Shallow soil temperatures have been monitored at several depth sections (0 to 40 m) in two experimental borehole sites: (i) Sporilov (50.04ºN, 14.48ºE, 274 m asl) since 1993 and (ii) Kocelovice (49.47ºN, 13.84ºE, 518 m asl) since 1999. We explored the downward penetration (fading) of the surface temperature signal in the relation to the reported climate warming. The first site represents a typically urban and the other a typically rural environment. The gradual year-to-year increase of temperature below the “seasonal-variation zone” for Sporilov amounts to about 0.03 K/yr, while Kocelovice gave lower value of 0.02 K/yr. Monitoring data have been compared with the surface air temperature records from 30 local meteorological stations to evaluate and discuss the regional climate warming pattern. The temperature monitoring was later completed by detail studies of the effect of various surfaces (asphalt, bare soil, sand, grass) on the penetration process and also on the effect of snow cover, ground freezing and precipitation. The 17-years Sporilov records were further processed with the help of the Fast Fourier Transform (FFT) and Recurrence Quantification Interval (RQI) analysis to uncover the potential hidden periodicities in the noisy time series. The results show considerable similarity for all investigated depth levels; besides the characteristic pronounced annual wave all series contain 8-year and 11-year periodicities. The hypotheses about possible dynamics responsible for the occurrence of the 8-year wave are discussed.