



Extreme air temperature in Ukraine: data rescue, homogenization and trend analysis

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Digital databases of monthly means of daily extreme, minimum (T_n) and maximum (T_x), air temperature collected in Ukraine were created. The databases contain temperature records of 371/340 (T_n/T_x) climatological stations which recorded data on the territory of Ukraine anytime during 1881-2015. The significant part of the datasets (~48/47%) was obtained after conducting a Data Rescue process, recovering historical paper records. Due to a great deal of missing data during World War I and II, homogenization was possible to perform only for 178 time series covering the period of 1946-2015. A homogenization procedure, conducted by means of the HOMER software, revealed 323 break points for minimum temperature (~1.8 breaks per station) and 310 for maximum temperature (~1.7 breaks per station). Approximately 37/33% (T_n/T_x) of the breaks can be explained by metadata. Shift amplitudes in T_n time series ranged between -1.18°C and 1.71°C, while for maximum temperature the range was slightly less: from -0.99°C to 1.15°C. For both temperatures, mean values of shift amplitudes were near zero (-0.04/-0.05°C). To validate the homogenization results, several statistical procedures were performed to compare inhomogeneous and homogeneous time series. Based on homogenized datasets the analysis of extreme air temperature trends observed in Ukraine during 1946-2015 was performed. The analysis revealed non-linear trends of extreme air temperature and its daily range (DTR). During the first half of the studied period (namely, 1946-1980) completely different tendencies of T_n, T_x and DTR are observed comparing to its second half (1981-2015). Moreover, the trends for minimum temperature also significantly differ from the similar values for maximum temperature, what leads to a considerable daily asymmetry of temperature changes in Ukraine. Seasonal and spatial features of the revealed temperature tendencies were studied in detail. Finally, the influence of an inhomogeneity of raw time series on their trends was also studied.