A MULTIDISCIPLINARY OBSERVATORY TO ASSIST THE CLIMATE CHANGE ADAPTATION POLICY: THE EXAMPLE OF THE GREATER LYON
AN ONGOING CLIMATE CHANGE ADAPTATION POLICY

2005-2010: launching of the first projects

• EU Amica project: heatwaves identified as the main local climate change issue
• First maps of the Urban Heat Island (UHI) local variations

Geo-statistical approach (Champiat, 2008)
Remote-sensing identification (UrbaLyon, 2010)
AN ONGOING CLIMATE CHANGE ADAPTATION POLICY

2010-2015: public and private research initiatives

• PhD thesis to improve the knowledge of UHI spatialisation in three different cities
• Environmental analysis in “La Duchère” district by a design office
• First thermal model in the “Confluence” district by researchers on urban sciences and techniques
• Temperature measurements in the “Part-Dieu” district during summer 2011
• Road dampening project in the “Part-Dieu” district between 2012 and 2014
• EVA project: impacts of water, vegetation and albedo on microclimate

Many questions still remain:
• How to model local urban microclimates? Which districts? Which interactions with climate change?
• Where are located the most heat-related vulnerable assets?
• How to evaluate local adaptive capacities?
• Which are the best practices to refresh hot urban areas?
• Which are the best-climate adapted materials?
• How to deal with citizens for a better sharing of good practices?
Statistical trends concerning mean temperatures and heatwaves

At the Lyon-Bron station, between 1959-2013 (reference period 1981-2010), there have been:
• An increase of the mean annual temperature of 1.7°C.
• An increase of the mean summer temperature of 2.4°C
• Three main heat waves: 1976, 2003 and 2015

Future climate change projections according to European models

Summer temperature differences (°C) relative to the 1976-2005 period according to RCP 8.5
An increase between 0.5 and 1.5°C

Number of heat wave days differences relative to the 1976-2005 period according to RCP 8.5
An increase between 0 and 10 days
THE HEAT-RELATED RISK, A COMBINATION BETWEEN HAZARD AND VULNERABILITIES

Excess mortality risk:
- 1976: excess mortality of 6,000 people in France
- 2003: excess mortality of 15,000 people in France
- 2015: excess mortality of 3,000 people in France

Many determinants of heat exposure:
- Urban determinants: highly mineral environments; anthropogenic additive heat; pollutant emissions...
- Climatic determinants: precocity and length of the heatwave; very high minimal temperatures...

Many determinants of heat-related urban vulnerability:
- Physiological determinants: elderly, children, people with pre-existing health impairments...
- Socio-economic determinants: education, income, poverty, home amenity, housing quality, healthcare access, social isolation...
- Institutional determinants: ability to deliver services, willingness to invest in adaptation, barriers to adaptation, participatory decision making...
A SCIENTIFIC APPROACH THAT SHOULD BE EXTENDED

Global approach of heat-related risk

Hazard
- Local climate measurement
  - Instrumentation
  - Multi-scale modelling

Impacts
- Health impacts
  - Environmental impacts
  - Economical impacts

Vulnerabilities
- Vulnerabilities of human and material assets
  - Observation
    - Assessment of territorial vulnerabilities

Resilience
- Reactive resilience
  - Observation
    - Assessment of adaptive capacities
  - Proactive resilience
EPOC project:
Foreshadowing study of a local climate observatory
Length: 2 years (2014-2016)
Multidisciplinary researches
Researchers-practitioners rapprochement

...through an observatory, considered as an interface between:
• researchers
• technicians from local authorities
• consultants
• managing directors
• professional association networks
• citizen associations

Many objectives:
• Sharing scientific knowledge
• Overviewing local scientific, technic and socio-economic abilities
• Foreshadowing the structure, its governance and its funding
• Experimenting some expected deliverables

An adaptation strategy with a partnership approach...

First workshop of the EPOC project organized in 2015
AN OBSERVATORY TO BRING MULTIDISCIPLINARY AND OPERATIONAL ANSWERS

Multidisciplinary group

Building physics  Civil engineering, architecture and urbanism  Meteorology and urban climatology  Environmental health

Geography  Sociology  Economics  Anthropology  Social psychology

Three main topics: urban microclimates characterization; assessment of territorial vulnerabilities; diagnosis of adaptive capacities

Public stakeholders (local authorities)

Development projects  Operational needs

Guidance documents  Prof. training  Tools, software

Innovation, Experimentation

Participatory researches  Education and outreach

Practices and knowledge

Private stakeholders (businesses, professional associations...)

Civil society (citizens, associations...)

Diagnosis Report  Decision aid  Indicators
Building of a heat-related vulnerability index:

- Quantification of the socio-economic assets

- Assessment of the vulnerability based on expert judgments (doctors, nurses, epidemiologists)

- Weighting of the assets with a multicriteria decision analysis method

Three main vulnerable assets: elderly, children, people with pre-existing health impairments
Modelling:
3 different districts:
- Lyon-Terreaux (old buildings)
- Lyon-Perrache (ancient suburb in full renovation)
- Rillieux-Semailles (residential suburbs)

Selection criteria:
- High values of vulnerability index (top decile)
- Various shapes and ages of buildings
Rillieux-Semailles, a residential suburb district with one of the higher values of vulnerability index.

“Solene microclimate” process (in brief): land-use characterisation; 3-D shaping; attribution of thermodynamic properties; computational fluid dynamics.

Surface temperature; air temperature; velocity.

Study area
Mineral roads
Built-up surfaces
Vegetated surfaces
Paths
Wolf and McGregor (2013)

**Quantitative socio-economic indicators:**
demographics, health status; access to resources, mobility

**Qualitative indicators:**
behaviour, access to support, access to information

Scientific barrier: how to assess?

Multidisciplinary researches with geographers, social psychologists, sociologists and anthropologists

First diagnosis: citizen consultation
EPOC 3rd Project: Diagnosis of Local Adaptive Capacities

- First step: “street interviews”: individuals motivations to be part to a participatory research
- Second step: creation of a multidisciplinary group to elaborate participatory methods and tools
- Third step: “focus-groups”: experimentation of participatory methods on individuals from civic and environmental associations (neighbourhoods councils...)
- Fourth step: “market stall”: experimentation on participatory methods on individuals in a familiar environment with a focus on “emotions and feelings” about climate change
- Fifth step: multidisciplinary analysis by the previously established group
RD PROJECT: DIAGNOSIS OF LOCAL ADAPTIVE CAPACITIES

Semantic repartition of the social representations according to three levels:

- **Central core**: most established representations
- **Surroundings elements**: representations which are the most able to change
- **Ambiguous zone**: transition zone between consolidated ideas and movable representations

First knowledge to determine citizens' behaviour and practices
CONCLUSIONS

An ongoing local adaptation policy, which is currently facing several scientific and technical barriers

A local community of researchers working on urban climates and climate change

The solution to all problems!

A structure interface is needed to ensure the mediation and the translation of, in one hand, the operational needs and, on the other hand, the scientific data, concepts and methods.

is one possible solution to address the climate change adaptation and many projects have been launched to consolidate relations between researchers, practitioners and citizens.

Now, we need to sustain this structure with consolidated scientific and technical deliverables, an established budget (scientific programs from European or national funding, public and private contributions) and a staff to animate the network.

Thank you for your attention!