

## Monitoring of urban thermal fringes using remote sensing data and GIS: a case study of Tsukuba City

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- (1) **Introduction :** Urban thermal fringe is one of the results from the UHI (Urban Heat Island) effect where the city has low vegetation or less evaporation than surrounding areas. Monitoring of urban thermal fringes is important for city and urban planners to reduce the UHI effect within the city in their planning works.
- (2) **Objective:** The main objective of this study is to monitor the thermal fringe patterns in order to assess the environmental quality changes over times and to reduce the UHI effect in future urban development planning.
- (3) **Data:** Following are the list of data used in this study.
  - (1) Three Landsat images; Path 107 and Row 035 of Landsat TM5 (acquired on: 19-04-1987), Landsat TM5 (acquired on: 22-04-1994) and Landsat ETM+ (acquired on: 14-01-2002) were used to calculate  $T_s$  (Surface Temperature).
  - (2) Tsukuba City administration boundary in the ESRI Shape file format.
- (4) **Methodology:** First we computed the surface temperature for each Landsat TM/ETM image and

then applied focal statistical analysis to each pixel which measures the standard deviation of surface temperature ( $T_s$ -STD) with two neighboring pixels (radius 300m). The purpose of this analysis is to measure the homogeneity of  $T_s$  which is directly controlled by the spatial distribution pattern of land use and land cover. This information is useful for city and urban planners to identify the UHI effect inside the city. If the city has a weaker UHI effect, the  $T_s$ -STD value becomes low.

- (5) **Result:** Fig. 1 shows the delineation of urban thermal fringes from surface temperature, and Fig. 2 shows the cumulative curves of  $T_s$ -STD for 1987, 1994 and 2002.
- (6) **Conclusion:** Focal statistical analysis is one of the useful techniques in spatial data mining processes which measures the statistical properties of the object with neighboring features. According to Fig. 2, Tsukuba City surface temperature is becoming homogeneity and reducing the UHI effect compares to previous years.

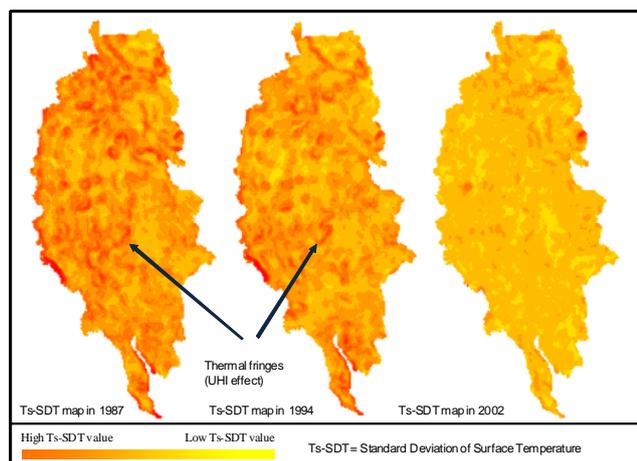


Fig. 1: Mapping of  $T_s$ -STD (Surface Temperature Standard Deviation) for 1987, 1994 and 2002

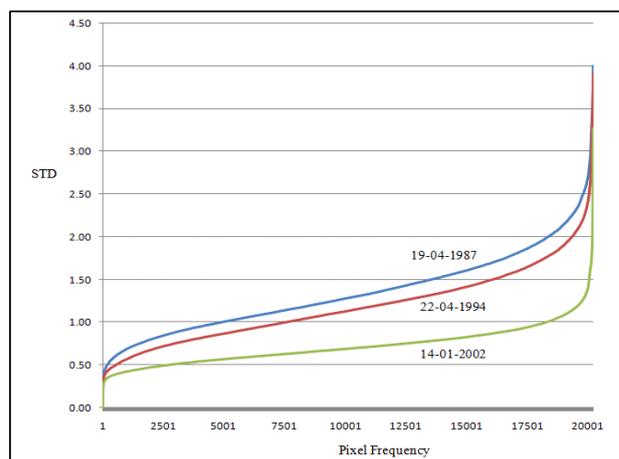


Fig. 2: Cumulative curves of  $T_s$ -STD for 1987, 1994 and 2002. Y-axis shows the  $T_s$  Standard Deviation and X-axis shows the number of pixels (frequency).