CZECH TECHNICAL UNIVERSITY IN PRAGUE

Faculty of Transportation Sciences
Department of Transport Telematics

ON THE DEVELOPMENT OF URBAN ADAPTATION STRATEGIES USING ECOSYSTEM-BASED APPROACHES TO ADAPTATION

Working Group: P. Derbek, J. Blümelová, J. Resler, P. Juruš, P. Krč, O. Vlček, N. Benešová, P. Bauerová, D. Srbová, K. Eben, P. Hrubeš

Přemysl Derbek

25. 6. 2015, Prague

Overview

- **UrbanAdapt, the project**
- **Main project objective**
- **Anthropogenic heat, heat island**
- **State of the art**
- **RayMan (model)**
- **Own research (PALM model)**
- **Conclusion**

Introduction

UrbanAdapt, the project

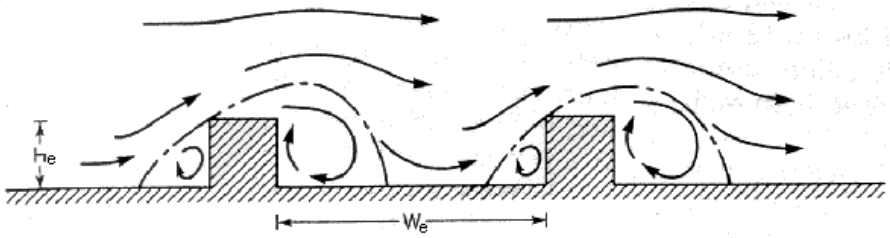
- **Czech Technical University in Prague, Faculty of Transportation Sciences**
- **Academy of Sciences of the Czech Republic, Institute of Computer Science, Prague**
- **Czech Hydrometeorological Institute, Prague**

- **Project supported by Iceland, Liechtenstein and Norway grants**

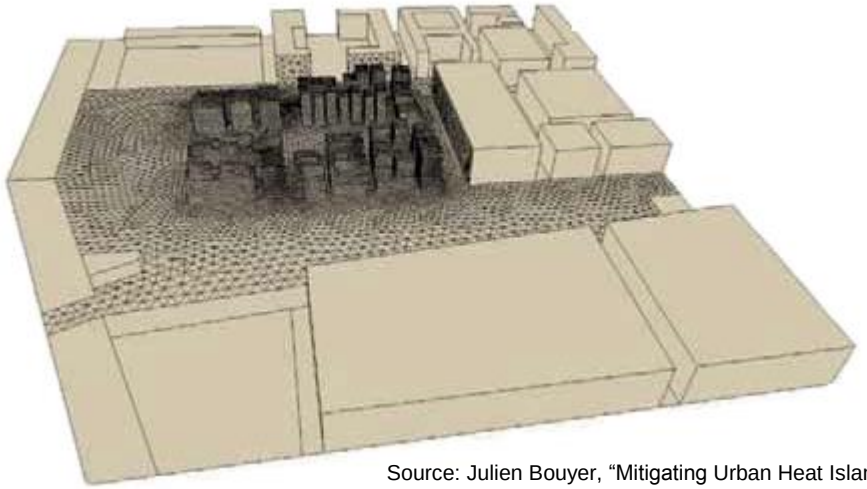
Main project objective

Modelling of adaptation measures and climatic impacts for the city of **Prague**.

- Assessment of energy balance of city
- Interaction of solar radiation
- Atmosphere and urban environment



Source: I.N.Harman, "The energy balance of urban areas"



Source: Julien Bouyer, “Mitigating Urban Heat Island Effect by Urban Design: Forms and Materials”

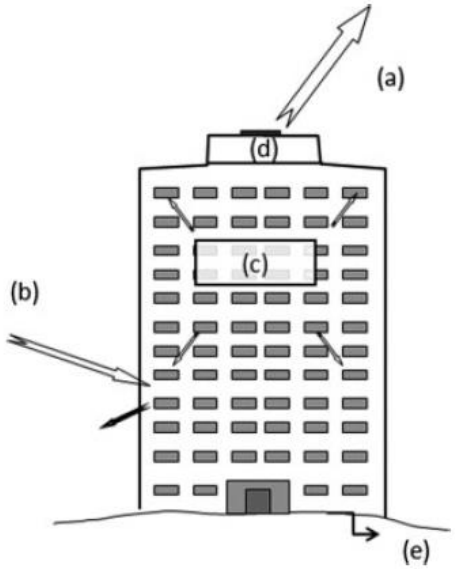
Object of interest

Anthropogenic heat

- Latent
- Sensible

Heat island

- City
- Town



(a) Represents waste heat rejected from a building,
(b) represents the sum of the environmental loads,
(c) represents the internal building loads,
(d) represents the building air-conditioning energy consumption,
(e) any heat stored or exhausted through other means (e.g. waste water).

Fig. source: D. J. Sailor, L. Lu, “A top–down methodology for developing diurnal and seasonal anthropogenic heating profiles for urban areas”

State of the art

David J. Sailor

Main accredited anthropogenic heat sources:

- **Buildings (HVAC + sun cumulated radiation)**
  - **40%**
- **Industry and manufacturing**
  - **30%**
- **Transportation**
  - **30%**
- **Metabolism**
  - **?**

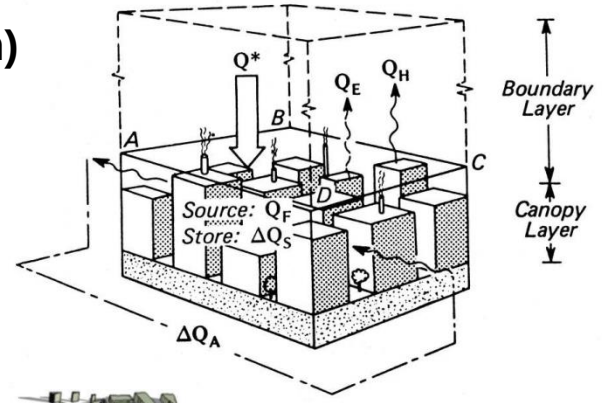


Fig. sources: I.N.Harman, "The energy balance of urban areas" and http://dx.doi.org/10.1155/2013/487695

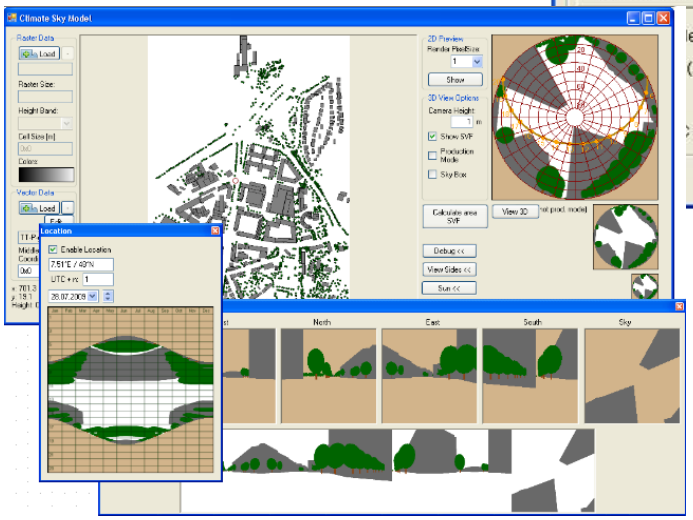
RayMan (the model)

Prof. Dr. Andreas Matzarakis

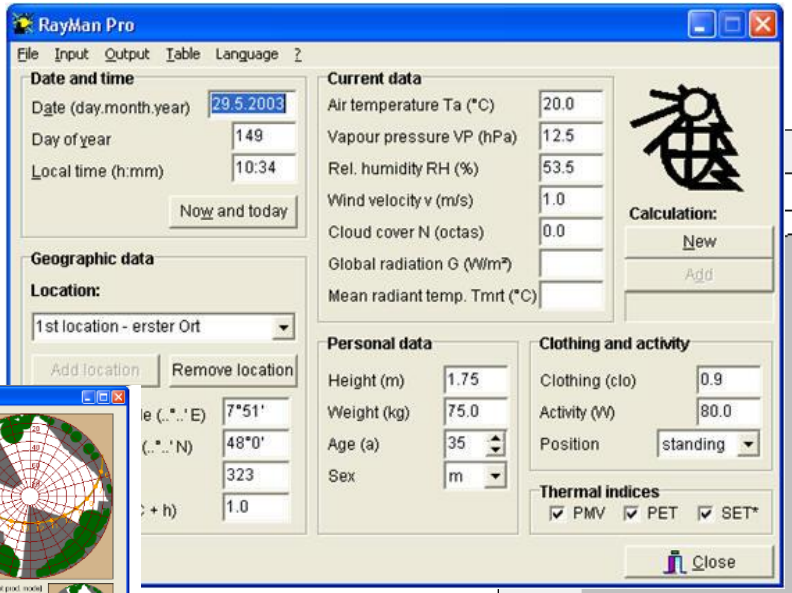
Compare

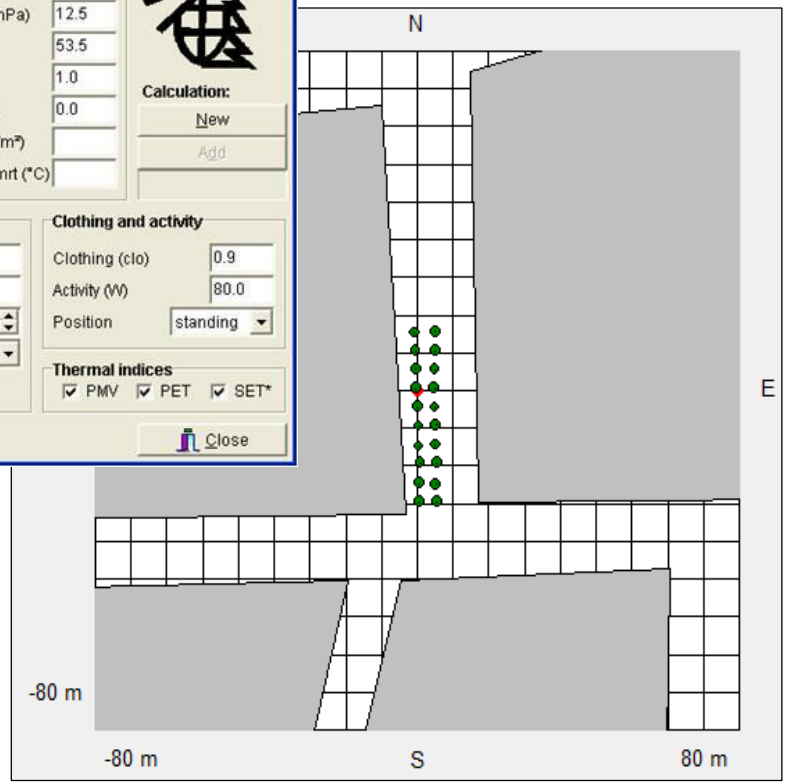
PET

Albedo



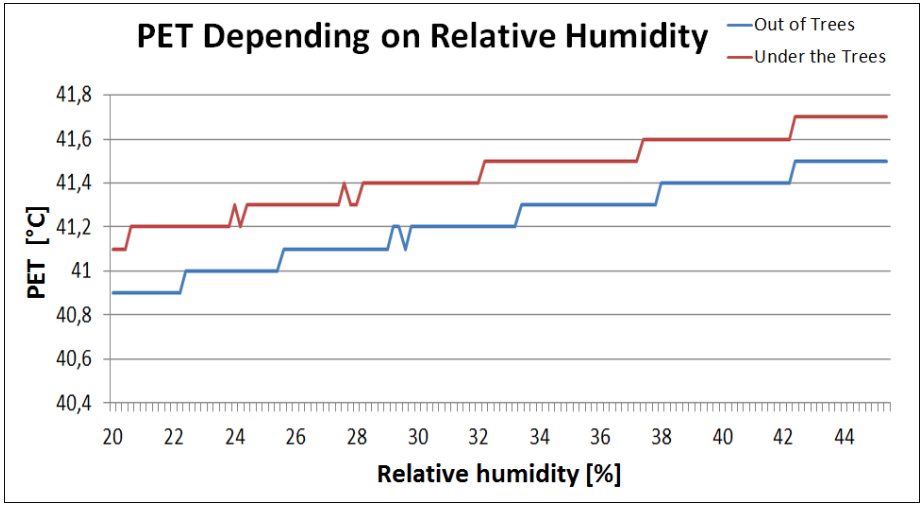
Source: http://www.urbanclimate.net/skyhelios/

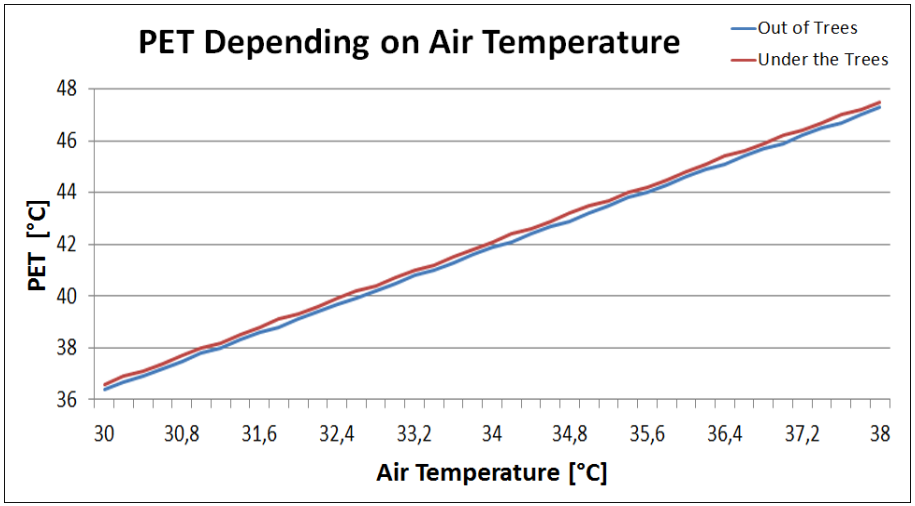




Modelled situation layout in front of Masaryk Railway Station

RayMan, graphical outputs



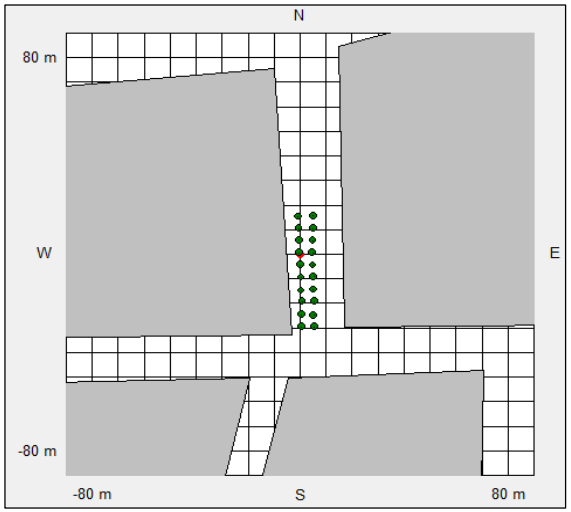


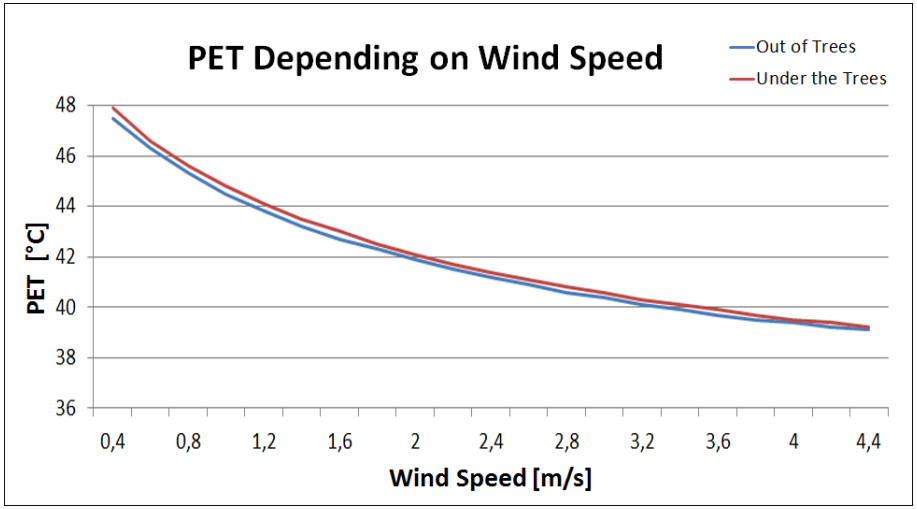
PET

Physiological

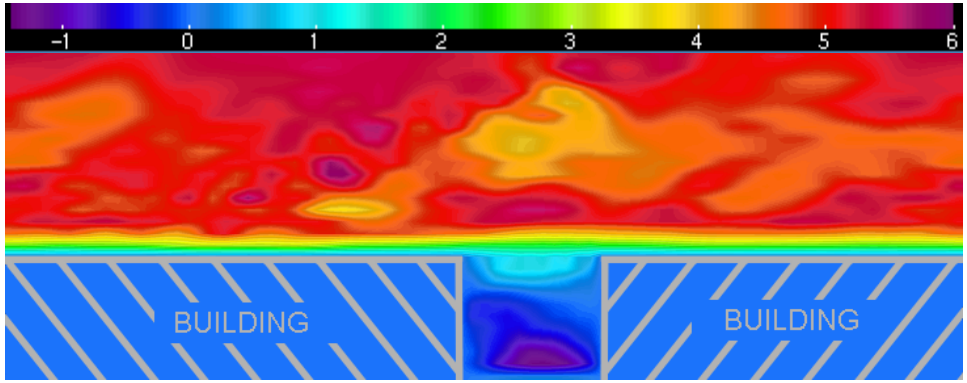
Equivalent

Temperature



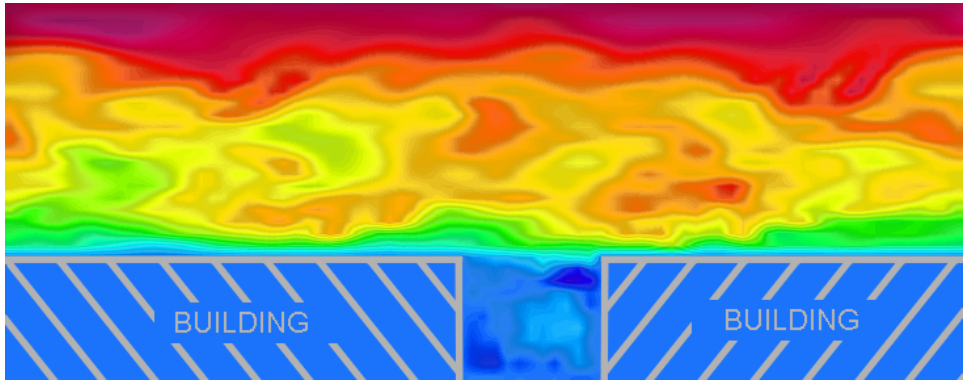


Project current results (PALM model)

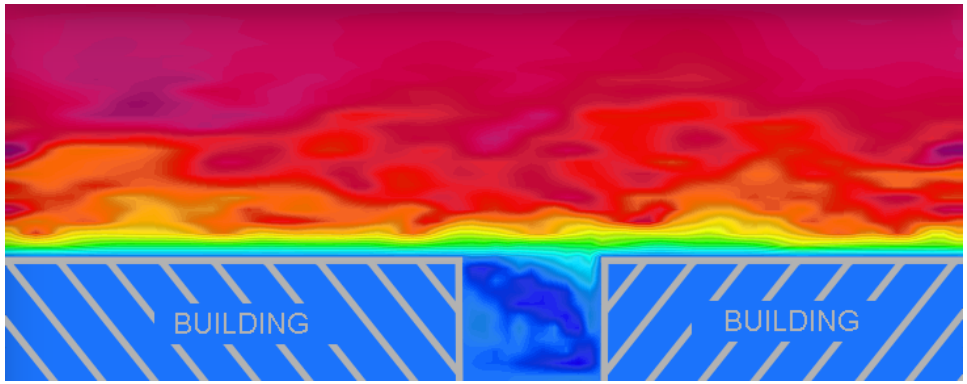


The horizontal (V) component of the air speed [m/s].

Shown is the reference simulation with prescribed heating of the street surface and roofs and no heating of the walls.

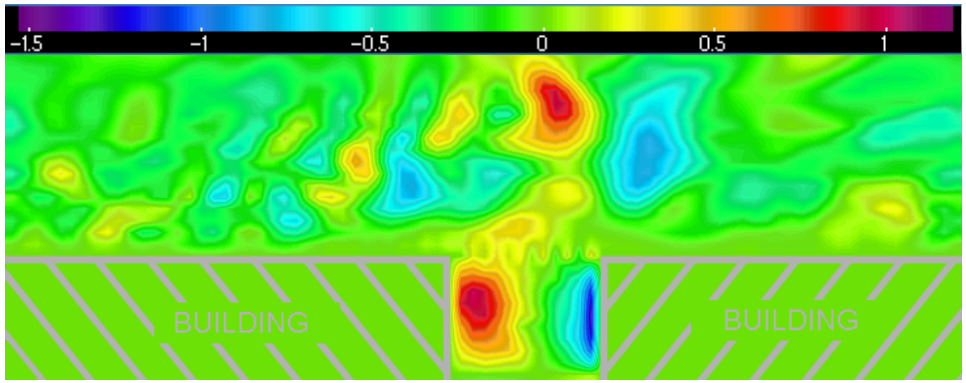


Shown is the situation with heating of the south wall only.

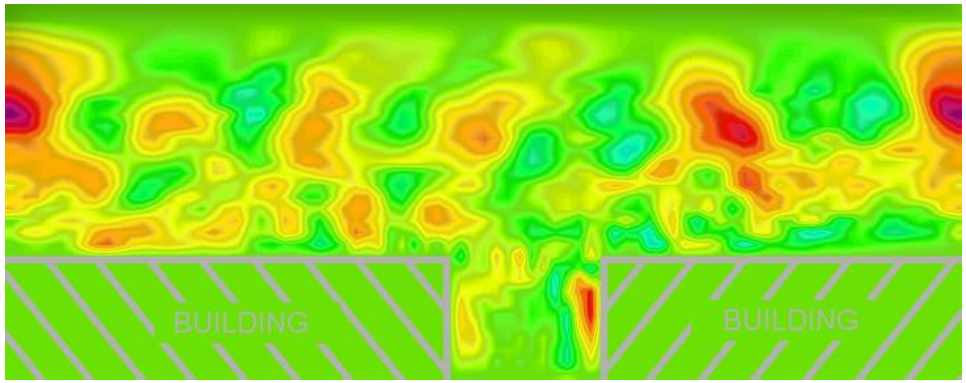


Shown is the same case of heating of the south wall, but with a line of trees added to the center of the street.

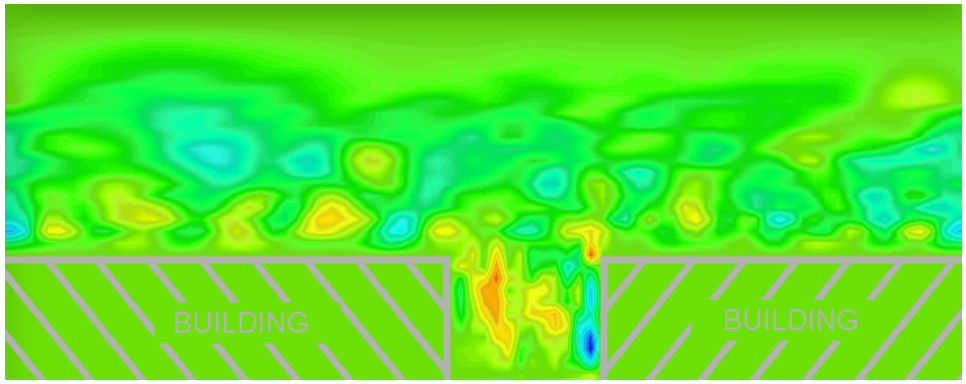
Project current results (PALM model)



The vertical (W) component of the air speed [m/s].



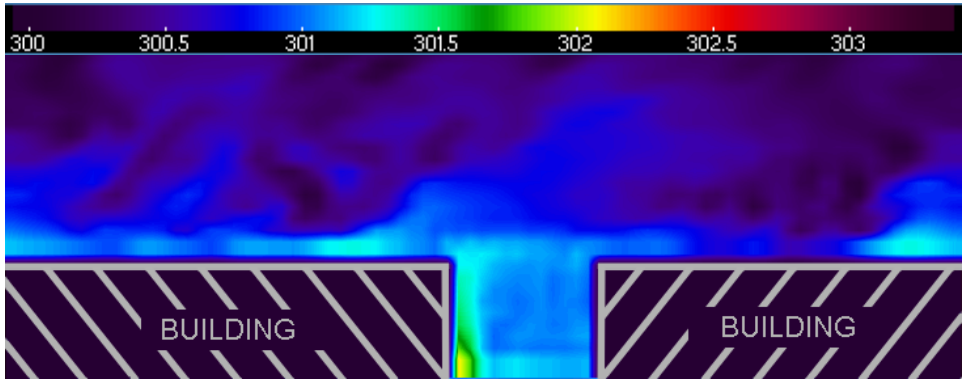
Shown is the reference simulation with prescribed heating of the street surface and roofs and no heating of the walls.



Shown is the situation with heating of the south wall only.

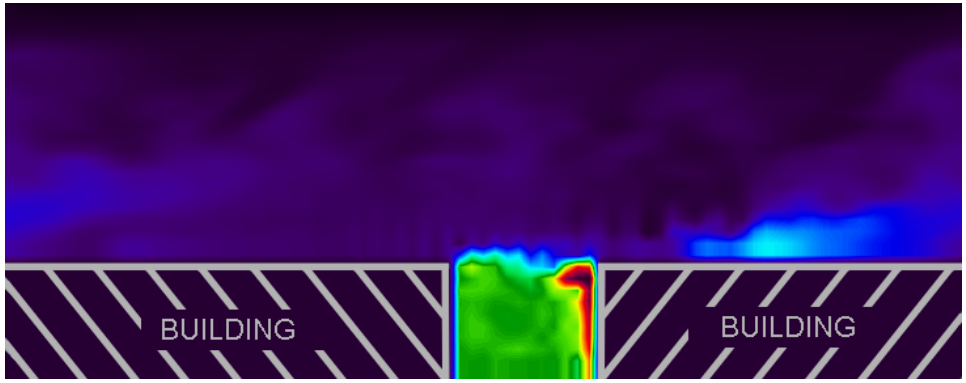
Shown is the same case of heating of the south wall, but with a line of trees added to the center of the street.

Project current results (PALM model)

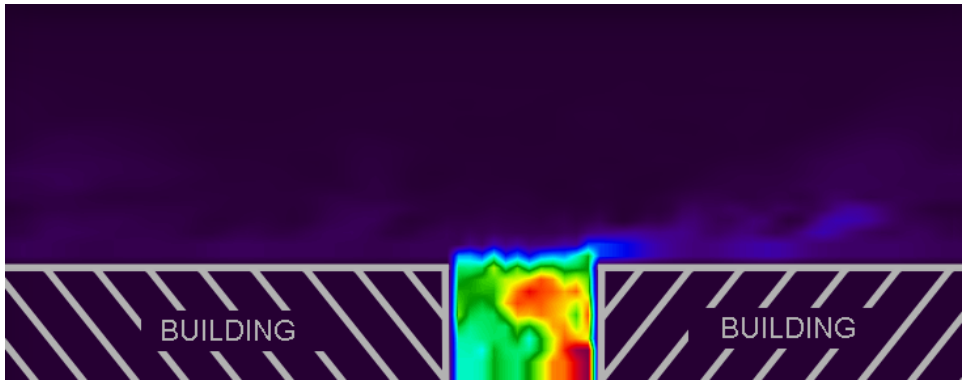


Potential temperature PT [K].

Shown is the reference simulation with prescribed heating of the street surface and roofs and no heating of the walls.



Shown is the situation with heating of the south wall only.



Shown is the same case of heating of the south wall, but with a line of trees added to the center of the street.

Conclusion

Project purpose:

- **to provide necessary decision making tools in climatic conditions,**
- **to start the process of preparation of cities adaptation strategies,**
- **developing adaptation scenarios,**
- **testing the effects and benefits of particular measures.**

THANK YOU

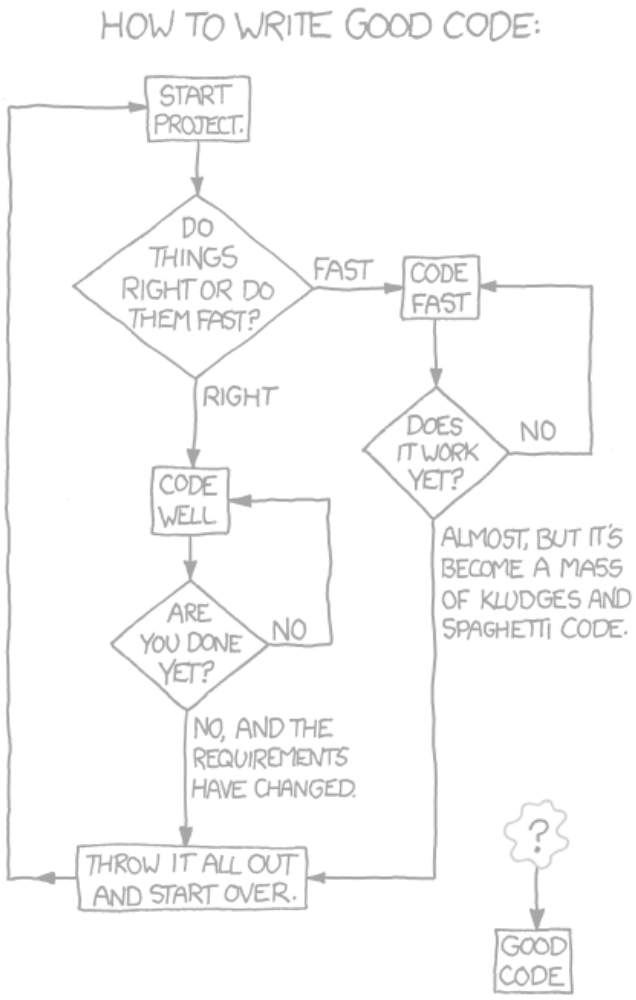


Figure source: google.com