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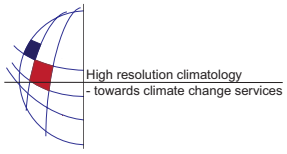

Analysis of climate change impacts on Urban Heat Island through geospatial data

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Through spatio-temporal changes of micro and macro-meteorological conditions in metropolitan areas, climate change due to increased anthropogenic emissions of greenhouse gases and carbon dioxide (CO2) represents a long-term climate hazard with high potential to alter the intensity, temporal pattern, and spatial extent of the urban heat island (UHI).
Instrumental observations and numerical reconstructions of global temperature evolution reveal a pronounced warming during the past 150 years. One expression of this warming is the observed increase in the occurrence of summer heat waves. Conceptually this increase is understood as a shift of the statistical distribution towards warmer temperatures, while changes in the width of the distribution are often considered small.
Urban areas tend to experience a relatively higher temperature compared with the surrounding rural areas. This thermal difference, in conjunction with waste heat released from urban houses, transportation and industry, contribute to the development of urban heat island (UHI). Summer heat waves will affect much more urban temperatures and microclimates with adverse effects on human health. Remote sensing is a key application in global change science and urban climatology. Urbanization, the conversion of other types of land to uses associated with growth of populations and economy has a great impact on both micro-climate as well as macro-climate. Remote sensing derived biophysical attributes provide great potential for establishing parameters describing urban land cover/use (construction materials and the composition and structure of urban canopies) for improving the understanding of the urban surface energy budgets, and observing the urban heat island (UHI) effect.In this study, Landsat TM and ETM+ , MODIS, IKONOS images over Bucharest metropolitan area from 1988 to 2008 have been selected to retrieve the urban biogeophysical parameters and brightness temperatures in relation with changes of cover/use types. The spatial distribution of heat islands has been changed from a mixed pattern, where bare land, semi-bare land and land under development were warmer than other surface types, to extensive UHI. Our analysis showed that higher temperature in the UHI was located with a scattered pattern, which was related to certain land-cover types. In order to analyze the relationship between UHI and land-cover changes, this study attempted to employ a quantitative approach in exploring the relationship between temperature and several indices, including the Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), Normalized Difference Bareness Index (NDBaI) and Normalized Difference Build-up Index (NDBI). It was found that correlations between NDVI, NDWI, NDBaI and temperature are negative when NDVI is limited in range, but positive correlation is shown between NDBI and temperature.Such analysis is very helpful in urban mesoscale models and urban climate studies.