

The diversity of land surface temperatures in the Greater Lyon (France): preliminary characterization with Landsat 8 TIRS to monitor heat waves impacts

*Florent Renard¹, Didier Soto²

1.University Jean Moulin Lyon 3, UMR 5600 CNRS Environment City Society, 2.LABEX IMU, UMR 5600 CNRS Environment City Society

The health impacts of heat waves are a 21st century challenge facing the world and France in particular. Measures have to be taken to avoid disasters like those of 2003, 2006 and 2015 that respectively caused 15,000, 1400 and 3300 deaths, according to the International Disaster Database EM-DAT (Guha-Sapir et al., 2016). The victims were mainly recorded in large cities because of rising temperatures due to global climate change are amplified by the effect of urban heat island (UHI). This study aims to characterize the phenomenon of UHI on the Greater Lyon area. Located in the southeastern part of France, it focuses 1.3 million people about 500 km², with a high rate of elderly. A parallel study identified the sectors with the most vulnerable populations in terms of health criteria, such as age or physical condition (Renard et al., 2015). The aim of this study is to determine the most frequently hot areas of the city and to compare them with the places where people are the most vulnerable, in order to target priority areas for mitigation and adaptation to this risk.

The method is based on remote sensing. The bands 10 and 11 of the landsat-8 thermal infrared sensor (TIRS) are to calculate the land surface temperature (LST). This temperature estimation procedure follows the ones established by Jimenez-Munoz and Sobrino (2003), Sobrino et al., 2004 and Cristobal et al., 2009. This implies to convert in a first step the Landsat thermal band to at-sensor spectral radiance and then to at-sensor brightness temperature. In second time, the land surface emissivity is estimated using the NDVI threshold methods, according to Sobrino et al., 1990 and 2008. Finally, the land surface temperature (LST) is obtained thanks to the single-channel algorithm (Jimenez-Munoz and Sobrino (2003), Sobrino et al., 2004 and Cristobal et al., 2009) and the results are converted from degrees Kelvin to Celsius.

The results show strong LST spatial disparities in the Greater Lyon. Indeed, variations of several tens of degrees in just a few kilometers are found between rural and urban territory, as for the 4th of July, 2015 (fig. 1). The warmest part of the city is located into the ancient town center and the industrial areas. However, the most sensitive persons are located into the town center, where air conditioning is not frequently used. Consequently, strategies of mitigation and adaptation should be quickly focused on these precise areas.

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