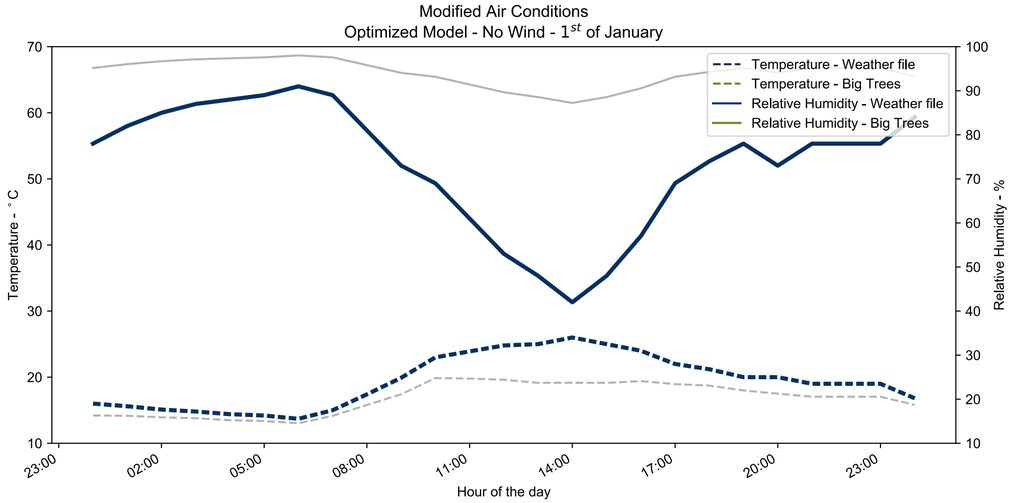
Simple Air Volume Model

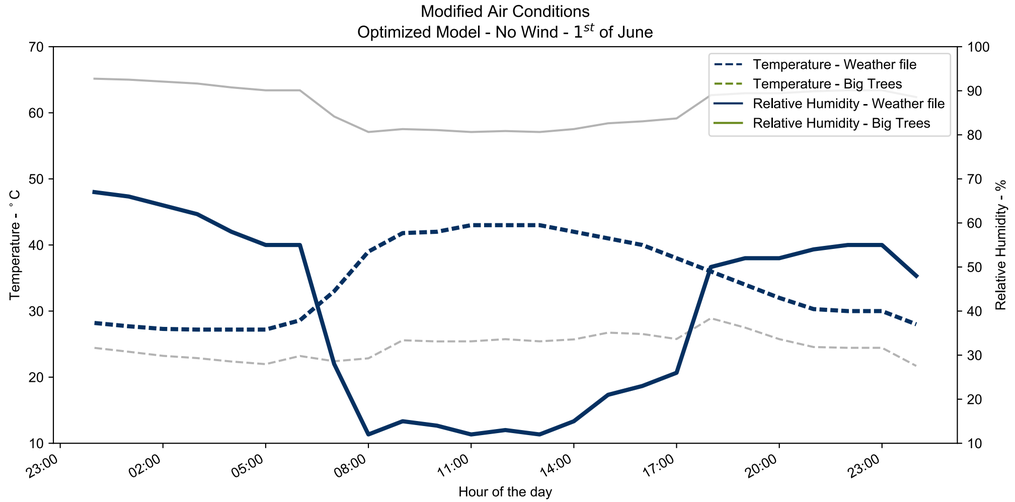
- Converts the Vapour Flux
- Disconected Air Volumes
- Wind Speed Adjusted
- Livestock Template Method



AIR CONDITION ANALYSIS

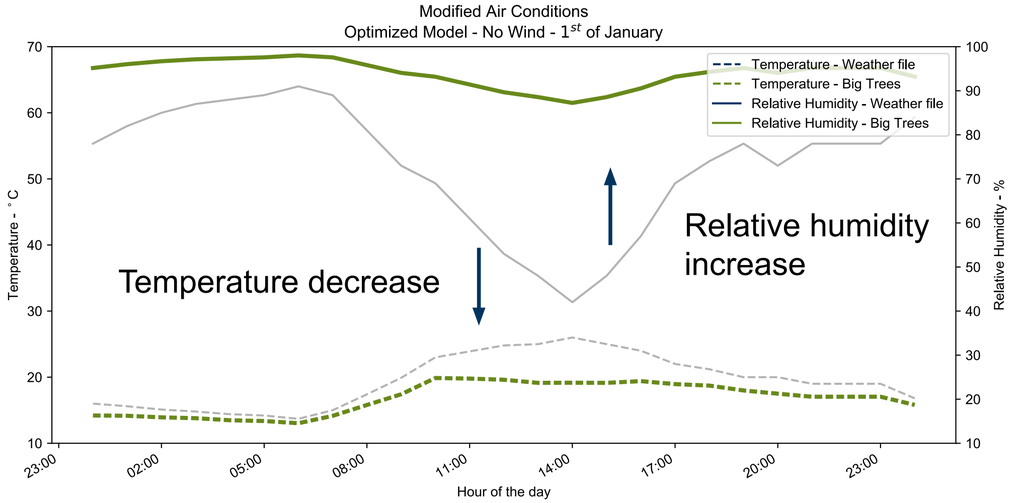
- Weather File

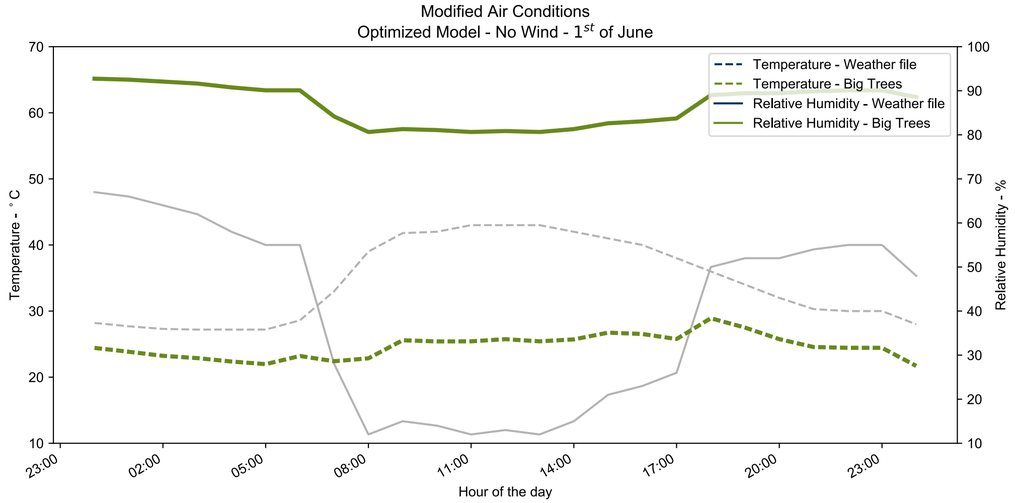




AIR CONDITION ANALYSIS

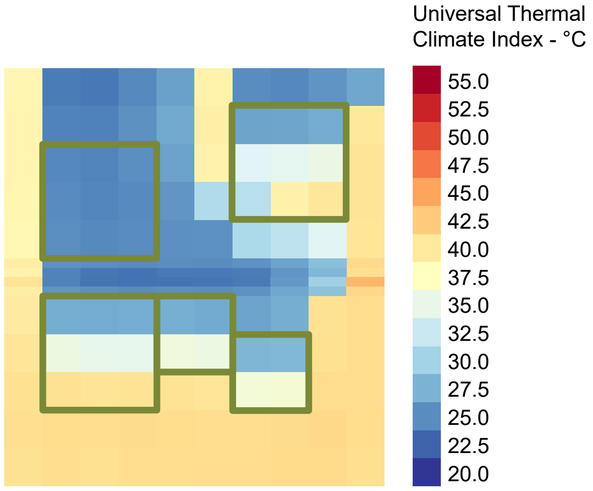
- Atmosphere Model Applied



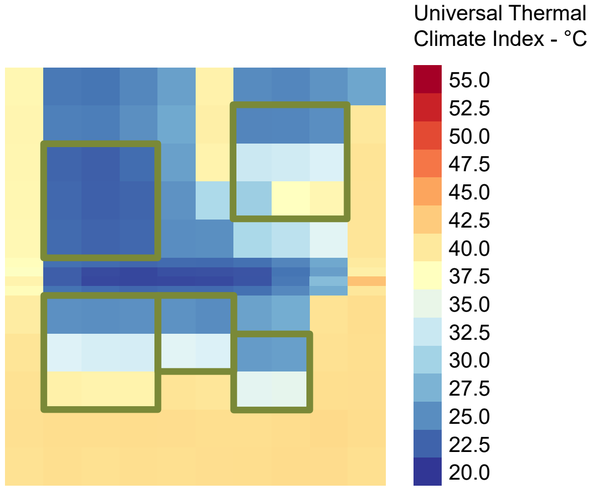


COMFORT ANALYSIS

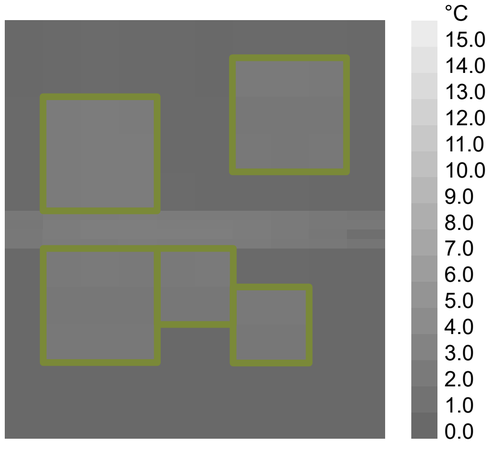
UTCI (°C)	Physiological Stress
Above +46	Extreme heat stress
+38 to +46	Very strong heat stress
+32 to +38	Strong heat stress
+26 to +32	Moderate heat stress
+18 to +26	Thermal comfort zone
+9 to +18	No thermal stress
0 to +9	Slight cold stress
-13 to 0	Moderate cold stress
-27 to -13	Strong cold stress
-40 to -27	Very strong cold stress
Below -40	Extreme cold stress



Thermal Comfort without Evapotranspiration
1 JAN 12:00



Thermal Comfort with Evapotranspiration
No Wind
1 JAN 12:00



Thermal Comfort Difference
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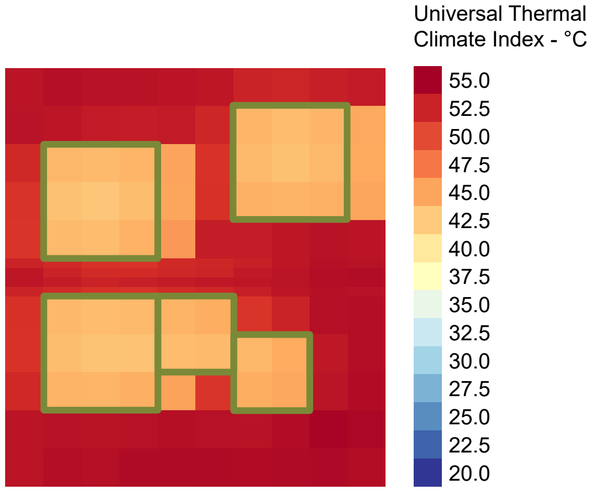
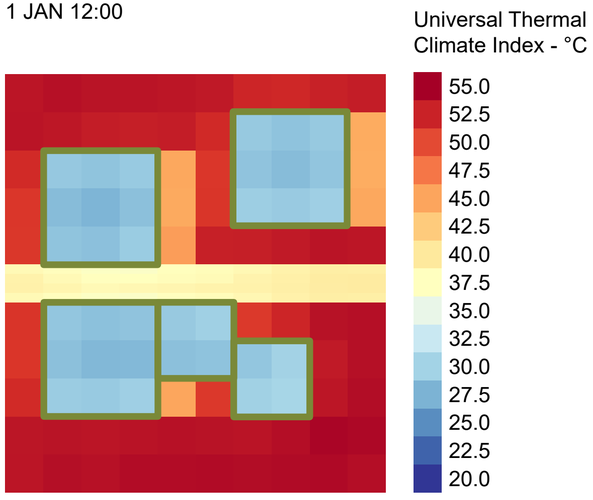
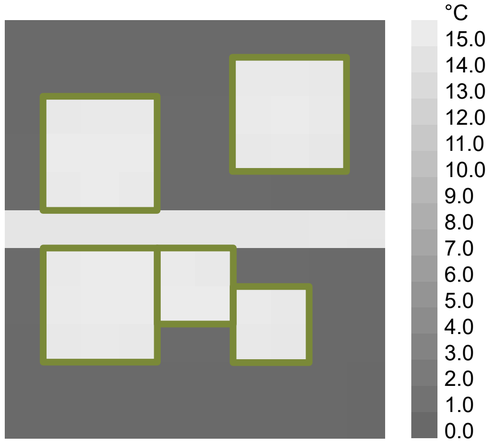


Thermal Comfort without Evapotranspiration
1 JUN 12:00



Thermal Comfort with Evapotranspiration
No Wind
1 JUN 12:00



Thermal Comfort Difference
1 JUN 12:00

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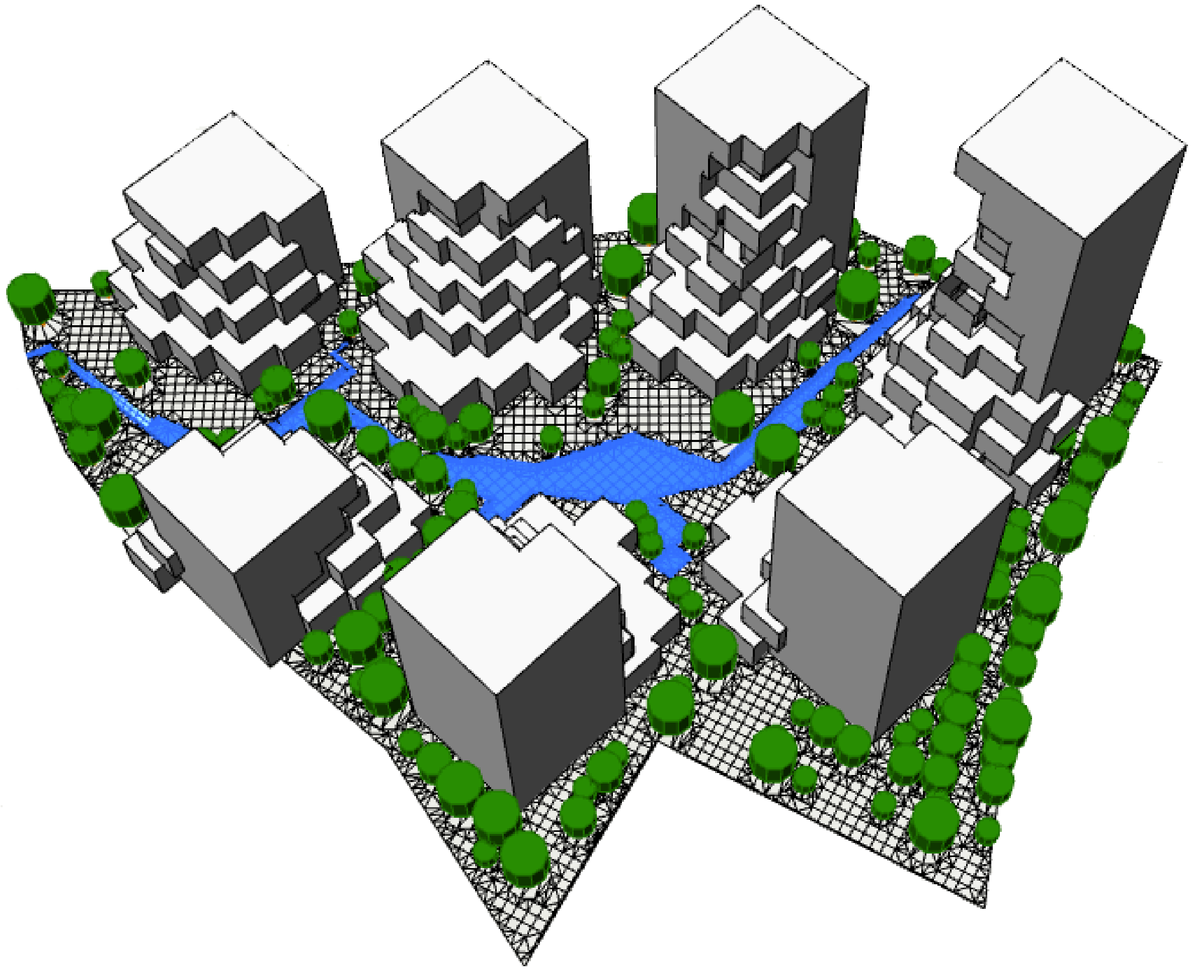

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