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Differences and similarities of the satellite- and ground-based urban heat island effects

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Although large scale atmospheric evolution involves far more energy due to solar income energy, human settlements (especially, the large urban areas) are able to significantly modify the environment. Atmospheric composition near urban agglomerations is highly affected mainly due to industrial activity and road traffic. Urban smog events are common characteristics of large, very populated cities. Furthermore, artificial covers (i.e. concrete, asphalt) considerably modify the energy budget of urban regions, and thus, local climatic conditions. One of the most often analyzed phenomena related to cities is the urban heat island (UHI) effect, which can be characterized by the temperature anomaly between urban and rural regions.
In this poster, UHI effects calculated from ground-based air temperature observations and remotely sensed surface temperature measurements are analyzed and compared for Budapest (the capital of Hungary, with about 1.7 million inhabitants) and its vicinity for the period 2001-2009. Hourly recorded air temperature observations are available from six climatological stations of the Hungarian Meteorological Service. Remotely sensed surface temperature data is available from the measurements of sensor MODIS (Moderate Resolution Imaging Spectroradiometer), which is one of the sensors on-board American satellites Terra and Aqua. They were launched to polar orbit as part of the NASA's Earth Observing System in December 1999, and in May 2002, respectively.
In the frame of our analysis, monthly and seasonal mean values for day-time (morning and afternoon) and night-time (late evening and before dawn) are evaluated. Furthermore, distribution of temperature values is analyzed on a seasonal scale. The results suggest that day-time satellite-based surface temperature is larger than ground-based air temperature (especially from spring to autumn), during night-time the opposite is valid (especially in winter). The main reason for this is simply the fact that the surface gets warm and cold directly, faster than the atmosphere.