# A user-friendly multi-model platform to simulate urban evolution and urban climate in a context of adaptation to climate change

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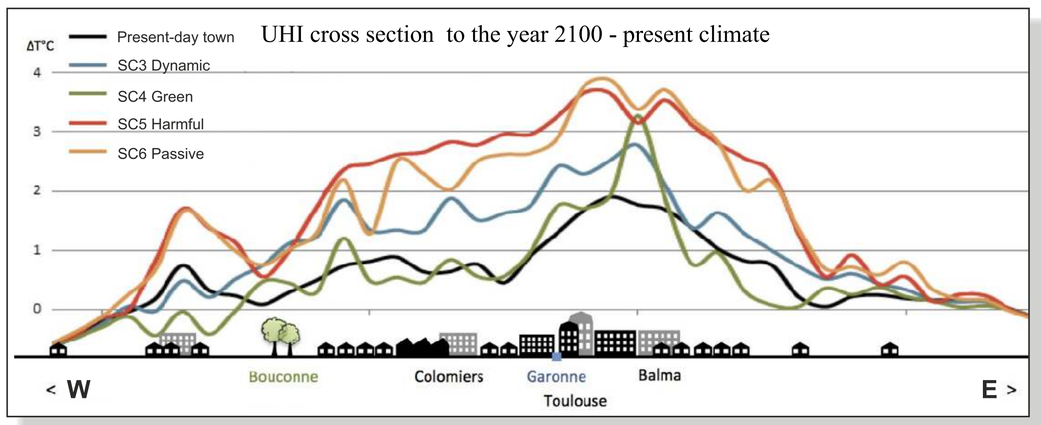
## How to provide decision makers with a reliable urban microclimate diagnosis at an affordable cost ?

**Needs expressed in the scope of urban climate**

- ❑ urban areas vulnerability, facing heat waves, in a context of climate change
- ❑ impact of urban planning policies on microclimate and energy consumption
- ❑ hydrological risks in urban areas




**Challenges in meeting the needs**

- ❑ case-by-case treatment due to heterogeneous requests
- ❑ gathering of homogeneous urban descriptive information
- ❑ use of multidisciplinary models
- ❑ transcription of urban development scenarios

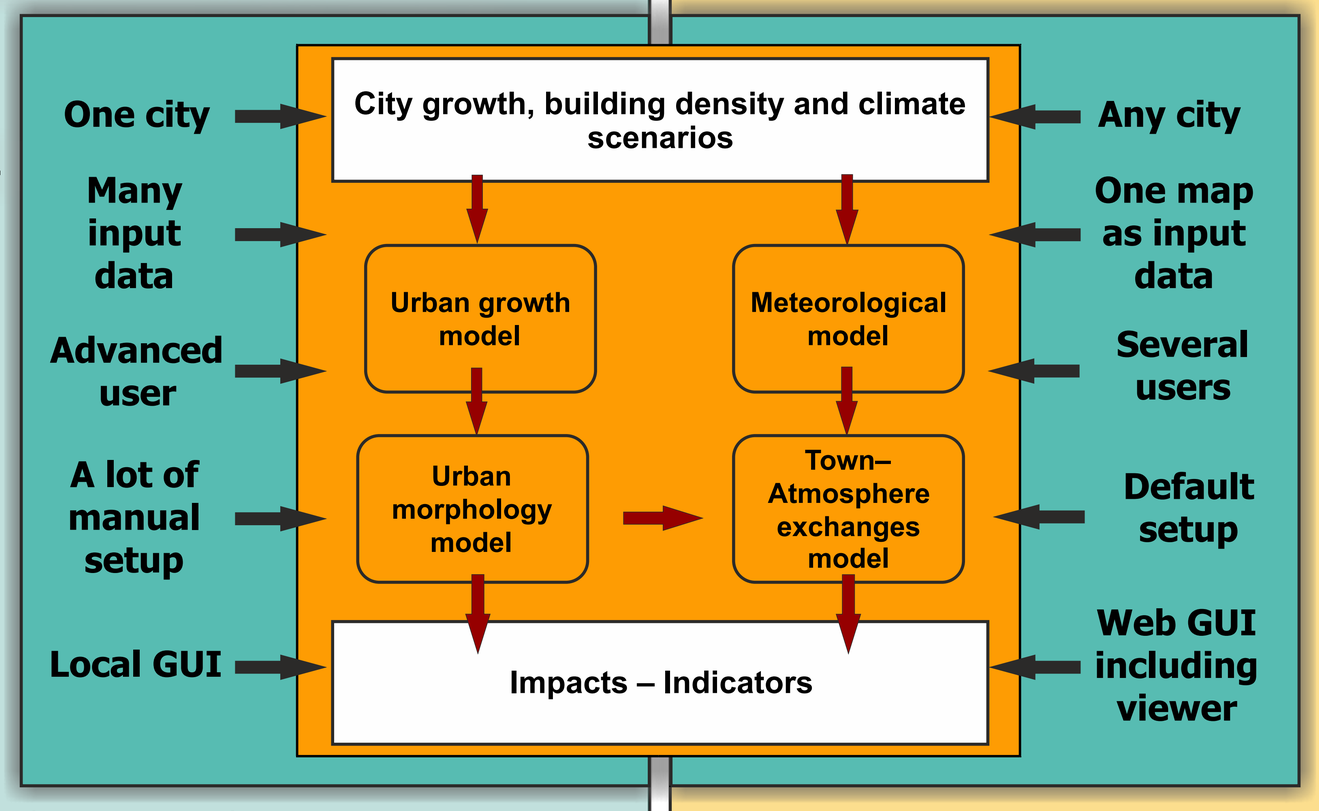
**This poster presents the steps performed to offer a user-friendly multi-model platform able to simulate the evolution of the city and the urban climate over a century.**

## From a research approach ...

From 2009 to 2013, 8 French labs contributed to the ACCLIMAT project[3]. The aim of the project set-up to study the interactions between urban development, urban microclimate and climate change processes.
ACCLIMAT was designed as a demonstrator for the Toulouse urban area. It aimed to answer practical issues :

- ❑ Which socio-economic levers have an effect on urban expansion ?
- ❑ What are, for the Toulouse urban area, the possible projections of the city expansion ?
- ❑ Which socio-economic factors have impacts on the urban expansion ?
- ❑ What are the potential impacts of a given adaptation strategy ?
- ❑ What are the impact of urbanization on local climate ?
- ❑ Can we quantify these combined effects on energy consumption, comfort of the inhabitants, economic and environmental costs ?

Scenarios of evolution were applied to the Toulouse metropolitan area and served to force urbanization models, as well as an urban-block model, and a climate model.




**Main results of the ACCLIMAT research project**

- The main levers are : the urban form, the vegetation density and the behaviours of inhabitants. The temperature set point for heating or air conditioning, or the use of shelters in summertime can have more impact than technical aspects, such as the renovation of buildings.
- High-rise buildings increases the Urban Heat Island (UHI) impact. They induce warmer UHI in summer (due to lack of green areas) but reduce it in winter (due to increase of the ventilation).
- Simulations with different future urbanization patterns lead to a UHI increase of 1°C to 3°C by the end of the XXIe century. As a reminder, in addition to the UHI, the climate warming signal ranges between +2°C and +6°C.
- A compact city increases the exposure to heat in summer, especially because the population is more concentrated downtown, where UHI is the strongest.

## ... to an application for climate services

The main goals of the transfer from research to our consulting department are :

- ❑ to offer an efficient and simple tool for urban climate studies
- ❑ to perform simulations on any large town, including coastal and border site
- ❑ to enlarge panel of users :
  - adding multi-users management
  - designing a user-friendly interface with a drastic reduction of the required input data.

**Simplicity and efficiency**

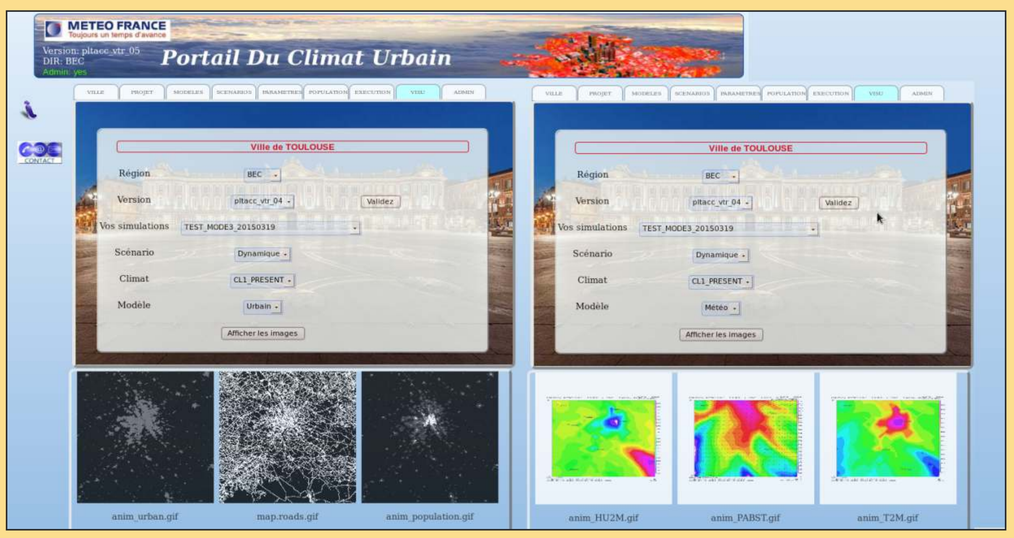
Efforts have been made to simplify the whole process by :

- ❑ conducting an analysis of models to be retained
- ❑ drastically reducing the number of required input data.
- ❑ restricting pre and post-processing steps
- ❑ providing support to prepare, launch and analyse experiments.

Using the new platform instead of the previous research tools should reduce by 30% the time needed to lead a new urban climate study.

**Main steps to achieve a user-friendly multi-model platform**

- ❑ Changes in urban models
- ❑ Simplified town description as single input map
- ❑ Preparation of large-scale forcing integrated into the platform
- ❑ Graphical User Interface (GUI) including a quick look of some output




User interface : visualization of some simulated output parameters (to control the simulation)

A set of chronological tabs helps the engineer in the various stages of the preparation:

- ❑ selection of the city
- ❑ design of urban evolution and building technology scenarios, over three consecutive 30 year periods
- ❑ change of models default setup
- ❑ choice of the weather conditions (among a set of available situations).

**Post-processing**

The set of available output fields, describing either climate or town, has been updated, adding new meteorological parameters.

## Further tests and perspectives

The simplifications brought to the prototype will be tested on Toulouse city and will be assessed using some key indicators and scenarios inherited from ACCLIMAT.

## References

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