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Observation of urban climate variability at local scale and comparison with human perception

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Experimentally, the Urban Heat Island (UHI) is often studied at the scale of the entire city or by differentiating its effects according to homogeneous neighbourhoods. Nevertheless, the urban climate variability at very local scale may be of the same order of magnitude than at city scale. The neighbourhood is besides a quite interesting and challenging microclimate study field. The comprehension of microclimate variability and involved physical processes may open short-term perspectives regarding the local urban planning, with the double objective of improving thermal comfort while meeting as much as possible inhabitant expectations.

With this aim, an interdisciplinary field experiment associating researchers in meteorology and human and social sciences was carried out in a neighbourhood of the city of Toulouse (France). The area covered about 1 km x 0.5 km and was composed of different urban fabrics. From January to June 2014, a permanent network was setup, composed of ten weather stations recording near-surface temperature, humidity, wind speed and direction, and completed by a roof-level reference station in order to document larger scale atmospheric variables including the incoming short- and long-wave radiation. Also, three intensive observational periods were conducted in January, April and June 2014. For three successive days, every three hours, mobile measurements of temperature, humidity and wind were continuously recorded along a predefined itinerary through the neighbourhood, with a GPS recording associated. Moreover, black and grey globes were used to appreciate the “perceived” temperature. Finally, during “commented walks”, the inhabitants completed a social survey (simultaneously to measurements) about their feeling perception, especially in terms of thermal comfort.

The data analysis first focuses on the objective detection of a microclimate variability at this study scale, while considering the possible seasonal influences. It also addresses the issue of climatic atmosphere or “ambiance” through the coupling of different measured meteorological parameters, and the evaluation of a perceived temperature computed using grey globes. Finally, a first cross-analysis is proposed in order to put in perspective the environmental physical parameter measurements and the results of social surveys questioning people about their perception.