



DETECTING RECENT SPATIAL CHANGES IN THE URBAN HEAT ISLAND OF A MEDIUM-SIZED CITY DUE TO THE INCREASING HUMAN ACTIVITY

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ABSTRACT: We attempt to assess the urban heat island (UHI) changes in a medium-sized city due to its recent considerable increase in urban extension and population. We apply the study to the city of Vic, located in north-eastern Iberian Peninsula, which has over 40.000 inhabitants. The cold half of the year (October to March) is considered to compare the data measured in 2001-2002 with those ones in 2006-2007. Actually, Vic's population has increased almost 20% during these last five years. We used the method of the urban transects using a digital thermohygrometric probe covering almost all the city and its outskirts. The main results show nonsignificant variations in mean intensity of the UHI despite the urban surface expansion. Nevertheless, the maximum intensity and the UHI spatial shape has experienced some important changes: the UHI core has enlarged due to the increasing human impact concerning industrial activities. This fact might lead in the near future to such a potential energy saving on housing heating in midwinter over a very extensive area of the city.

INTRODUCTION: The city of Vic and its outskirts are located in a structural depression from the centre of Catalonia (Osona) in the northeast of the Iberian Peninsula. Calldetenes is an eastern town placed nearby (Figure 4). During the past years has connected to Vic (Figures 1, 3 and 4). Vic is crossed by two little rivers, Mèder and Gurri (Figure 3). The industry of the city was developed during the XIX century thanks to the presence of these rivers. As many other medium-sized cities from Catalonia, Vic's population has increased significantly in the past 5 years (Figure 2), giving an important impact on the urban extension of the city (Figure 1). On the other hand, the energy consumption also has experienced an increase during the same period (Figure 2).



Figure 1: City of Vic in 1997, 2003, and 2006. Source: Institut Cartogràfic de Catalunya (ICC) (1997, 2003) and Google Earth (2006).

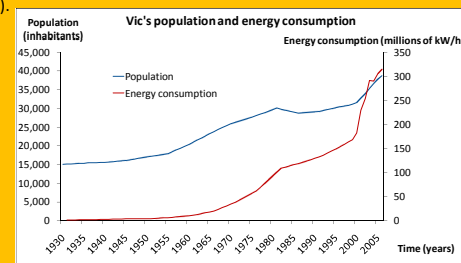


Figure 2: Vic's population and energy consumption temporal evolution. Data source: Idescat (Statistical Institute of Catalonia) and Agència de l'Energia d'Osona (Osona Energy Agency).

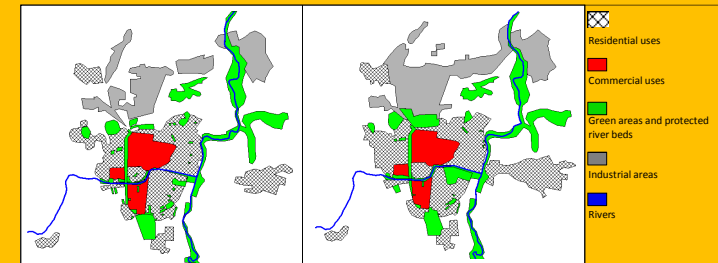


Figure 3: Land uses of the city of Vic in 2001 (left) and 2006 (right).

METHODOLOGY and DATA: Data has been obtained over two campaigns. The first one took place from October 2001 to March 2002, while the second one between October 2006 and March 2007. We applied the method of the urban transects (Figure 4) using three axis crossing the main parts of the city with 47 observation points. The measurements took place about three and a half hours after sunset. After correcting data and discarding erroneous observations, we worked with 14 days for the first campaign and 19 for the second one.

RESULTS:

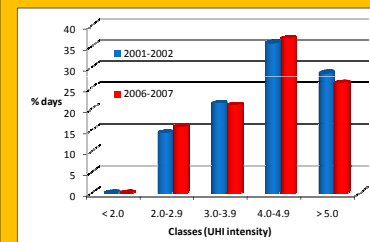


Figure 5: Class distribution of UHI intensity

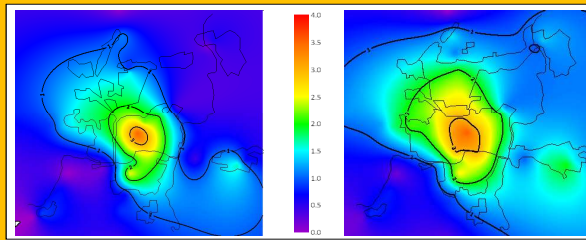


Figure 6: UHI mean intensity in 2001-2002 campaign (left) and in 2006-2007 campaign (right). The values show intensity, not absolute temperature.

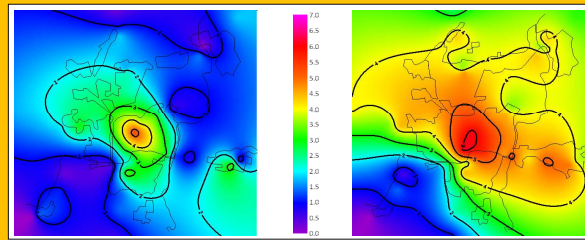


Figure 7: UHI maximum intensity in 2001-2002 campaign (left, on 25th March 2002) and in 2006-2007 campaign (right, 23rd February 2007). The values show intensity, not absolute temperature.

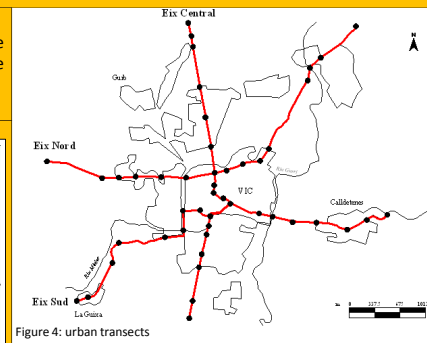


Figure 4: urban transects

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CONCLUSIONS:

- Recent urban transformations in western, northern and eastern Vic, and the important increase of the internal mobility (51% to 58%), seems to have led to a significant variation in the extension and spatial structure of the UHI.
- The increase in population, extension of urban area, energy consumption and internal mobility might have some repercussion in the stronger UHI maximum intensity and in the light increase of the UHI mean intensity (from 3.5°C to 3.6°C).
- Newest built and urban expansion areas (in the west, the junction of Calldetenes and Vic in the east and the junction of the whole industrial area in the north) seems to play an important role in the new spatial configuration, structure and core expansion.