

Heat Islands identification through remote sensing images and surface data: a case study of extreme events in the atypical summer 2013/2014 in Campinas-SP

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Abstract

The formation of heat islands in the city of Campinas is related to the intense process of urbanization that expands through vertical integration, and the inappropriate use of land, changing the surface and the local atmosphere, favoring the increased absorption of solar radiant flux. With these changes, the urban climate undergoes variations in temperature, humidity and wind. This research project used the techniques of remote sensing geoprocessing through images of the satellite Landsat 8, bands 10 and 11 (bands of thermal) to identify and analyze the heat island phenomenon, and its influence on the local climate in the atypical summer 2013/2014.

Key words:

heat islands, urban climate, remote sensing.

Introduction

The data time series of satellite Landsat8 and surface meteorological in the city of Campinas has shown rising temperatures in recent decades and, according to scientific studies, this increase may be related to the urban expansion of the city that currently has 98, 28% degree of urbanization, and approximately 1,164,098 inhabitants. Assuming that thermal images may represent reliable information of the surface temperature and that it varies according to the land use and occupation, we used images of TIRS sensor (Thermal Infrared Sensor), band 10 and spatial resolution of 100 meters aboard satellite Landsat8 distributed between 2013 and 2015, and further surface data from three meteorological stations of the city in different locations.

Results and Discussion

To develop the project, we used temperature, precipitation and relative humidity data of three weather station surfaces in Campinas: Center for Weather and Climate Research Applied to Agriculture (Cepagri), Agronomic Institute of Campinas (IAC), Viracopos airport, and pictures from TIRS sensor present in satellite Landsat8. The selected scenes were submitted to the ENVI, an image digital geoprocessing software that allowed better exploration and analysis of surface temperature data. Later, we used the Pearson Correlation between the temperature data measured in meteorological shelter at 1.5 meters from the ground, and the temperature data estimated by satellite with a real difference 1 hour to less between stations. It was obtained a correlation of 49% at Cepagri station/Unicamp, 86% at the Agronomic Institute of Campinas station, and 90% at the International Viracopos Airport.

Conclusions

The different degrees of urbanization where each weather station is located and the heterogeneous characteristics of the local area, such as its roughness, impermeability, vegetation cover, and concentration of buildings, explains the different values between the correlations of the stations. These factors contribute to the distortion of the surface temperature values detected by the satellite, making it difficult to obtain more accurate data through remote sensing.

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