Données climatiques pour le bâtiment

Modélisation couplée intérieur et extérieur d'un bâtiment pour l'étude des ambiances vécues en période de surchauffe urbaine

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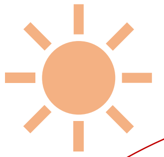
Financement : Bourse Enjeux Environnement INSA

Context and objectives

CONTEXT

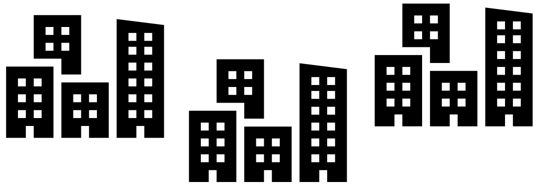
Climatic Hazards

Heat waves Intensity and frequency



Exposure environment

Urban densification



Heat Stress

Long term - cumulative

ex : DDH, NDH

Heat Strain

Short term : ex. PET / UTCI

OBJECTIVES

*Assess **heat stress** and **heat strain** in the dwelling and the nearby environment*

Thermal parameters

- Temperature (Ta)
- Humidity (RH)
- Wind speed (v_a)
- Radiative exchange (T_{mrt})

Exposure duration

- Short term : hour-5days
- Long term : Seasons

Exposure environment

Near outdoor Dwelling

~ 100m x 100m

Discretization parameters

- **Timestep** : depending on input data (generally hourly)
- **Spatial discretization** : 1m-15m

*Heat stress : linked to "the total **heat load** on the body imposed by **cumulative environmental**, **physical, and individual factors**" (Y. Yang et Albert P.C. Chan, 2015)*

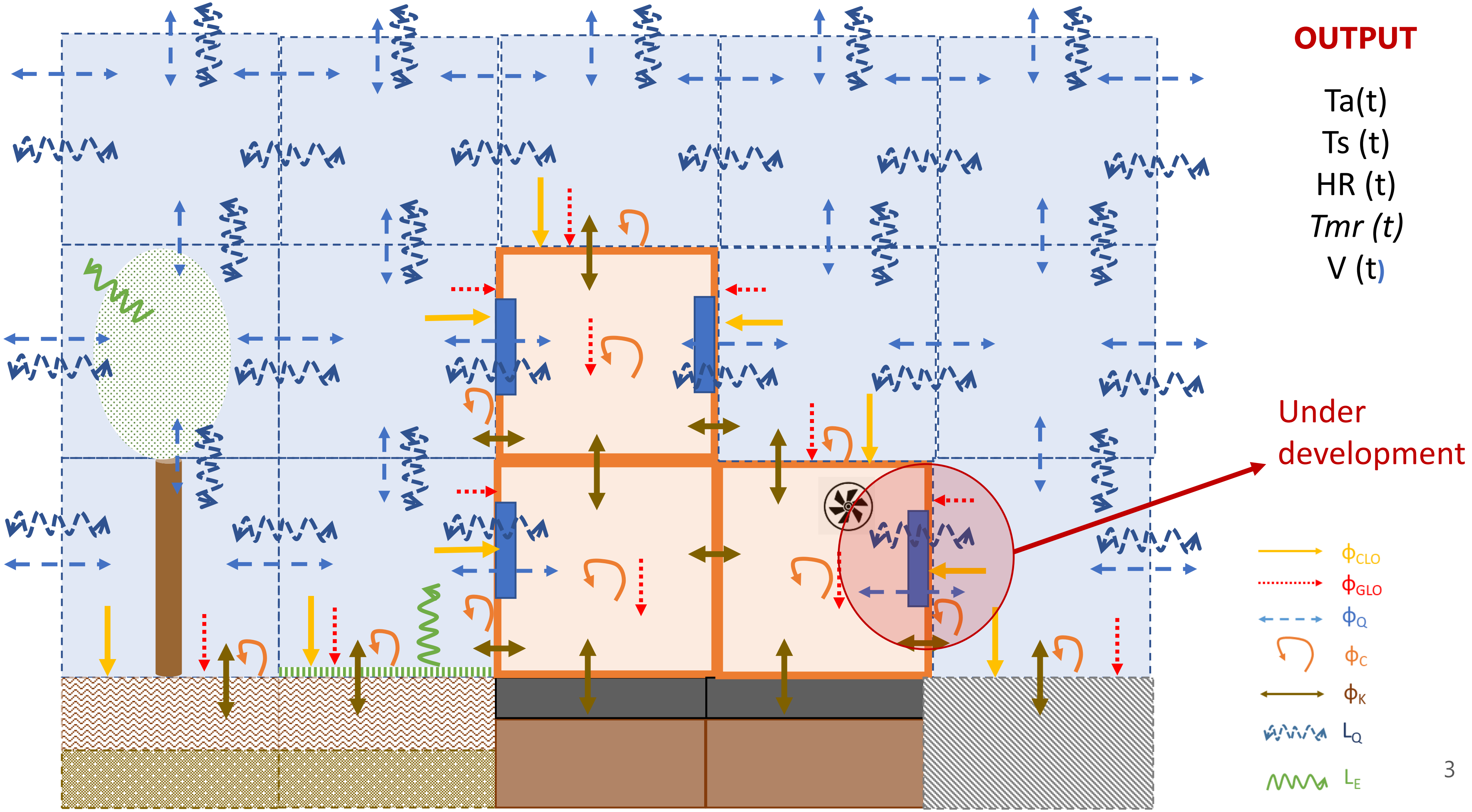
Zonal thermal model to asses local heat stress

INPUT

Cubic 3D geometry + Thermal properties + Activities

SW and View Factor preprocessin

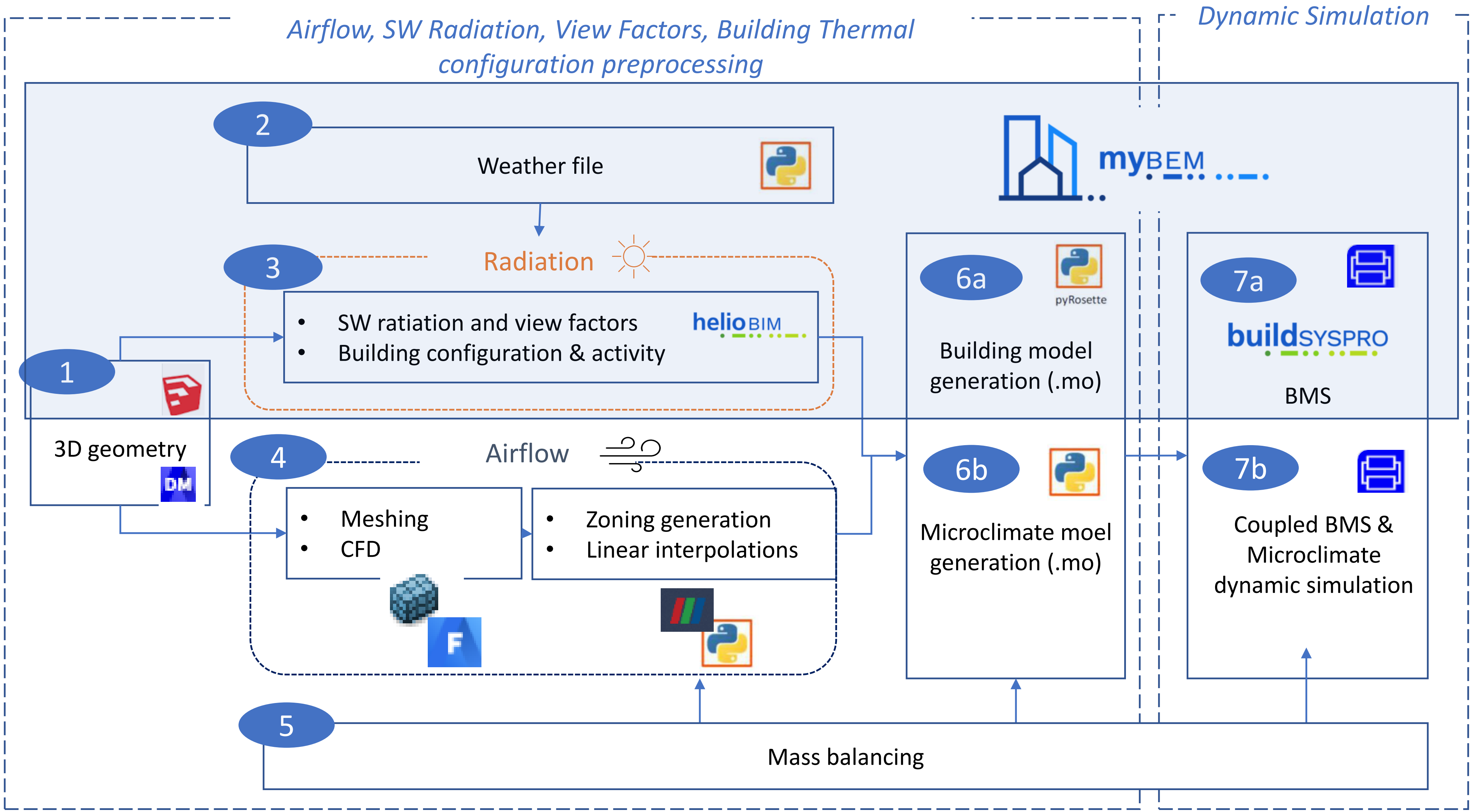
Airflow Preprocessing



OUTPUT

Ta(t)
Ts (t)
HR (t)
Tmr (t)
V (t)

Model structure



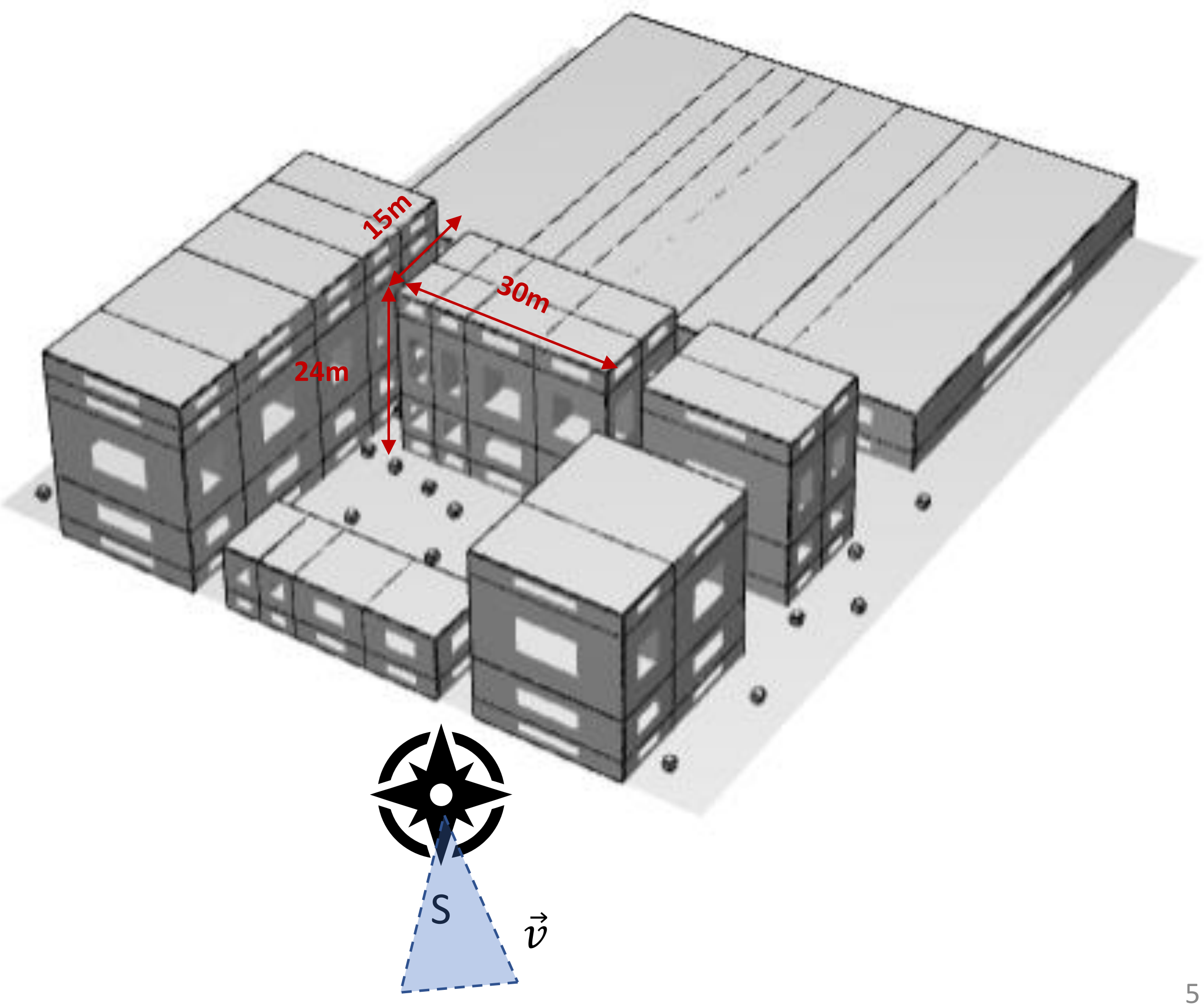
Study case configuration

Ydeal square : Lyon Confluences

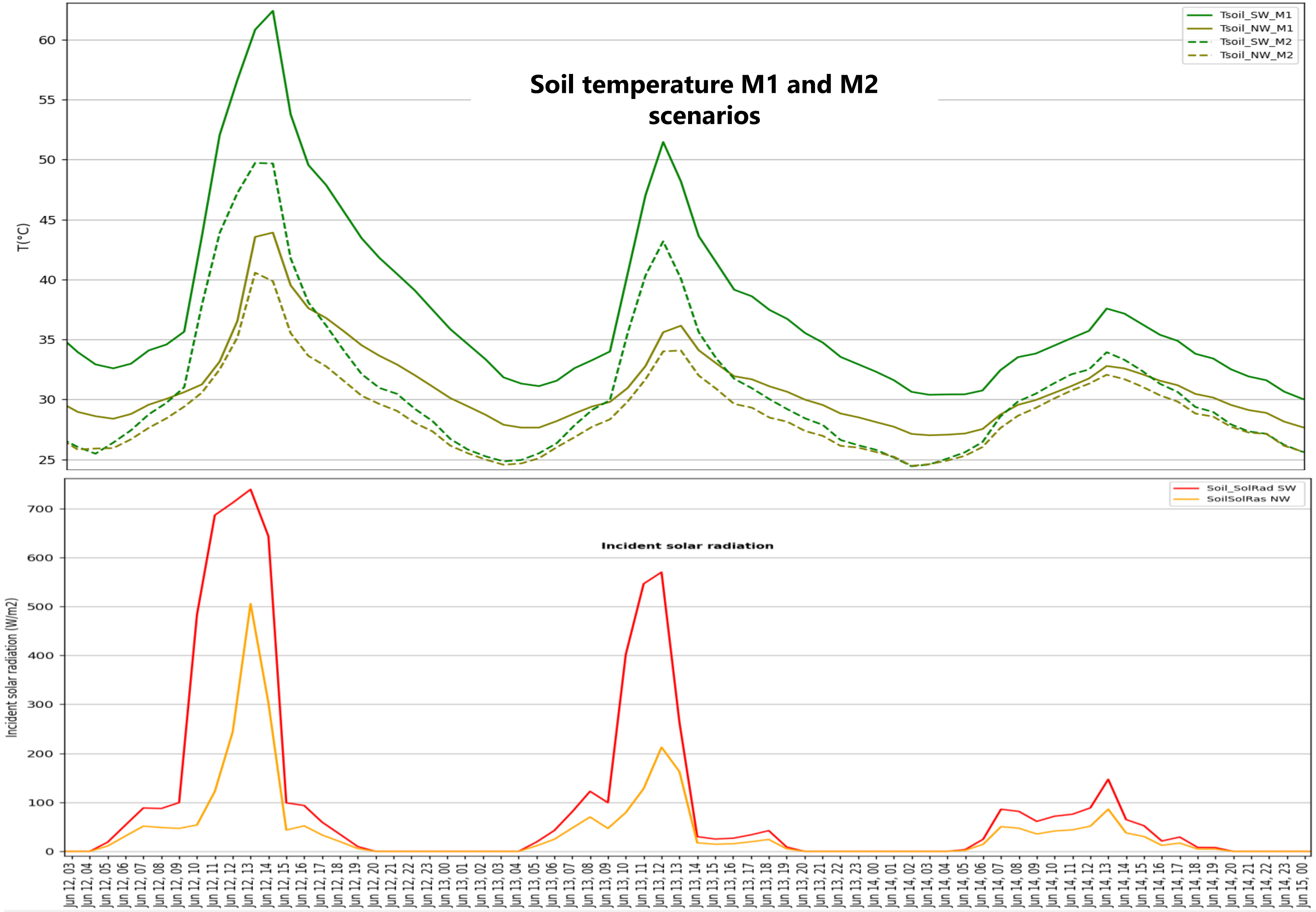
	Exteriors walls	Roof	Floor	Openings
U (W/(m2K))	0.18	0.11	0.22	1.24
Albedo	0.4	0.3		
Solar factor				66%

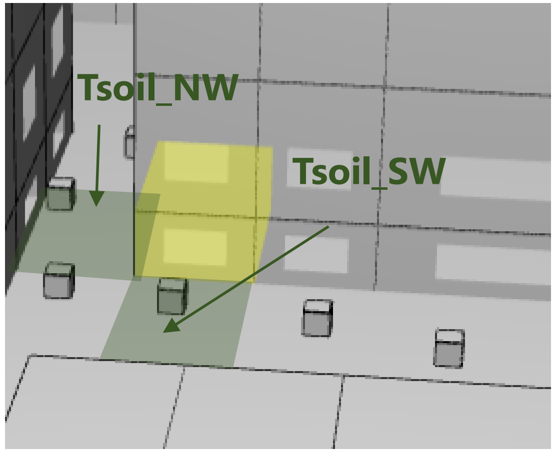
Mechanical ventilation (V/h)	0.7
Internal sensible sources (W/m2)	5
% opening	27

	Simulations	
	M1	M2
Building model	x	x
Microclimate model	x	x
hc_const = 21W/(m2K)		x
hc_interpolation	x	
hr_ext= 4W/(m2K)	x	x
Ext Soil impermeable	x	x
Model Boundary Conditions	*Local weather 10m*	

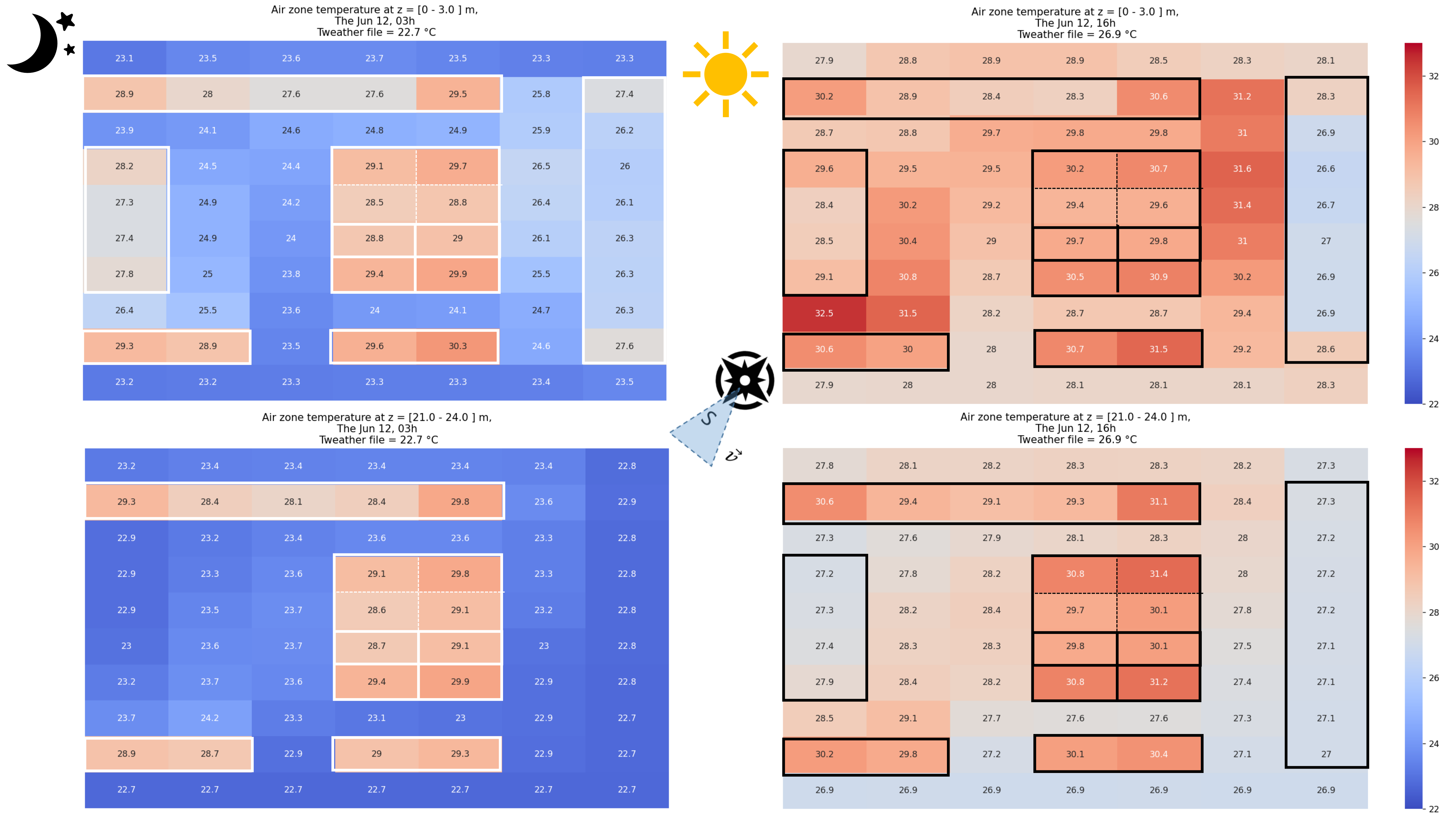


The influence of the hc coefficient on the external soil surface temperature





- In M1 scenario the hc results from a linear interpolation of precomputed CFD reults. The hc values are lower than the one used in the M2 scenario (25 W/Km2) ➔ This explains why the Tsoil in the M1> Tsoil in the M2
- South West exposed soils have higher surface temperatures than the North West ones


Air zone temperature at z = [0 - 3.0] m,
The Jun 12, 03h
Tweather file = 22.7 °C
23.1 23.5 23.6 23.7 23.5 23.3 23.3
28.9 28 27.6 27.6 29.5 25.8 27.4
23.9 24.1 24.6 24.8 24.9 25.9 26.2
28.2 24.5 24.4 29.1 29.7 26.5 26
27.3 24.9 24.2 28.5 28.8 26.4 26.1
27.4 24.9 24 28.8 29 26.1 26.3
27.8 25 23.8 29.4 29.9 25.5 26.3
26.4 25.5 23.6 24 24.1 24.7 26.3
29.3 28.9 23.5 29.6 30.3 24.6 27.6
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Air zone temperature at z = [0 - 3.0] m,
The Jun 12, 16h
Tweather file = 26.9 °C
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Air zone temperature at z = [21.0 - 24.0] m,
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