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Satellite remotely-sensed land surface parameters and their climatic effects on urban areas

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Rapid urbanization transforms the natural landscape to anthropogenic urban land and changes surface biogeophysical characteristics.Urban growth affects the ecology of cities in a number of ways, such as eliminating and fragmenting native habitats, modifying local climate conditions, and generating anthropogenic pollutants.Urbanization has changed many landscapes throughout the world with serious ecological consequences.To understand the ecology of urban systems, it is necessary to quantify the spatial and temporal patterns of urbanization, which often requires dynamic modeling and spatial analysis. Geospatial information provided by satellite remote sensing sensors and biogeophysical field data are very useful for urban landuse-landcover dynamics and impacts analysis.

The spatial and spectral variability of urban environments present fundamental challenges to deriving accurate remote sensing information for urban areas. By integrating high-resolution and medium-resolution satellite imagery with other geospatial information, have been investigated several land surface parameters including impervious surfaces and land surface temperatures for Bucharest metropolitan area in Romania. Percent impervious surface was used to quantitatively define the spatial extent and development density of urban land use. Land surface temperatures were retrieved by using a single band algorithm that processes both thermal infrared satellite data and total atmospheric water vapour content. Land surface temperatures have been analysed for different land use and land cover categories both in urban as well as in periurban areas. Because of the removal of vegetative cover and the reduction in evaporation over urban impervious surfaces, the urban heterogeneity of land surface and associated spatial extents influence surface thermal conditions. In situ meteorological data were integrated to assess regional climatic conditions. The spatial structure of surface heating influenced by landscape characteristics has a serious impact on regional climate conditions, especially through urban heat island effects.

This papers aims to provide a spatio-temporal analysis of urban structure for Bucharest urban area based on multi-spectral and multi-temporal satellite imagery (LANDSAT TM, ETM; MODIS, IKONOS) over 1987 – 2007 period. Understanding the structure of urban cover dynamics and land surface parameters and their climatic effects on urban areas is very important to urban management for reasons such as runoff control, urban forest planning, air quality improvement, and mitigation of global climate change. Accurate maps of urban tree and other surface cover types can provide critical information to better understand urban ecosystems and help improve environmental quality and human health in urban areas.

This paper demonstrates the potential of moderate-and high resolution, multispectral imagery to map and monitor the evolution of the physical urban environment in relation with micro and macroclimate conditions and their feedbacks.