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Partitioning Ground and Canopy Layers on an Urban Thermal Image – a Review

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ABSTRACT

The analysis of Johannesburg (South Africa) city heat island started in the sixties by traversing its urban area with the aid of a mobile unit recording the air wet and dry bulb temperature. Applying multiple regression technique (with the aid of urban and topographical predictors) enabled to determine the heat Island magnitude. This study continued in the seventies by analyzing the urban heat island from an airborne remote sensing thermal image of Johannesburg downtown and vicinity (Figure 1). In order to locate the thermal center (the thermal heat island) and the spatial thermal pattern the DISTCORMAT technique was applied. The DISTCORMAT technique is a distance correlation spatial trend analysis that correlates spatial variables against the distance at every variable point. However, the thermal image does not distinguish between the various urban levels, i.e., between ground and the top of the urban canopy layer (roofs surfaces). Automatic and unbiased separation between ground and the top of the canopy layer on an urban thermal image is not straightforward. The simplest technique is to choose a certain thermal range on the grey scale output which should represent the roads emission. Such a technique was applied in the eighties. Based on the roofs pattern recognition by applying some image processing routines has improved (in the nineties) the two level partitioning. The last idea (during the last decade) was to concentrate on the roads semi-automated technique instead of marking the roofs which was found more practically. Applying this new image processing idea for roofs/ground partitioning and analyzing these levels separately by DISTCORMAT spatial technique (Figures 2-4) reveals that the heat island centers do not coincide. The distance between these centers on a nocturnal image of Johannesburg may reach more than 300 m.

Key words: airborne thermography, urban heat island, roofs/ground partitioning,

DISTCORMAT spatial analysis technique

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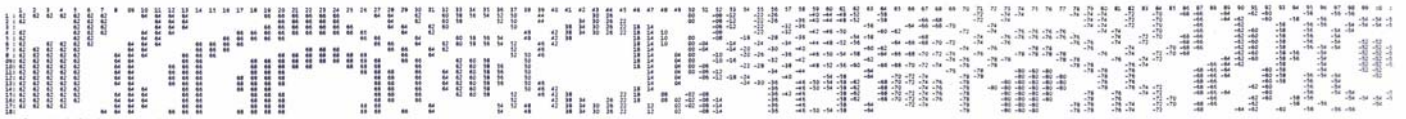
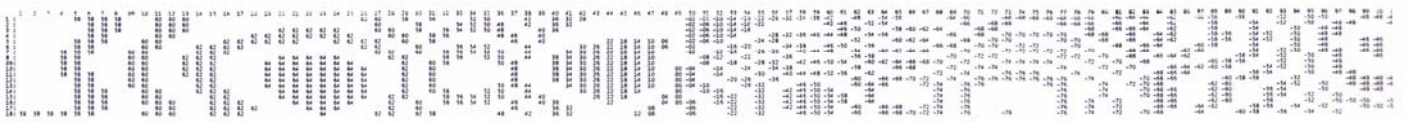
Figure 1: Airborne thermal image of Johannesburg center (brighter – warmer)



point (14,024) max=69.67
point (14,075) min=-80.62

Figure 2: DISTCORMAT all data, distance decay log function JHB



point (12,023) max=64.79
point (18,073) min=-78.04

Figure 3: DISTCORMAT roofs only, distance decay log function JHB

point (18,022) max=71.82
point (11,076) min=-82.34

Figure 4: DISTCORMAT GR only, distance decay log function JHB