

Cambiamenti climatici ed effetti sulle città

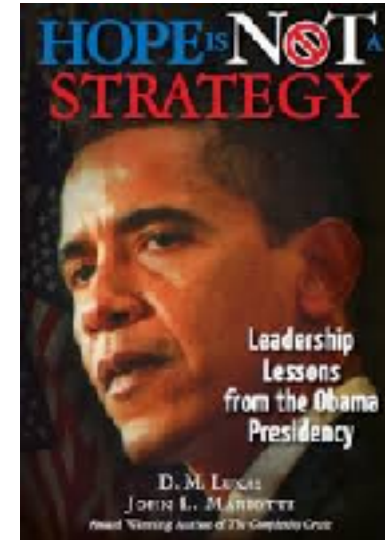
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- **Policy and Science**
- **The climate problem**
- **Architectural and Physical approaches**
- **Nature Based Solutions**
- **The modelling**

How long does it take to build a city?

How long does it take to be re-elected?





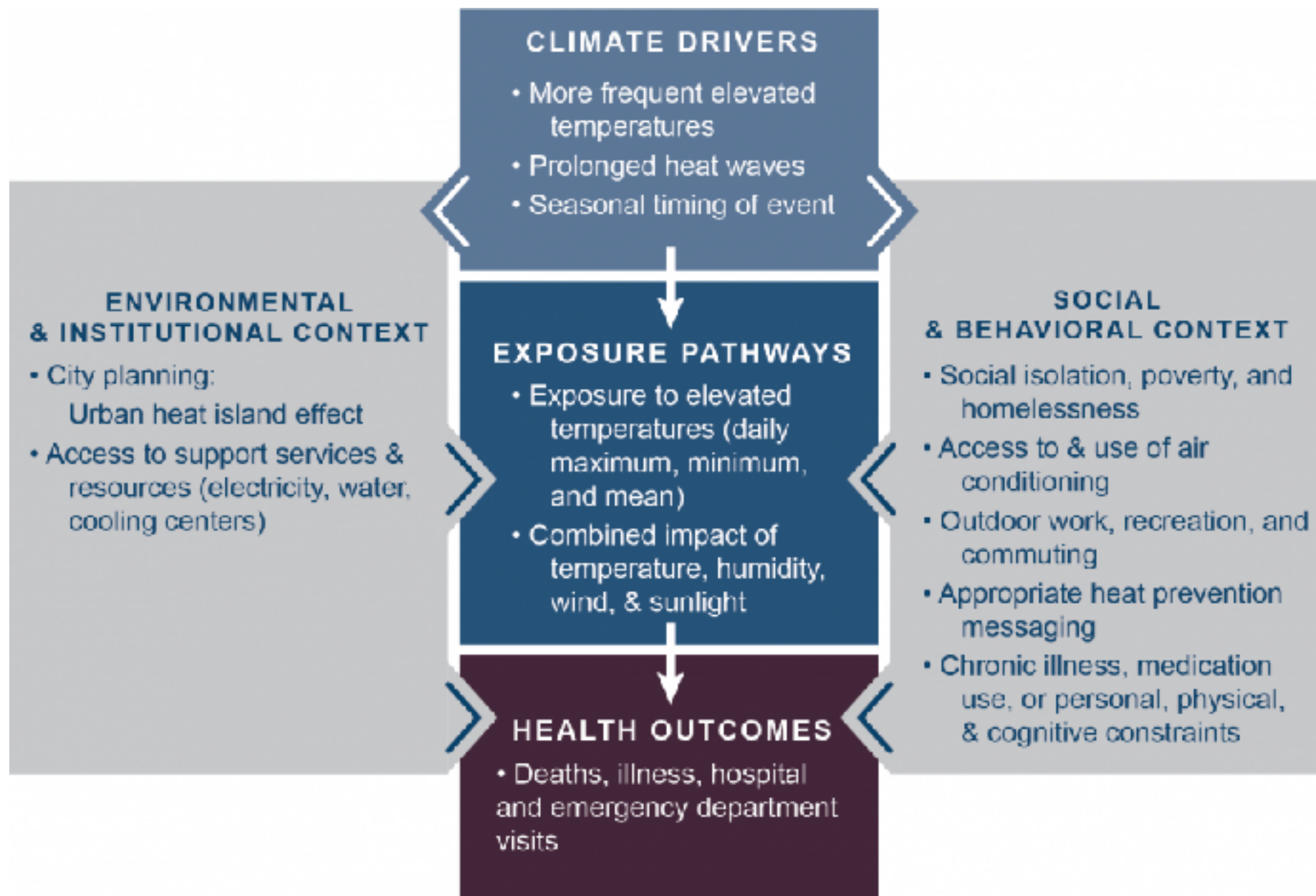
← Temperature issue



Water issue →







Models of cities / City models

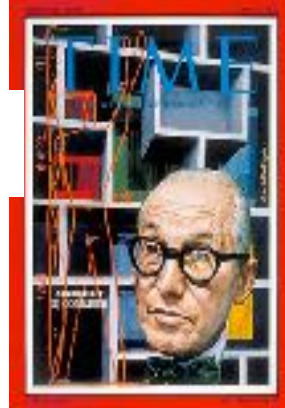


Architects
Urbanists
Engineers
Social scientists
Biologists
Agronomers
Economists
Historians
Chemists
Physicists
Policy makers
...

*A wonderfully complex
world*

- **"Les matériaux de l'urbanisme sont le soleil, le ciel, les arbres, l'acier, le ciment dans cet ordre et dans cette hiérarchie."**

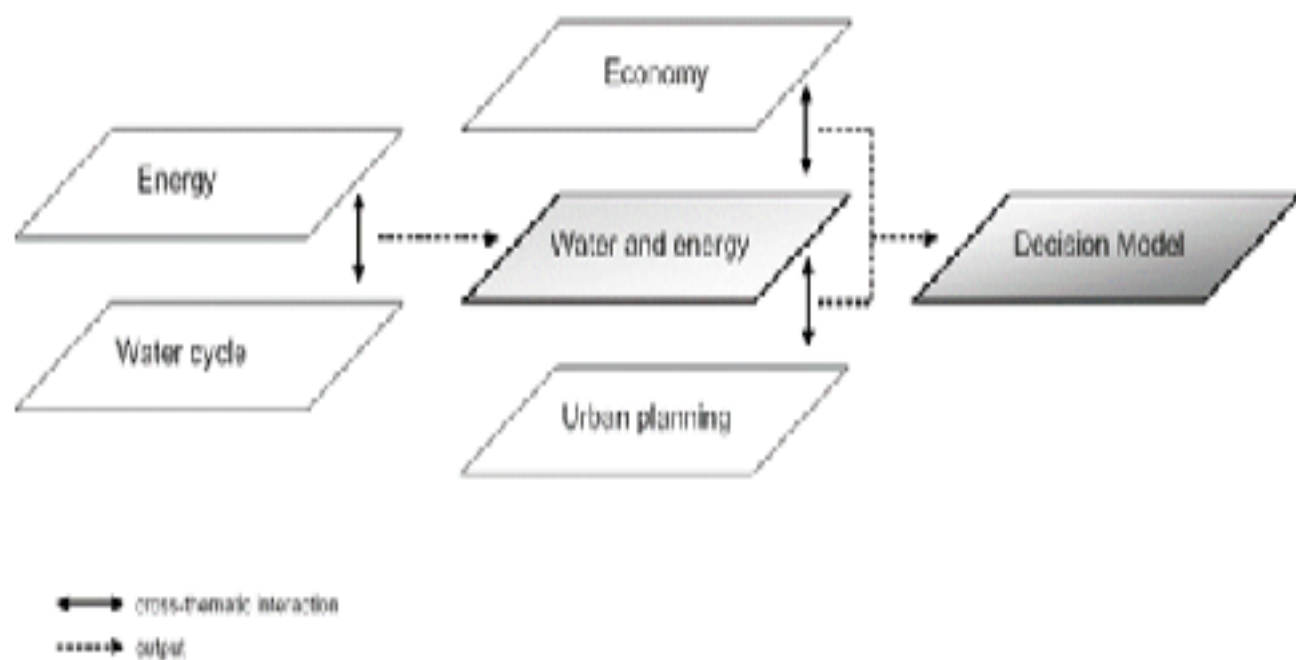
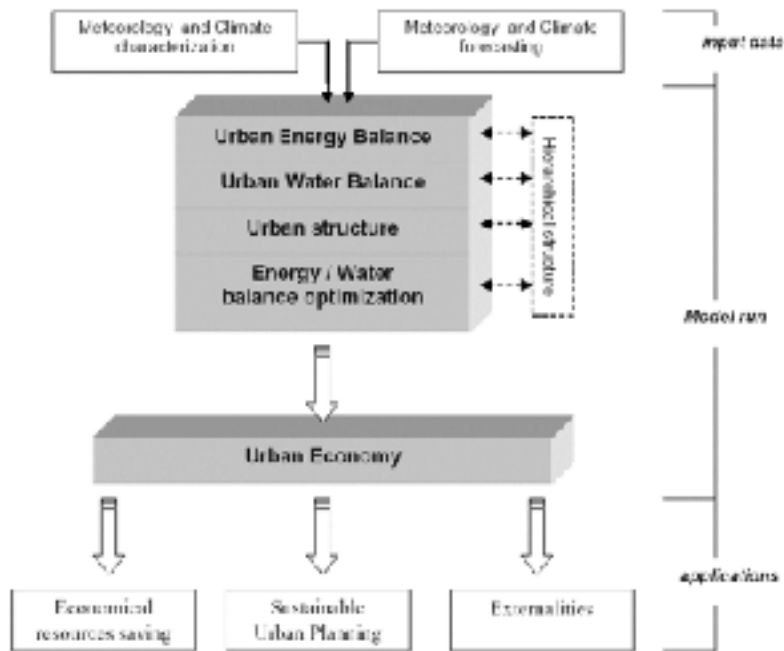
Le Modulor



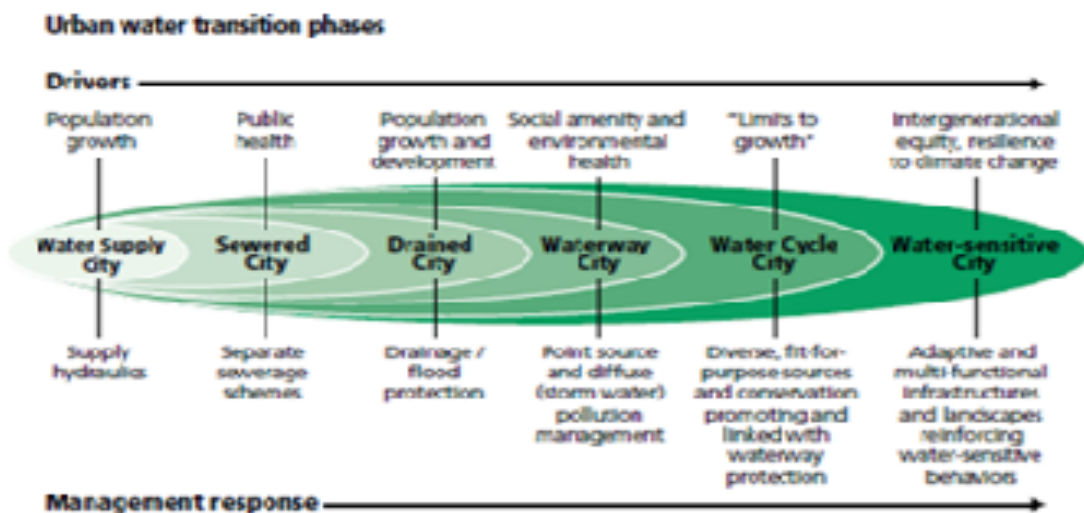
Le Modulor

Une nouvelle mesure humaine



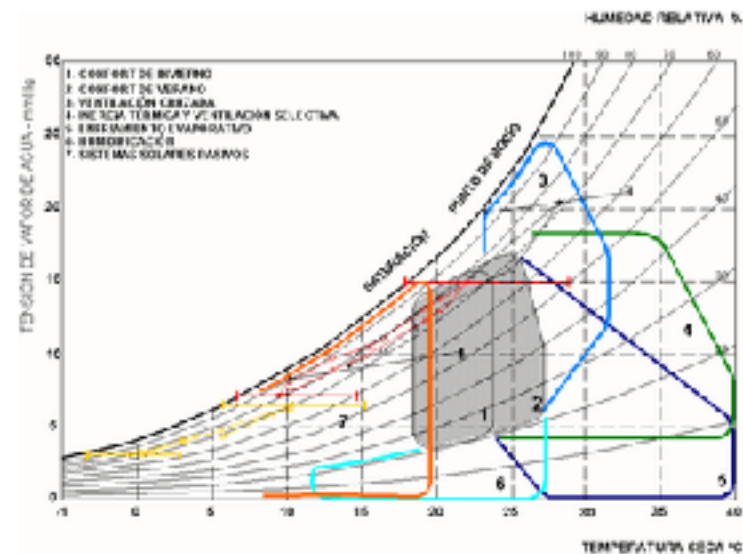


Water-Sensitive Cities Framework



Source: Based on T. Wong and R. R. Brown, 2009. *The Water Sensitive City: Principles for Practice*. *Water Science and Technology* 60(3):673-682.

Heat-Sensitive cities Framework





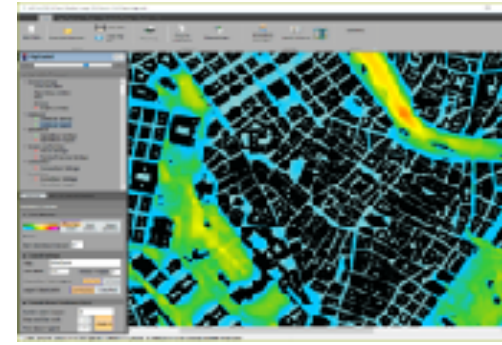
NATURE BASED SOLUTIONS



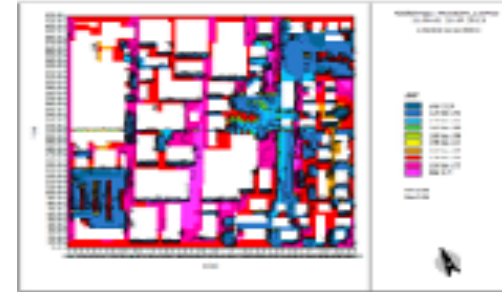
Modelling what?



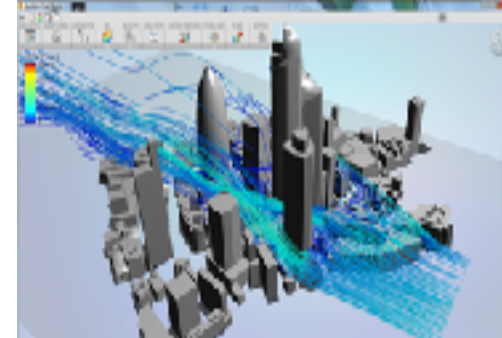
HEAT



WELLNESS

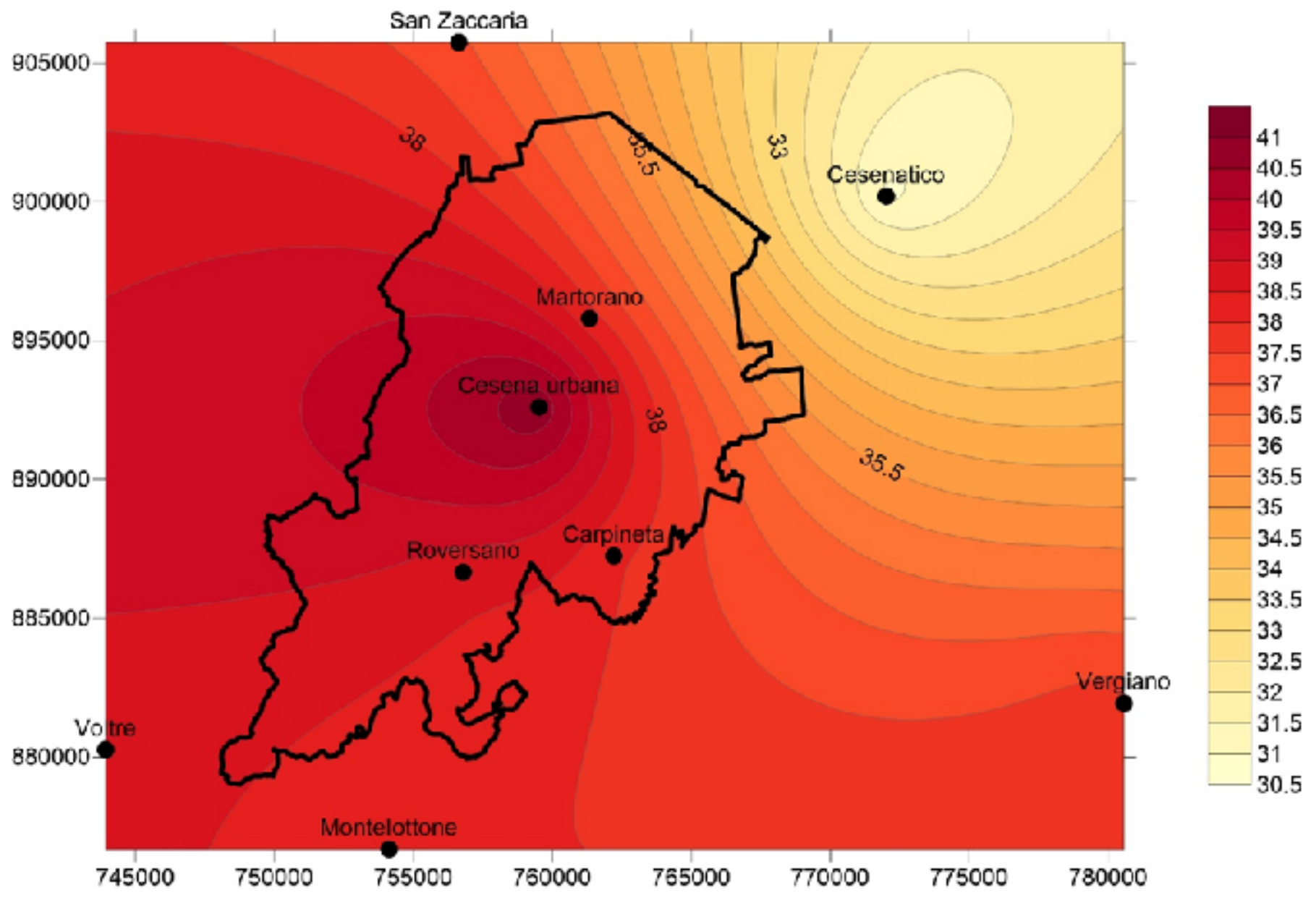


AIR-FLOW



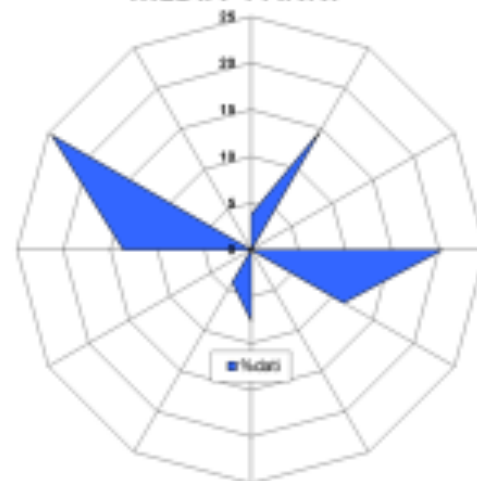
ECO-SYSTEM SERVICES





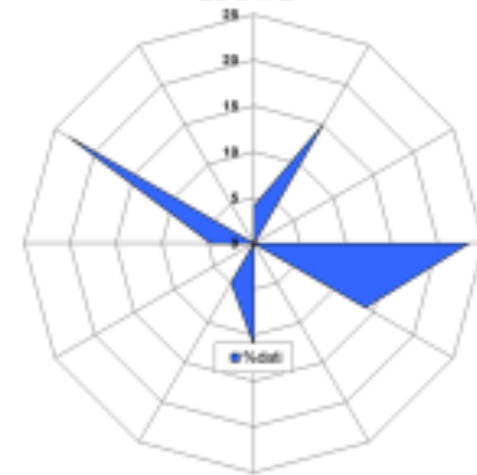


MEDIA 4 ANNI



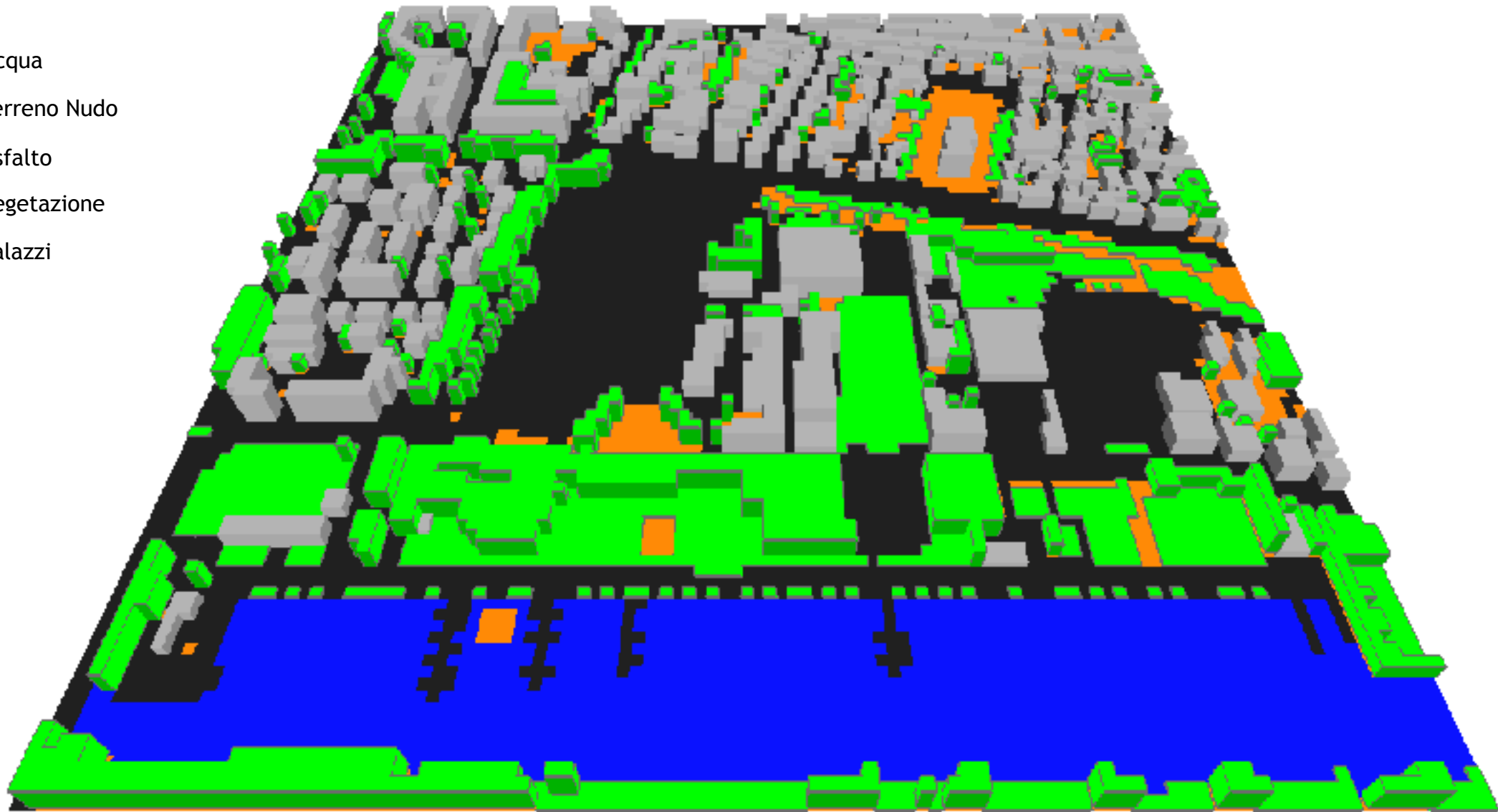
	T (°C)	RH(%)	Vel (m/s)
MEDIA 4 ANNI	14.76	69.15	2.20
MEDIA ESTIVA	24.40	56.78	2.20

ESTATE

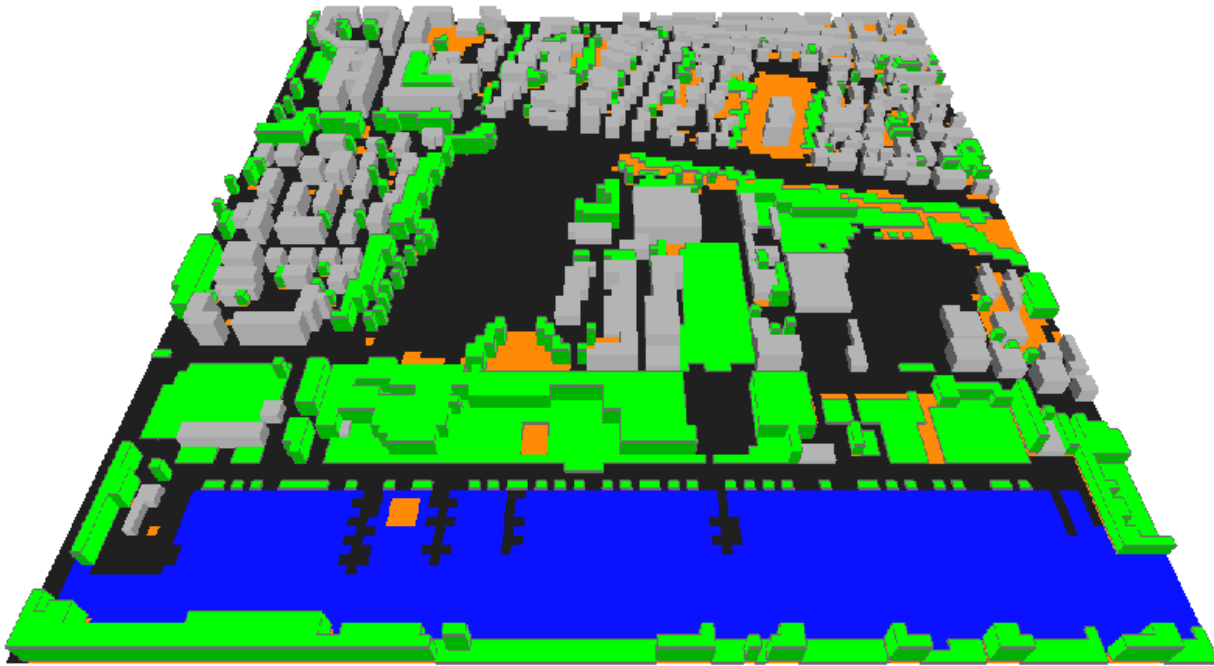


Ferrara Via Darsena- Envimet

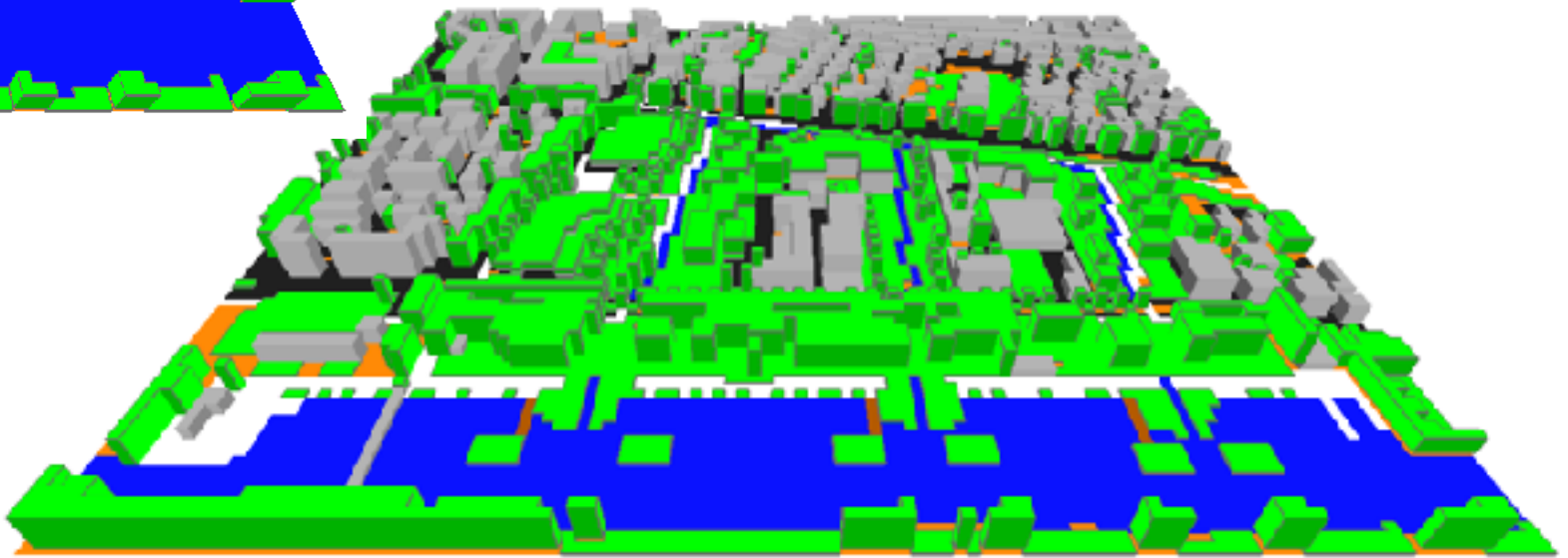
- Acqua
- Terreno Nudo
- Asfalto
- Vegetazione
- Palazzi



Ferrara Via Darsena- Envimet



- Acqua
- Terreno Nudo
- Asfalto
- Vegetazione
- Palazzi



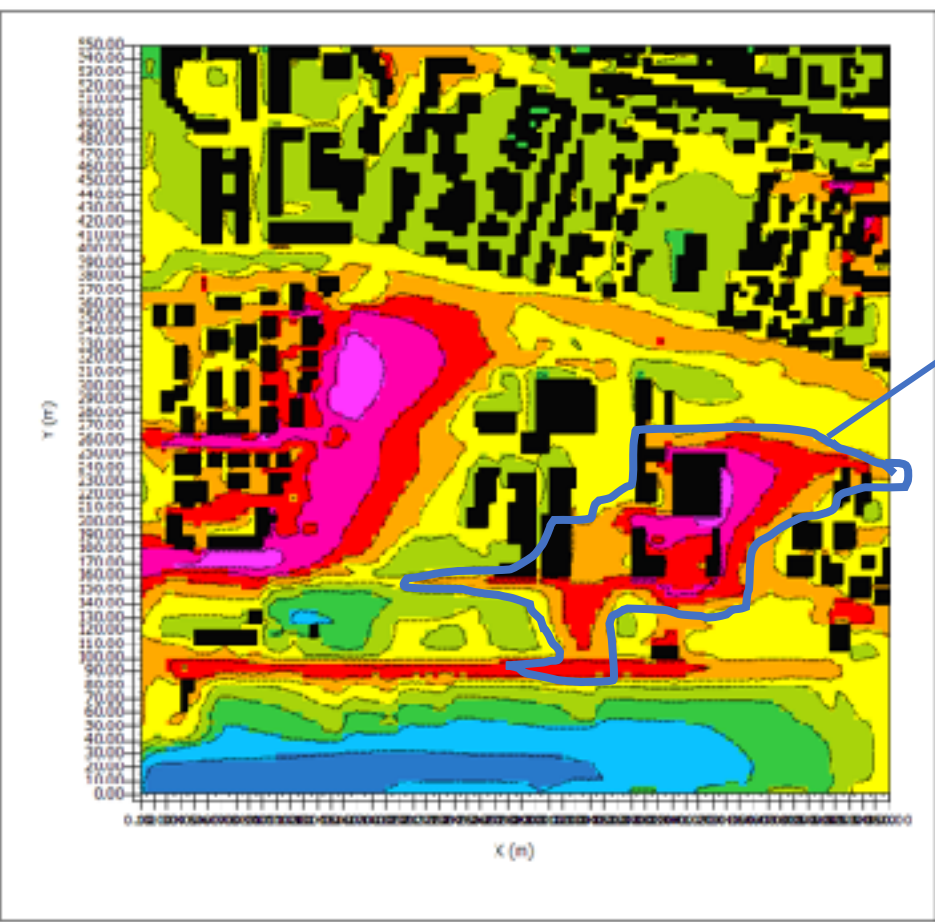


Figure 1: Sim Ferrara
12:00:00 24.06.2017
city: Ferrara (lat:44.4, lon:11.2000 m)

Reduction area with $T > 33^{\circ}\text{C}$

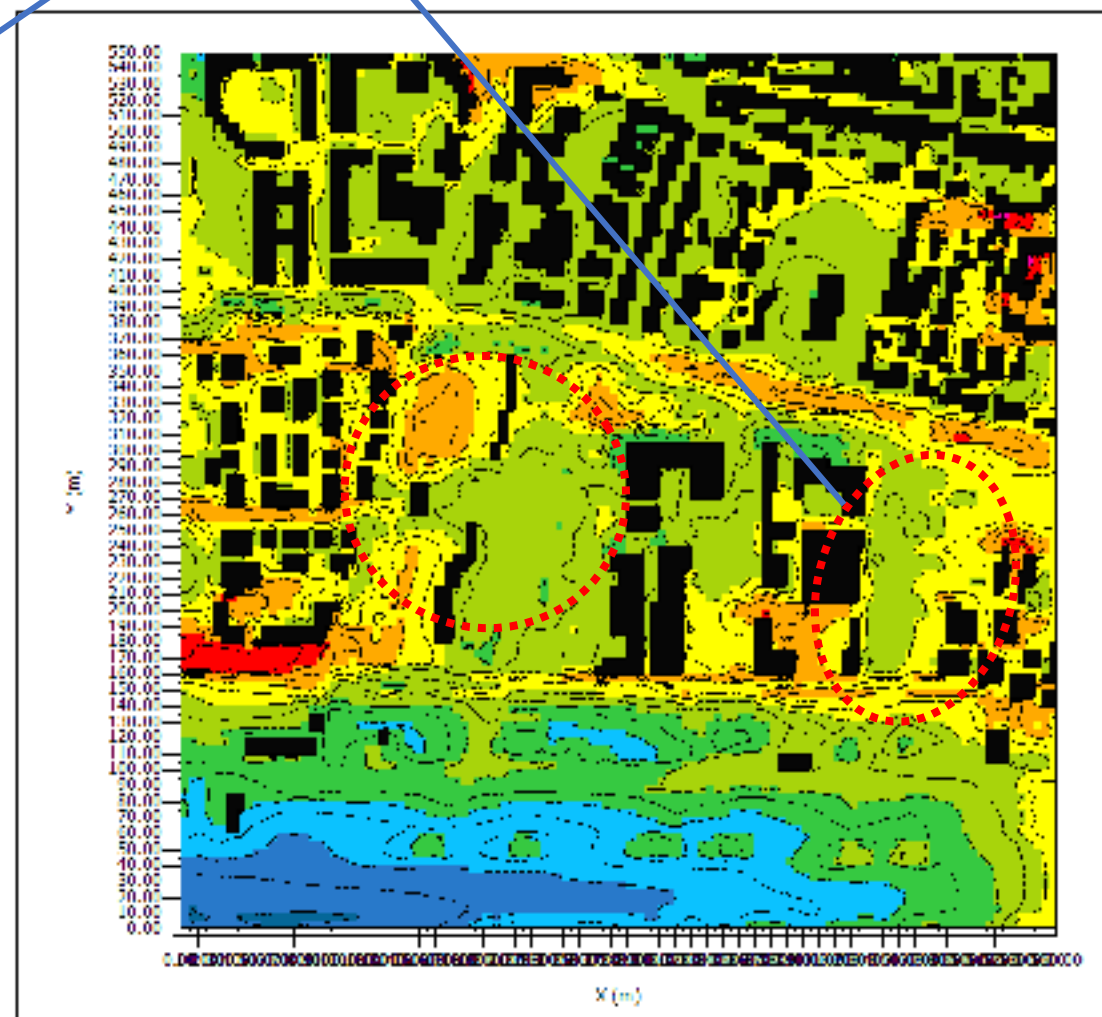
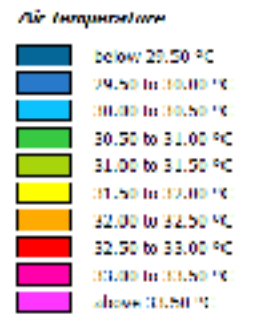


Figure 1: Sim Ferrara Post
12:00:00 24.06.2017
city: Ferrara (lat:44.4, lon:11.2000 m)



Min: 29.47 °C
Max: 33.16 °C



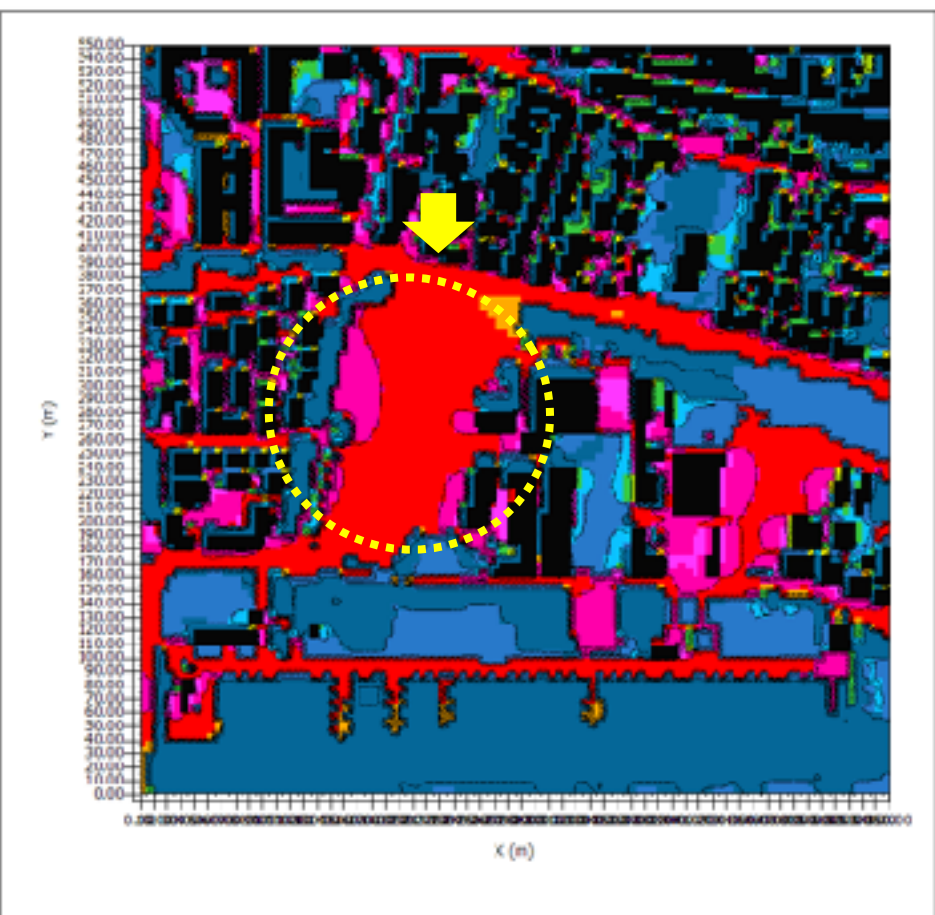


Figure 1: Sim Ferrara
12:00:00 24.06.2017
city: Ferrara (245000 m)

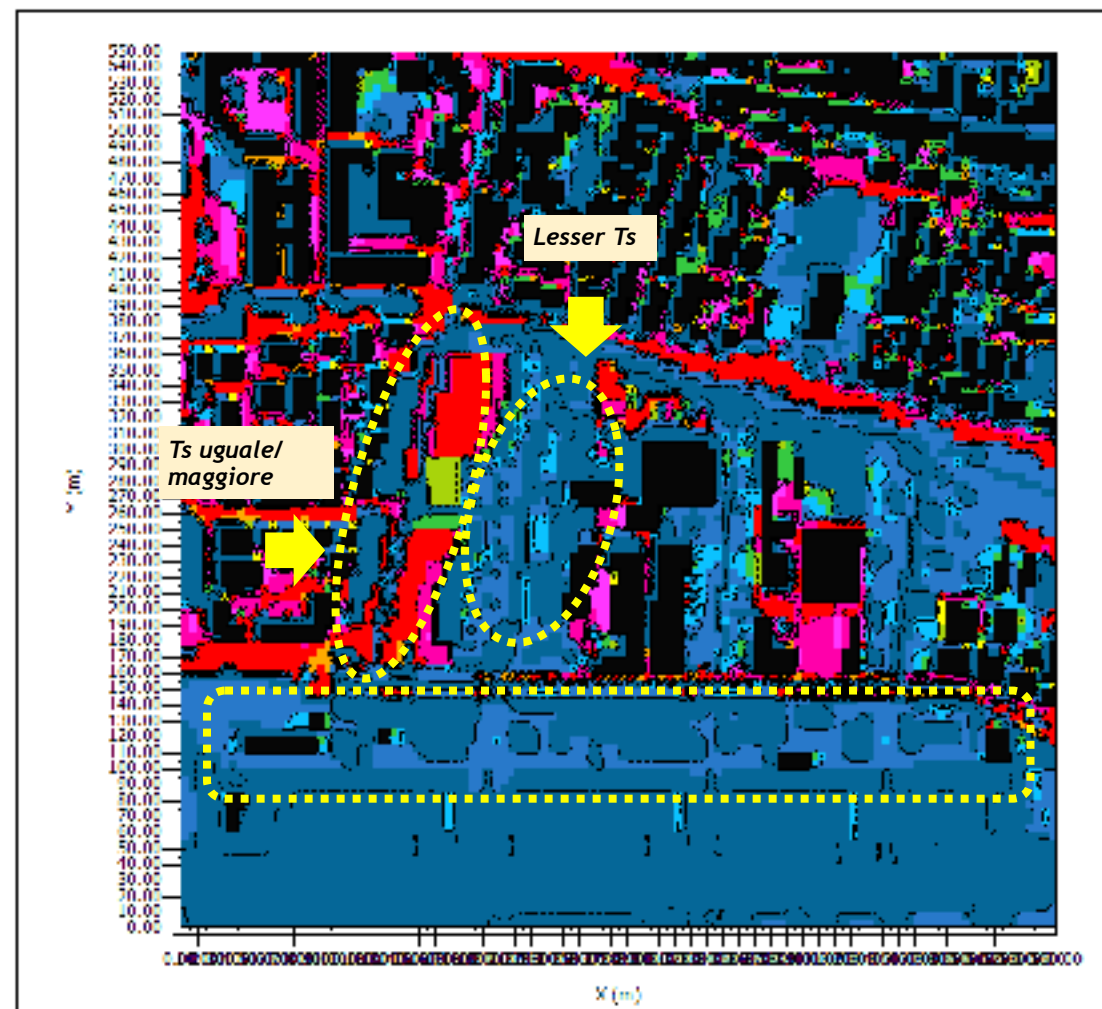


Figure 1: Sim Ferrara Post
12:00:00 24.06.2017
city: Ferrara (245000 m)

- T Surface*
- below 30.00 °C
 - 30.00 to 32.00 °C
 - 32.00 to 34.00 °C
 - 34.00 to 36.00 °C
 - 36.00 to 38.00 °C
 - 38.00 to 39.00 °C
 - 39.00 to 41.00 °C
 - 41.00 to 43.00 °C
 - 43.00 to 45.00 °C
 - above 45.00 °C

Min: 19.05 °C
Max: 45.97 °C



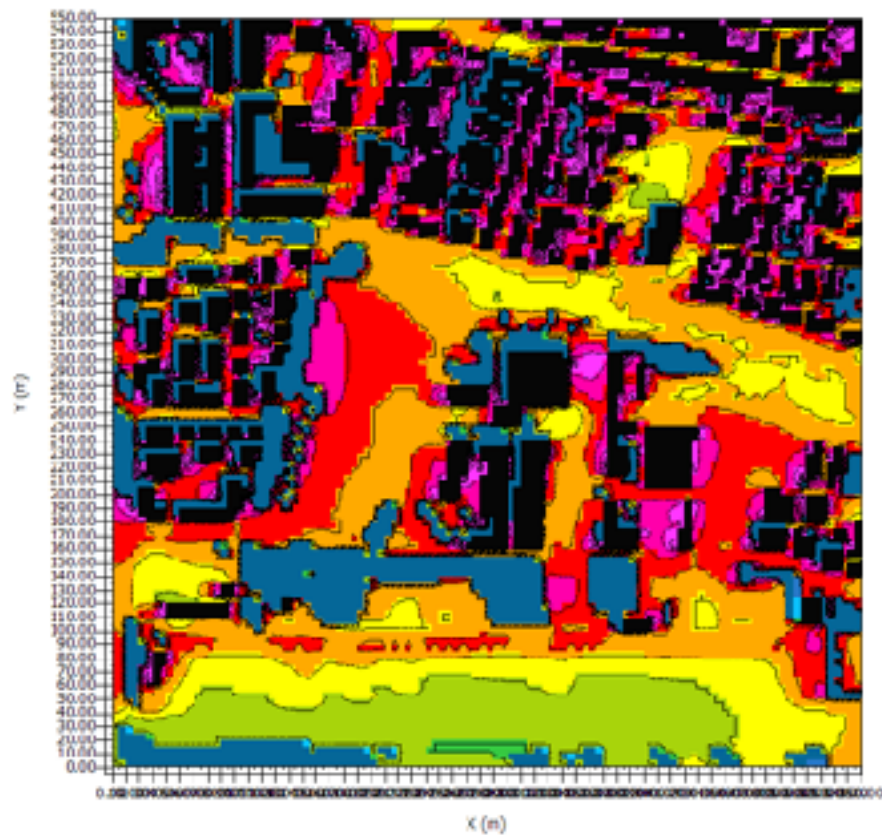


Figure 1: Sim Ferrara
12:00:00 24.06.2017
city: Ferrara (215x400 m)

Improvement of PET from VERY HOT to WARM

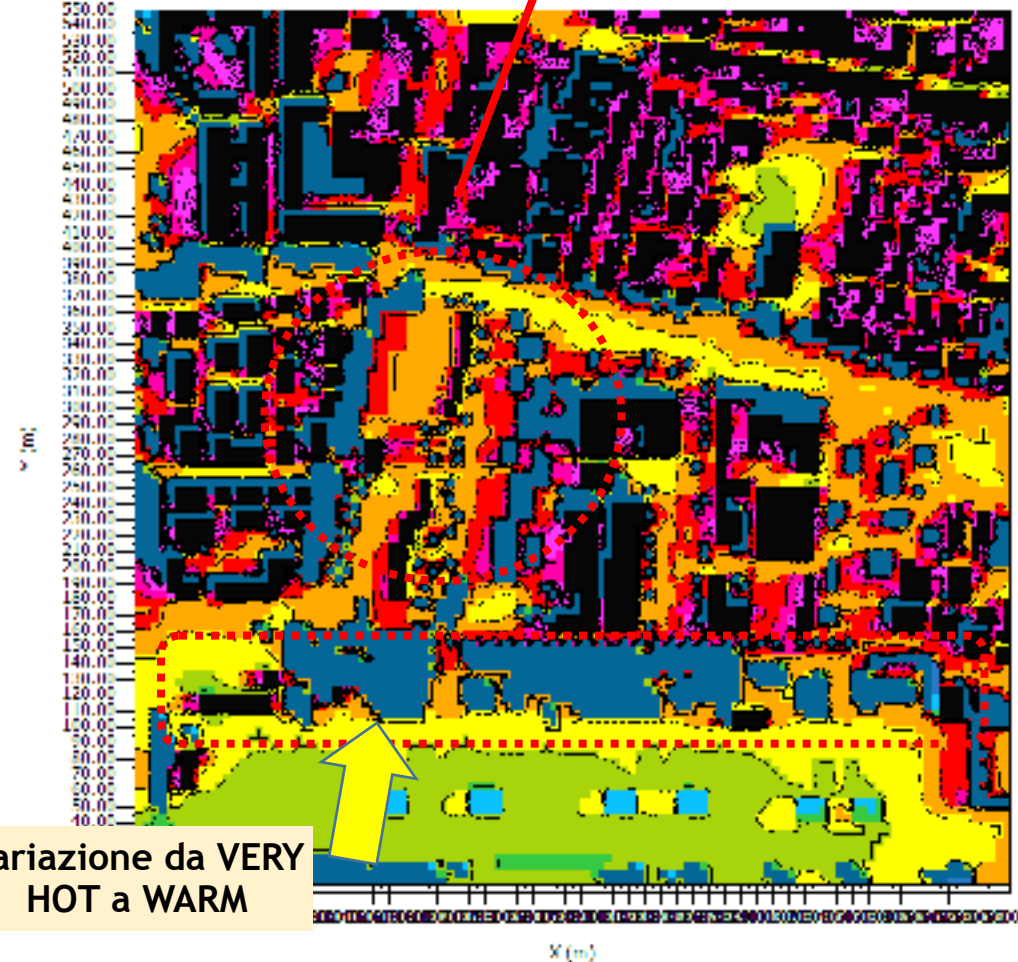
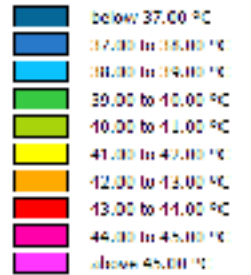


Figure 1: Sim Ferrara: Post
12:00:00 24.06.2017
city: Ferrara (215x400 m)

PET



Min: 31.67 °C
Max: 52.00 °C

PET physiological effective temperature

PMV	PET (°C)	Thermal perception	Grade of physiological stress
-3.5	4	Very cold	Extreme cold stress
-2.5	8	Cold	Strong cold stress
-1.5	13	Cool	Moderate cold stress
-0.5	18	Slightly cool	Slight cold stress
0.5	23	Comfortable	No thermal stress
1.5	29	Slightly warm	Slight heat stress
2.5	35	Warm	Moderate heat stress
3.5	41	Hot	Strong heat stress
		Very hot	Extreme heat stress

Variazione da VERY HOT a WARM

Urban Climate and Risk 

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Rooftop Urban Agriculture

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City Resilience to Climate Change

Georgiadis, Teodoro (et al.)

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