



Eleven years of ground-air temperature tracking over different land cover materials

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We have analyzed series of air, near surface and shallow ground temperatures under four different land covers, namely bare clayey soil, sand, grass and asphalt, collected between 2002 and 2013, monitored at the Geothermal Climate Change Observatory Sporilov. All obtained temperature series revealed a strong dependence of the sub-surface thermal regime on the surface cover material. The ground “skin” temperatures are generally warmer than the surface air temperatures for all monitored surfaces; however they mutually differ significantly reflecting the nature of the land surface. Asphalt shows the highest temperatures, temperatures below the grassy surface are the lowest. A special interest was paid to the assessment of the “temperature offset”, the difference between the surface ground temperature and the surface air temperature. Even when its instant value varies dramatically on both, daily and annual scale, by up to 30+ K, on a long time scale it is believed to be generally constant. The characteristic 2003-2013 mean offset values for the individual covers are following: asphalt 4.1 K, sand 1.6 K, clay 1.3 K and grass 0.2-0.3 K. All four surface covers revealed their daily and inter-annual cycles. Incident solar radiation is the primary variable in determining the amount of the temperature offset value and its time changes. A linear relationship between air-ground temperature differences and incident solar radiation was detected. The slope of the linear regression between both variables is clearly surface cover dependent. The greatest value of 3.3 K per 100 W.m⁻² was found for asphalt, rates of 1.0 to 1.2 apply for bare soil and sand covers and negative slope of -0.44 K per 100 W.m⁻² stands for grass, during the day or year the slope rates may vary extensively reflecting the periodic daily and/or annual cycle as well as the irregular instant deviations in solar radiation.