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BREATHING DISEASES AND INTRA-URBAN CLIMATE

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ABSTRACT

The main objective of this work was the investigation of possible influences of the urban heat islands in the increase of breathing diseases in children up to four years. The study area was the city of Vitória da Conquista, located in the Southwest of Bahia, Brazil, in the which, historically, the incidence of this kind of disease is the largest in the state and in the country of Brazil. The methodological procedure used geo-processing techniques for the location of the urban heat islands together with the installation of meteorological stations. The number of cases of breathing diseases in the infantile population was obtained through the analysis of the handbooks of all the hospitals that assisted children in the city. Three heat islands were identified in the central area of the urban area that presented values of relative humidity inferior to 25% when compared with the values of the station located out of the urban area and temperatures of up to 4,1°C superiors. The largest number of children's cases with breathing diseases happened near the heat islands, indicating the increase of the studied disease due to the decrease of the temperature and increase of the relative humidity in these places during the coldest months.

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INTRODUCTION

It has been having prominence in the last decades, the best need to understand the current meteorological effects of urban environmental alterations in the health of the population (SILVA, 2005). According to Rizwan *et al*. (2008), the urban heat islands are the main manifestations of the urban climate being considered one of the principal environmental problems of the century XXI deriving from the urbanization and industrialization, associated to changes in the covering of the urban surface. The urban heat islands are resulting from alterations in the atmospheric parameters, (TAHA, 1997; ARNFIELD, 2003; KANDA, 2006). The present article investigates possible influences of the urban heat islands in the increase number of diseases relatedto the breathing apparel to the infantile population. It was developed in the urban area of the city of Vitória da Conquista - Bahia, in the which, historically the incidence of these diseases is the largest from Bahia and Brazil (DATASUS, 2010). The city presents a demographic area of 3204,25 km², located in the Southwest of Bahia, distant 509 kilometers of the city of Salvador, capital of the State. It possesses a tropical climate of altitude because of the elevation of the city, with average of 923 m and more than 1100 m in the highest neighborhoods. It registers inferior temperatures to 10°C in some days of the year and the hottest month is March, with medium temperature of 21,8°C, while the coldest month is July, with average of 17,8°C. The annual average rainfall is of 734 mm (SOARES, 2009). According to IBGE (2010), Vitória da Conquista possesses a population of 306.866 inhabitants, with 96,1 inhabitants' demographic density for km², and the children's population up to 4 years is of 23.000 inhabitants.

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This work is a cutting of the doctorate thesis denominated: Urban biometeorologia and breathing diseases" presented to the Program in Development and Environment of the Santa Cruz's State University. In order to investigate possible influences of the urban heat islands and the increase of breathing diseases in children up to four years, the urban area of the city was analyzed by neighborhoods, three urban heat islands were located and three meteorological stations installed in the center of these areas using geo-processing techniques. The number of the breathing diseases was monitored at the four hospitals that assisted this demand type. The understanding of the relationship between the atmospheric conditions and the breathing diseases could subsidize alert systems, procedures of conduct and of emergency attendance on behalf of the of the human life quality.

MATERIALS AND METHODS

Identification of the Urban Heat Islands: It was accomplished through data of the thermal sensor of the satellites Lands at TM 5 and 8. The Lands at 5images are available in the site of the National Institute of Space Researches - INPE, and the Lands at 8images in the American Geological Service - USGS. Later the atmospheric corrections and conversions were accomplished in units of temperature related to the levels of ash tones generated by the satellite for values of the surface temperature.

The Data Geo-processing: Once the thermal data was obtained, it was necessary to perform the atmospheric corrections and conversions in conventional units of temperature. The atmospheric corrections were performed in the software IDRISI Taiga. Using the imported rude images, the module "executed ATMOSC" (that automatically correct some atmospheric influences as gases, clouds, wave length, etc.).After that, the tool "THERMAL" was applied, which converts the ash tones to spectral radiance values (L λ). The corrected images were manipulated in the software ArcGis 9.3, being accomplished the conversion of the spectral radiance values to temperature in degrees Kelvin. That conversion is possible starting from the Equation 1developed by (MARKHAM *et al*., 1986). Where:

$$T = \frac{K_2}{\ln\left(\frac{K_1}{L\lambda} + 1\right)}$$

T = Effective temperature (ºK);
K2 = constant of calibration (607.76 go Landsat 5 TM);
K1 = constant of calibration (1260.56 for Landsat 5 TM);
L? = Spectral radiance (watt / (m^2 x ster x μm).

In this way, it was concentrated the temperature information for study area.

Meteorological Monitoring: The installed stations were of the model Instrutemp WH-1080PC, equipped with barometer, termometer-hygrometer, pluviometer and anemometer. The reading was accomplished every 60 minutes. The configuration of the station, reading and access to the database formed were accomplished through the interface with the Software Easy Weather. AnUSB connection allowed the capture of data in the format xls, in a spreadsheet with cryptography for the Software Excel.

The Mapping of the Breathing Diseases: The number of cases of breathing diseases in the infantile population was mapped and obtained through the analysis of the handbooks of all the hospitals that assisted pediatric emergencies in the city (Hospital Isaú Matos, CAMI (Center of Infantile Medical Attendance), Hospital São Vicente and the Hospital São Geraldo). It was selected the cases with diagnosis belonged to following groupings CID'S - 10 (International Classification of Diseases): J00 - J06: Sharp infections of the superior aerial roads; J10 - J18, Influenza (flu) and pneumonia; J20 - J22, other sharp infections of the superior aerial roads; J40 - J47, chronic diseases of the inferior aerial roads (CBCD, 2008).

RESULTS

Urban Heat Islands : The method used with the satellite images allowed the identification of 3 places with larger temperatures on the surface concentrated on points of characteristics urbanized, being those points the 3 urban heat islands of Vitória da Conquista (Figure 1) located in the neighborhoods totally inserted in the central zone of the city. Being them: Neighborhood Brazil, Centro and Candeias.

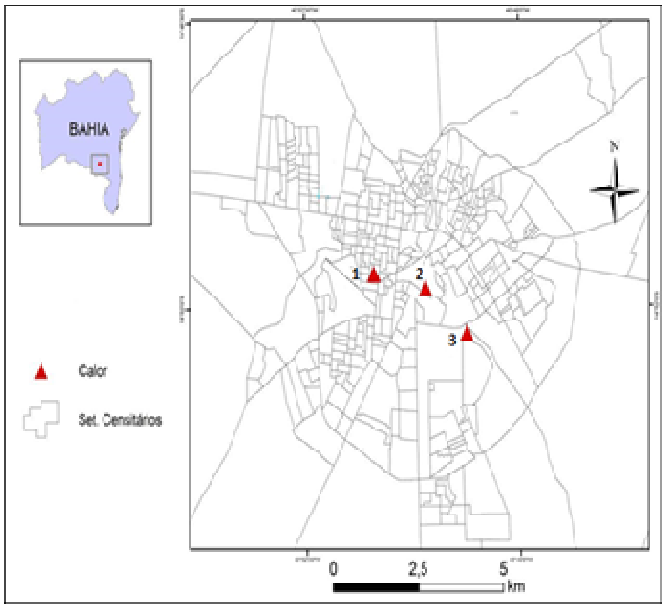

Figure 1. Urban heat islands

Meteorological Monitoring

Places and Period: The sampling period was from April/2015 to December/2015 with hourly registrations of the precipitation, temperature and relative humidity. For comparison of the data obtained in the intra-urban points (P1, P2 and P3) were obtained from the data of the Meteorological Station of UESB (INMET) located out of the urban area (P4) in the same period.

Data Analysis

Precipitation: The result of ANOVA with F (0,04) <critical F (2,90) did not demonstrated the existence of significant statistical differences to 5% of probability among the collection points.

Relative Humidity: ANOVA with F (3,23)> critical F (2,30) demonstrated the existence of significant differences among the monthly averages values of relative humidity. The difference found among the average of the relative humidity of the points located in the heat islands (P1, P2 and P3) and the

values obtained in the Meteorological Station of UESB shown in the Figure2 It could be observed that during the month of December the medium relative humidity was 25% inferior in the urban zone of Vitória da Conquista.

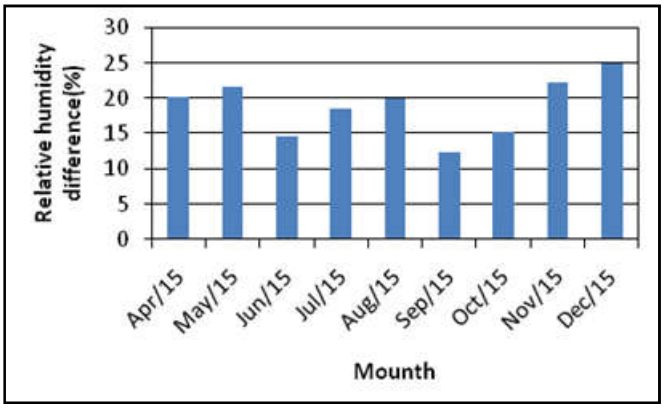

Figure 2. Relative Humidity

Temperature : The temperature difference among the mean of the points 1, 2 and 3 and the average of Point 4 is presented in the Figure3, demonstrating that the located points in the heat islands (P1, P2 and P3) presented in every month larger values than the Point 4, being more significant the hottest months (October, November, December and April).

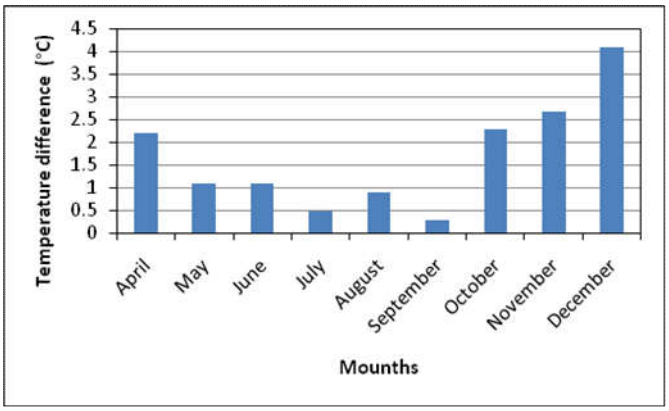

Figure 3. Temperature difference

Mapping of the Breathing Diseases: Considering the sampling period and the number of attendance of the 4 hospitals, Figure4 showed the number of attendances in each one of the months, where there was an increment in the number of attendances from April to July and subsequent decreasing until the month of November. In December the number of attendances arose again.

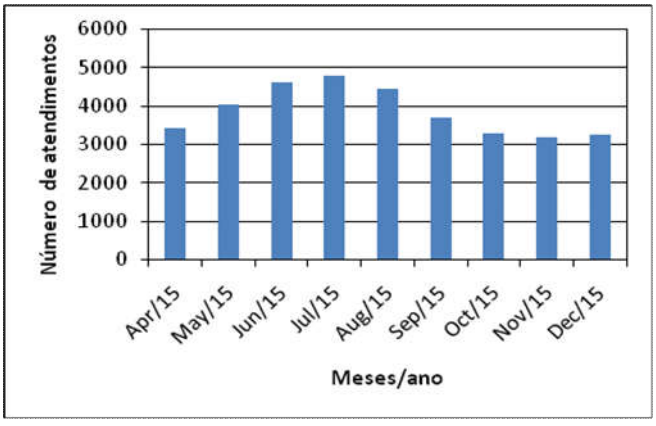

Figure 4. Attendence number /mounth

Figure 5 shows the number of attendances by neighborhood. The ones that presented larger numbers of individuals assisted at all the hospitals were from the neighborhoods of Candeias, Centro and Recreio and the smallest number was presented by the neighborhood of Zabelê.

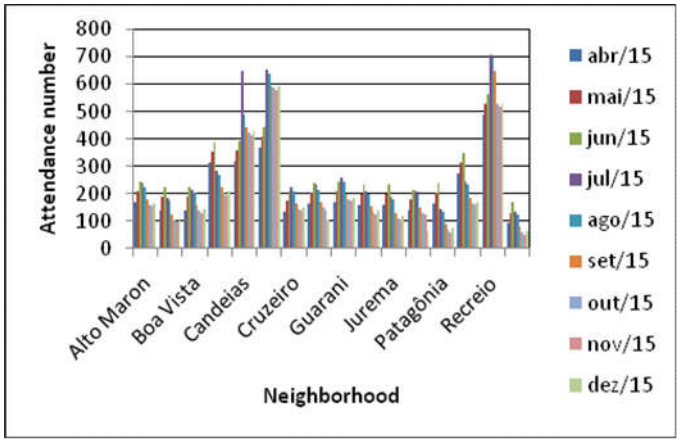

Figure 5. Attendance number /neighborhood

DISCUSSION

This article made possible to analyze the influence of the urban heat islands of the area of the city of Vitória da Conquista in the increase of breathing diseases in children up to four years. The conclusions obtained by Lombard 1985; Carnaham *et al*., 1990; Perez *et al*., 2001 and Weng, 2001, in which the heat islands are more intense in the summer, corroborate with the acquired data in this work. The results allow to infer that the largest number of assisted children resided in the neighborhoods where were located the heat islands, suggesting therefore that the meteorological conditions of the heat islands increase of breathing diseases. These conclusions are in agreement with the work of (Sant'annaNeto *et al*., 2000), Persinger (1980), (Confalonieri *et al*., 2007), Sant'anna (2008) and EPA (2008). Consequently, it can her therefore to affirm that the central areas of the city of Vitória da Conquista are more vulnerable to the adverse effects of the climate tends in view the decrease of the relative humidity and increase of the temperature, mainly during the hottest months of the year.

The results obtained in the present work they are in agreement with verified by Zem (2004) in that the low temperatures and high relative humidity of the air increased the incidences of breathing diseases in São JosédosPinhais (PR). According to Sobral (1998), the environmental factor that more presented influence in the breathing diseases was the temperature of the air, while in the case of Vitória da Conquista, the largest number of attendances was correlated in 2 of the 3 cases to the humidity of the air. Therefore, the results allow to infer that the largest number of assisted children resided in the neighborhoods where were located the heat islands due to decrease of the temperature and increase of the relative humidity in these places during the coldest months. Finally, the results suggest the adoption of mitigating measures (planting of trees, creation of green areas and aquatic surfaces) that can subsidize the urban planning as support decisions and in the construction of strategies to be adopted in the central area of the city in the sense of minimizing the thermal discomfort, in the appearance of heat islands and consequently the number of children with breathing diseases.

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