Geophysical Research Abstracts
Vol. 12, EGU2010-13876, 2010
EGU General Assembly 2010

Comparison of kinetic and air temperatures in Budapest aiming applications in weather forecasting

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Moderate Resolution Imaging Spectroradiometer (MODIS) based kinetic temperature data are compared with the surface air temperature data at the four weather stations in Budapest, Hun-gary. Dependence of these temperature characteristics on weather conditions, characterised by macrosynoptic types and by objective weather types, is in the focus of the study.

Day- and night-time kinetic temperature series are used from the period 2001-2008. Four automatic stations are also used as the surface-based control variables. The four MODIS-pixels, covering one station, each, are the sites of our comparison. One of the four stations has strictly urban situation at the roof level in a strongly built-in region of Budapest. Another one, used as background rural station is at the east-west edge of the town with gar-dened environment. Two other stations are positioned near the river Danube at the northern and southern edges of Budapest, still under mezo-scale effect of the city. The number of elaborated hourly values is 4300-4400 above each pixel, depending on the cloudiness.

At the four station automatic observations on air temperature, cloudiness (=0), relative humidity and wind-speed are observed in the hours of the MODIS observations. From these elements air temperature is used for comparison with the satellite-based kinetic temperature, and also as the main components of the Physiologically Equivalent Temperature (PET), de-rived to characterise usefulness of the kinetic temperature.

Our first aim is to specify detailed relationship between the two temperatures consider-ing the seasonal and diurnal cycles and synoptic situation. This comparison is also performed by using the PET to establish which kind of temperature reminds this human bioclimatic in-dex better. If we could establish effective relationships with the synoptic situations (or weather types) we could use them in two further applications. The first one is the everyday forecasting of dangerous situations within the city on the days when the rural weather forecast claims about extreme temperature even at the rural sites. On summer hot days the weather-dependent UHI increases but on cold winter days decreases the risks on human health and technical equipments. The other scientific problem is whether the long-term season-dependent changes of the atmospheric circulation can modify the behaviour of the UHI even without fur-ther changes in the building in of the city. To answer this question the established relation-ships are combined with regional climate change projections of the circulation conditions.