



Nachhaltiges Bauen mit dem Mikroklima: Nature-Based Solutions für den Komfort im Außenraum



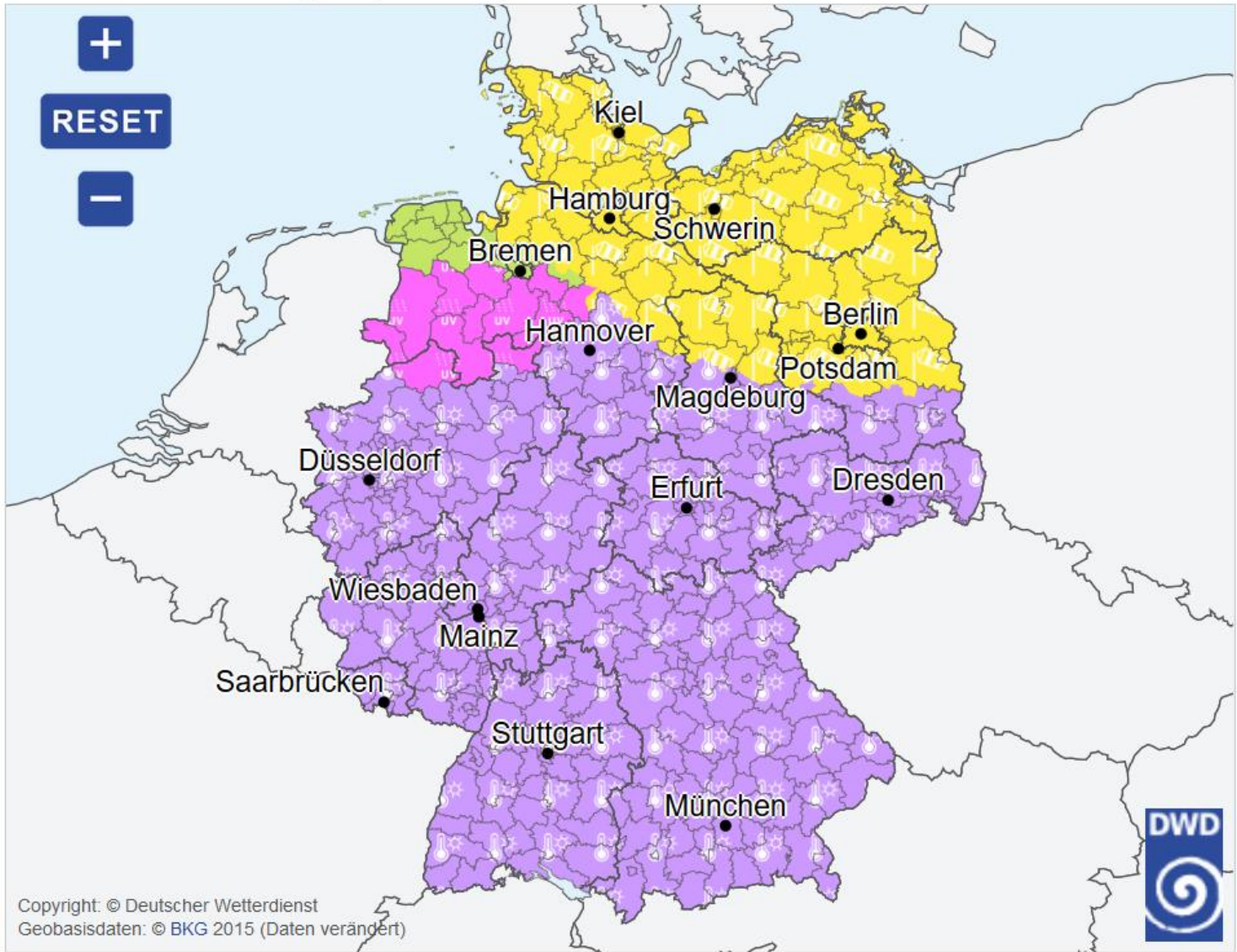
09.06.2021




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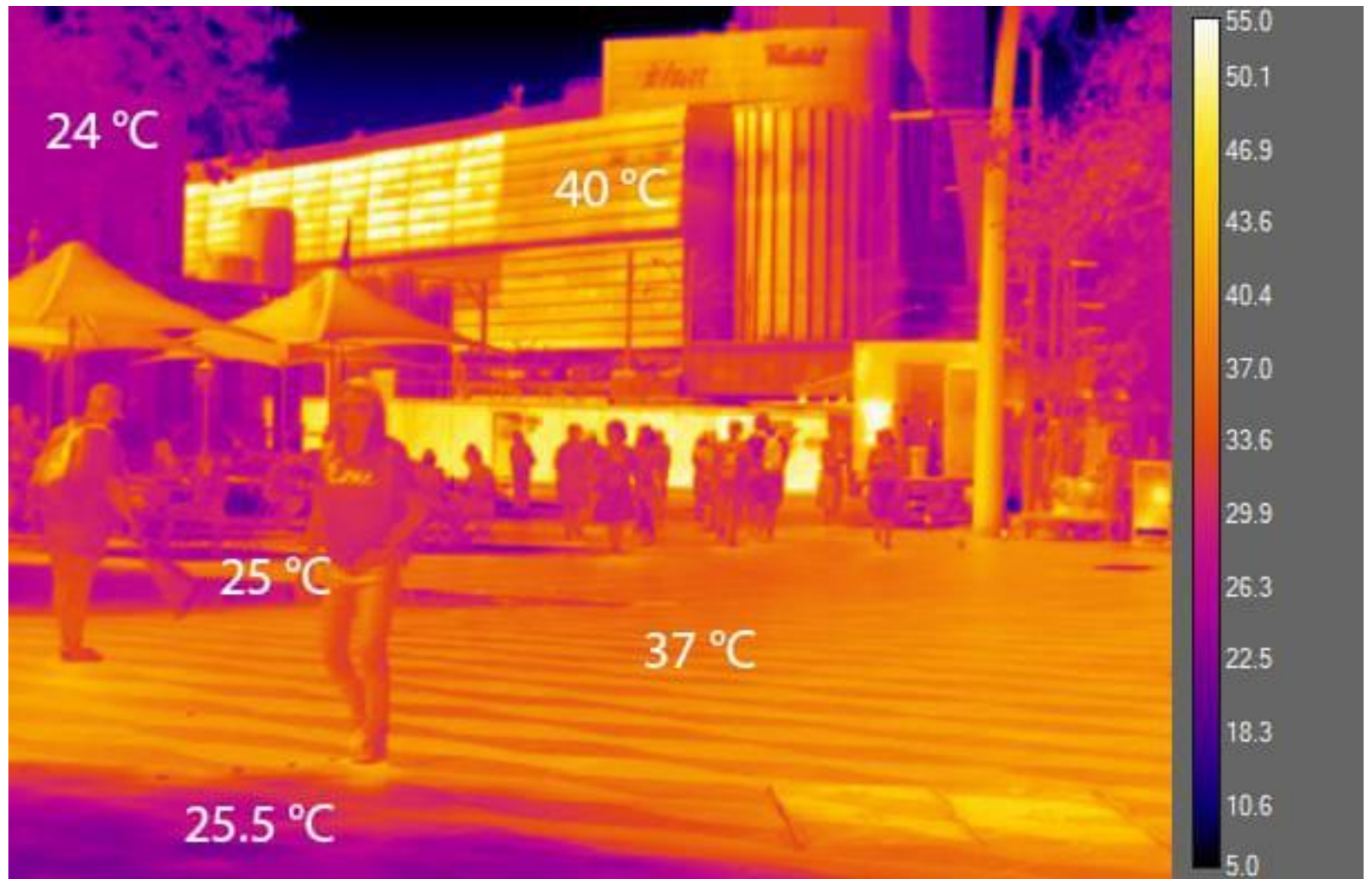




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Adaption

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_MET

DECODING
URBAN
NATURE

Adaptionsmaßnahmen

- Aufhellen von Oberflächen
- Entsiegelung von Flächen
- Erhaltung/ Neuanlage Baumbestand
- Dach- und Fassadenbegrünung
- Beschattung
- Erhaltung der Luftzirkulation
- Vernetzung von Grünflächen
- Anlegen von Wasserflächen
- Kühl- und Lüftungskonzept Gebäude
- ...

Bewertung?

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Shortwave Radiation
(incl. Shading)

Longwave Radiation
(Sky, Environment, Vegetation)

Main Model: Atmosphere (3D)

- Wind
- Temperature
- Humidity
- Turbulence
- Scalars

Heat Flux through Walls and Roofs

Processes at Rooftops and Façades

Vegetation

- Leaf temperature
- Evaporation/Transpiration
- Shading

Walls/Roofs

- Temperature
- Shading

Natural Surface

- Temperature
- Humidity

Indoor Climate

Sealed Surface
- Temperature

Soil

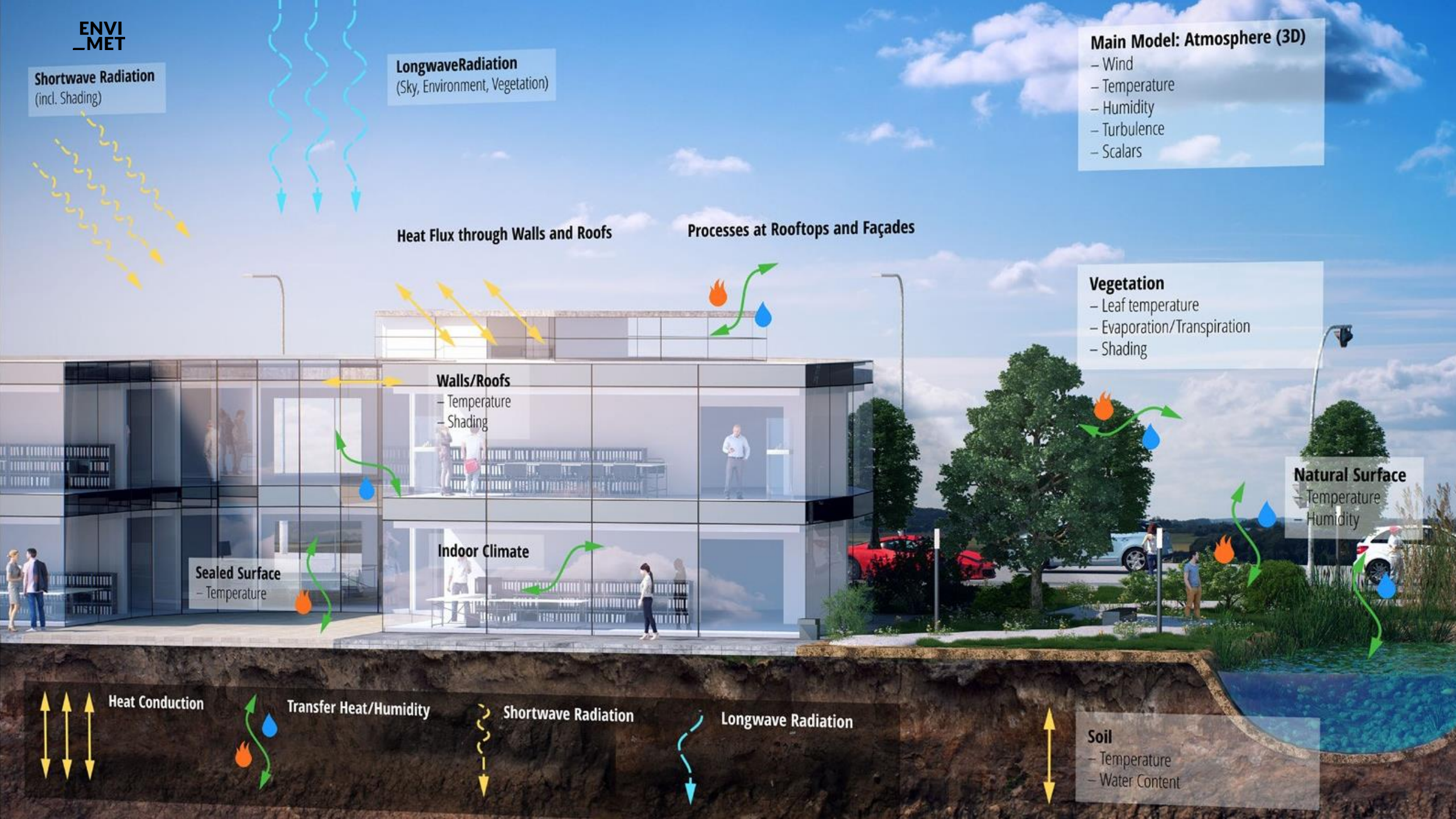
- Temperature
- Water Content

Heat Conduction

Transfer Heat/Humidity

Shortwave Radiation

Longwave Radiation



— Re-Think Athens



2013

Re-Think Athens

Mit OKRA Landscape architects Utrecht, Netherlands

- 1. Platz Wettbewerb der Onassis Foundation 2013
- Gewinner 2018: Reclaiming Streets 2018 (World Architecture)



Visionen für ein neues,
nachhaltiges Athen für die
Bewohner





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VISION OMONIA SQUARE



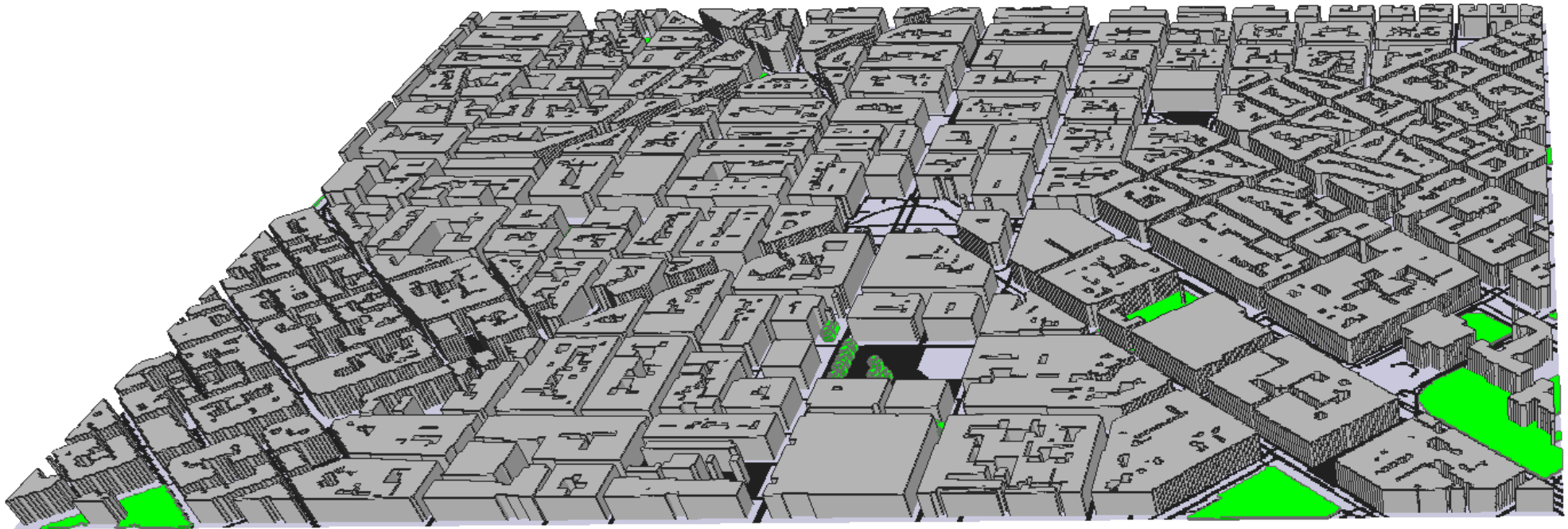
Re-Think Athens

Aufgabe: Optimierung des Re-Designs, Evaluation der Auswirkungen

Bioklimatologische Ziele (müssen erreicht werden)

- Reduktion der maximalen Lufttemperatur um mindestens 1.5 °C
- Reduktion der maximalen Oberflächentemperatur um mindestens 5%
- Verbesserung eines thermischen Komfort-Indexes um mindestens 20% während des Tages
- Reduktion des Klimaanlage-Einsatzes (Kühlstunden über 26 °C) um mindestens 20%

— Simulationen

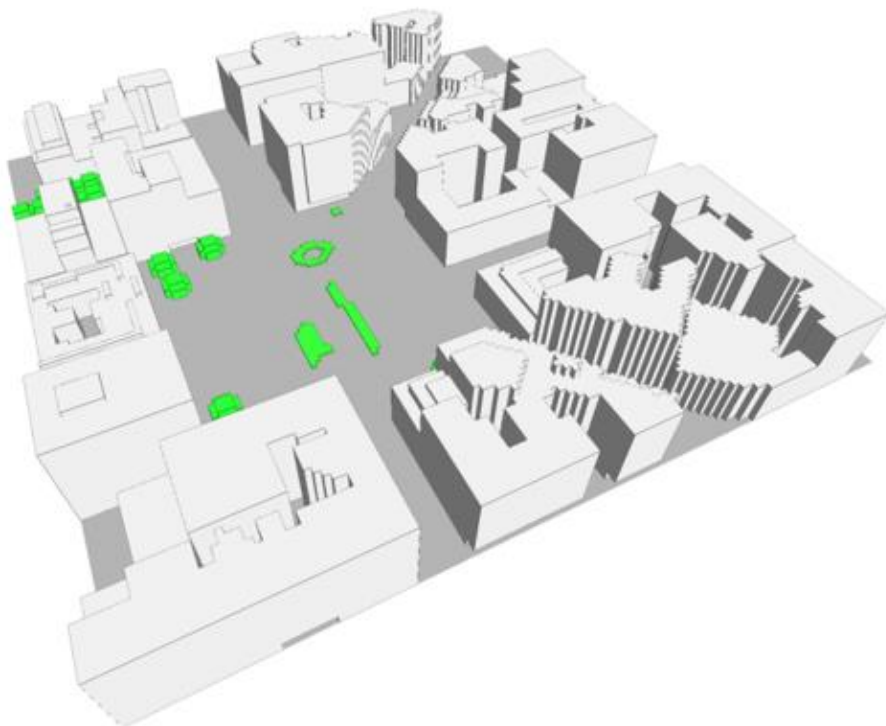


Model Simulationen

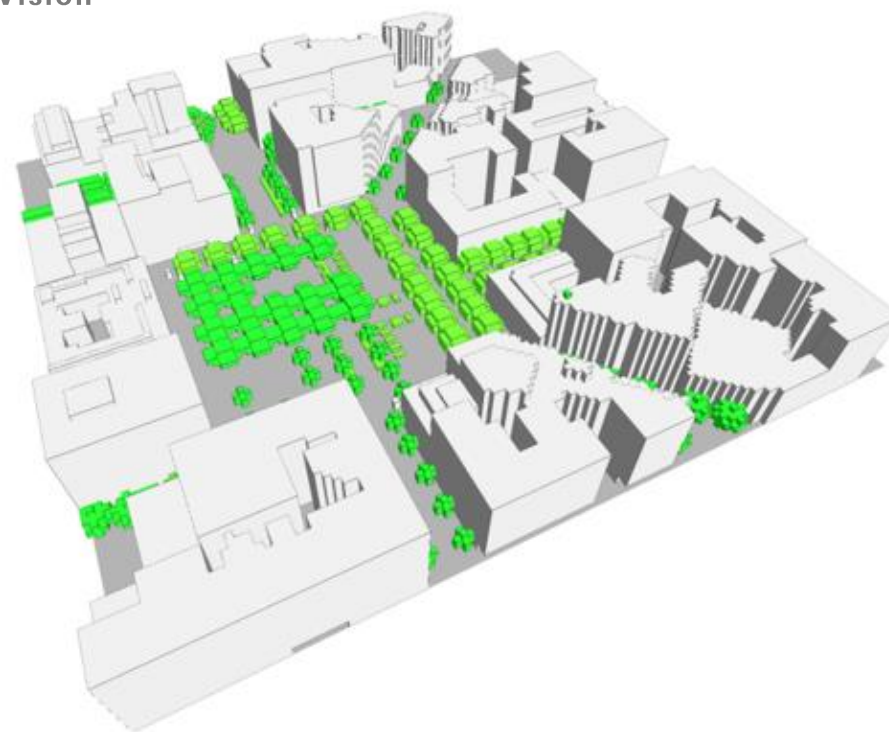
Omonia Square



Heute



Vision



Simulationsergebnisse

Heute | July 31st

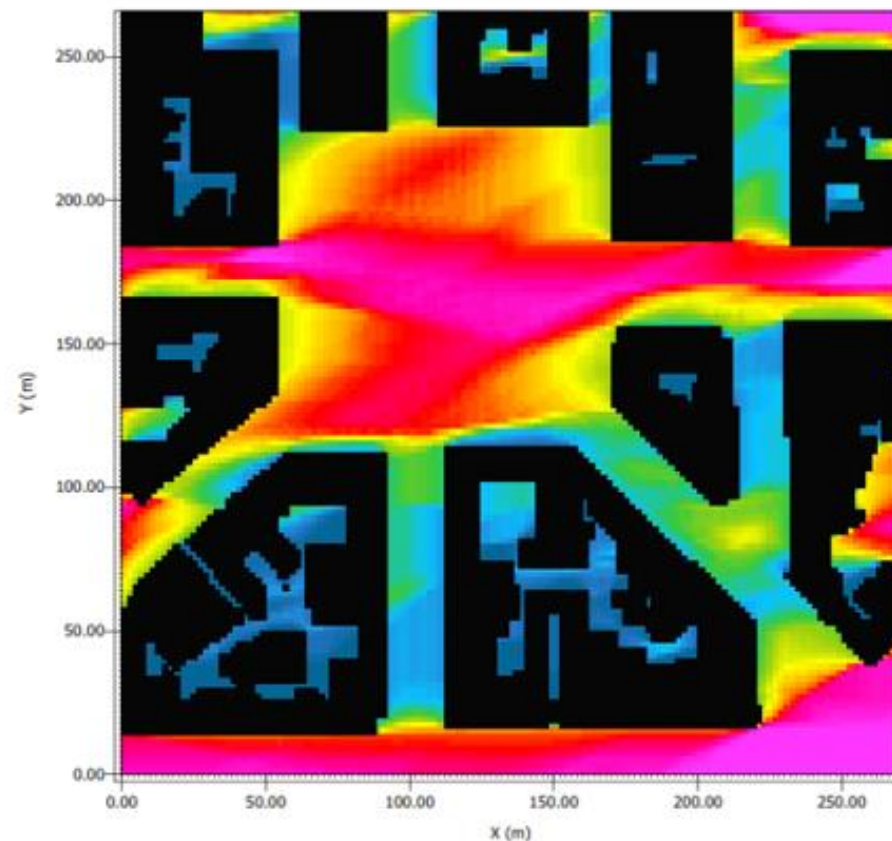
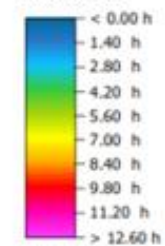


Figure II.7: Simulation
Rethink Athens: Omonia Sq
Today

**Sun hours Terrain level
31.07.2013**



Min: 0.00 h
Max: 14.00 h

Buildings

Buildings



Sonnenstunden

Simulationsergebnisse

Heute | July 31st

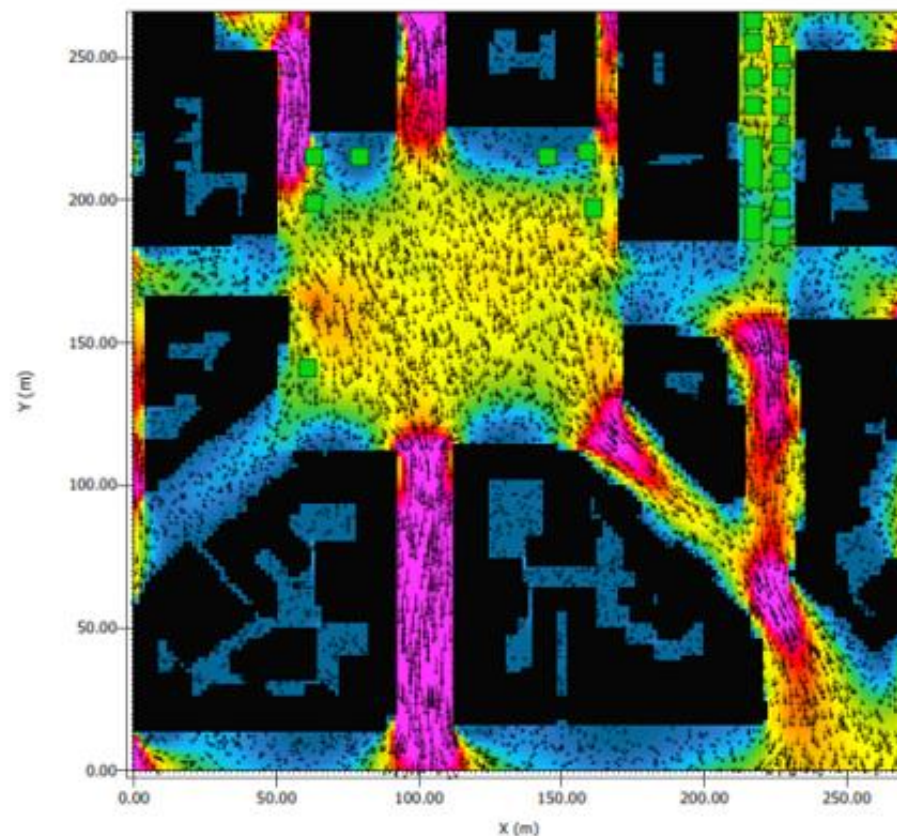
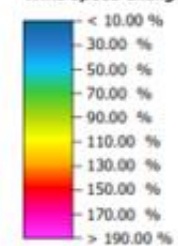


Figure II.9: Simulation
Rethink Athens: Omonia Sq
Today

s/y out at h=4 (z=1.80 m)

Wind Speed Change



Min: 0.00 %
Max: 306.54 %

Wind

- 0.50 m/s
- ← 1.00 m/s
- ← 1.50 m/s
- ← 2.00 m/s
- ← 2.50 m/s



Windfeld (Landwind von N)

Simulationsergebnisse

Heute | July 31st

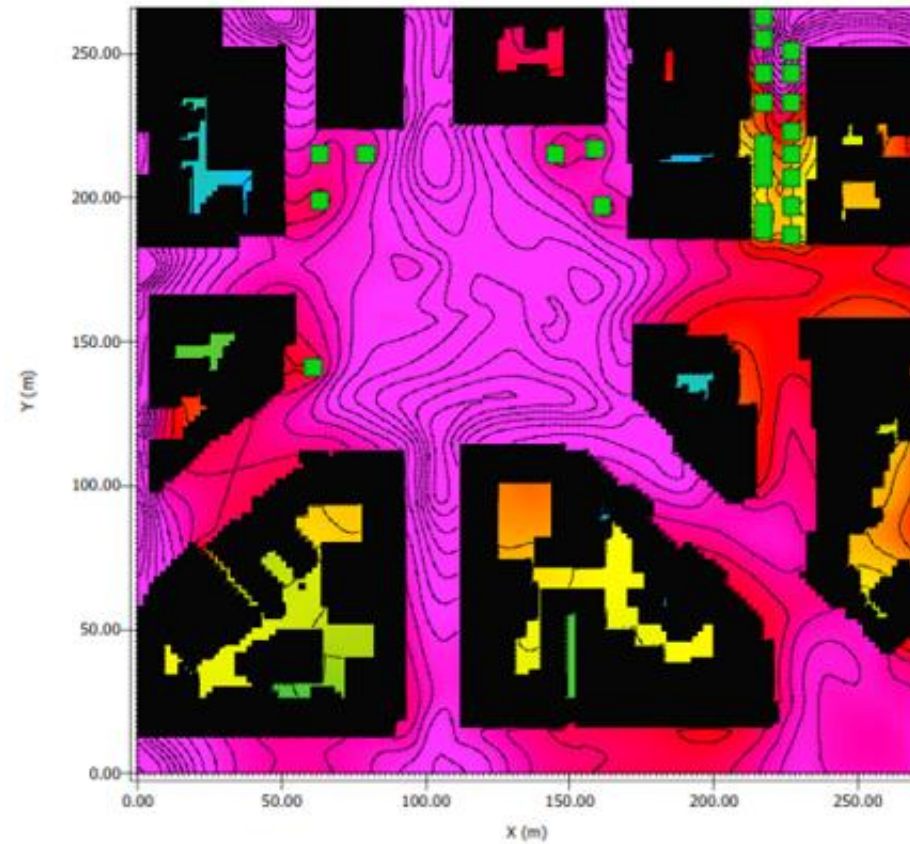
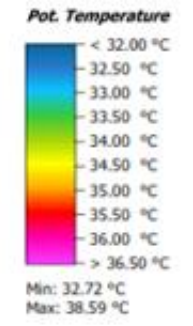


Figure II.11: Simulation
Rethink Athens: Omonia Sq
Today 15:00:01 31.07.2013
xy out at k=4 (z=1.80 m)



Lufttemperatur | 15:00

Simulationsergebnisse

Redesign | July 31st

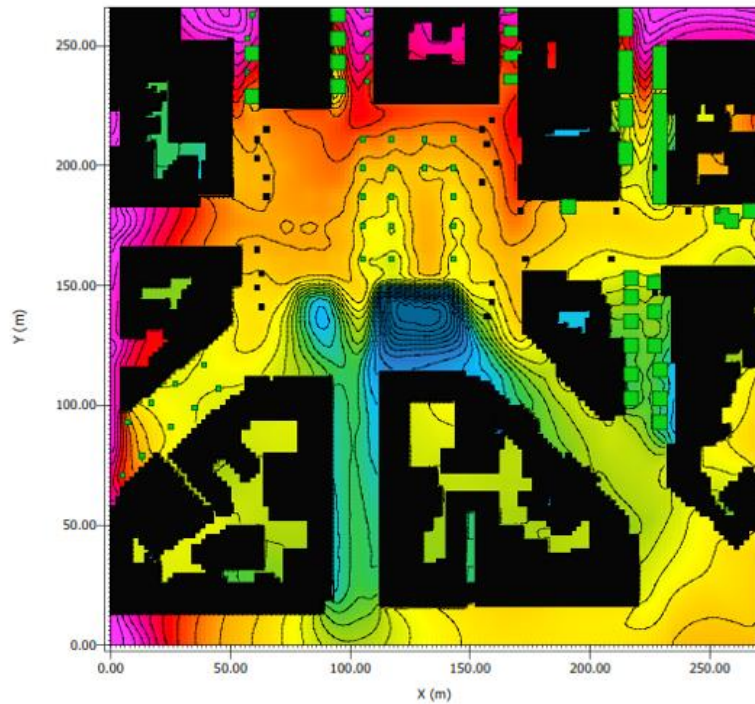
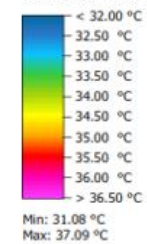


Figure II.12: Simulation Rethink Athens: Omonia Sq Design 15:00:01 31.07.2013
x/y out at kv=4 (z=1.80 m)

Pot. Temperature



Objects

- Buildings
- Vegetation: LAD lower 0.5
- Vegetation: LAD 0.5 - 1.0
- Vegetation: LAD 1.0 - 1.5
- Vegetation: LAD 1.5 - 2.0
- Vegetation: LAD above 2.0



Lufttemperatur | 15:00

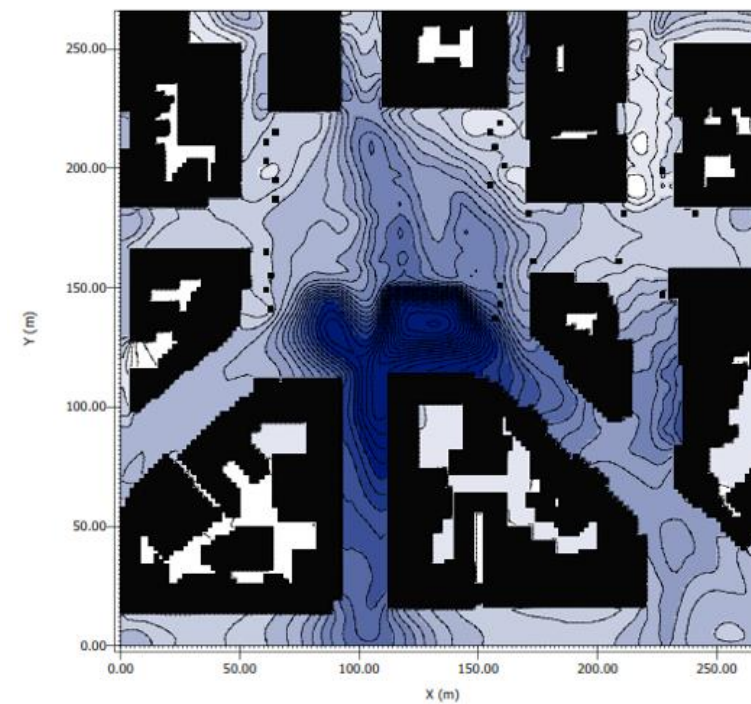
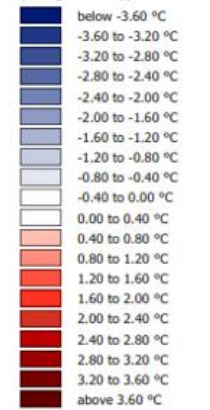


Figure II.13: Simulation Rethink Athens: Omonia Sq Design 15:00 31.07.2013
Average -1.80 K

Change air temperature (Design - Today)



Veränderung Lufttemperatur | 15:00

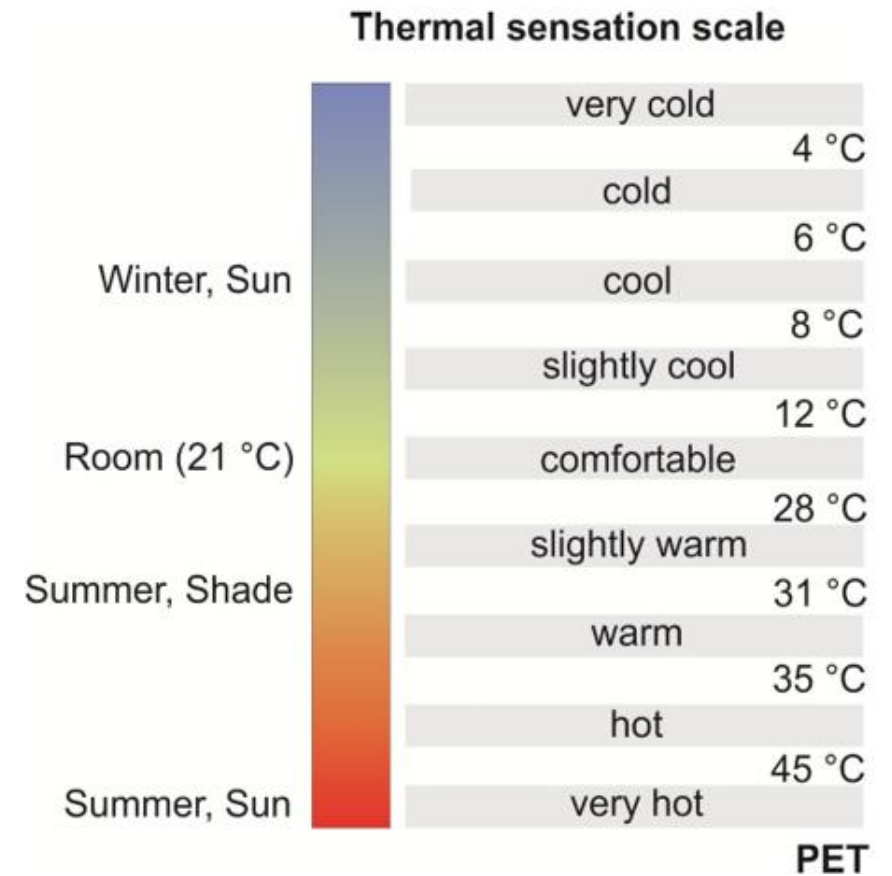
Simulation

Thermischer Komfort

PET – Physiological Equivalent Temperature

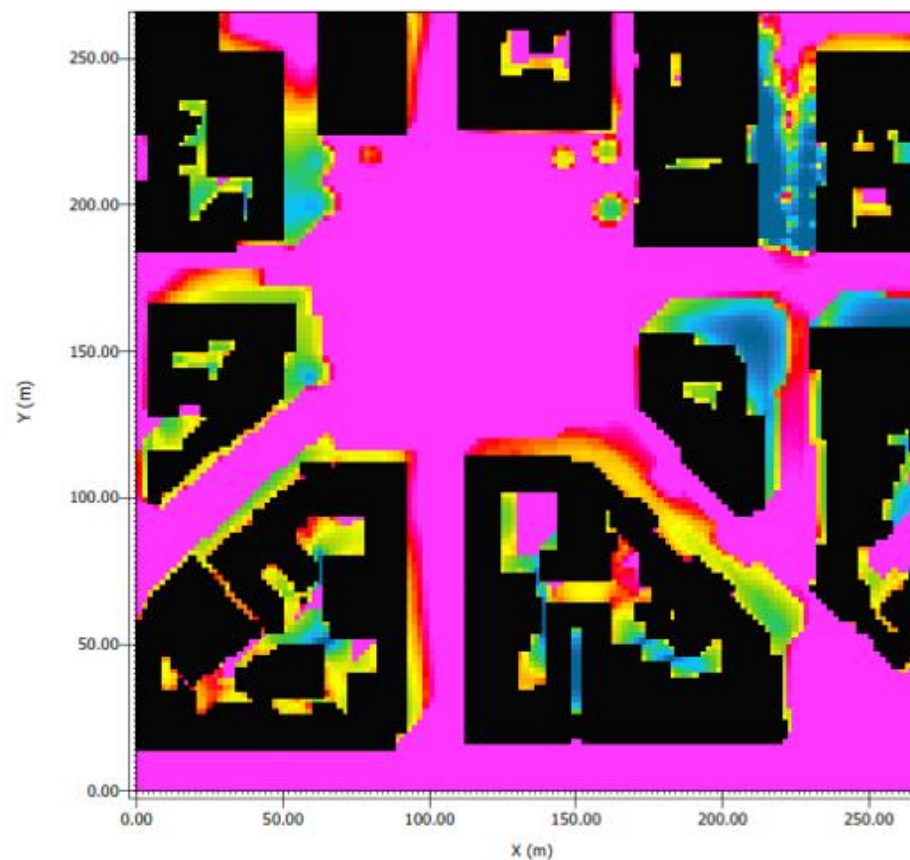
Berücksichtigt

- Wind
- Solarstrahlung und Wärmestrahlung
- Lufttemperatur
- Luftfeuchte



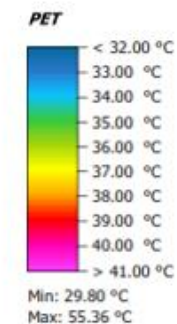
Simulationsergebnisse

Heute | July 31st



Thermischer Komfort PET | 14:00

Figure II.17: Simulation
Rethink Athens: Omonia Sq
Today 14:00:01 31.07.2013
s/y cut at k=4 (z=1.80 m)

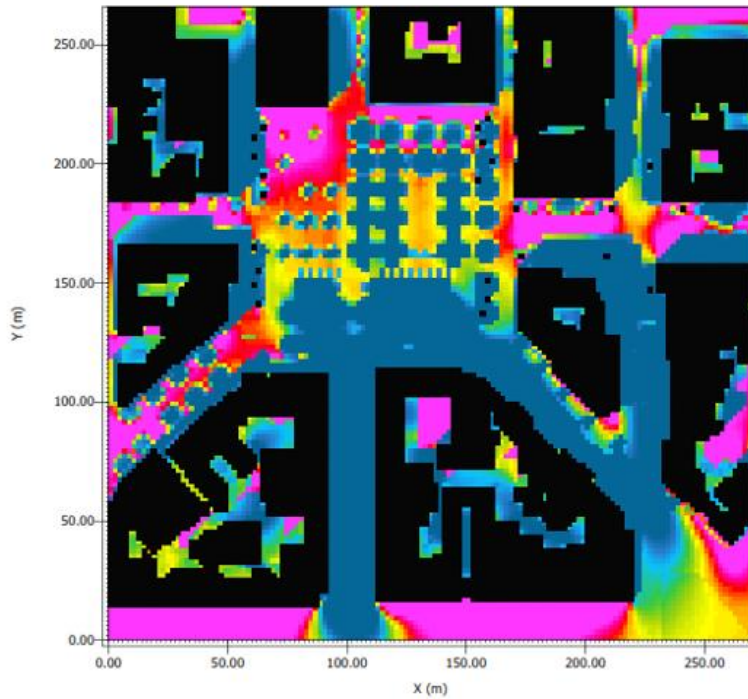


Objects
Buildings



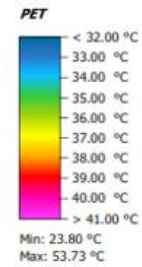
Simulationsergebnisse

Redesign | July 31st

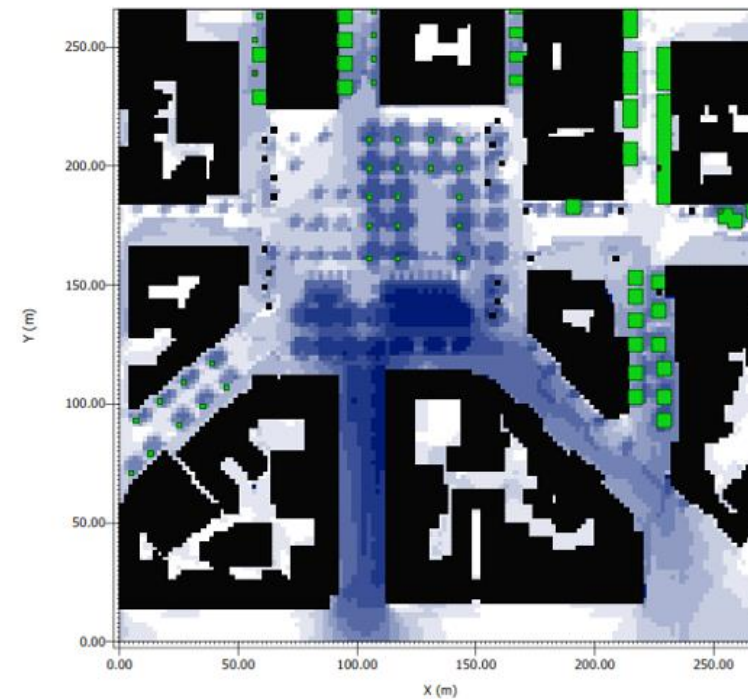


Thermischer Komfort PET | 14:00

Figure II.18: Simulation
Rethink Athens: Omonia Sq
Design 14:00:01 31.07.2013
x/y cut at k=4 (z=1.80 m)

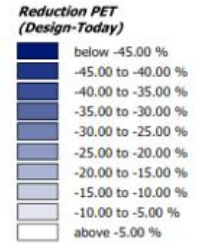


Objects
Buildings



Veränderung Thermischer Komfort PET | 14:00

Figure II.19: Simulation
Rethink Athens: Omonia Sq
Design 14:00 31.07.2013
Reduction PET
x/y cut at k=4 (z=1.80 m)



Evaluation



Re-Think Athens

Evaluation des Re-Designs hinsichtlich der Zielvorgaben in 4 Teilgebieten

Simulationsergebnisse

Bioclimate Criteria	Air Temp	Surface Temp	PET	AC usage
Target	- 1.50 K	- 5%	- 20%	- 20%
Justice Square (Land)	- 2.83 K	- 29%	- 28%	- 39%
Justice Square (Sea)	- 3.00 K	n.a.	- 29%	- 42%
Omonia Square (Land)	- 1.80 K	- 27%	- 21%	- 25%
Omonia Square (Sea)	- 1.94 K	n.a.	- 21%	- 23%
Panepistimiou (Land)	- 1.60 K	- 23%	- 20%	- 24%
Panepistimiou (Sea)	- 1.85 K	n.a.	- 19%	- 23%
Patission (Land)	- 2.11 K	- 25%	- 23%	- 30%
Patission (Sea)	- 2.16 K	n.a.	- 24%	- 28%

Vielen Dank