USING SAR DATA FOR SOIL TEMPERATURE REGIMES CLASSIFICTION IN SÃO PAULO, BRAZIL.

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INTRODUCTION

The climatic variables are used in Soil Taxonomy (Soil Survey Staff, 1999) for soil classification, because it is important to plant germination and growth, soil formation and others soil properties.

Synthetic aperture radar (SAR) interferometry has been shown to be a very cost effective tool for measuring digital topography (Zyl, 2001). The data of Shuttle Radar Topography Mission (SRTM) were the results of an international mission that generate a digital elevation model (DEM) with high resolution (Souza Filho, 2003). The data were generate and provided for South America with 90m spatial resolution. The SRTM was in February, 2000 and produced the most complete terrain map of the world (Foni, Seal, 2004).

A radar interferometer images a scene from two slightly different positions. In the case of a single-pass interferometer, such as SRTM, these images are acquired simultaneously. This means that one needs to separate the antenna systems in space, but always know the relative positions of the antennas in order to reconstruct the topography correctly (Zyl, 2001). The SRTM actually flew two interferometers, a C-band system, and a X-band system.

The DEM generate by SRTM has a good accuracy, and besides a great advantage in the homogeneous DEM quality. Therefore, it can be used to estimate the air temperature using multiple regression analysis, based on geographic coordinates and altitude as independent variables (Pinto et al., 1972; Pedro Júnior et al., 1991; Marin et al., 2003).

The Soil Taxonomy criteria to define soil temperature regimes consider soil temperature at a depth of 50cm from the soil surface, these data are rare in Brasil, and are poor to classify soil temperature regimes in brazilian territory, classifying the major portion of the country in isohyperthermic regime. The objective of this paper is present a new perspective to classify soil temperature regimes based in air temperature estimated from SRTM data, for São Paulo State.

MATERIAL AND METHODS

This study focuses the São Paulo State. To minimize computing processing SRTM data, originally with 90m spatial resolution, pixels were clustered and transformed in 900m spatial resolution using the software Erdas Imagine. Figure 1 shows the data processing flowchart. In the processing data were converted from raster to this sequence: grid, ASCII table, point vector, raster, and polygon vector. The software Arcmap 8.3 was used to create the triangulated irregular network (TIN), convert to vector and made the intersections.

A PHPalgorithm was developed to convert the altitude data, in ASCII format, to an ASCII table containing altitude and coordinate system data.

SRTM data was the base to estimate the air temperature. Air temperature were estimated by multiple regression analysis proposed by Pedro Jr et al. (1991), based on geographic coordinates and altitude as independent variables.

RESULTS AND DISCUSSION

Figure 2 shows temperature regimes of São Paulo State. The map produced have details such as temperature gradients caused by Ribeira, Paraná, and Tietê river basins and high plateau of “Serra do Mar”. The classes are negatively correlated with the relief, showing that in high altitudes the temperatures are minor.

Based on Soil Taxonomy rules, the State of São Paulo would have four classes. However, take in account the spatial distribution of soil types in São Paulo, it was defined new criteria to stabilish regime temperature classes coherent with soil types in the State.

Thus, five temperature regimes were distinguished in as following:

Microthermic – The mean annual air temperature is lower than 21ºC, and the difference between mean summer and mean winter air temperature is more than 6ºC. Represents 22.1% state's area.

Isomicrothermic – The mean annual air temperature is lower than 21ºC. Represents 4.4% state's area.

Mesothermic - The mean annual air temperature is 21ºC or higher but lower than 24ºC, and the difference between mean summer and mean winter air temperature is more than 6ºC. Represents 10.0% state's area.

Isomesothermic - The mean annual air temperature is 21ºC or higher but lower than 24ºC. Represents 56.5% state's area.

Isomegathermic - The mean annual air temperature is 24ºC or higher. Represents 7.0% state's area.

If the name of a soil temperature regime has the prefix *iso* , the mean summer and mean winter soil temperatures differ by less than 6ºC.

The accuracy of the map elaborated with the presented method depends on the confidence of regression equation. Worst precision exists in mountainous regions on center-west part in reference the temperature amplitude. Data from meteorological stations indicate errors of the order 0.5ºC. In the others parts of the map the accuracy between estimated and measured data are good.

The spatial resolution of the data was satisfactory, presenting a good details from the temperature regimes classes. The geographic position of the São Paulo State, on transition zone between tropical and subtropical climates reflect in the variability of temperature regimes.

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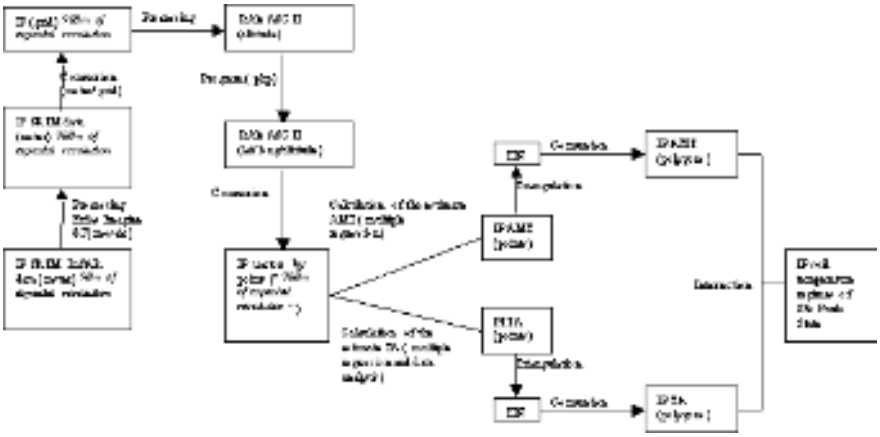

Figure 1 – Simplified flowchart for elaboration of soil temperature regimes of São Paulo State. IP=information plan. AMT=annual mean temperature of air. TA= temperature amplitude. InSAR=synthetic aperture radar interferometry.

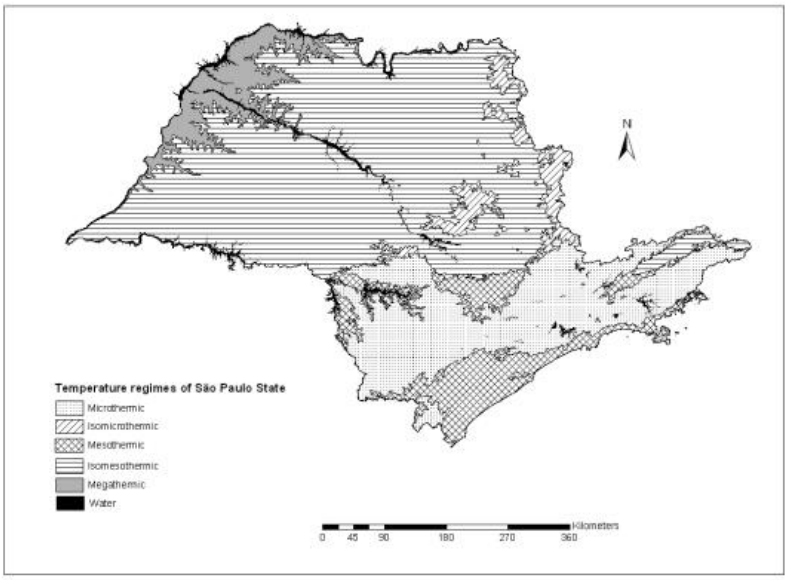

Figure 2 – Temperature regimes of São Paulo State.

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