A further analysis of the urban environment in post Olympic Athens

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- **Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER)** orthorectified were used as reference datasets to geometrically correct the time-series of the Landsat images.

- In the geometric correction process, several ground control points were used to achieve a sub-pixel accuracy. Then, the brightness normalization method proposed by Wu (2004) was applied to the Landsat images so as to handle difficulties in quantifying urban composition.

- Urban components may show significant brightness differences, but they share the same characteristics. The normalization method highlights the shape information while minimizing the effects of absolute reflectance values.

- **Despite the significant spectral variations in different land cover types (e.g. dark and bright soil), the same spectral shape of the reflectance behaviour is observed.**

- **Hence, spectral normalization aims at reducing the spectral variations between pure land use types in order to eliminate the brightness differences between similar land cover types.**

- **The geometrically corrected images were used for the shoreline extraction, which was performed for each image separately to avoid any possible mapping errors. Next, polygon masks were created so as to separate land surface from water bodies.**

- **A suite of machine-learning algorithms were applied to extract urban features from the Landsat images by using the Feature Analyst tool.**

- **The feature extraction procedure was broken down into the following steps:**

a) training sets were created (decisions were made regarding the number of classes based on the "density" of each urban class and about the training sets of each image and why);

b) the training sets were combined;

c) the feature extraction algorithm was parameterized and run;

d) the resulted classes were split out by removing background pixels and keeping only the pixels corresponding to impervious surfaces;

e) clutter was removed from each class separately;

f) results were combined to a vector format;

g) clutter was removed from the final vector considering the results of the preceding year.

- The next step of the procedure was the production of thematic maps. These maps were raster image data of the study area, having a 30-m spatial resolution.

- Each pixel was assigned to one of the following classes: background, water body, non-urban, urban.

- To validate the classification results, the produced thematic maps were compared with satellite data of higher spatial resolution from the ASTER and Ikonos sensors acquired in 2001, 2004 and 2007 over the study area.

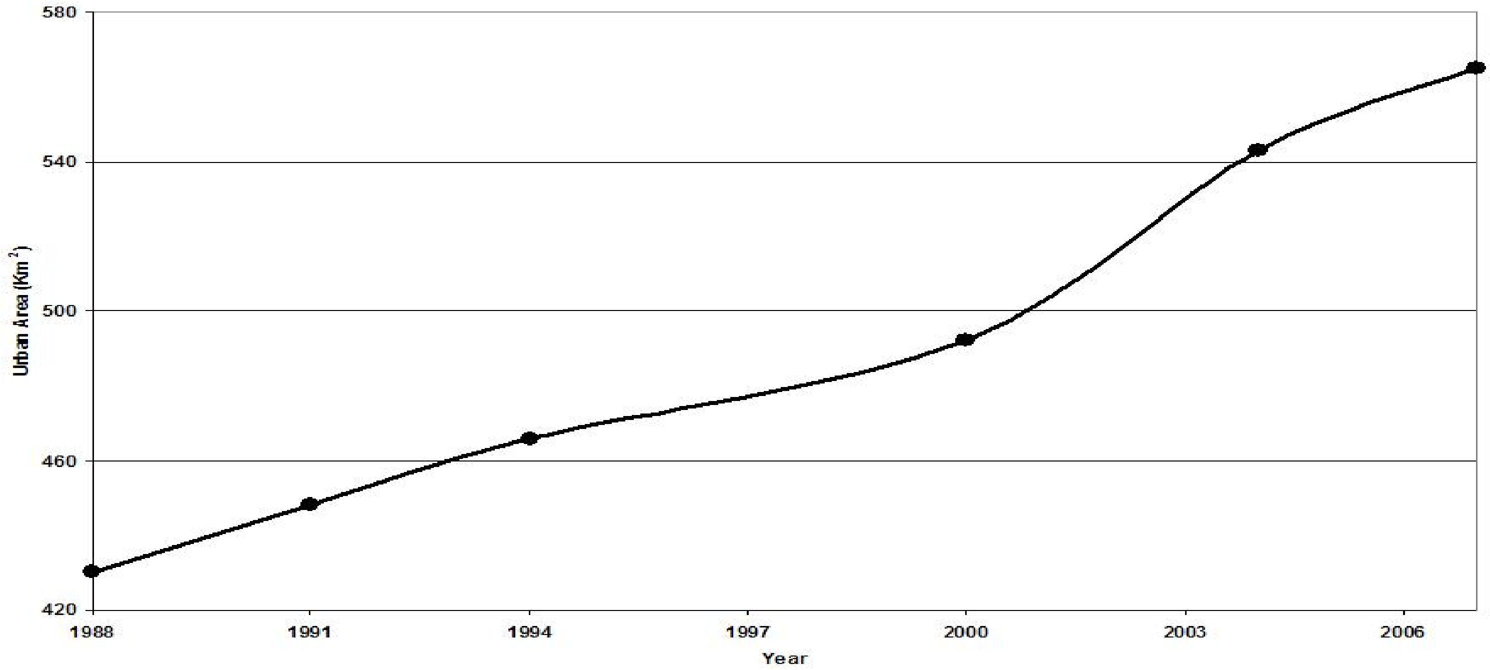
- The discrimination between urban and non-urban features in these images was performed based on photointerpretation. A number of 200 reference pixels were chosen randomly in each thematic map to estimate the mean accuracy of a class

- The validation process resulted to an overall classification accuracy of 94.77%, 93.33% and 95.86% for the years 2007, 2004 and 2001, respectively.

- The k-coefficient was also calculated for the three years considered. In general, the k-coefficient expresses the proportionate reduction in error produced by a classification process compared with the error emerged from a completely random classification.

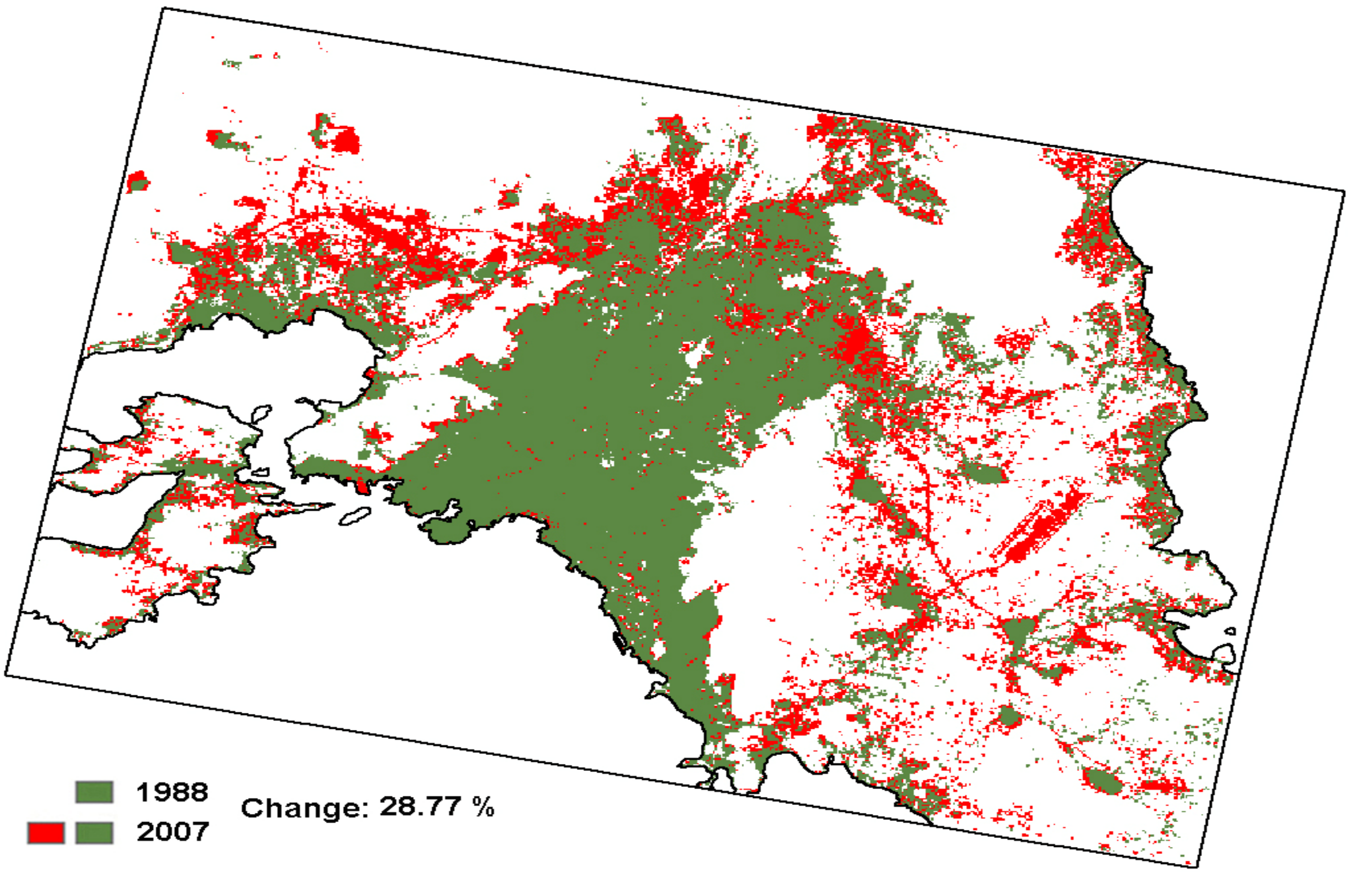
- The k-coefficient values were found to be 0.8948, 0.8642 and 0.9166, for 2007, 2004 and 2001, respectively.

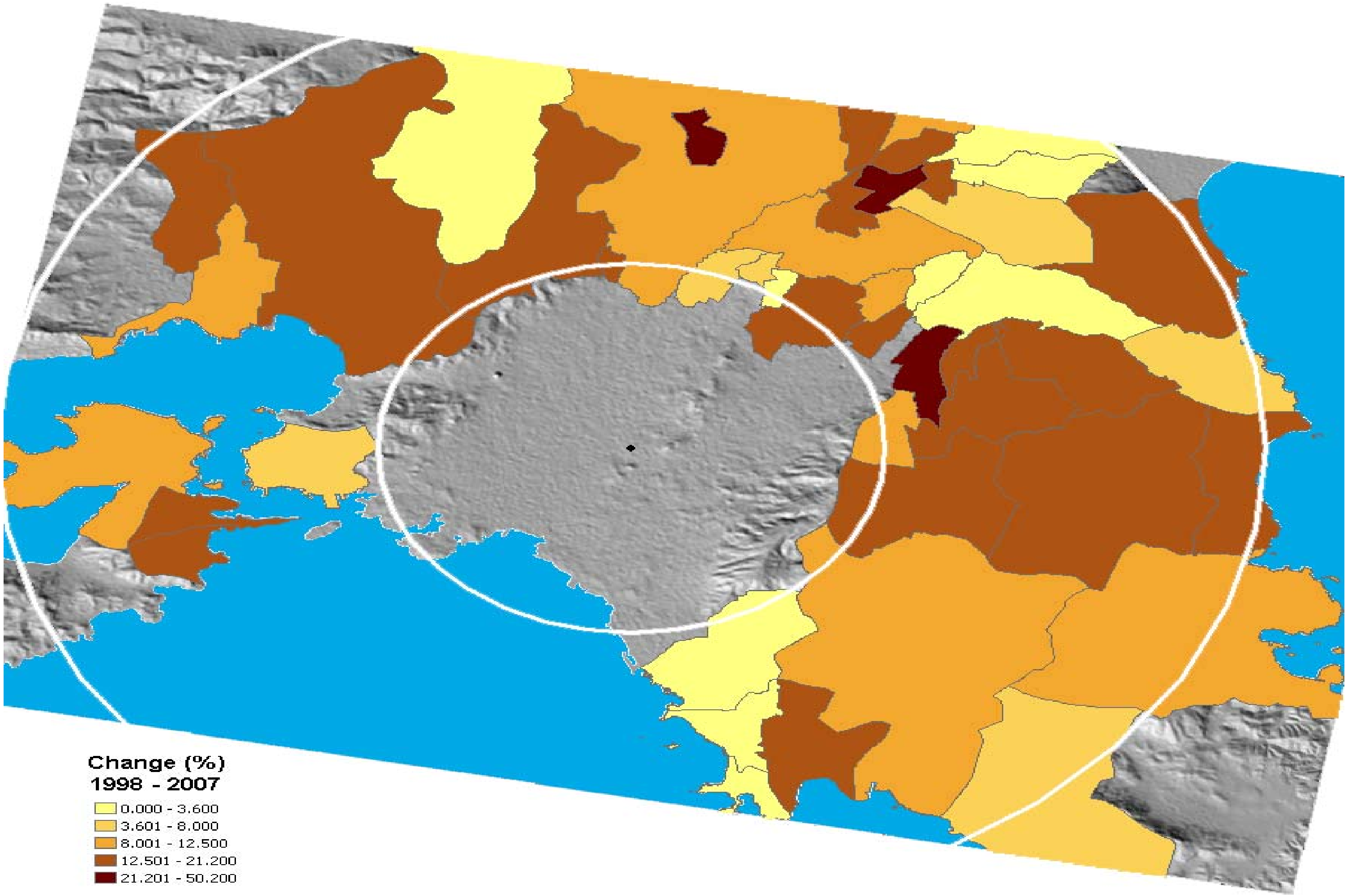
- Apart from the overall classification accuracy, the accuracy of each class was also computed. For the urban class, the accuracies achieved were 91.46% (2007), 86.67% (2004) and 94.03% (2001), whereas for the non-urban class, accuracies of 97.78% (2007), 98.89% (2004) and 97.44% (2001) were computed



It yields that there is an increase of 4.19 % between 1988 and 1991, 4.02% between 1991 and 1994, 5.58% between 1994 and 2000, 10.37% between 2000 and 2004 and 4.05% between 2004 and 2007.

- The urban areas growth of 5.58% that was computed for the period 1994 and 2000 can be considered reasonable.
- Development projects such as the national airport was completed within this period and can justify an approximately 2.18% of the overall change in urban areas observed between these years.
- ***The increase of 10.37% between 2000 and 2004 although high, it can be considered realistic for this period. This is because of the numerous public works and development projects that took place in Athens during this period in the frame of the city preparation for the 2004 Olympic Games.***


1988
2007
Change: 28.77 %


Change (%)
1998 - 2007
0.000 - 3.600
3.601 - 8.000
8.001 - 12.500
12.501 - 21.200
21.201 - 50.200

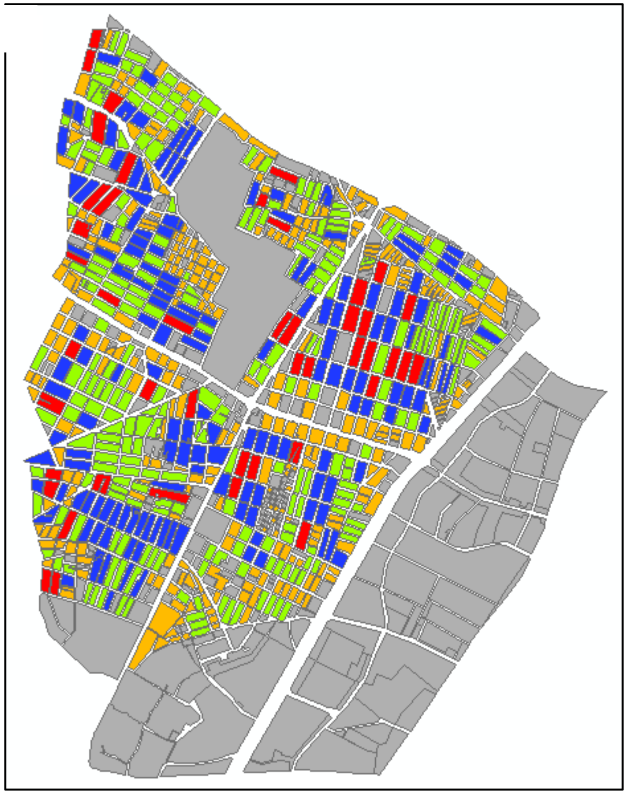
Urban environment at the micro level

- **Industrialized area lacking an organized urban planning into practice.**
- **Intense environmental problems because of the existence of the industrial region and two roads that cross the city.**
- **Residential zone area with land uses incompatible with residence.**
- **Locally degraded residential areas.**
- **Commercial centre that serves also neighbouring municipalities leading to traffic congestion.**
- **Small communal spaces with large dispersion.**
- **High levels of unemployment rate.**
- **Deficit of social infrastructure and open spaces.**

Urban planning scenarios for Eleonas

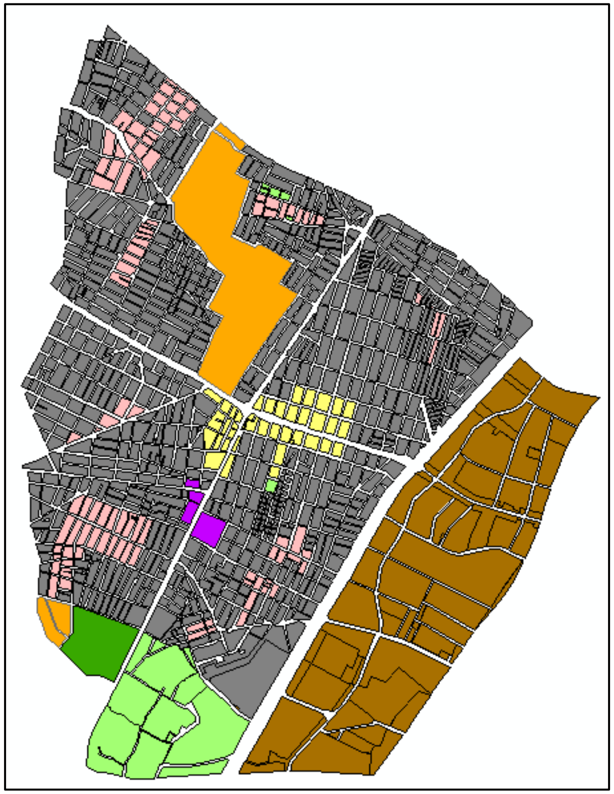
- Baseline scenario
  - current land use of Eleonas: brownfield/industrial
- Planning alternative 1
  - use of cool materials in the urbanized area
- Planning alternative 2
  - Change of Eleonas land use: brownfield/industrial to urban area
  - New building blocks were generated and considered
  - New roadnet was produced and considered
- Planning alternative 3
  - Change of Eleonas land use: brownfield/industrial to green area
  - 100% coverage of the Eleonas area (111ha) by green vegetation & open spaces

Baseline scenario – brownfield/industrial



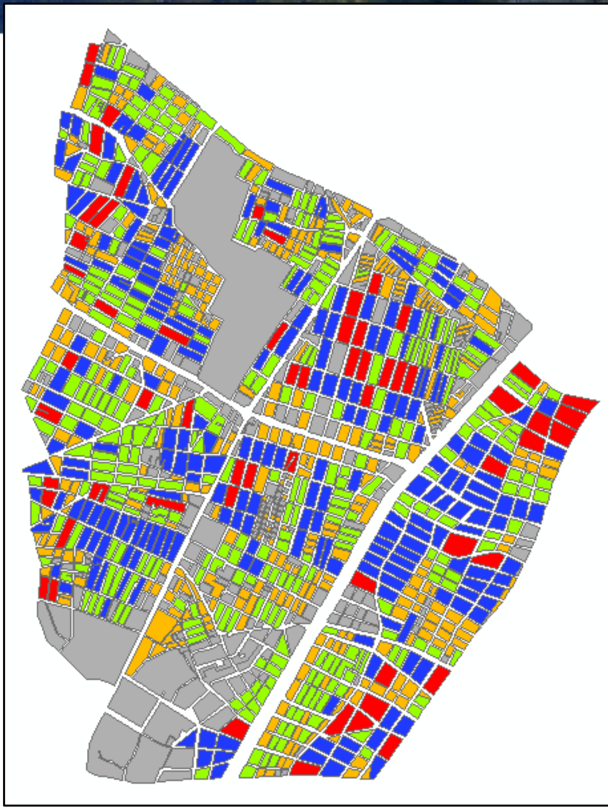
building block population
HOUSES
0 - 13
14 - 33
34 - 53
54 - 78
79 - 154

roadnet



LANDUSE_1
Biotechnological park
Brownfield/industrial area
Education units
Municipality central district
Neighbourhood central district
Residential zone
Sports units
Urban vegetation - Open spaces

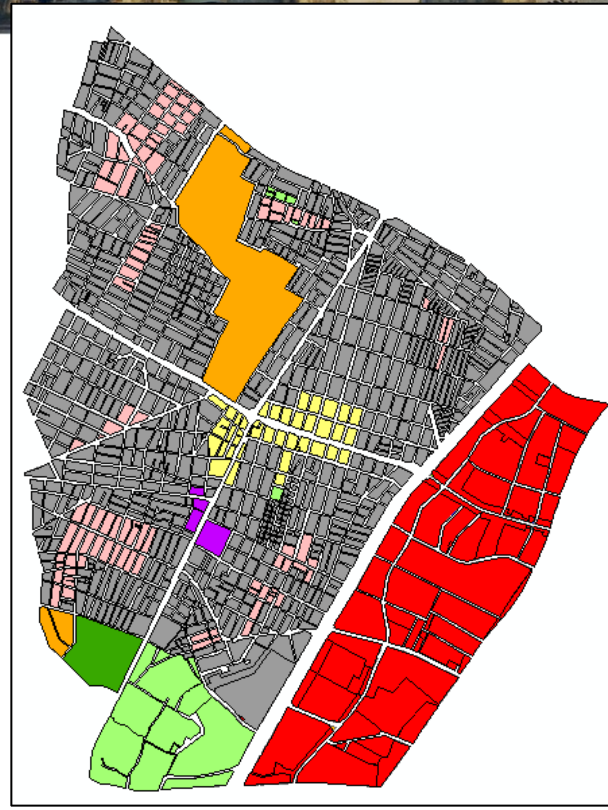
Planning Alternative 2 – urban



building_block_eleonas

HOUSES

- 0 - 14
- 15 - 32
- 33 - 52
- 53 - 79
- 80 - 154

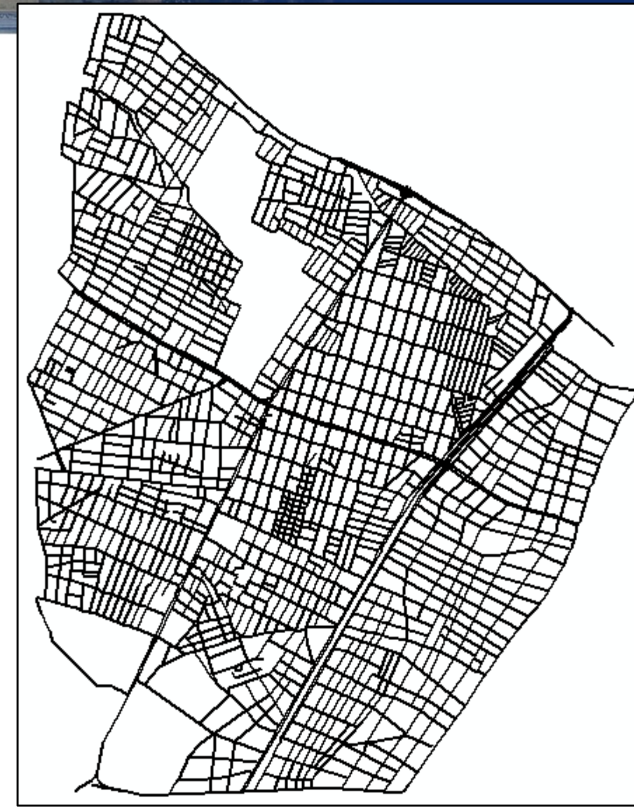


landuse_eleonas_urban

- <all other values>

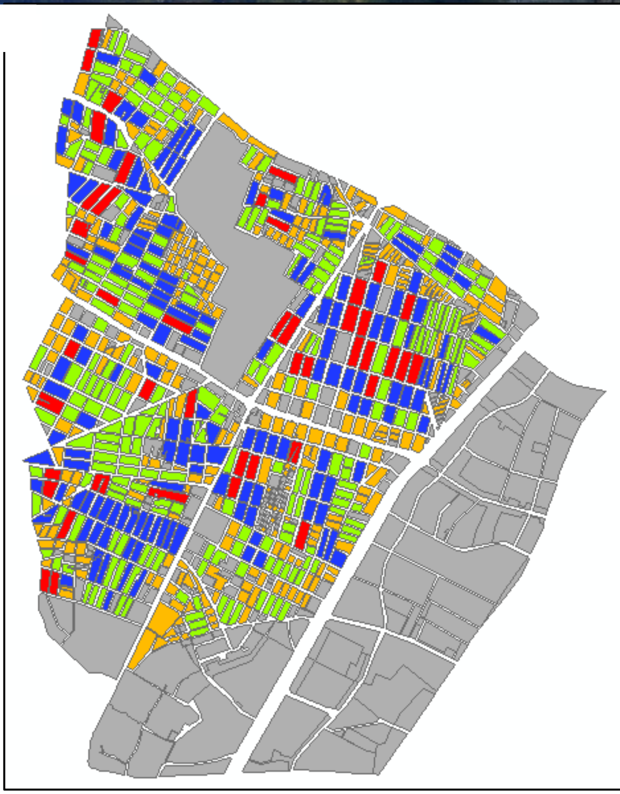
LANDUSE_1

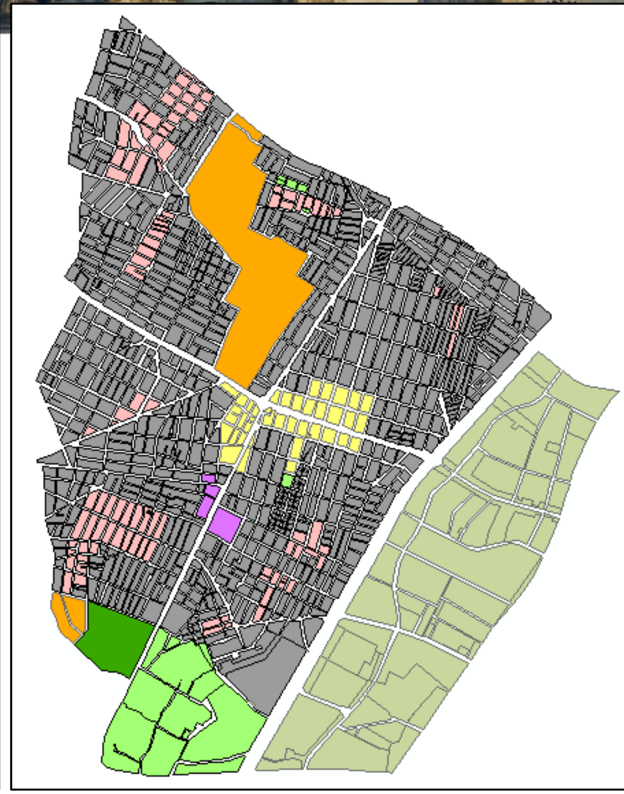
- Biotechnological park
- Education units
- Municipality central district
- Neighbourhood central district
- Residential zone
- Sports units
- Urban fabric
- Urban vegetation - Open spaces

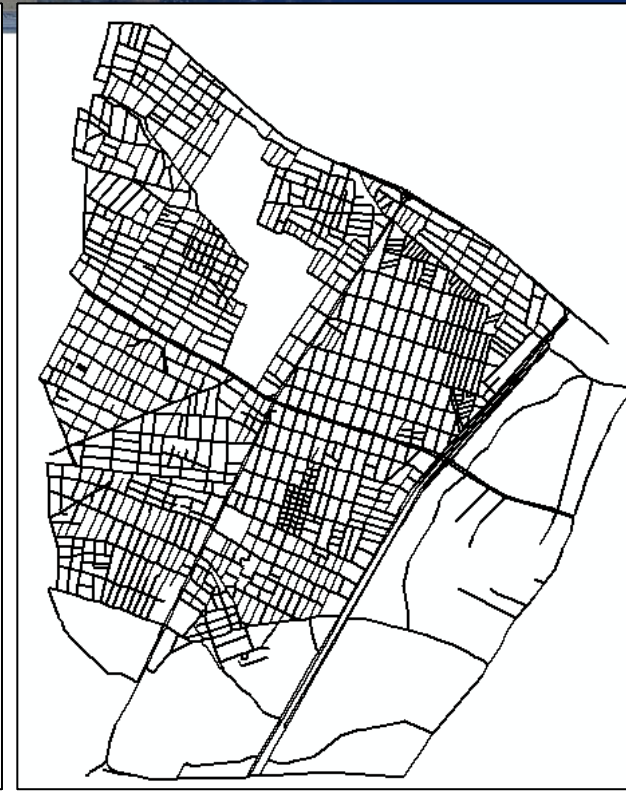


roadnet

Planning Alternative 3 - green







building block population

HOUSES

- 0 - 13
- 14 - 33
- 34 - 53
- 54 - 78
- 79 - 154

landuse_eleonas_green

<all other values>

LANDUSE_1

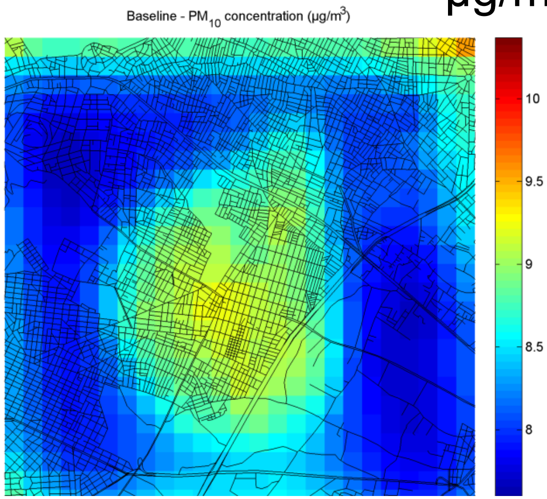
- Biotechnological park
- Education units
- Green spaces
- Municipality central district
- Neighbourhood central district
- Residential zone
- Sports units
- Urban vegetation - Open spaces

roadnet

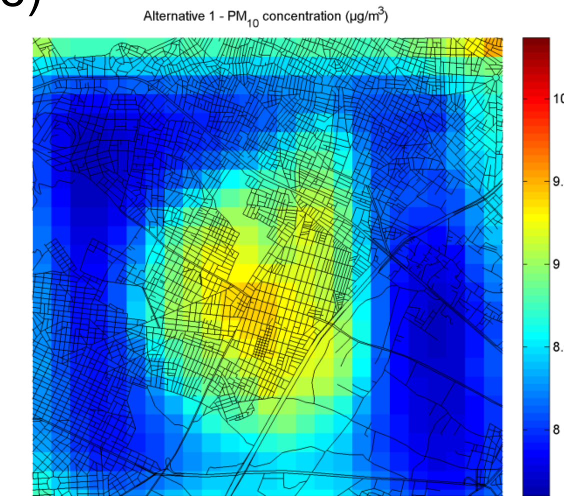
PM_{10} Concentrations

- µg/m³ (2008 average)

Baseline



Alternative 1



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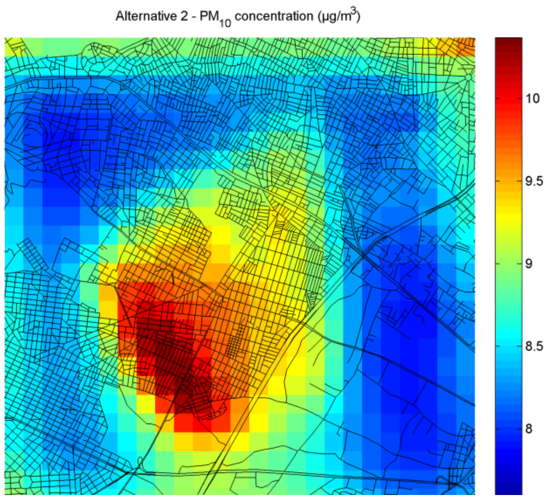
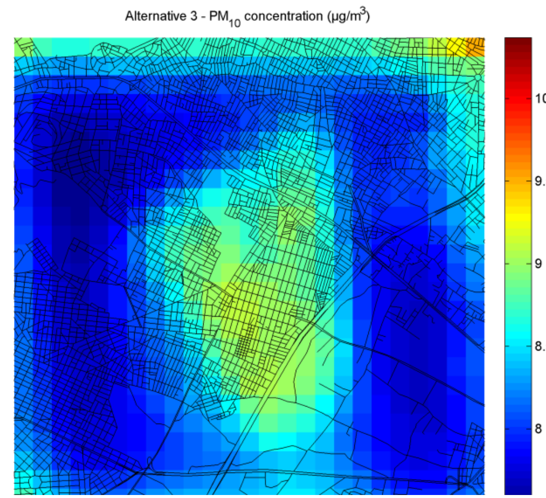


Alternative 3

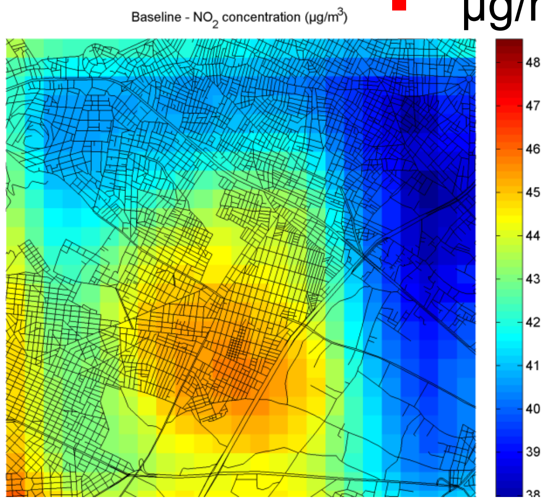


Simulations by WRF/UCM-EMIMO-CMAQ (FP7-BRIDGE, Universidad Politécnica de Madrid)

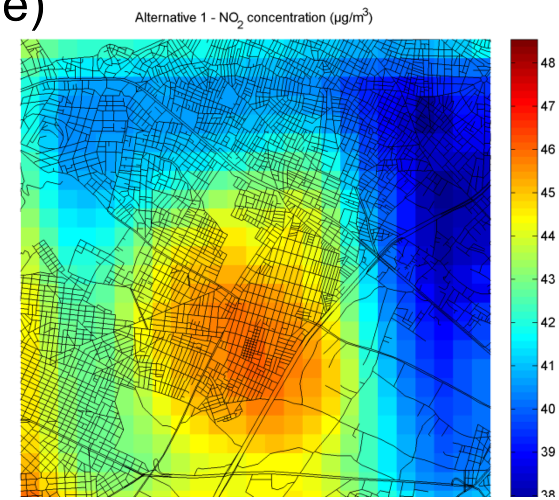
NO_2 Concentrations

- µg/m³ (2008 average)

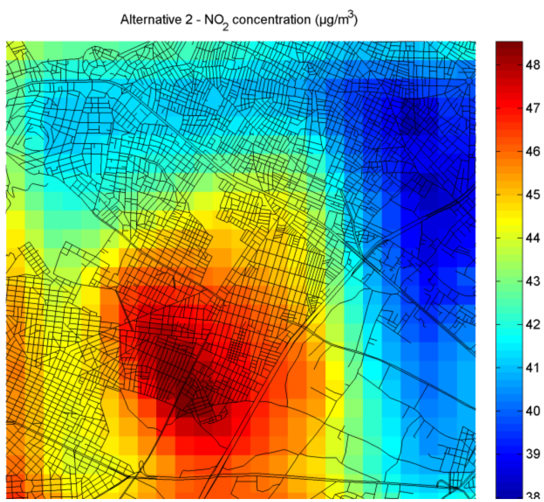
Baseline



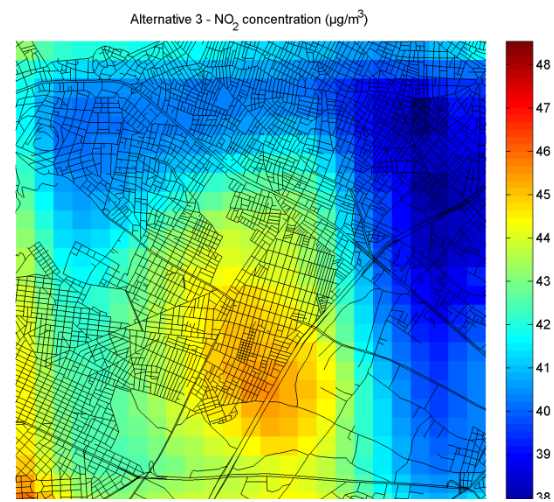
Alternative 1



Alternative 2



Alternative 3



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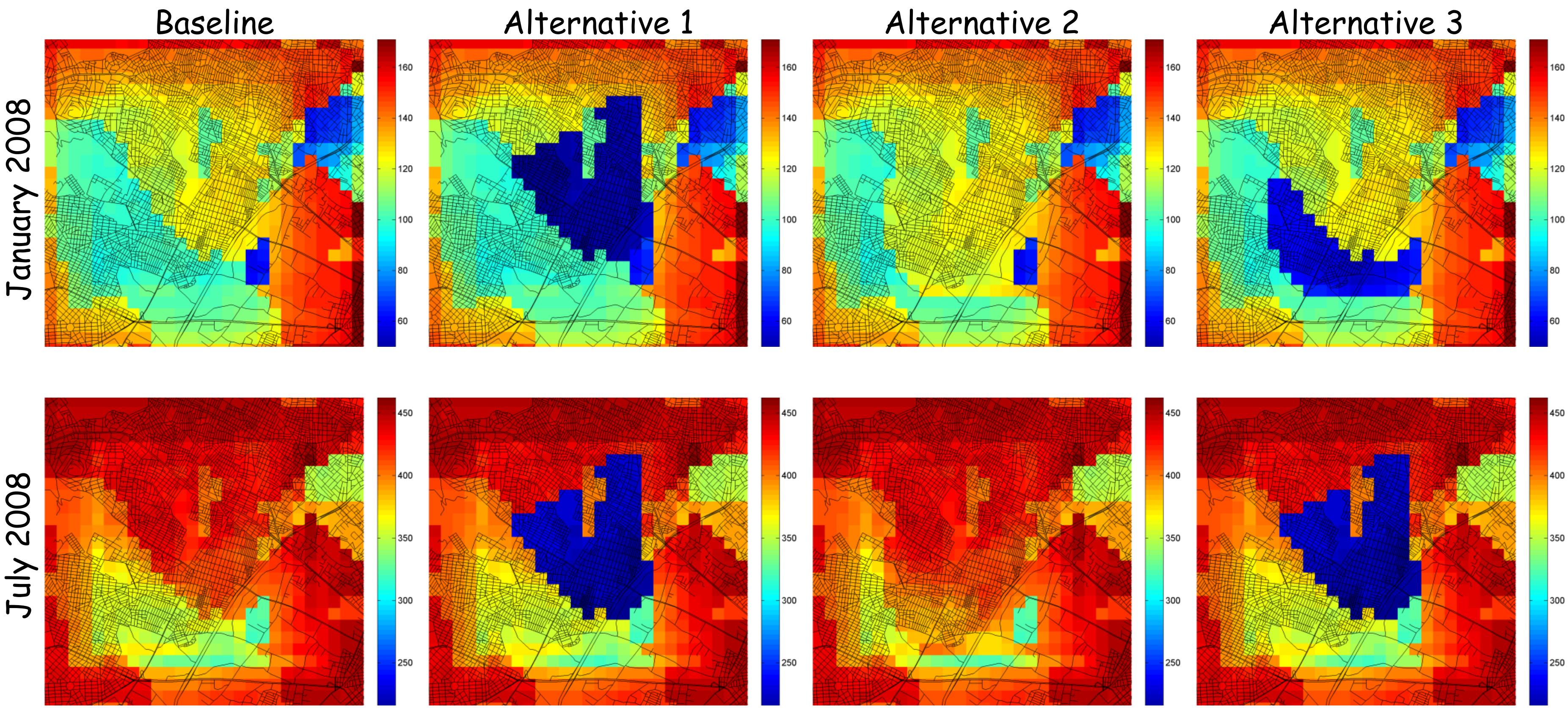
Sensible Heat Flux

- W/m² (average for 12:00 Local Time)



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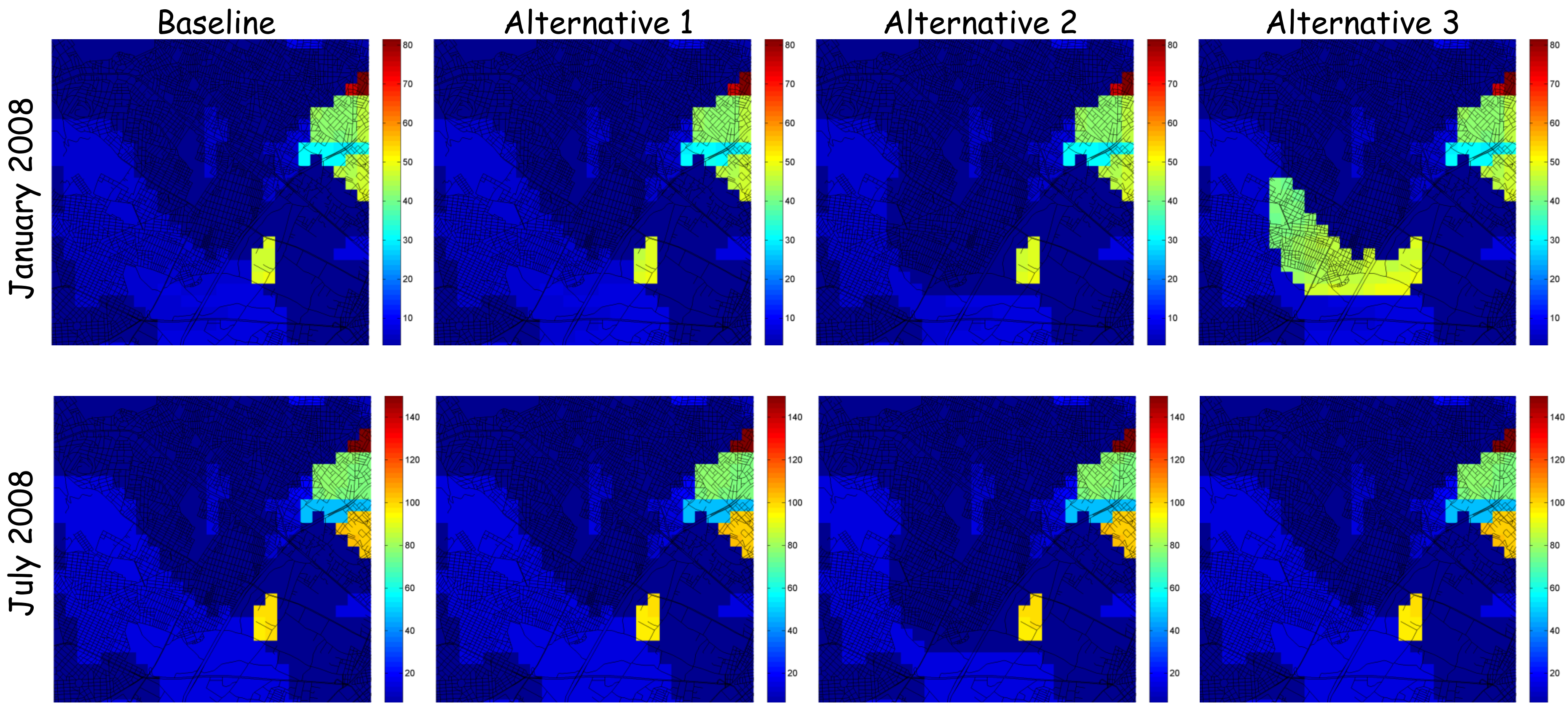
Latent Heat Flux

- W/m² (average for 12:00 Local Time)



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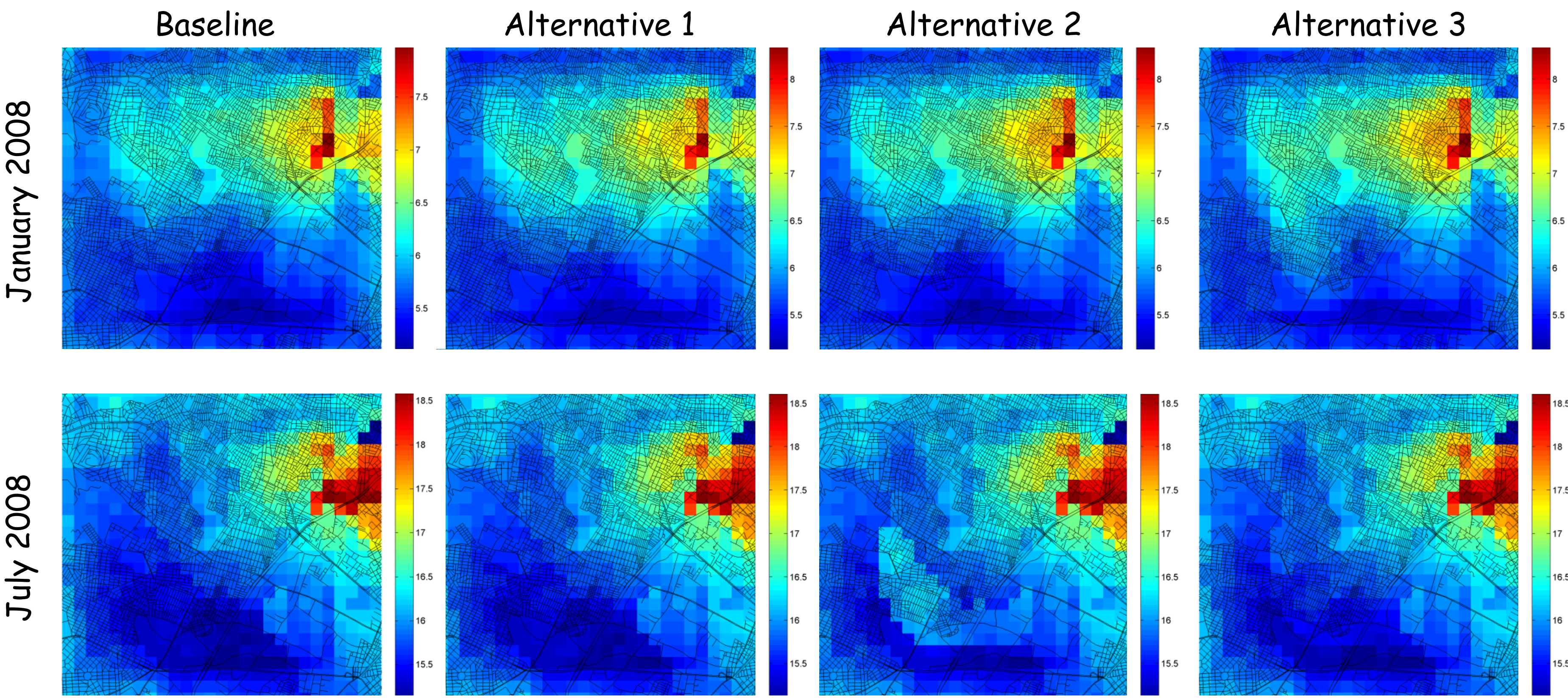
Thermal Comfort Index

- Cooling Power (Monthly Mean)



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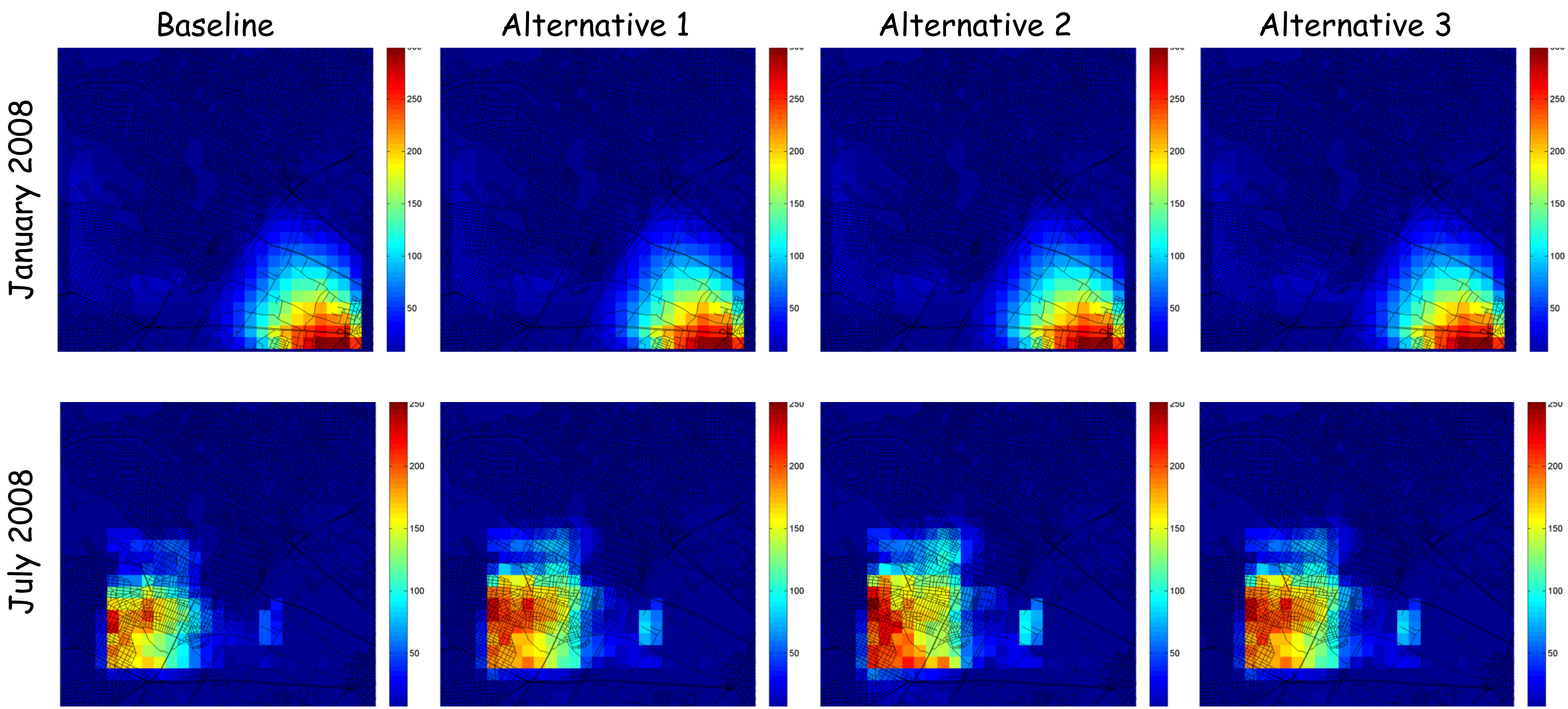
Surface Run-off

- mm (monthly sum)



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