Modélisation de l'expansion urbaine à l'aide du mode NEDUM-2D

utilisation pour l'étude de politiques environnementales (climat et qualité de l'air)

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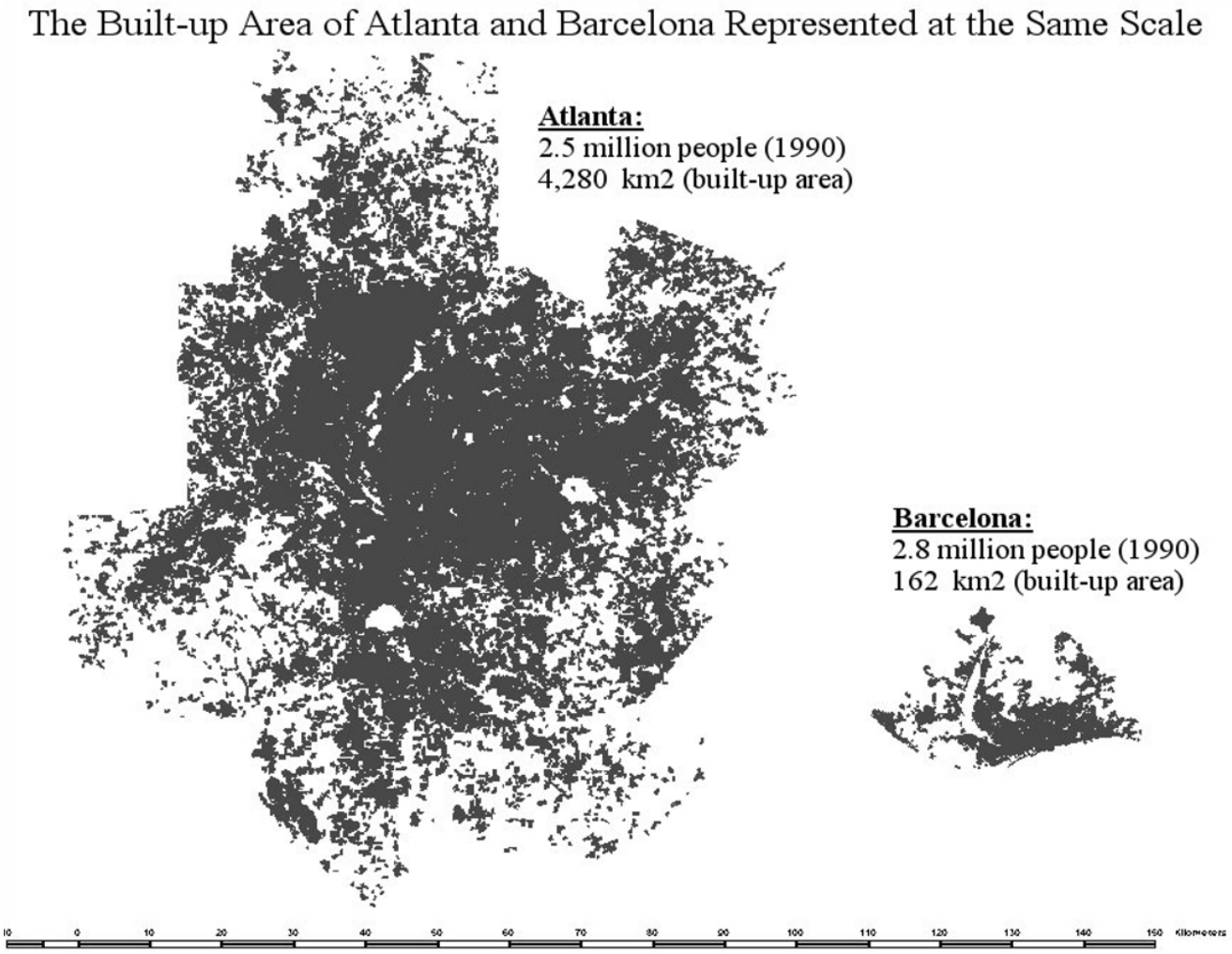
07/04/2015

Urban forms matter for greenhouse gas emissions…



Lower emissions in Barcelona because of:

1 - Shorter travel distance;

2 – Easier use of public transport:

Barcelona has 99 km of metro line.

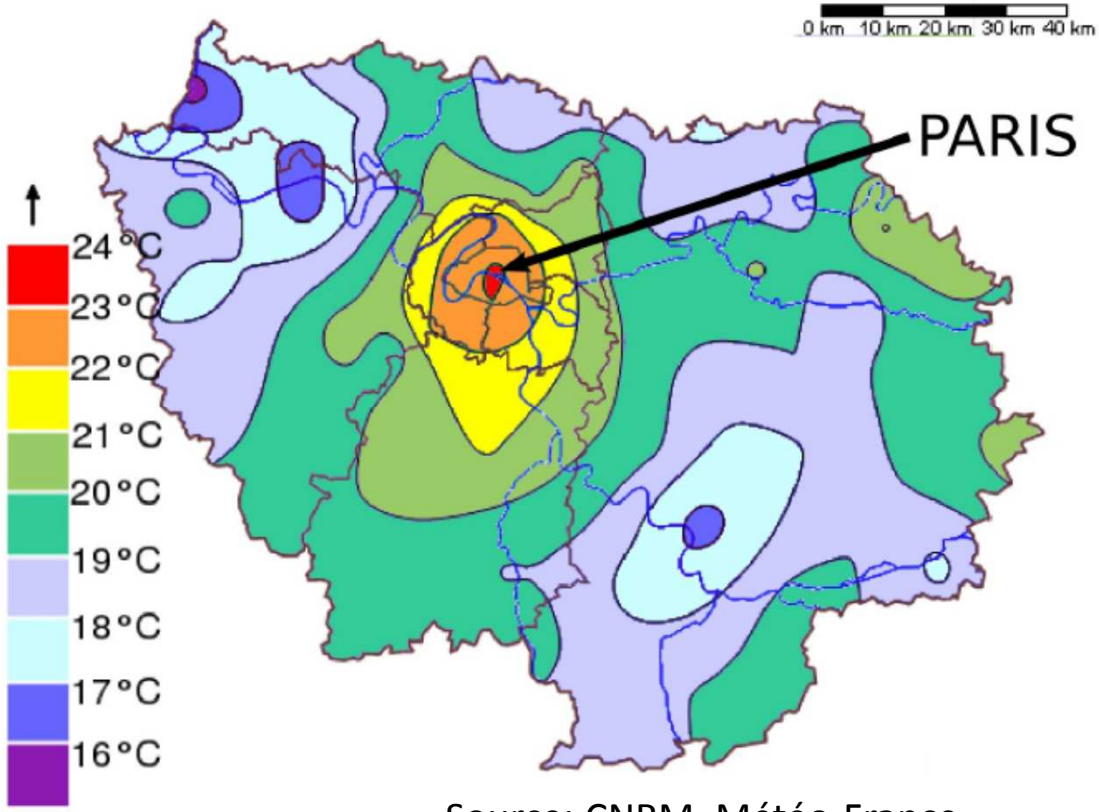
To provide the same accessibility to metro in Atlanta, 3400 km would be necessary.

Urban forms matter for climate-change vulnerability…

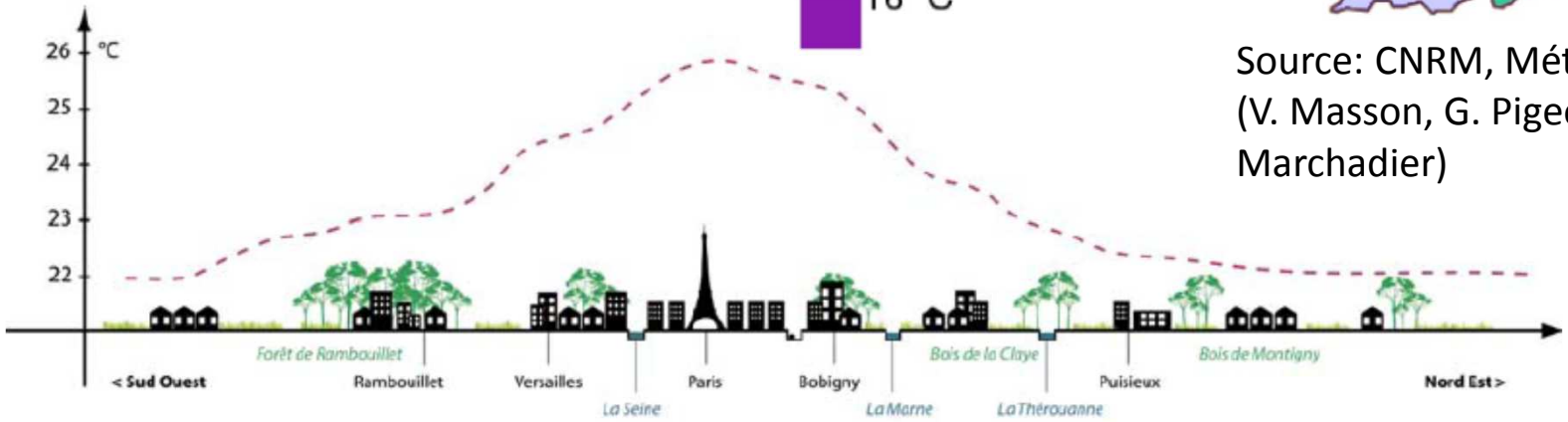
Urban Heat Island effect

Temperatures are higher in cities than in rural areas, especially at night.

Example of the 2003 heat wave.



Source: CNRM, Météo-France
(V. Masson, G. Pigeon, A. Lemonsu, C. Marchadier)



Modelling urban form over the very long term?

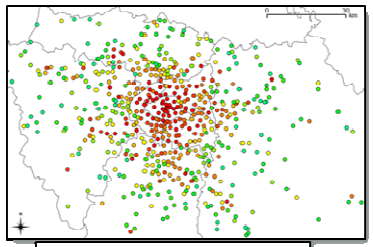
- **Standard urban economics modelling *(Alonso 1964, Mills 1967, Muth 1969)***

- **3 mechanisms :**
  1. Households' tradeoff:
     - Lower transportation costs and shorter commuting time when living close to the city center, and
     - Larger dwellings and lower rent in remote areas
  2. Investors optimize the housing density as a function of rents and construction costs
  3. Different evolution timescales for rents, population density, buildings etc.

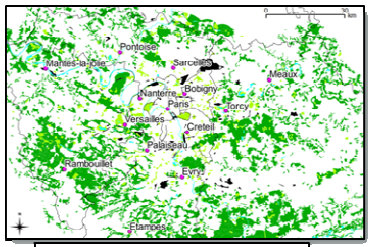
- **Simplifying hypotheses :**
  - All households have the same income.
  - One trip per day towards jos.

NEDUM-2D model

INPUTS

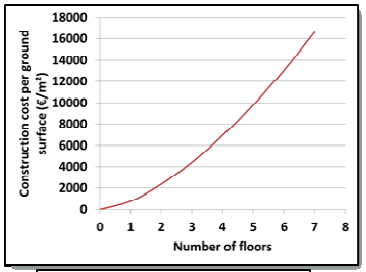


Employment centers and number of jobs and related households income



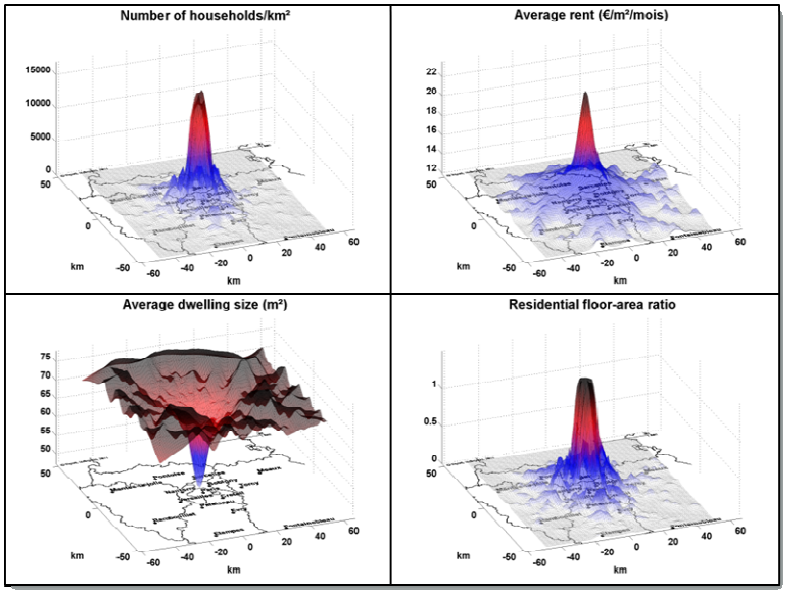
Land-use constraints

Transport times and costs



Construction costs

OUTPUTS



Rents, population density, floor-area ratio, and average dwelling size

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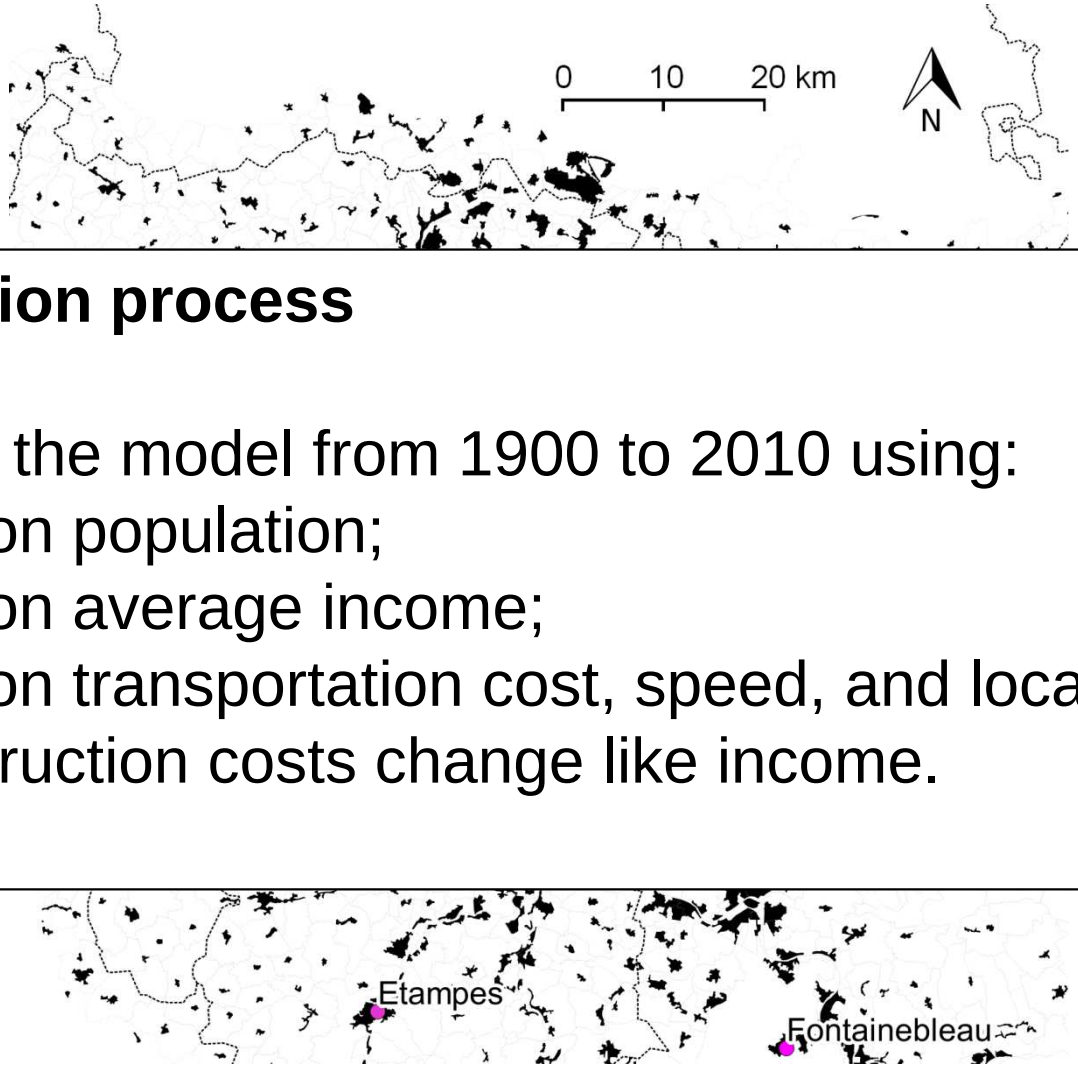
Paris, 2006

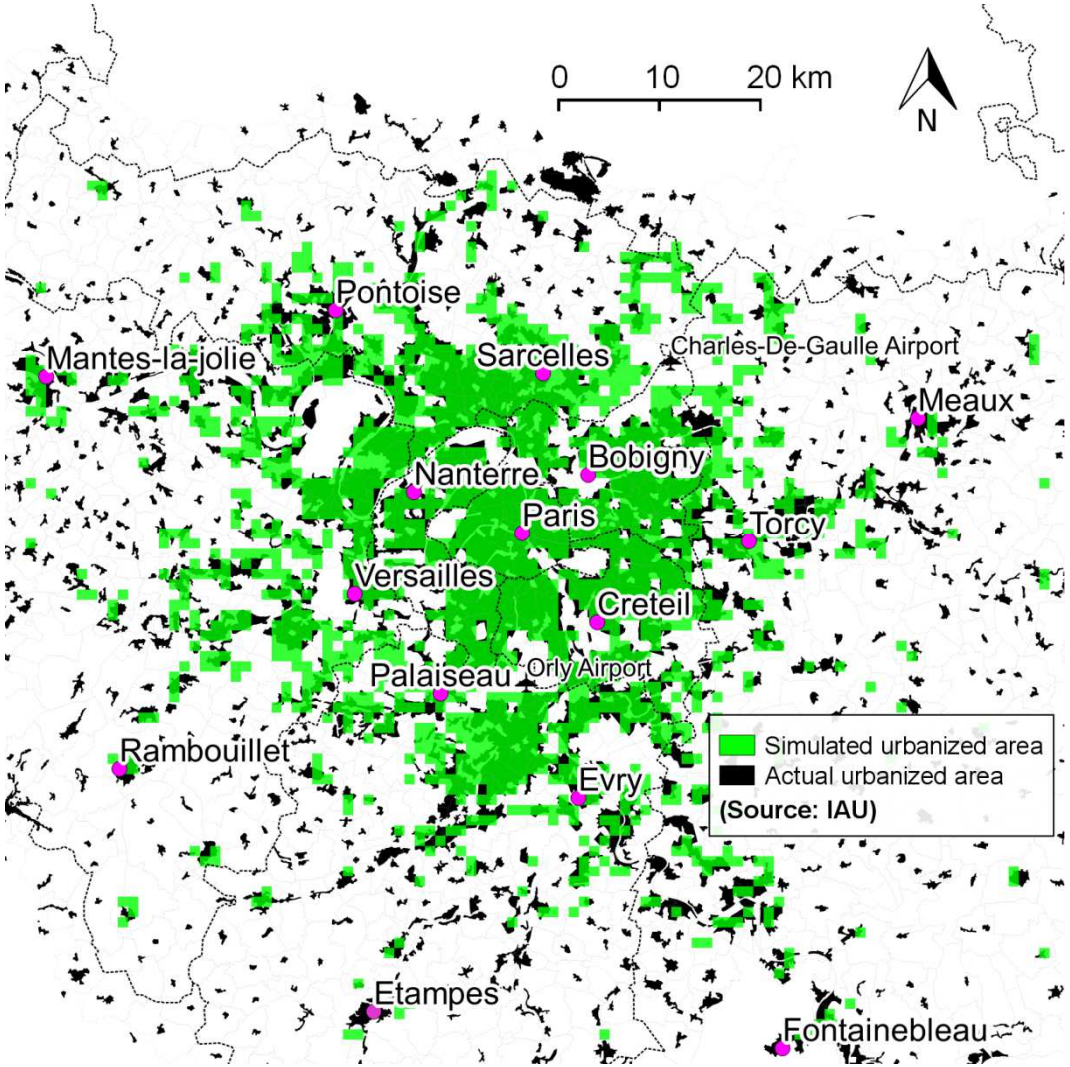


Validation process

We run the model from 1900 to 2010 using:

- Data on population;
- Data on average income;
- Data on transportation cost, speed, and localization;
- Construction costs change like income.

Paris, 2006



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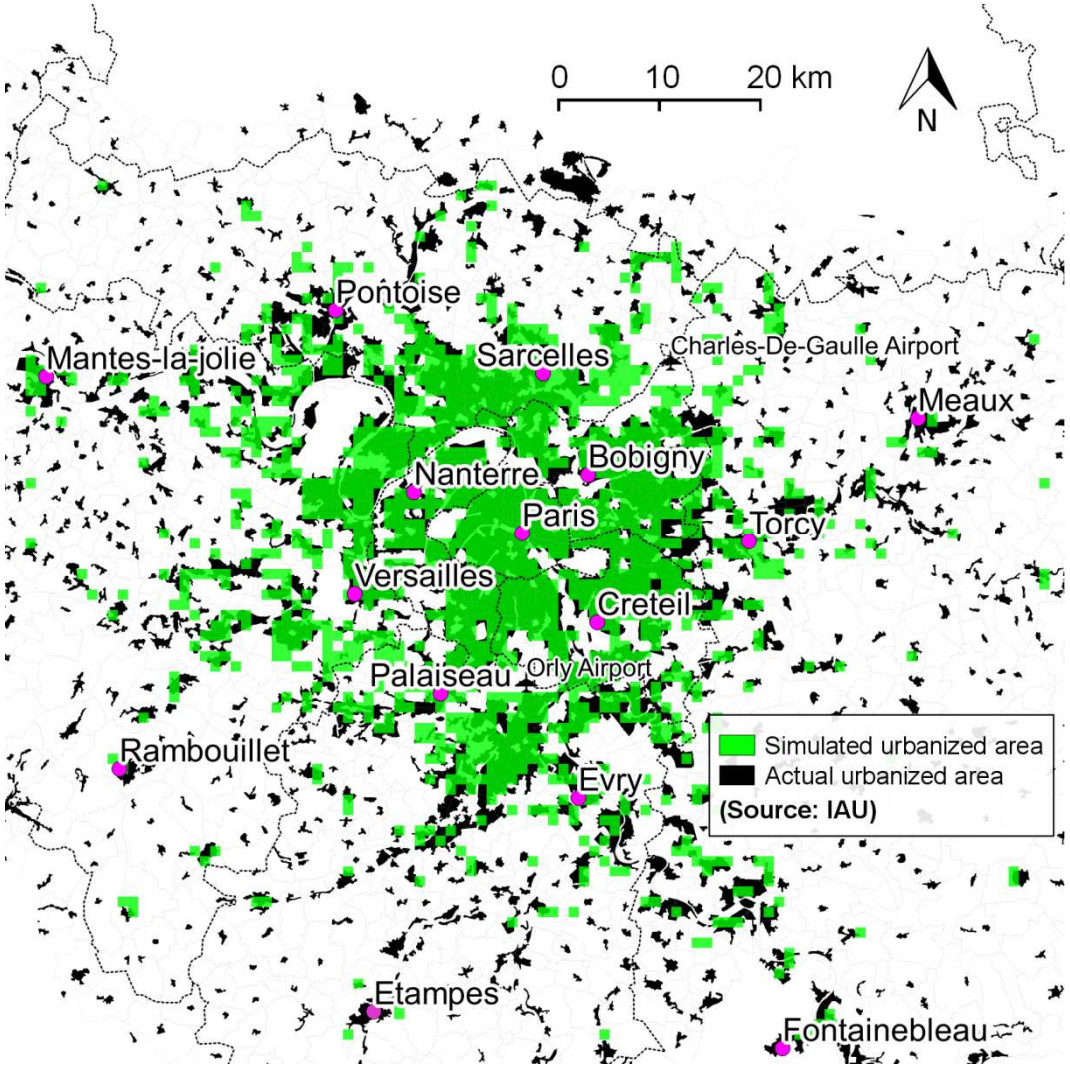
Paris, 1990



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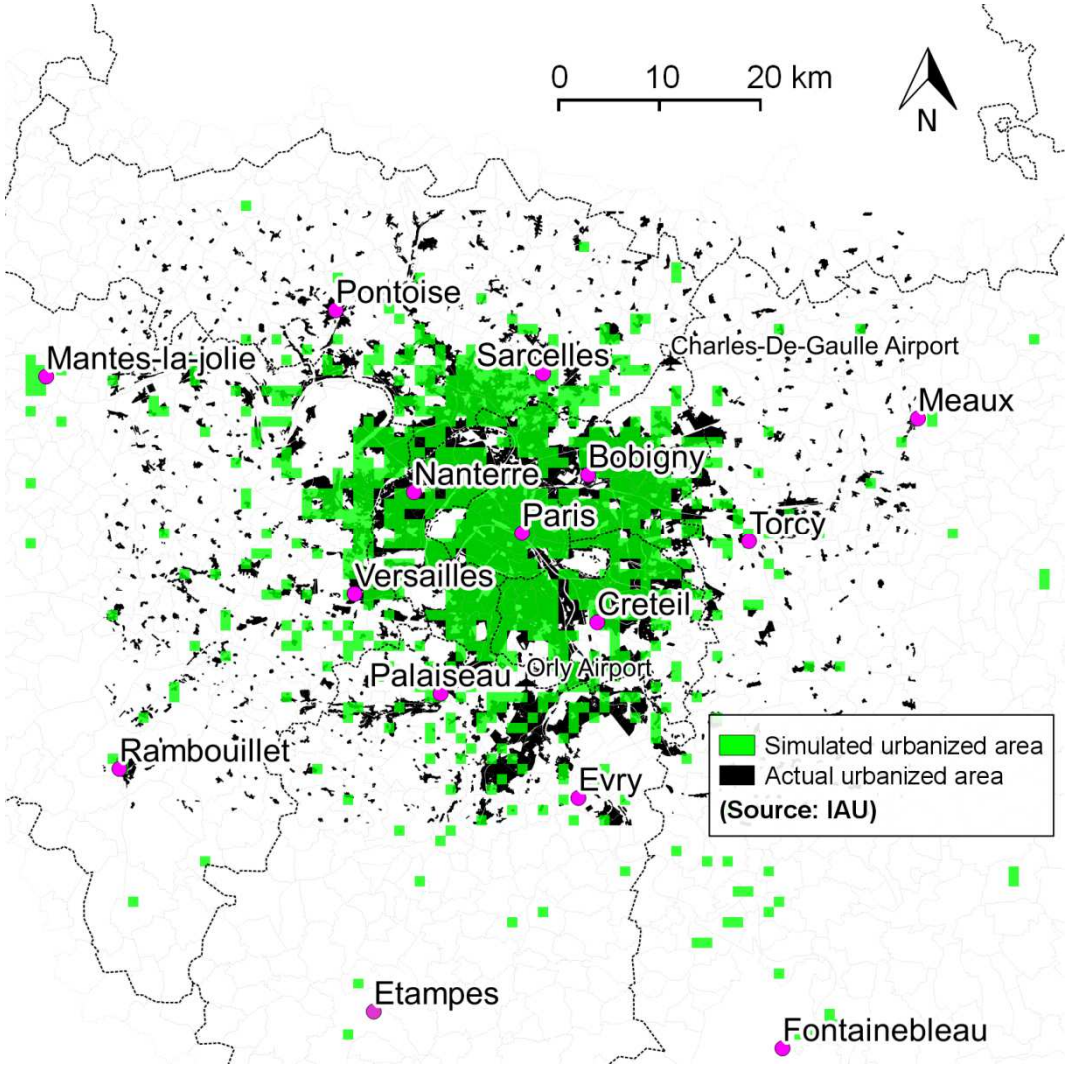
Paris, 1960



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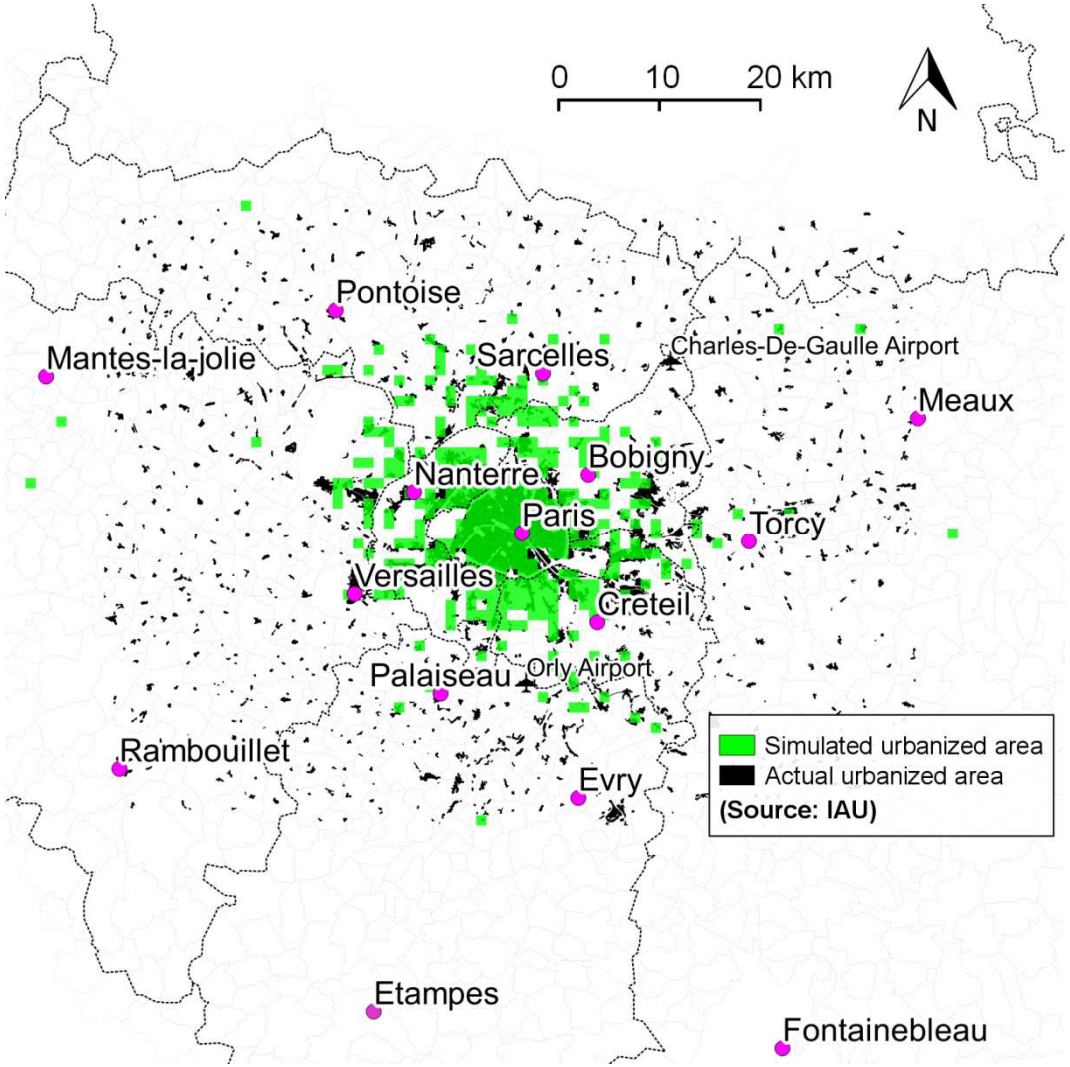
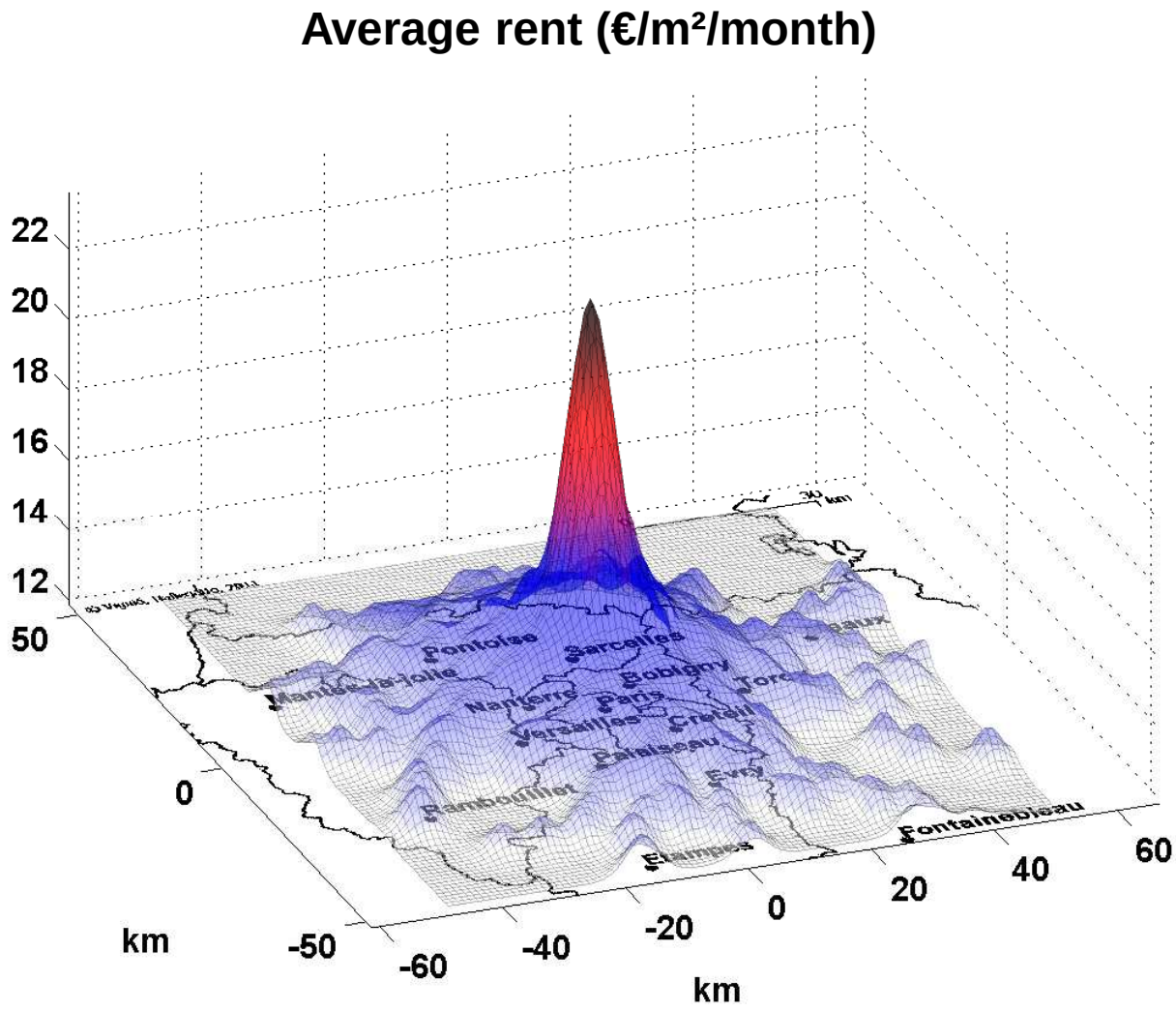
Paris, 1900



Model results: Rents (2008)



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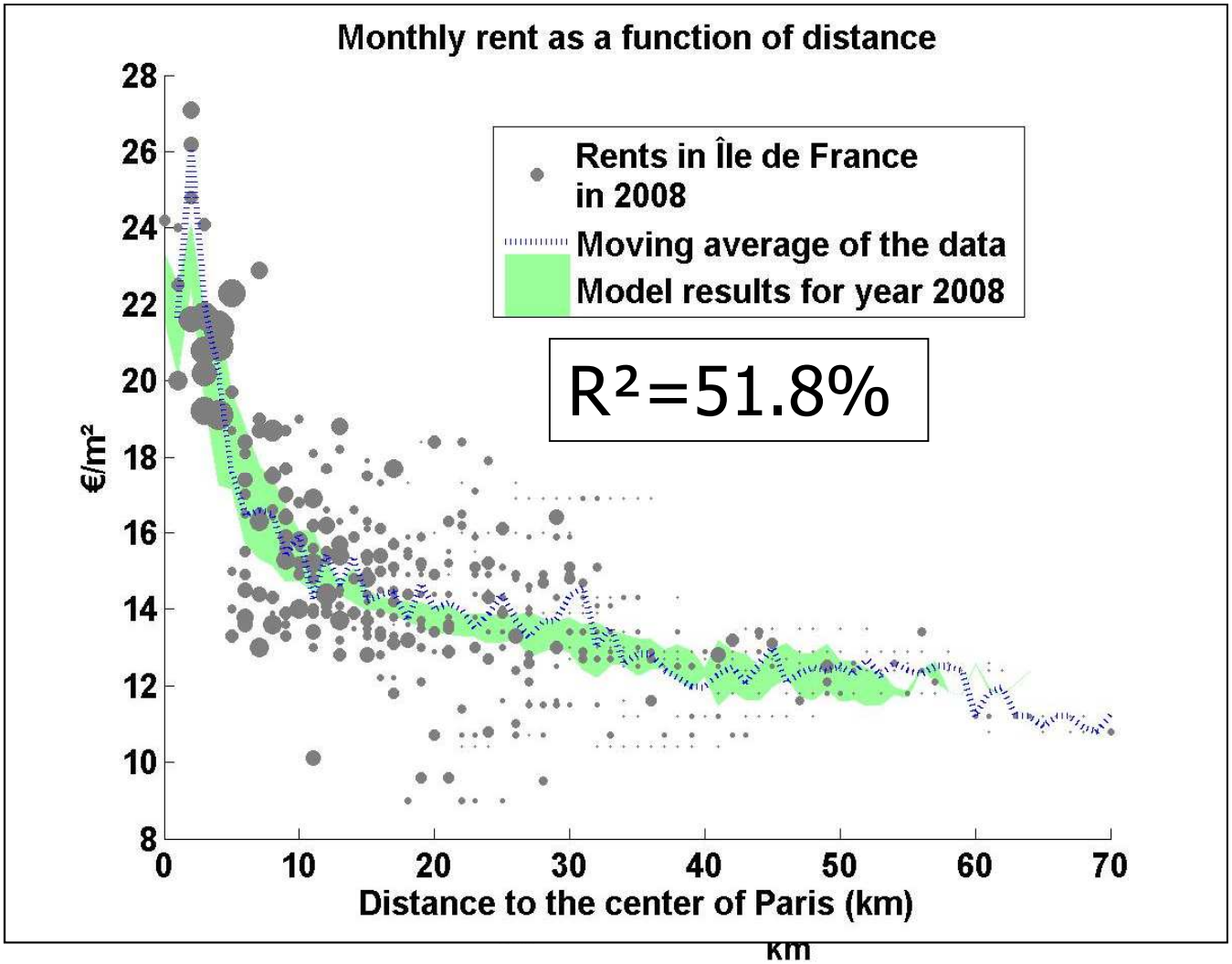
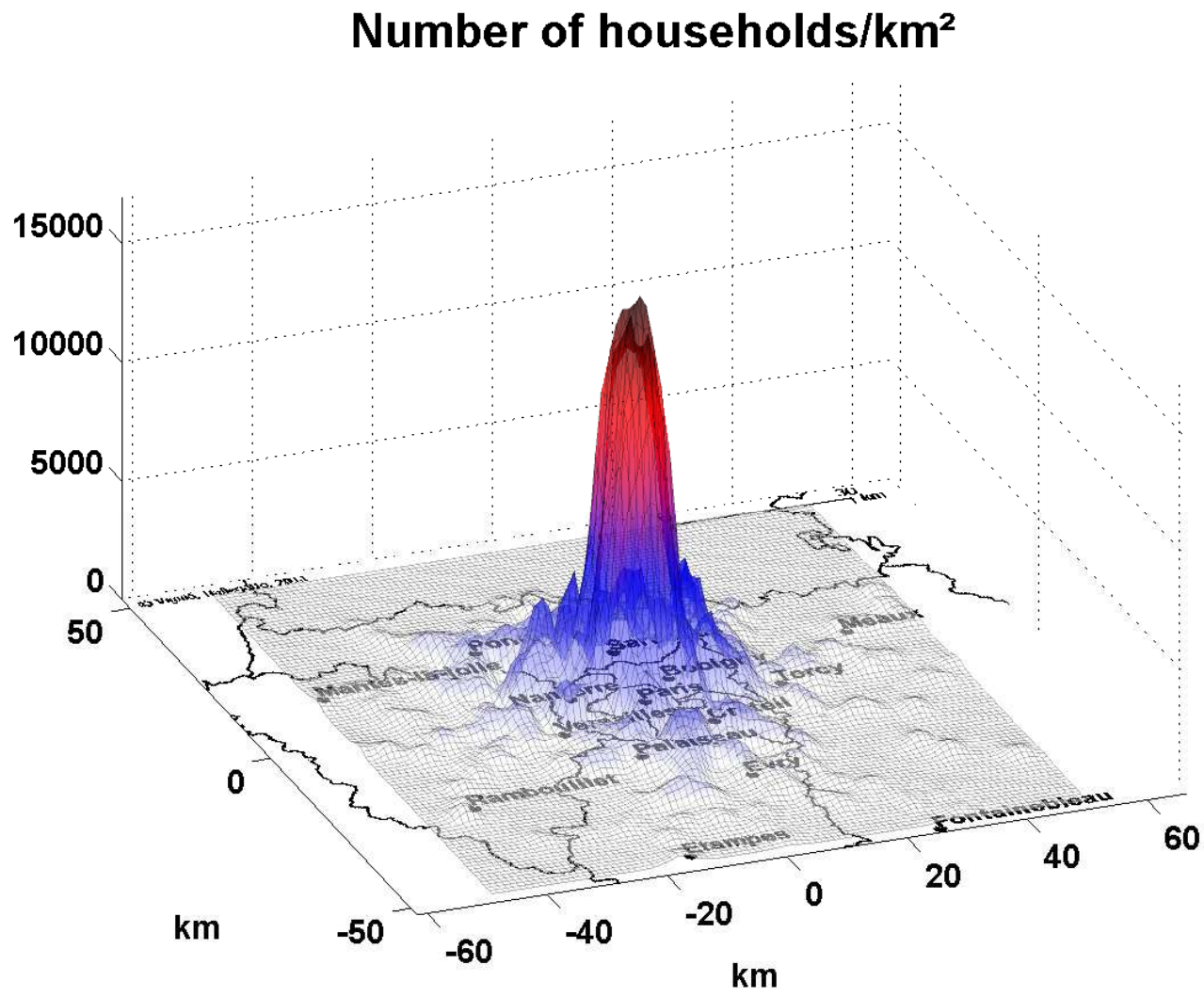


Model results: Population density (2006)



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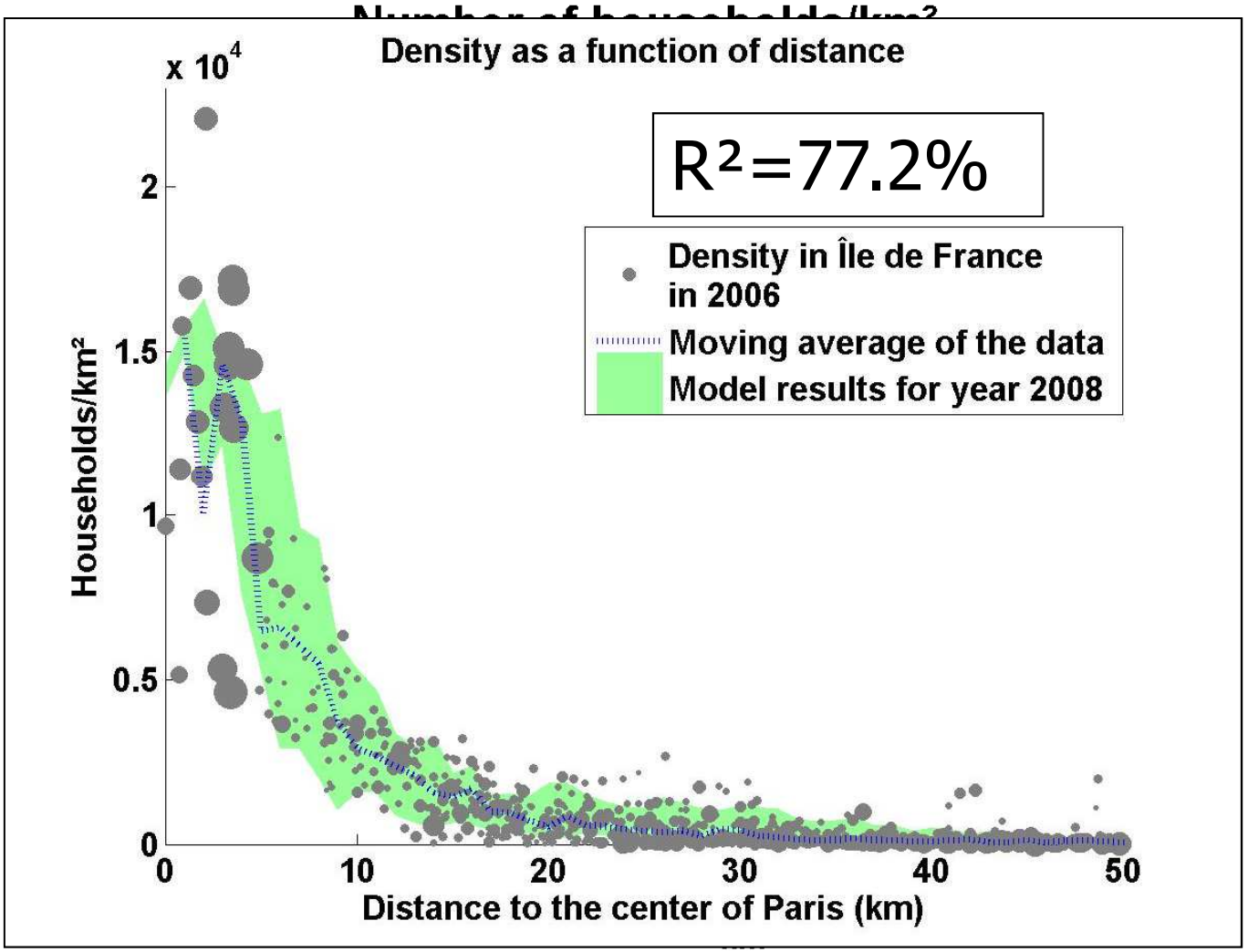
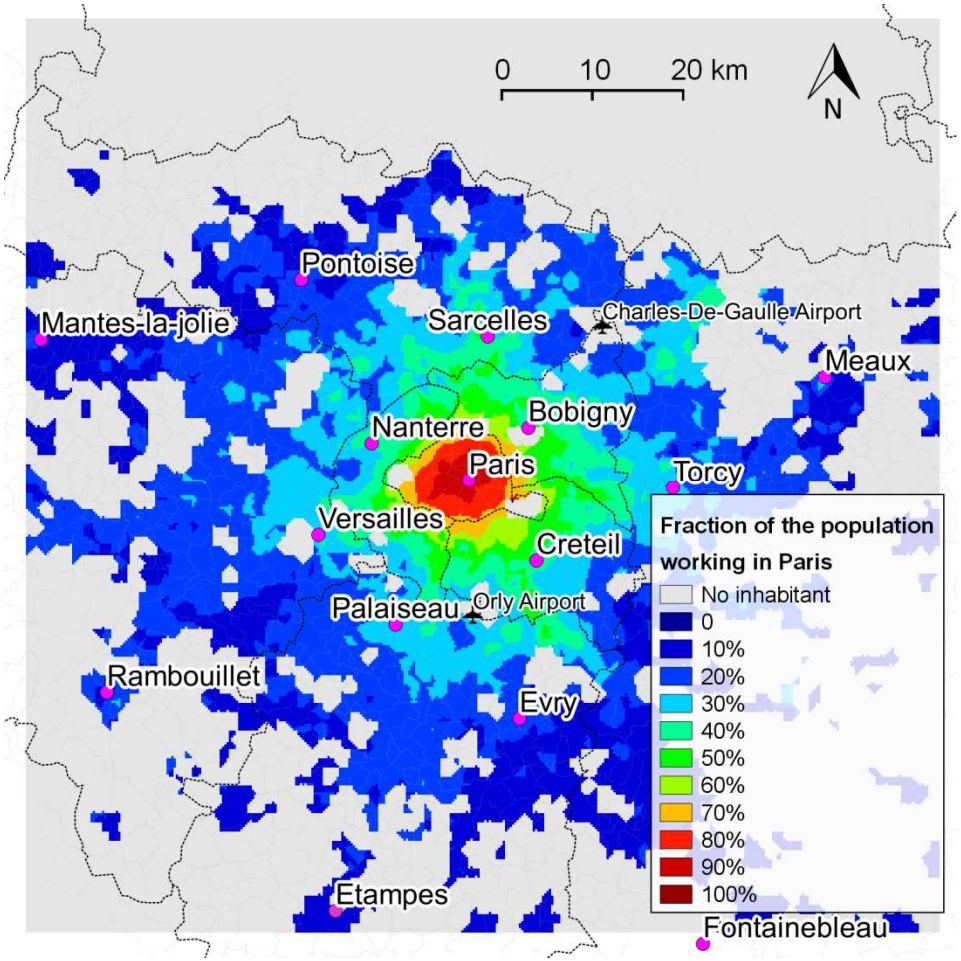


Excess commuting: commuting distance (2006)



An example of simulated excess commuting: simulated fraction of the inhabitants who work inside Paris city

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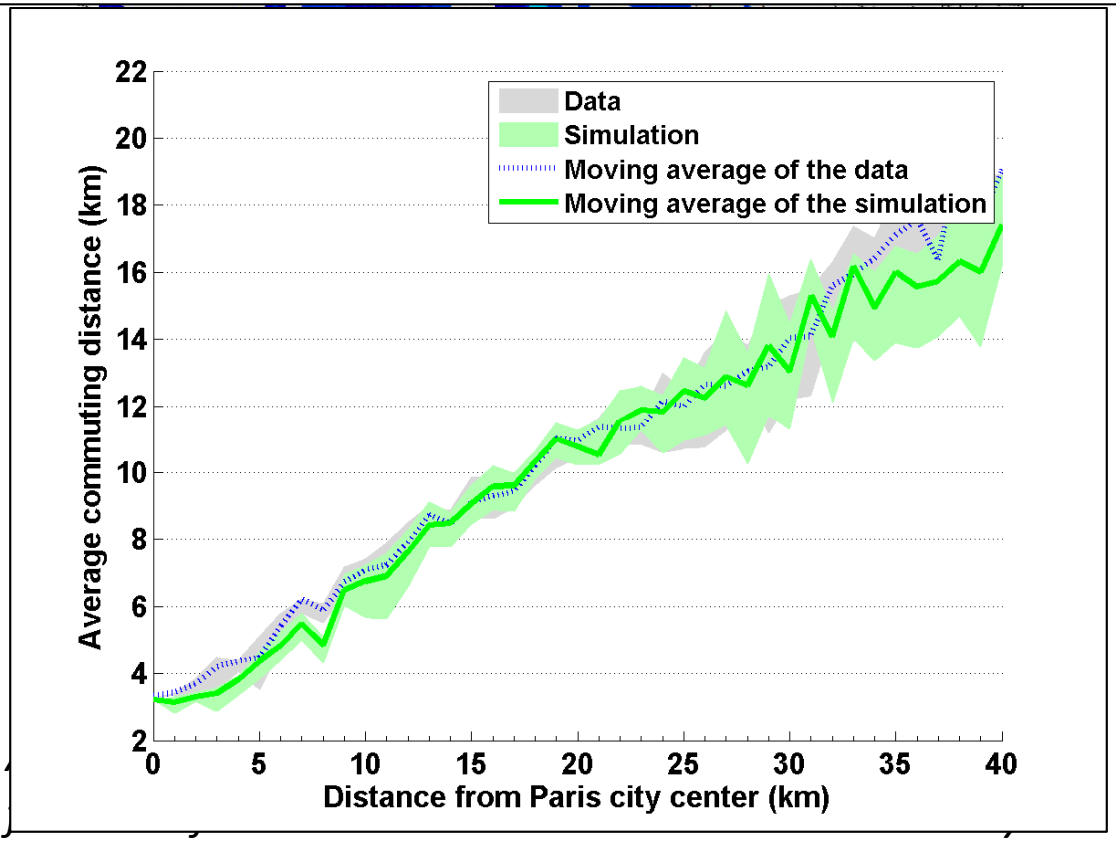
Excess commuting: commuting distance (2006)

Simulated average commuting distance : **8.9 km**,
Actual average commuting distance : **9.2 km**
(Source: INSEE, French population census)



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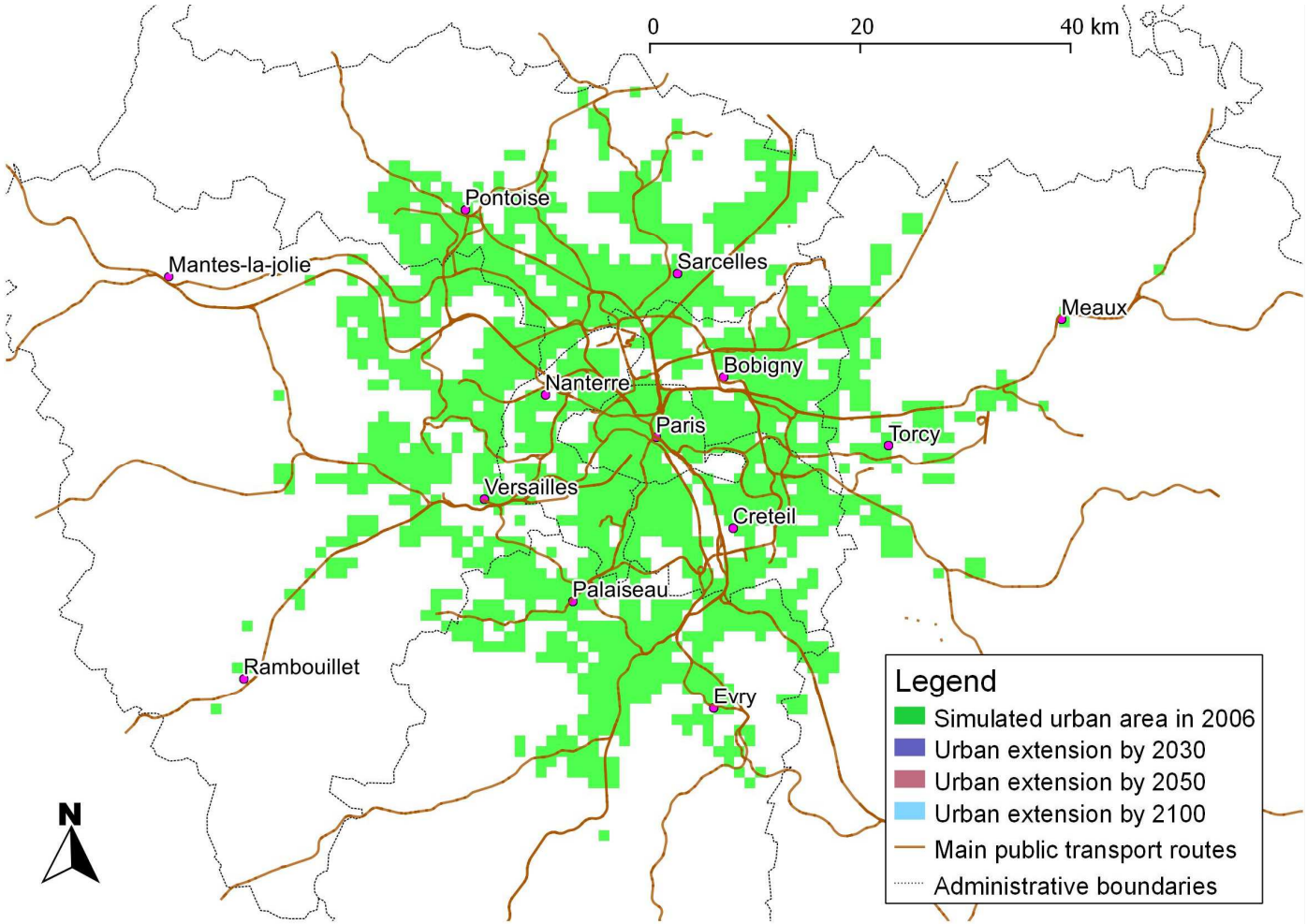
CLIMATE POLICIES ANALYSIS

Example of Paris urban area extension prospective scenario (high demographic scenario+scenario1)



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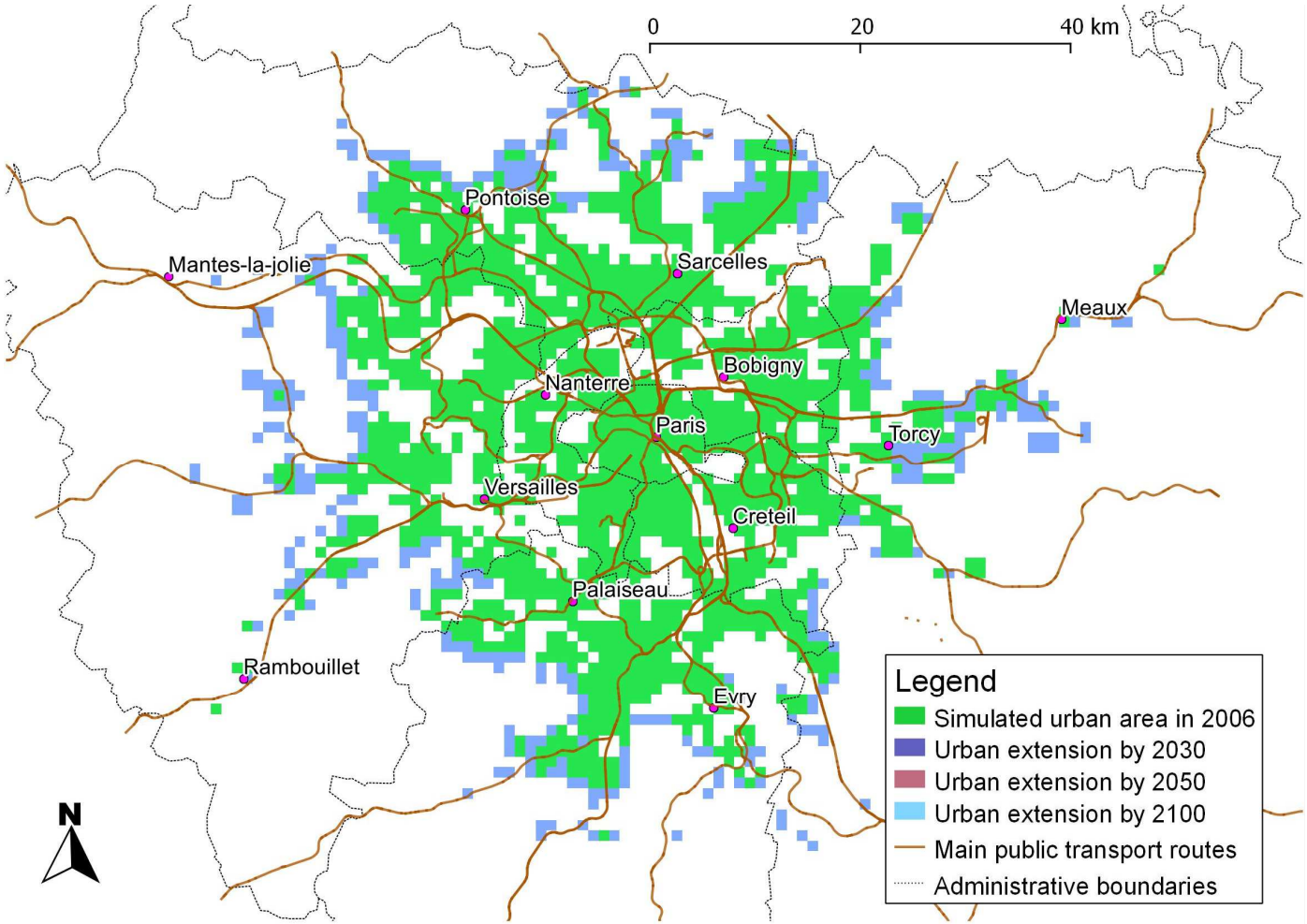

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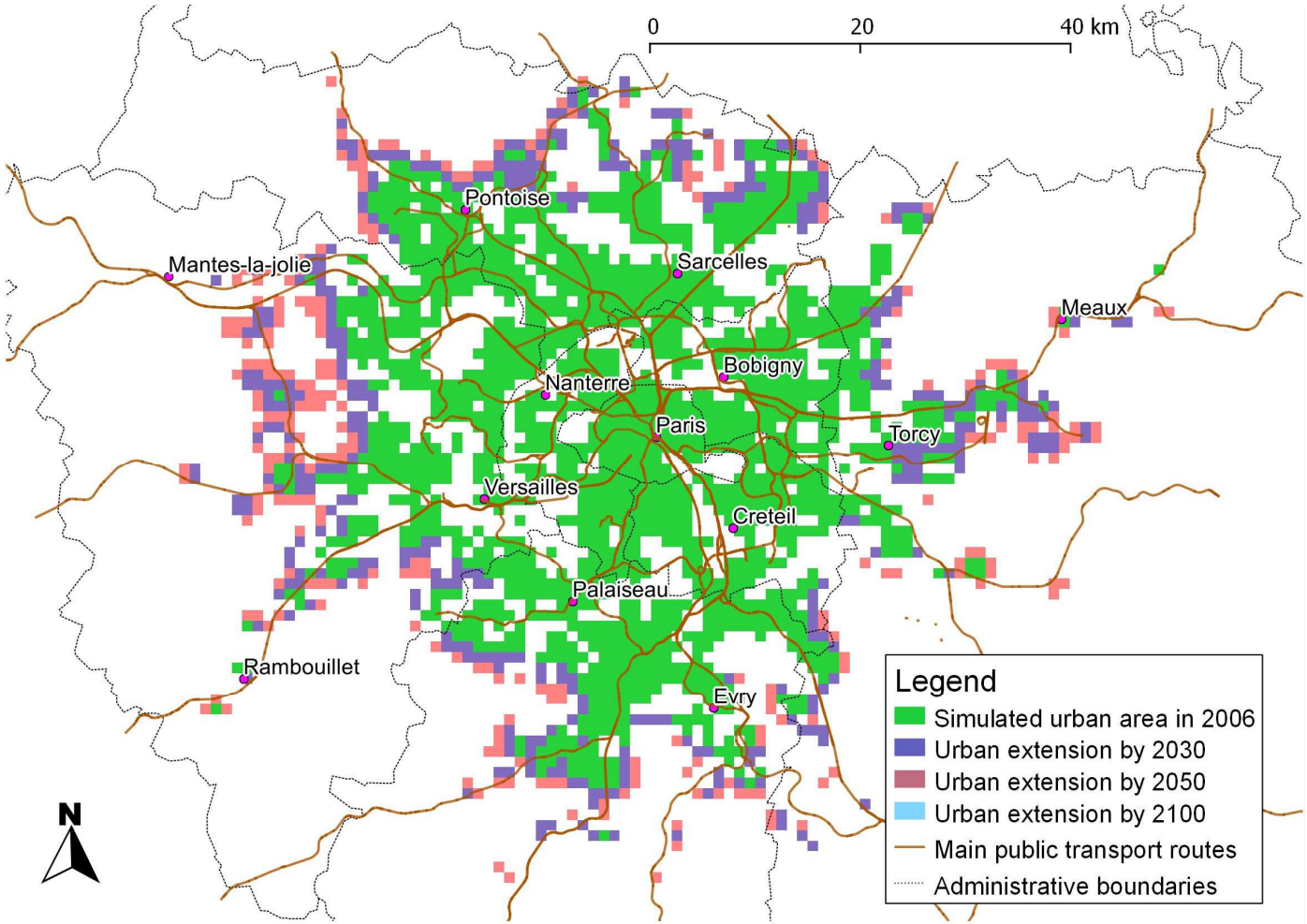

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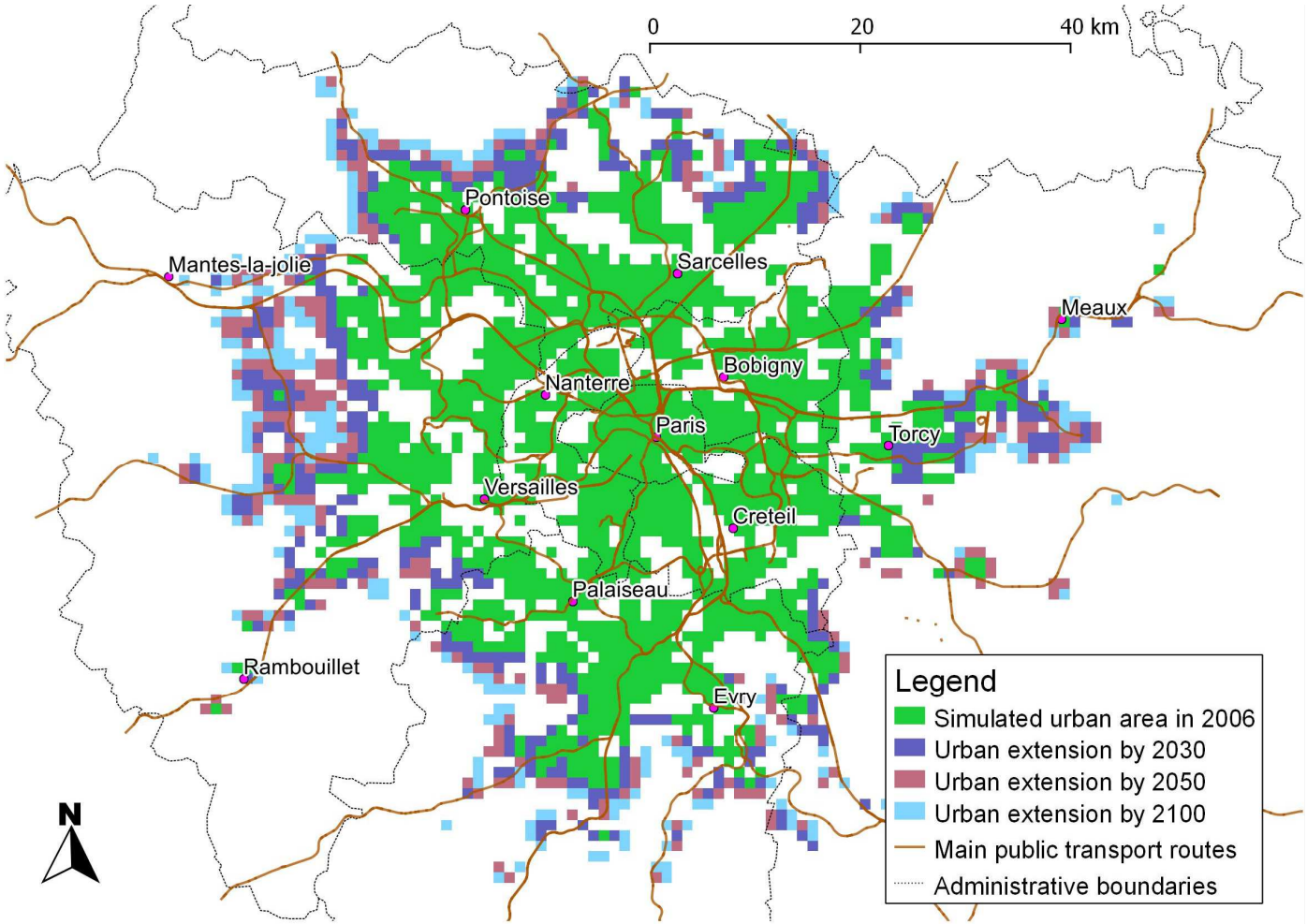

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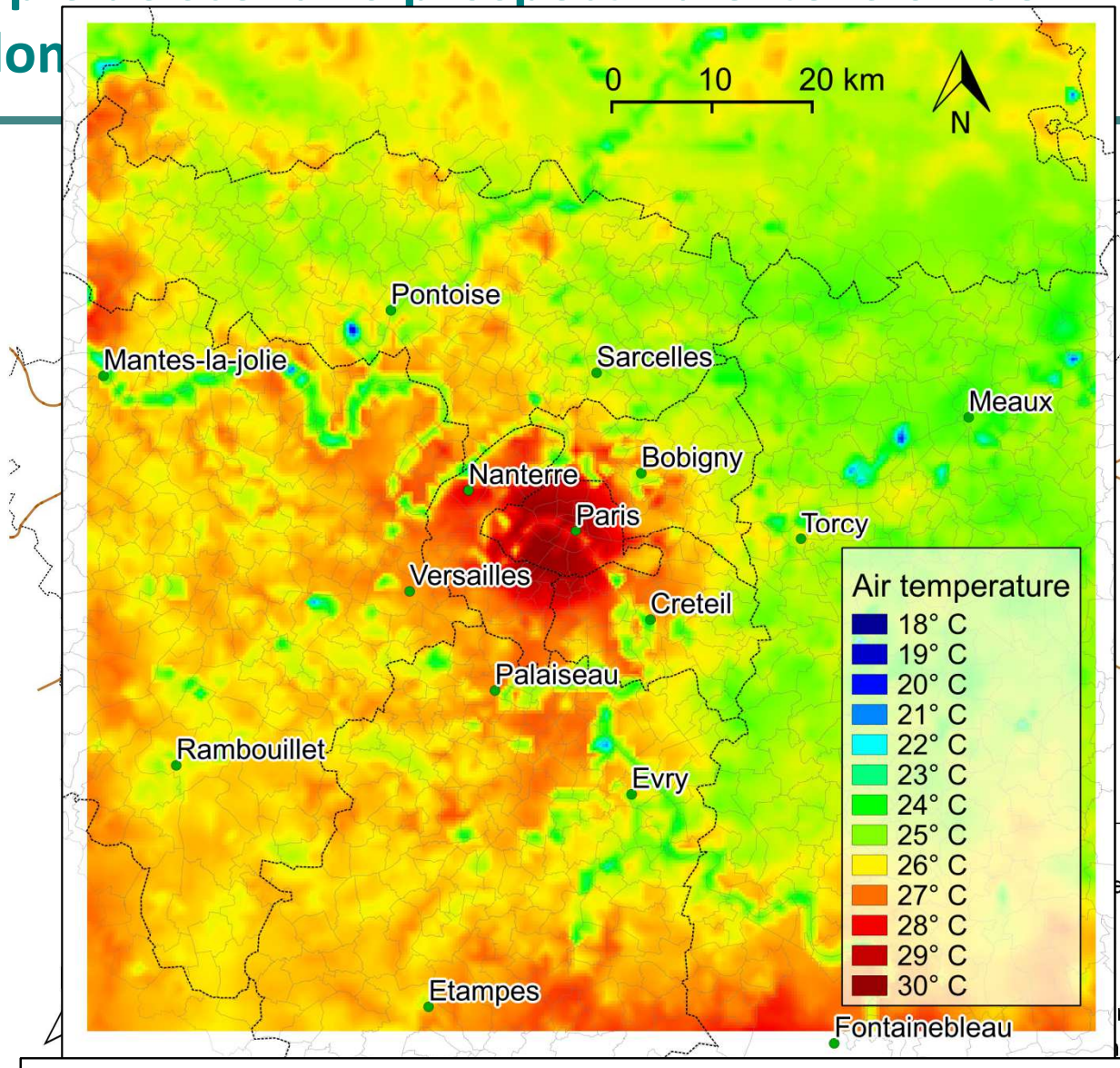
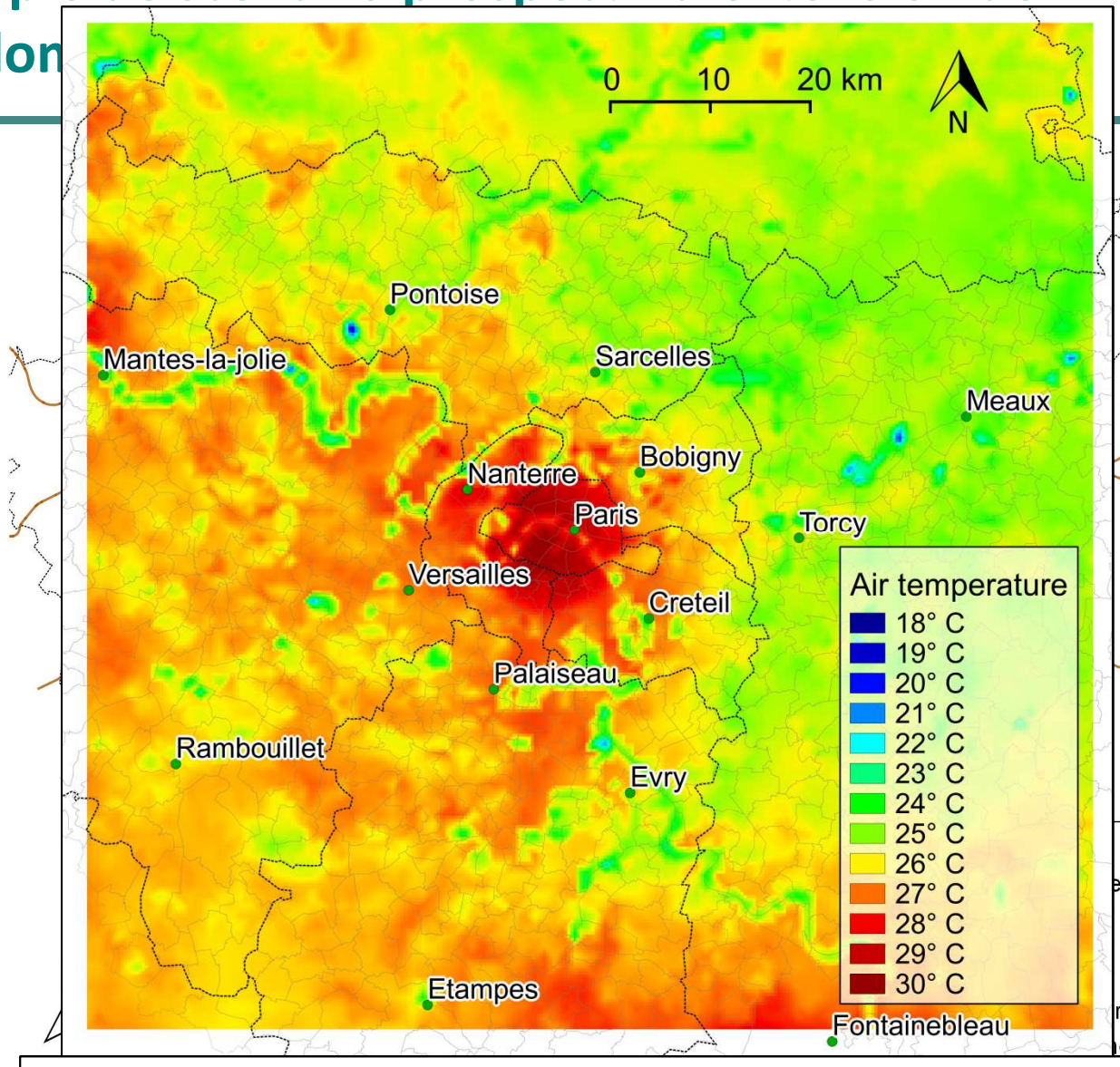
Exemple de scénario prospectif d'extension de l'agglon



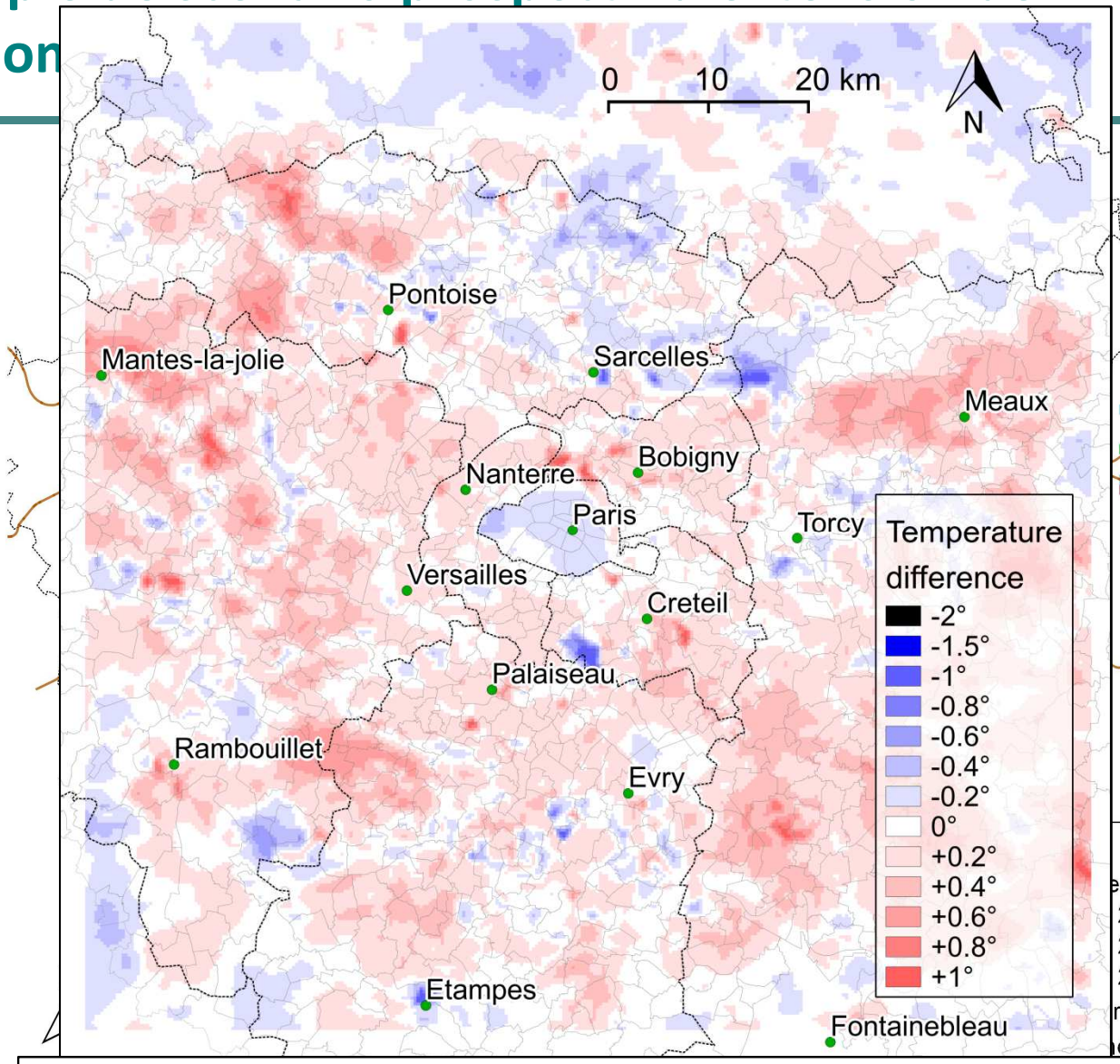
Simulation de l'effet d'îlot de chaleur urbain si Paris continue de s'étendre jusqu'en 2100 (cf. transparent précédent)

Exemple de scénario prospectif d'extension de l'agglon



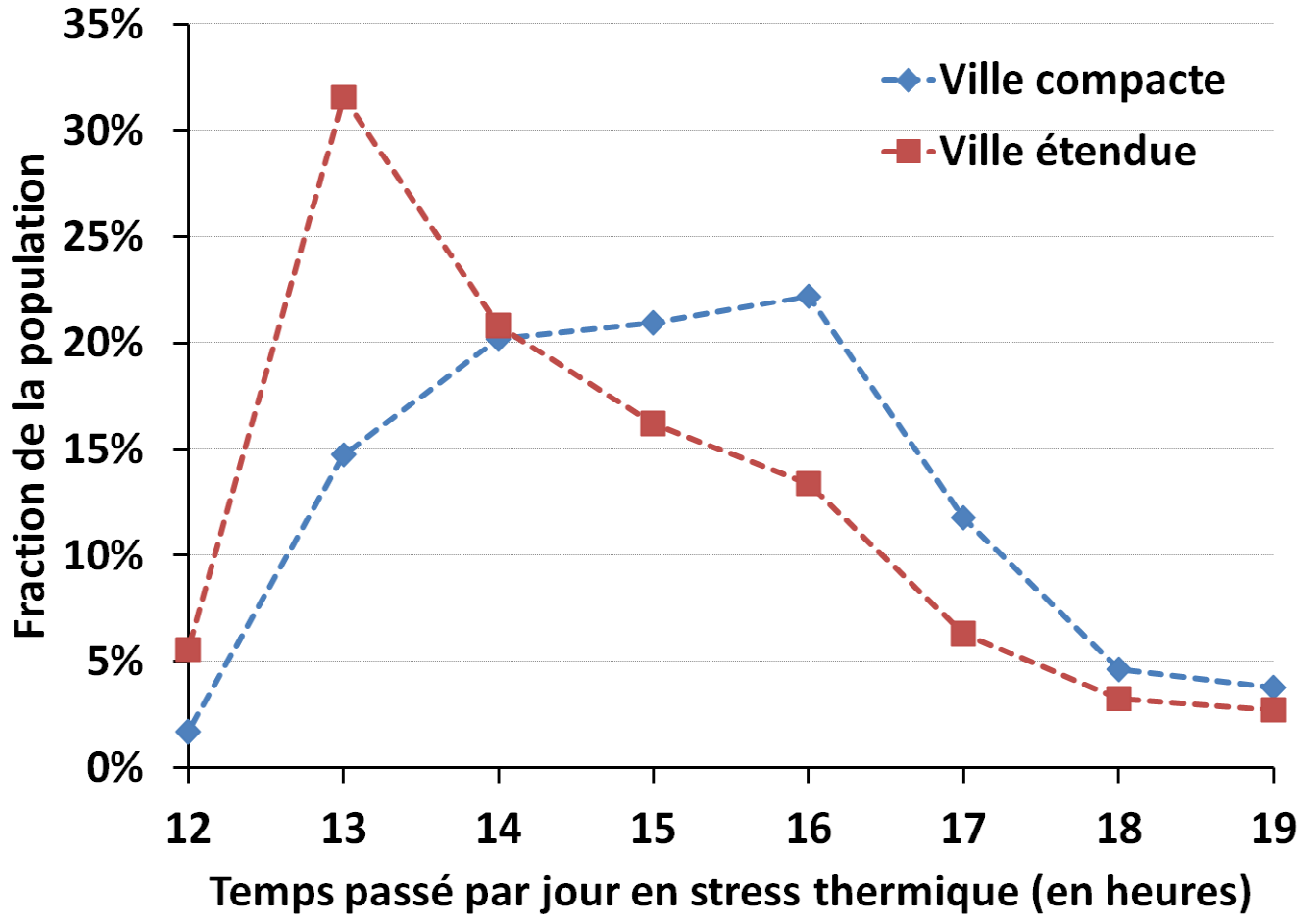
Scenario alternatif avec mise en place d'une limite à la croissance urbaine

Exemple de scénario prospectif d'extension de l'agglon

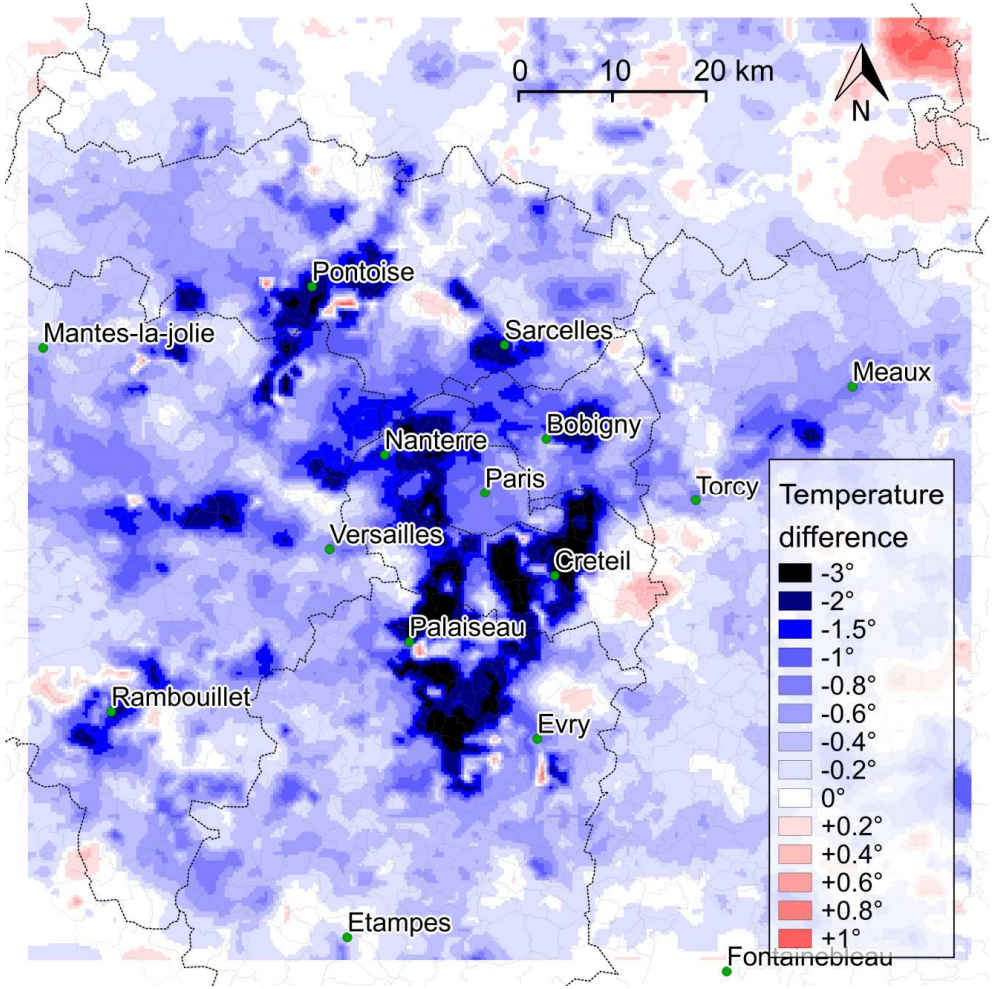


Différence entre les températures

Répartition de la population



Mise en place de mesures d'adaptation (parcs, toitures réfléchisssantes, isolation des bâtiments)



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